Document Status

The most recent version of this document (Amendment 20), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective on 29 November 2021 and supersedes all previous versions of this document.The previous Amendment 19 can be used to show compliance until 2 November 2022 and can be used for building consent applications submitted before 3 November 2022. 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 version of Verification Methods and Acceptable Solutions are available from www.building.govt.nz

B1: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	September 1993	p. ix–xii, References p. 1, 1.3, 1.4.1–1.4.3, 2.1, 2.2, 3.1–3.3, 4.1, 5.1 p. 2, 6.1, 6.2, 8.1, 9.1 p. 4, 11.1, 12.1 p. 5, 1.2, 2.1, 2.2, 3.1, 3.2,s 4.1, 4.2, 6.1, 6.2, 7.1	p. 9, 1.0.1, 1.0.5 b) c) p. 10, 2.3.5 p. 13, Figure 4 p. 14, 2.3.6 p. 16, 2.3.8, 2.3.9 p. 34, Table 1 p. 47, 1.0.1 pp. 49-54, Index
Amendment 2	19 August 1994	pp. i and ii, Document History pp. vii and viii, Contents pp. x and xi, References p. xiv, Definitions p. 1, 1.4.2, 5.1 p. 2, 6.1 p. 5, 1.3, 3.1, 4.1 p. 6, 7.1 p. 10, 2.3.5 p. 12, Figure 3 p. 13, Figure 4 p. 14, 2.3.6, 2.3.7	p. 15, Tables 4 and 5 p.16, 2.4.1 p. 21, Figure 2 p. 22, Figure 3 p. 32, 2.2.4 p. 33, 1.0.2 p. 34, 3.2.1, Table 1 p. 35, 4.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3, 4.3.1, 5.0.1, Table 2 p. 36, 6.1.2, 7.1, 7.1.1 p. 37, 7.3.4 pp. 49, 50, 51, 54, Index
Reprintedincorporating Amendments 1 and 2	October 1994		
Amendment 3	1 December 1995	p. ii, Document History p. ix, References p. 1, 3.1	p. 5, 6.2 p. 50, Index
Reprinted incorporating Amendments 1, 2 and 3	July 1996		
Amendment 4	1 December 2000	p. ii, Document History pp. vii and viii, Contents pp. ix – xii, Revised References pp. xiii and xiv, Definitions	pp. 1–4A, Revised B1/VM1 pp. 5 and 6, Revised B1/AS1 pp. 33–63, Revised B1/VM4 p. 65, Revised B1/AS4 pp. 67–72, Revised Index
Erratum	9 February 2001	p. 46, 4.3.2 a) i)	
Amendment 5 incorporating Erratum	1 July 2001	p. 2, Document Status p. 3, Document History p. 7, References	p. 41, 1.7.2 Comment p. 49, 2.2.4 p. 48, 1.9.1 b) i)
Amendment 6	1 March 2005	p. 11, References	
Amendment 7	1 April 2007	pp. 11–12, 14, References pp. 15–16, Definitions	p. 18, 6.1

B1: Document History			
Amendment 8	1 December 2008	p. 2, Document Status p. 3, Document History p. 9, Contents pp. 11–14, References pp. 15–16, Definitions	pp. 17–22B, B1/VM1 p. 51, B1/VM4 1.0.5, 2.0.1 p. 56, B1/VM4 Figure 2 p. 70, B1/VM4 B1.0.2 pp. 83–84, 86 Index
Amendment 9	30 September 2010	pp. 2–3, Document History, Status, pp. 11–14, References p. 20, B1/VM1 2.2.13 p. 21, B1/VM1 3.0, 5.1 pp. 22–22B, B1/VM1 11.0 pp. 23–24, B1/AS1 6.0, 6.1, 6.2, 6.3, 6.4, 7.1, 7.2, 7.3, 7.4	p. 27, B1/AS2 1.0.5 p. 44, B1/AS3 1.7.9 p. 47, B1/AS3 1.8.5, 1.8.6 p. 49, B1/AS3 2.1.1, 2.2.4 p. 63, B1/VM4 4.3.2 p. 67, B1/VM4 5.3.1
Reprinted incorporating Amendments 4–9	30 September 2010		
Erratum 1	30 September 2010	p. 21, B1/VM1 3.1	
Amendment 10 (Canterbury)	Effective from 19 May 2011 until 31 January 2012	p. 9, Contents p. 12–14, References p. 15, Definitions p. 17, B1/VM1	p. 20, B1/VM1 2.2.14A to 2.2.14D pp. 23–23C B1/AS1 1.4, 2.0, 3.0, 4.0 p. 48, B1/AS3 1.9.3 p. 84, Index
Amendment 11	Effective from 1 August 2011 until 14 August 2014	p. 9, Contents p. 11–14, References p. 17–22B, B1/VM1 1.0, 2.0, 2.2.9, 2.2.14C, 5.2, 6.1, 7.1, 8.1, 12.1, 13.0	pp. 23–24, B1/AS1 1.2, 2.0, 3.0, 4.0, 7.0, 8.0, 9.0 pp. 27–34, B1/AS2 pp. 83–87, Index
Amendment 12	Effective from 14 February 2014 until 31 May 2016	p. 9, Contents pp. 11–13, References pp. 15, 16, Definitions pp. 17, 18, 20, 22, 22A, 22B, B1/VM1 2.1, 2.2.6, 2.2.11, 5.2, 9.0, 12.1	pp. 23–23C, 24 B1/AS1 1.1, 1.2, 2.1.1–2.1.10, 3.1.9, 4.1.5, 8.0, 9.0 p. 79 , B1/VM4 C11.0
Amendment 13	Effective from 1 June 2016 until 30 May 2017	p. 13, References	p. 24 , B1/AS1 7.3.3, 7.3.4
Amendment 14	Effective from 4 November 2016 until 30 May 2017 Effective from 1 January 2017 until 30 May 2017	p. 9 Contents p.p. 14 References p. 22 B1/VM1 3.1 d) p. 22C VM1 14.1.1	pp. 22C–22F B1/VM1 14.1, 14.1.2 - 14.1.22 pp. 23, 23B B1/AS1 2.1.3, 3.1.8 pp. 84, 87 Index
Amendment 15	Effective from 1 January 2017 until 30 June 2018	p. 13 References p. 20 B1/VM1 2.2.14A, 2.2.14B p. 21 B1/VM1 3.1 p. 22B 13.1 p. 23A B1/AS1 3.1.2A, 3.1.2B, 3.1.2C	p. 24 B1/AS1 7.0 p. 37 B1/AS3 Scope p. 41 B1/AS3 1.7.2 p. 49 B1/AS3 2.2.4 p. 54 B1/VM4 3.3.2
Amendment 16	Effective 3 April 2018 until 31 March 2019	p. 9 Contents pp. 11–14A References p. 18 B1/VM1 2.2.5	pp. 21-22 B1/VM1 3.1, 5.1 p. 57 B1/VM4 3.3.2 p. 65 B1/VM4 4.3.4
Amendment 17	Effective fom 30 November 2018 until 31 October 2019	p. 11–13 References p. 17 B1/VM1 2.1	p. 22 B1/VM1 5.1.4A, 5.1.9A p. 84 Index
Amendment 18	Effective from 27 June 2019 until 31 March 2020 except for Definition of Good ground in B1/AS1 (effective until 29 November 2021)	p. 9 Contents pp. 12, 14A References pp. 21, 22A B1/VM1 3.1.1, 3.1.2, 5.3	pp. 23, 24 B1/AS1 1.1, 9.0 p. 84 Index
Amendment 19	Effective on 28 November 2019 until 2 November 2022	p. 9 Contents pp. 11–14A References p. 15 Definitions p. 21 B1/VM1 5.1.1	pp. 23–23H B1/AS1 1.2, 2.1.2, 3.1.1 3.1.8, 3.1.14, 3.2, 4.1.5, 6.1, 6.2
Amendment 20	Effective on 29 November 2021	pp. 12, 14-14A References p. 21 B1/VM1 3.1.0, 4.1.0 p. 22B B1/VM1 11.1 pp. 22C-22F B1/VM1 14.1.1-14.1.22	p. 23 B1/AS1 2.1.0, 2.1.2 p. 23A B1/AS1 3.1.0 p. 23D B1/AS1 7.5.2, 4.4 Comment

New Zealand Building Code Clause B1 Structure

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE—*continued*

Clause B1—STRUCTURE

Provisions	Limits on application
OBJECTIVE	
B1.1 The objective of this provision is to:	
(a) Safeguard people from injury caused by structural failure.	
(b) Safeguard people from loss of *amenity* caused by structural behaviour, and	
(c) Protect *other property* from physical damage caused by structural failure.	
FUNCTIONAL REQUIREMENT	
B1.2 *Buildings, building elements* and *sitework* shall withstand the combination of loads that they are likely to experience during *construction* or *alteration* and throughout their lives.	
PERFORMANCE	
B1.3.1 *Buildings, building elements* and *sitework* shall have a low probability of rupturing, becoming unstable, losing equilibrium, or collapsing during *construction* or *alteration* and throughout their lives.	
B1.3.2 *Buildings, building elements* and *sitework* shall have a low probability of causing loss of *amenity* through undue deformation, vibratory response, degradation, or other physical characteristics throughout their lives, or during *construction* or *alteration* when the *building* is in use.	
B1.3.3 Account shall be taken of all physical conditions likely to affect the stability of *buildings, building elements* and *sitework*, including:	
(a) Self-weight,	
(b) Imposed gravity loads arising from use,	
(c) Temperature,	

FIRST SCHEDULE—*continued*

Provisions	Limits on application
(d) Earth pressure,	
(e) Water and other liquids,	
(f) Earthquake,	
(g) Snow,	
(h) Wind,	
(i) *Fire*,	
(j) Impact,	
(k) Explosion,	
(l) Reversing or fluctuating effects,	
(m) Differential movement,	
(n) Vegetation,	
(o) Adverse effects due to insufficient separation from other *buildings*,	
(p) Influence of equipment, services, non-structural elements and contents,	
(q) Time dependent effects including creep and shrinkage, and	
(r) Removal of support.	
B1.3.4 Due allowance shall be made for:	
(a) The consequences of failure,	
(b) The intended use of the *building*,	
(c) Effects of uncertainties resulting from *construction* activities, or the sequence in which *construction* activities occur,	
(d) Variations in the properties of materials and the characteristics of the site, and	
(e) Accuracy limitations inherent in the methods used to predict the stability of *buildings*.	
B1.3.5 The demolition of *buildings* shall be carried out in a way that avoids the likelihood of premature collapse.	
B1.3.6 *Sitework*, where necessary, shall be carried out to:	

FIRST SCHEDULE—*continued*

Provisions	Limits on application
(a) Provide stability for *construction* on the site, and	
(b) Avoid the likelihood of damage to *other property*.	
B1.3.7 Any *sitework* and associated supports shall take account of the effects of:	
(a) Changes in ground water level,	
(b) Water, weather and vegetation, and	
(c) Ground loss and slumping.	

Contents

Amend 4 Dec 2000
Amend 8 and 16
Amend 3 Dec 1995
Amend 10 May 2011
Amends 11 and 18
Amend 10 May 2011
Amend 20 Nov 2021
Amend 20 Nov 2021
Amend 20 Nov 2021
Amend 20 Nov 2021
Amend 20 Nov 2021
Amend 20 Nov 2021
Amend 20 Nov 2021
Amend 19 Nov 2019
Amend 4 Dec 2000
Amend 12 Feb 2014
Amends 11 and 18
Amend 11 Aug 2011

Amend 4 Dec 2000

Amend 4 Dec 2000

Amend 4 Dec 2000

Amend 11 Aug 2011

References

For the purposes of New Zealand Building Code compliance, the acceptable New Zealand and other Standards, and other documents referred to in these Verification Methods and Acceptable Solutions (primary reference documents) shall be the editions, along with their specific amendments, listed below. Where the primary reference documents refer to other Standards or other documents (secondary reference documents), which in turn may also refer to other Standards or other documents, and so on (lower order reference documents), then the applicable version of these secondary and lower order reference documents shall be the version in effect at the date these Verification Methods and Acceptable Solutions were published.

Amend 7 Apr 2007

Amend 12 Feb 2014

Amend 12 Feb 2014

Amendment	Standards New Zealand		Where quoted
Amend 16 Apr 2018	AS/NZS 1163: 2016	Cold-formed structural steel hollow sections	VM1 5.1.1
Amend 19 Nov 2019		*Amend: 1*	
	AS/NZS 1170:	Structural design actions –	VM1 1.0, 2.1, 2.2, 5.2, 6.1, 7.1, 8.1
Amend 11 Aug 2011			AS1 7.2, 7.3
	Part 0: 2002	General principles	VM4 2.0, B1.0
Amend 12 Feb 2014		*Amends: 1, 2, 3, 4, 5*	
	Part 1: 2002	Permanent imposed and other actions	
Amend 12 Feb 2014		*Amends: 1, 2*	
	Part 2: 2011	Wind actions	
Amends 12 and 17		*Amends: 1, 2, 3, 4, 5*	
	Part 3: 2003	Snow and ice actions	
		Amend: 1	
	NZS 1170:	Structural design actions –	VM1 2.1, 2.2
Amends 10 and 11	Part 5: 2004	Earthquake actions – New Zealand	

COMMENT
The above suite of Structural Design Action Standards, together with their amendments, are referred to collectively as "AS/NZS 1170".

Amend 11 Aug 2011

Amend 8 Dec 2008

Amendment	Standard		Where quoted
	AS/NZS 1554:	Structural steel welding	
	Part 1: 2014	Welding of steel structures	VM1 5.1.13
		Amends: 1, 2	
Amend 16 Apr 2018	AS/NZS 1594: 2002	Hot-rolled steel flat products	VM1 5.1.1
	AS/NZS 1664:	Aluminium structures –	VM1 7.1
	Part 1: 1997	Limit state design	
Amends 8 and 9		*Amend: 1*	
Amend 7 Apr 2007	AS/NZS 1748:-	Timber – Stress graded for structural purposes	VM1 6.1
	Part 1: 2011	General requirements	VM1 6.1
		Amend: 1	
Amend 12 Feb 2014	Part 2: 2011	Qualification of grading method	VM1 6.1
		Amend: 1	
	AS/NZS 2032: 2006	Installation of PVC pipe systems	AS1 6.3
Amend 9 Sep 2010		*Amend: 1*	

		Where quoted
Amend 9 Sep 2010 AS/NZS 2033: 2008	Installation of polyethylene pipe systems *Amends 1, 2*	AS1 6.4
Amend 17 Nov 2018 AS/NZS 2327: 2017	Composite structures – Composite steel-concrete construction in buildings *Amend: 1* (Amend 20 Nov 2021)	VM1 5.1.4A
Amend 9 Sep 2010 AS/NZS 2566: 2002	Buried Flexible pipelines.	
Part 1: 1998	Structural Design *Amend: 1* (Amend 19 Nov 2019)	AS1 6.1
Part 2: 2002	Installation *Amends: 1, 2, 3* (Amend 19 Nov 2019)	AS1 6.2
AS/NZS 2918: 2001	Domestic solid fuel heating appliances installation	AS3 3.2.1, 2.2.4
NZS 3101:-	Concrete structures standard	(Amend 18 Jun 2019)
Part 1: 2006	The design of concrete structures *Amends: 1, 2, 3* (Amend 16 Apr 2018; Amend 6 Mar 2005)	VM1 3.1, 11.1
Amend 8 Dec 2008 NZS 3106: 2009	Design of concrete structures for the storage of liquids.	VM1 3.2
Amend 9 Sep 2010 NZS 3109: 1997	Concrete construction *Amend: 1, 2* (Amend 7 Apr 2007)	AS3 1.8.2, 1.8.5 b), 2.2.1 c), 2.2.3
NZS 3112:-	Methods of test for concrete	
Part 2: 1986	Tests relating to the determination of strength of concrete *Amend: 1, 2* (Amend 9 Sep 2010)	AS3 1.8.3 c)
Amend 9 Sep 2010 NZS 3404:-	Steel structures standard	
Part 1: 1997	Steel structures standard *Amend: 1, 2* (Amend 9 Sep 2010)	VM1 5.1
SNZ TS 3404: 2018	Durability requirements for steel structures and components (Amend 17 Nov 2018; Amend 9 Sep 2010; Amend 11 Aug 2011)	VM1 5.1.9A
NZS 3603: 1993	Timber structures standard *Amend: 1, 2* (Applies to building work consented prior to 1 April 2007) *Amend: 1, 2, 4* (Applies to building work consented on or after 1 April 2007) (Amend 7 Apr 2007)	VM1 6.1, VM4 5.3.1
Amend 10 May 2011 NZS 3604: 2011	Timber framed buildings (Amend 11 Aug 2011)	AS1 1.4, 3.1, 3.2, 4.1 (Amend 19 Nov 2019) AS3 1.1.1, 1.9.1 b), 1.9.2, 1.9.5, 2.2.1 b),
Amend 9 Sep 2010 NZS 3605: 2001	Timber piles and poles for use in building	VM4 5.3.1

Amendment	Standard	Title	Where quoted
Amend 7 Apr 2007	NZS 3622: 2004	Verification of timber properties *Amend: 1*	VM1 6.1
Amend 11 Aug 2011			
Amends 9 and 12	NZS 3640: 2003	Chemical preservation of round and sawn timber *Amends: 1, 2, 3, 4, 5*	VM4 5.3.1
	AS/NZS 3678: 2016	Structural steel – Hot-rolled plates, floorplates and slabs	VM1 5.1.9
	AS/NZS 3679	Structural steel	
	Part 1: 2016	Hot-rolled bars and sections	VM1 5.1.9
Amend 16 Apr 2018	Part 2: 2016	Welded I sections	VM1 5.1.9
	AS/NZS 3725: 2007	Design for installation of buried concrete pipes	VM1 11.1
Amend 8 Dec 2008			
	AS/NZS 3869: 1999	Domestic solid fuel burning appliances – Design and construction	AS3 2.1
Amend 9 Sep 2010	AS/NZS 4058: 2007	Pre cast concrete pipes(pressure and non-pressure)	VM1 11.1
Amends 10 and 11; Amend 9 Sep 2010	NZS 4210: 2001	Code of practice for masonry construction: materials and workmanship *Amend: 1*	AS3 1.8.1, 1.8.3 (f and g)
Amend 11 Aug 2011; Amend 17 Nov 2018; Amend 8 Dec 2008	NZS 4211: 2008	Specification for performance of windows *Amend: 1*	VM1 12.1
Amend 11 Aug 2011	NZS 4219 : 2009	Seismic Performance of Engineering Systems in Buildings	VM1 1.3.1
	NZS 4223:-	Glazing in buildings	
Amend 9 Sep 2010	Part 1: 2008	Glass selection and glazing *Amend 1*	AS1 7.1, 7.2.1, 7.3.7
Amend 9 Sep 2010; Amend 15 Jan 2017	Part 2: 2016	Insulating glass units	AS1 7.2
Amends 13 & 15; Amend 15 Jan 2017	Part 3: 2016	Human impact safety requirements *Amend: 1*	AS1 7.3
Amend 9 Sep 2010; Amend 15 Jan 2017	Part 4: 2008	Wind, dead, snow, and live actions *Amend 1*	AS1 7.4
Amends 10 and 11; Amend 12 Feb 2014	NZS 4229: 2013	Concrete masonry buildings not requiring specific engineering design	AS1 1.4, 2.1; AS3 1.1.1, 1.8.4, 1.9.2, 1.9.5, 2.2.1 b)
Amend 8 Dec 2008	NZS 4230: 2004	Design of reinforced concrete masonry structures *Amend: 1*	VM1 4.0
	NZS 4251:-	Solid plastering	AS1 5.1
Amend 11 Aug 2011	Part 1: 2007	Cement plasters for walls, ceilings and soffits	

		Where quoted
NZS 4297: 1998	Engineering design of earth buildings	VM1 8.1
NZS 4299: 1998	Earth buildings not requiring specific design *Amend: 1*	AS1 1.4, 4.1
NZS 4402:-	Methods of testing soils for civil engineering purposes.	VM1 11.1
Test 2.2: 1986	Soil classification tests – Determination of liquid limit	Definitions
Test 2.4: 1986	Soil classification tests – Determination of plasticity index	VM1 11.1
Test 2.6: 1986	Soil classification tests – Determination of the linear shrinkage	Definitions
Test 2.8.1: 1986	Soil classification tests – Standard method by wet sieving	VM1 11.1
Test 2.8.2: 1986	Soil classification tests – Standard method by dry sieving	VM1 11.1
Test 2.8.3: 1986	Soil classification tests – Standard method for fine soils (pipette method)	VM1 11.1
Test 2.8.4: 1986	Soil classification tests – Subsidiary method for fine soils (hydrometer method)	VM1 11.1
Test 4.1.1: 1986	Soil compaction tests – Determination of the dry density/water content relationship – New Zealand standard compaction test	VM1 11.1
Test 4.2.1: 1988	Soil compaction tests – Determination of the minimum and maximum dry densities and relative density of a cohesionless soil – Minimum dry density	VM1 11.1
Test 4.2.2: 1988	Soil compaction tests – Determination of the minimum and maximum dry densities and relative density of a cohesionless soil – Maximum dry density	VM1 11.1
Test 4.2.3: 1988	Soil compaction tests – Determination of the minimum and maximum dry densities and relative density of a cohesionless soil – Relative density	VM1 11.1, VM4 4.1.1
Test 5.1.1: 1986	Soil density tests – Determination of the density of soil – Sand replacement test for the determination of in situ density	VM1 11.1
NZS 4431: 1989	Code of practice for earth fill for residential development *Amend: 1*	VM1 10.1
AS/NZS 4600: 2005	Cold-formed steel structures *Amend: 1*	VM1 5.2
AS/NZS 4671: 2019	Steel for the reinforcement of concrete	AS1 2.1.5, 3.1.8 AS3 1.8.5, VM1 14.0
AS/NZS 4680: 2006	Hot-Dip Galvanised (zinc) Coating	AS3 1.8.6
AS/NZS 5131: 2016	Structural steelwork – Fabrication and erection *Amend: 1*	VM1 5.1.3, 5.1.5-5.1.8, 5.1.10-5.1.12

Amends 10 and 11

Amend 16 Apr 2018

Amend 19 Nov 2019

Amend 20 Nov 2021

Amends 10 and 11

Amend 14 Nov 2016

Amend 9 Sep 2010

Amend 16 Apr 2018

Amend 20 Nov 2021

		Where quoted
Amend 8 Dec 2008 SNZ HB 8630: 2004	Tracks and outdoor visitor structures	VM1 2.2.9

The National Association of Steel Framed Housing Inc (NASH)

Amend 11 Aug 2011

Amend 18 Jun 2019

NASH Standard Part 2: May 2019	Light Steel Framed Buildings	AS1 9.1

British Standards Institution

BS 8004: 1986	Code of practice for foundations	VM4 4.0.3
BS EN 14399	High-strength structural bolting assemblies for preloading	
Part 1: 2015	General requirements	VM1 5.1.4
Part 2: 2015	Suitability for preloading	VM1 5.1.4
Part 3: 2015	System HR. Hexagon bolt and nut assemblies	VM1 5.1.2, 5.1.4
Part 5: 2015	Plain washers	VM1 5.1.2, 5.1.4

Amend 16 Apr 2018

Standards Australia

AS 1391: 2007	Metallic materials – Tensile testing at ambient temperature	VM1 14.1.1
AS 1397: 2011	Steel sheet and strip – Hot-dipped zinc-coated or aluminium/zinc-coated	AS3 1.7.9
AS 2159: 1995	Rules for the design and installation of piling (known as the SAA Piling Code) *Amend: 1*	VM4 4.0.3

Amend 14 Nov 2016

Amends 9 and 19

Amend 11 Aug 2011

American Society of Testing and Materials

ASTM D1143: 1981	Test method for piles under static axial compressive load	VM4 4.0.3

New Zealand Geotechnical Society Inc.

Field Description of Soil and Rock – Guidelines for the field descriptions of soils and rocks for engineering purposes. December 2005	VM1 11.1

Amend 20 Nov 2021

New Zealand Legislation

Chartered Professional Engineers of New Zealand Act 2002	VM1 1.0

Amend 8 Dec 2008

International Organization for Standardization

ISO 15630-2 2010:	Steel for the reinforcement and prestressing of concrete – Test Methods – Part 2 Welded Fabric	VM1 14.1.1
ISO 17025: 2005	General requirements for the competence of testing and calibration laboratories	VM1 14.1.1

Amend 14 Nov 2016

Definitions

This is an abbreviated list of definitions for words or terms particularly relevant to these Acceptable Solutions and Verification Methods. The definitions for any other italicised words may be found in the New Zealand Building Code Handbook. Amends 7 and 12

Adequate *Adequate* to achieve the objectives of the *Building Code*.

Amend 8 Dec 2008 **Alter** in relation to a *building*, includes to rebuild, re-erect, repair, enlarge and extend the *building*.

Baluster A post providing the support for the top and bottom rails of a barrier.

Boundary joist A joist running along the outer ends of the floor joists.

Amend 7 Apr 2007 **Building** has the meaning ascribed to it by sections 8 and 9 of the Building Act 2004.

Building element Any structural and non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.

Amend 10 May 2011 **Canterbury earthquake region** is the area contained within the boundaries of the Christchurch City Council, the Selwyn District Council and the Waimakariri District Council.

Chimney A *non-combustible* structure which encloses one or more *flues, fireplaces* or other heating appliances.

Chimney back The *non-combustible* wall forming the back of a *fireplace*.

Chimney base That part of a *chimney* which houses the *fireplace*.

Chimney jambs The side walls of a *fireplace*.

Combustible See *non-combustible*.

Amend 8 Dec 2008 **Construct** in relation to a *building*, includes to design, build, erect, prefabricate, and relocate the *building*.

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

Factor of safety in relation to any *building* means the ratio of resisting forces to applied forces for a given loading condition. It is generally expressed to two significant figures.

Fireplace A space formed by the *chimney back*, the *chimney jambs*, and the *chimney breast* in which fuel is burned for the purpose of heating the room into which it opens.

Fixture An article intended to remain permanently attached to and form part of a *building*.

Flue The passage through which the products of combustion are conveyed to the outside.

Gather That part of a *chimney* where the transition from *fireplace* to stack occurs.

Good ground means any soil or rock capable of permanently withstanding an ultimate bearing pressure of 300 kPa (i.e. an allowable bearing pressure of 100 kPa using a factor of safety of 3.0), but excludes:

a) Potentially compressible ground such as topsoil, soft soils such as clay which can be moulded easily in the fingers, and uncompacted loose gravel which contains obvious voids,

b) Expansive soils being those that have a liquid limit of more than 50% when tested in accordance with NZS 4402 Test 2.2, and a linear shrinkage of more than 15% when tested, from the liquid limit, in accordance with NZS 4402 Test 2.6, and Amend 4 Dec 2000

c) Any ground which could forseeably experience movement of 25 mm or greater for any reason including one or a combination of: land instability, ground creep, subsidence, liquefaction, lateral spread, seasonal swelling and shrinking, frost heave, changing ground water level, erosion, dissolution of soil in water, and effects of tree roots. Amends 10 and 19

COMMENT:

Soils (excepting those described in a), b) and c) above) tested with a dynamic cone penetrometer in accordance with NZS 4402 Test 6.5.2, shall be acceptable as good ground for *building* foundations if penetration resistance is no less than:

a) 5 blows per 100 mm at depths down to twice the footing width.

b) 3 blows per 100 mm at depths greater than twice the footing width.

Amend 12 Feb 2014

Depths shall be measured from the underside of the proposed footing.

Amend 4 Dec 2000

Hearth The insulating floor under the *fire* and in front and at the sides of the *fireplace*.

Intended use, in relation to a *building*:

Amend 7 Apr 2007

a) includes any or all of the following:

   i) any reasonably foreseeable occasional use that is not incompatible with the *intended use*;

   ii) normal maintenance;

   iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but

b) does not include any other maintenance and repairs or rebuilding.

Amend 7 Apr 2007

Nominal pile width The least width of a pile in side view and is equal to the diameter in round piles.

Non-combustible Materials shall be classified as *non-combustible* or *combustible* when tested to: AS 1530 – Part 1.

Other property

a) means any land or *buildings*, or part of any land or *buildings*, that are—

   i) not held under the same *allotment*; or

   ii) not held under the same ownership; and

b) includes a road

Amend 8 Dec 2008

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

Specified intended life has the meaning given to it by section 113(3) of the Building Act 2004.

Section 113(3) states:

"(3) In subsection (2), **specified intended life**, in relation to a building, means the period of time, as stated in an application for a building consent or in the consent itself, for which the building is proposed to be used for its intended use."

Amend 8 Dec 2008

Strength reduction factor The factor by which the ultimate strength is multiplied to obtain the design strength.

COMMENT:

NZS 4203: 1992 uses the terms ideal strength in place of ultimate strength, and dependable strength in place of design strength.

Amend 2 Aug 1994

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.

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.

Verification Method means a method by which compliance with the *Building Code* may be verified.

Amend 8 Dec 2008

Verification Method B1/VM1 General

Amend 10 May 2011

Amend 8 Dec 2008

1.0 General

1.0.1 The Standards cited in this *Verification Method* provide a means for the design of structures to meet the performance requirements of New Zealand Building Code Clause B1 Structure. For any particular *building* or *building* design, the *Verification Method* shall consist of AS/NZS 1170 used in conjunction with the relevant cited material standards as modified by this *Verification Method*.

Amend 11 Aug 2011

1.0.2 Modifications to the Standards, necessary for compliance with the New Zealand *Building Code*, are given against the relevant clause number of each Standard.

1.0.3 Citation of Standards in this *Verification Method* is subject to the following conditions.

a) The citation covers only the scope stated or implicit in each Standard. Aspects outside the scope, when applied to a particular *building*, are not part of the *Verification Method.*

b) Further limitations, modifications and/or constraints apply to each Standard as noted below.

c) Provisions in the cited Standards that are in non-specific or unquantified terms do not form part of the *Verification Method.* Non-specific or unquantified terms include, but are not limited to, special studies, manufacturer's advice and references to methods that are appropriate, adequate, suitable, relevant, satisfactory, acceptable, applicable, or the like.

Amend 11 Aug 2011

d) Where AS/NZS 1170 is used in combination with other Standards cited in this *Verification Method* and there are incompatibilities with these other Standards, then the underlying philosophy, general approach, currency of information and methods of AS/NZS 1170 are to take precedence.

Amend 11 Aug 2011

Amend 8 Dec 2008

e) An engineer with relevant experience and skills in structural engineering shall be responsible for interpretation of the requirements of the Standards cited when used for *building* structure design. A structural engineer who is chartered under the Chartered Professional Engineers of New Zealand Act 2002 would satisfy this requirement.

COMMENT

The Standards referenced in this *Verification Method* relating to *building* design require the application of specialist engineering knowledge, experience and judgement in their use.

2.0 Structural Design Actions Standards

2.1 The requirements of the AS/NZS 1170 suite of Standards are to be complied with. These comprise:

AS/NZS 1170.0: 2002 including Amendments 1, 2, 3, 4 and 5

Amend 12 Feb 2014

AS/NZS 1170.1: 2002 including Amendments 1 and 2

AS/NZS 1170.2: 2011 including Amendments 1, 2, 3, 4 and 5

Amend 17 Nov 2018

AS/NZS 1170.3: 2003 including Amendment 1,

and NZS 1170.5: 2004.

COMMENT

This suite of Standards, together with their amendments, are referred to collectively in this *Verification Method* as "AS/NZS 1170".

Amend 11 Aug 2011

2.2 The requirements of AS/NZS 1170 are subject to the following modifications.

Amend 11 Aug 2011

2.2.1 Material Standards Where AS/NZS 1170 calls for the use of appropriate material Standards, only those material Standards referenced in this *Verification Method* B1/VM1 are included. Use of other Standards with AS/NZS 1170 must be treated as an alternative means of verification.

Amend 11 Aug 2011

2.2.2 Notes in AS/NZS 1170"Notes" that relate to clauses, tables or figures of AS/NZS 1170 are part of the *Verification Method*.

Amend 11 Aug 2011

COMMENT

AS/NZS 1170 makes a general statement that notes are not an integral part of the Standard. However, in many cases the content of the notes makes them an integral part of the interpretation of the Standard. In these cases, the notes have been specifically cited as being part of this *Verification Method.*

2.2.3 AS/NZS 1170 Part 0, Clause 4.1 General Add the following to the end of the Clause:

"The combination factors for permanent actions (dead loads) are based on the assumption that they have a coefficient of variation of approximately 10%. Situations where this assumption is not valid are outside the scope of this *Verification Method.*"

2.2.4 AS/NZS 1170 Part 0, Clause 4.2.4 Replace the Clause with the following:

"The combination of actions for checking strength and stability for the ultimate limit state for *fire* shall be as follows:

(a) During the *fire*:

(i) [G, thermal actions arising from *fire*, $\Psi_{\ell}Q$]

together with:

(ii) a lateral force of 2.5% of ($G + \Psi_c Q$) applied as per Clause 6.2.2.

(b) After the *fire* until the *building* is either repaired or demolished:

(i) [G, thermal actions arising from fire, $\Psi_{\ell}Q$]

together with the more critical of either:

(ii) a lateral force of 2.5% of ($G + \Psi_c Q$) applied as per Clause 6.2.2.

or

(iii) a uniformly distributed horizontal face load of 0.5 kPa in any direction.

Account shall be taken of the effects of the *fire* on material properties and the geometry of the structure."

Amend 8 Dec 2008

Amend 16 Apr 2018

2.2.6 AS/NZS 1170 Part 1, Table 3.2 Replace the entry for "R2, Other roofs (i) Structural elements" with:

"R2 Other roofs (i) Structural elements 0.25 1.1"

Delete Note 2

Delete Note 3

Amend 12 Feb 2014

2.2.7 AS/NZS 1170 Part 1, Clause 3.6 Barriers In the first paragraph, second sentence, delete "… top edge or handrail…" and substitute "… top edge **and rail**…"

Delete the second paragraph and substitute:

"Apply as detailed below the uniformly distributed line loads (kN/m), uniformly distributed loads (kPa) and concentrated loads (kN) given in Table 3.3.

For the purposes of applying loads, a rail shall be any *handrail* or any top rail having a width in plan of greater than 30 mm.

The following are separate load cases, and one load at a time, either vertical or horizontal, is to be applied.

(a) Line loads (kN/m). Regardless of barrier height, line loads need not be applied more than 1200 mm above the floor (or stair pitch line):

(i) For domestic and residential activities, other residential (Row 2 of Table 3.3)

- For barriers with a rail or rails:
  - apply the horizontal load to the top rail

Amend 8 Dec 2008

- where the top of the barrier is not a rail and where it is less than 200 mm above the top rail, the horizontal load to the top of the barrier may be reduced by 50%, otherwise apply the full horizontal load
- apply the vertical load to the top of the barrier.

- For barriers without a rail, apply:
  - the horizontal load at 900 mm above the floor (or stair pitch line)
  - 50% of the horizontal load to the top of the barrier
  - the vertical load to the top of the barrier.

(ii) For all types of occupancy other than Row 2 of Table 3.3:

- apply the loads to the top edge of the barrier and to the top rail
- where the top of the barrier is not a rail and where it is less than 200 mm above the top rail, the horizontal load to the top of the barrier may be reduced by 50%, otherwise apply the full horizontal load.

(b) Distributed loads (kPa):

For all types of occupancy:

- consider the load as acting over the whole area bounded by the top of the barrier and the floor line for the full length of the barrier
- distribute this load to the appropriate solid portions of the barrier.

(c) Concentrated loads (kN):

For all types of occupancy:

- consider each concentrated load to be distributed over a circular or square area of 2000 mm^2
- apply concentrated loads so as to produce the most severe effect on the structural element being considered

Amend 8 Dec 2008

- concentrated loads applied more than 1200 mm above the floor (or stair pitch line) may be reduced by 50%
- where the barrier infill or *balustrade* consists of parallel vertical members, less than 100 mm wide and with spaces between them of less than 100 mm, 50% of the concentrated load may be applied to each vertical member."

COMMENT

In Table 3.3, "external balconies" for domestic and residential activities applies to decks, balconies, verandahs and the like of individual houses as well as multi household unit buildings. Such barriers may be required by Clause F4 of the *Building Code*.

2.2.8 AS/NZS 1170 Part 1, Clause 3.8 Car park Add to the last paragraph of Clause 3.8:

"The basis for determining the horizontal impact actions on barriers quoted in the Clause, including the assumed deceleration distances, is given in Clause C 3.8 of the Commentary to AS/NZS 1170 Part 1. Different design actions may be derived using Equation C3.8, provided that:

(i) The deceleration length applied is based on analysis or tests.

(ii) The vehicle mass and associated velocity are not reduced from those quoted in Commentary Clause C3.8."

2.2.9 AS/NZS 1170 Part 1, Appendix B Replace the last paragraph with the following:

"For the design of outdoor visitor structures as defined in SNZ HB 8630: 2004, the imposed actions must be as given by that publication with references to NZS 4203 replaced by equivalent references to AS/NZS 1170." Amend 11 Aug 2011

2.2.10 AS/NZS 1170 Part 2, Clauses 3.2 and 4.4.3 Add the following at the end of Clauses 3.2 and 4.4.3:

"Where local wind design information is more onerous than determined by this Standard and is published and required to be used by any *territorial authority* for its area, this local wind design information shall take precedence over the equivalent information in this Standard for the determination of wind actions on *buildings*.

Amend 8 Dec 2008

Where such local wind design information is less onerous than that of this Standard, the use of such information is not part of this *Verification Method.*"

Amend 12
Feb 2014

2.2.12 AS/NZS 1170 Part 3, Clause 2.1
Add the following at the end of Clause 2.1:

"Where local snow and ice design information is more onerous than determined by this Standard and is published by any *territorial authority* for its area, this local snow and ice design information shall take precedence over the equivalent information in this Standard for the determination of snow and ice actions on *buildings*.

Where such local snow and ice design information is less onerous than that of this Standard, the use of such information is not part of this *Verification Method.*"

2.2.13 AS/NZS 1170 Part 3, Clause 5.4.3
Add the following to end of Clause 5.4.3:

Amend 9
Sep 2010

"For Regions N4 and N5 the minimum value of s_g for the ultimate limit state only must be taken as 0.9 kPa."

2.2.14 NZS 1170 Part 5, Clause 1.4
Add the following to the end of the Clause 1.4:

"Where a special study yields a site-specific uniform risk design spectrum for 500 year return period equivalent to a hazard factor, *Z,* of less than 0.08, a design spectrum equivalent to at least *Z* = 0.10 may be adopted and the minimum magnitude 6.5 earthquake need not be considered.

Amend 8
Dec 2008

COMMENT:
In areas where the uniform risk hazard factor is less than 0.08, the use of a minimum hazard factor *Z* = 0.13 implies design for earthquakes with extremely low probabilities of occurrence. For some projects in these areas this may involve considerable cost consequences and a reduction in requirements is acceptable when site-specific hazard studies are undertaken."

Consequential changes due to 2010/11 Canterbury earthquakes

COMMENT:

1. As a result of the 2010/11 sequence of earthquakes in Canterbury, there is a heightened risk of seismic activity over the next few decades above that currently factored into structural design requirements. B1/VM1 is amended to reflect an increased seismic hazard factor for the *Canterbury earthquake region*.
2. The seismic hazard factor Z defined in NZS 1170 Part 5 (Table 3.3) has been raised for the *Canterbury earthquake region.* This is reflected in the following amendments to B1/VM1.

2.2.14A NZS 1170 Part 5, Clause 3.1.4
Add (to the end of Clause 3.1.4):

"The minimum hazard factor Z (defined in Table 3.3) for the *Canterbury earthquake region* shall be 0.3. Where factors within this region are greater than 0.3 as provided by NZS 1170 Part 5, then the higher value shall apply.

Amend 15
Jan 2017

2.2.14B NZS 1170 Part 5, Table 3.3

Delete row:	102	Christchurch	0.22	-
Replace with:	102	Christchurch	0.3	-
Delete row:	101	Akaroa	0.16	-
Replace with:	101	Akaroa	0.3	-

Amend 15
Jan 2017

Amend 11
Aug 2011

2.2.14D NZS 1170 Part 5, Figure 3.4
Figure 3.4 Hazard factor Z for the South Island is amended as per Paragraph 2.2.14A above.

Amend 10
May 2011

2.2.15 NZS 1170 Part 5, Clause 4.2 Seismic weight and seismic mass After: "0.3 is the earthquake imposed action (live load) combination factor for all other applications" add the following:

"except roofs.

ψ_E = 0.0 is the earthquake imposed action (live load) combination factor for roofs."

2.2.16 NZS 1170 Part 5, Sections 5 and 6 Time history analysis Time history analysis is not part of this *Verification Method.*

COMMENT:

Time history analysis is a highly specialised method of assessing structural response to earthquakes. It requires many detailed and interdependent assumptions to be made in relation to the nature of earthquake shaking and its propagation from the source, the properties of the *building* site and the detailed characteristics of the *building* and its structural elements.

AS/NZS 1170 outlines the steps for time history analysis in some detail, but the applicability of each step needs to be evaluated on a *building*-by-*building* basis. More importantly, the output of the analysis needs to be examined carefully in each particular context.

Time history analysis can be an acceptable aid to verifying compliance with structural requirements provided that:

- It is carried out by specialists with in-depth experience in applying the technique.
- The output of the analysis and the viability of the resulting structural design are reviewed by an independent team experienced in both analysis and design.

2.2.17 NZS 1170 Part 5, Clause 5.2.2.3, equation 5.2(4) Delete equation 5.2(4) and replace with:

$$C_d(T) = \frac{C\,(T)\,S_p}{k_\mu} \qquad \textbf{… 5.2(4)}$$

2.2.18 NZS 1170 Part 5, Clause 6.1.4.1 Requirement for modelling Delete the last sentence of the first paragraph and replace with:

"The model shall include representation of the diaphragm's flexibility."

Amend 8 Dec 2008

Delete the third (last) paragraph.

Amend 9 Sep 2010

3.0 Concrete

3.1 NZS 3101: Part 1 subject to the following modifications:

3.1.0 Referenced Documents
Replace reference to AS/NZS 4671: 2001, in NZS 3101: Part 1 with the 2019 version that is referenced in this Verification Method. Amend 20 Nov 2021

3.1.1 Clause 18.7.4.4 Detailing requirements for support of hollow core floors Amends 9, 14, 15, 16, Err 1

At the end of Clause 18.7.4.4 (b) add an additional sentence:

"The details given by C18.6.7(e) may be applied to hollow-core units where the depth of the precast unit is equal to or less than 400 mm." Amend 18 Jun 2019

COMMENT:
Welded wire fabric that is used in designs to NZS 3101 is subject to the requirements of Paragraph 14.0 Ductile Steel Mesh of this Verification Method. Amend 16 Apr 2018

3.2 NZS 3106 Amend 9 Sep 2010

4.0 Concrete Masonry

4.1 NZS 4230 subject to the following modification: Amend 8 Dec 2008

4.1.0 Referenced Documents
Replace reference to AS/NZS 4671: 2001, in NZS 4230 with the 2019 version that is referenced in this Verification Method. Amend 20 Nov 2021

5.0 Steel

5.1 NZS 3404: Part 1 subject to the following modifications: Amends 8 and 9

5.1.1 Clause 2.2.1 Specification
In Clause 2.2.1 a) replace:

"AS 1163 Cold-formed structural steel hollow sections AS 1594 Hot-rolled steel flat products", Amend 19 Nov 2019

with

"AS/NZS 1163 Cold-formed structural steel hollow sections

AS/NZS 1594 Hot-rolled steel flat products"

5.1.2 Clause 2.3.1 Steel bolts, nuts and washers
In Clause 2.3.1 add the following to the end of the Clause:

Amend 16 Apr 2018

"BS EN 14399-3 High-strength structural bolting assemblies for preloading, System

HR. Hexagon bolt and nut assemblies

BS EN 14399-5: High-strength structural bolting assemblies for preloading, Plain washers"

5.1.3 new Clause 3.10 Documentation
Insert the following after clause 3.9:

"Clause 3.10 Documentation

The requirements in AS/NZS 5131 Section 4.1.1 General shall be applied."

5.1.4 Clause 9.3.1 Bolts and bolting category
In Clause 9.3.1.2 replace:

"and AS 1559"

with

Amend 16 Apr 2018

", AS 1559, BS EN 14399.1, BS EN 14399.2, BS EN 14399.3 and BS EN 14399.5".

5.1.4A Section 13 Design of composite members and structures
Replace Section 13 Design of composite members and structures with the following:

Amend 17 Nov 2018

"13 Design of composite members and structures shall be in accordance with AS/NZS 2327."

5.1.5 Section 14 Fabrication
Replace Section 14 Fabrication with the following:

"14 Fabrication

The fabrication of steel structures shall be in accordance with AS/NZS 5131.

Construction categories for the purposes of this Standard shall be determined in accordance with Appendix C of AS/NZS 5131."

5.1.6 Section 15 Erection
Replace Section 15 Erection with the following:

"15 Erection

The erection of steel structures shall be in accordance with AS/NZS 5131.

Construction categories for the purposes of this standard shall be determined in accordance with Appendix C of AS/NZS 5131."

5.1.7 Section 16 Modification of Existing Structures
Replace Section 16 Modification of existing structures with the following:

Amend 16 Apr 2018

"16 Site modifications during erection and modification and repair of existing structures

Site modifications during erection and modification and repair of existing structures shall be in accordance with AS/NZS 5131 Section 14 Site modifications during erection and modification and repair of existing structures."

5.1.8 new Section 18 Architecturally Exposed Structural Steelwork

Insert the following after Section 17:

"18 Architecturally exposed structural steelwork

The requirements in AS/NZS 5131 Section 10 Architecturally exposed structural steelwork shall be applied."

5.1.9 Appendix A
Replace references to AS/NZS 3678, AS/NZS 3769.1 and AS/NZS 3679.2 in NZS 3404 with the 2016 versions that are referenced in this Verification Method

Amend 16 Apr 2018

5.1.9A Appendix C
Replace Appendix C Corrosion Protection with the following:

"Appendix C Corrosion Protection

Corrosion protection shall be in accordance with SNZ TS 3404."

Amend 17 Nov 2018

5.1.10 Appendix D
Replace Appendix D Inspection of Welding to AS/NZS 1554.1 with the following:

"Appendix D Inspection of Welding

The recommendations in AS/NZS 5131 Appendix I Inspection of Welding and Bolting. (Informative) should be used."

5.1.11 Appendix K
Replace Appendix K Standard test for evaluation of slip factor (normative) with the following:

"Appendix K Standard test for evaluation of slip factor (normative)

The requirements in AS/NZS 5131 Appendix G Standard test for evaluation of slip factor shall be used."

5.1.12 Appendix L
Replace Appendix L Inspection of bolt tension using a torque wrench (informative) with the following"

Amend 16 Apr 2018

"Appendix L Inspection of bolt tension using a torque wrench (informative)

The recommendations in AS/NZS 5131 Appendix H Inspection of bolt tension using a torque wrench should be used."

5.1.13 new Appendix R

Insert the following after Appendix Q:

"Appendix R Selection of materials for the avoidance of lamellar tearing (informative)

The guidance in AS/NZS 1554.1 Appendix H Selection of materials for the avoidance of lamellar tearing should be used."

Amend 16 Apr 2018

5.2 AS/NZS 4600 subject to the following modifications:

a) Actions must be determined in accordance with AS/NZS 1170. All references to NZS 4203 are replaced by equivalent references to AS/NZS 1170.

Amends 8 and 11

b) The term "normative" identifies a mandatory requirement for compliance with this Standard.

c) The term "informative" identifies information provided for guidance or background which may be of interest to the Standard's users. Informative provisions do not form part of the mandatory requirements of the Standard.

d) Where this Standard has provisions that are in non-specific or unquantified terms then these do not form part of the *Verification Method* and the proposed details must be submitted to the *territorial authority* for approval as part of the *building consent* application. This includes, but is not limited to, special studies and manufacturer's advice.

e) All stages of *construction* of a structure or part of a structure to which this Standard is applied shall be adequately reviewed by a person who, on the basis of experience or qualifications, is competent to undertake the review.

f) The extent of the review to be undertaken shall be nominated by the design engineer, taking into account those materials and workmanship factors which are likely to influence the ability of the finished construction to perform in the predicted manner.

g) At the end of the first paragraph of Appendix A add the words "Unless noted otherwise a document referred to below shall be the version of that document current at the date of issue of this Standard or if amendments are cited to this Standard in the "References" pages of this document at the latest date of those amendments."

Amend 12 Feb 2014

h) Appendix B shall be read as normative with "shoulds" changed to "shalls".

Amends 11 and 18

6.0 Timber

6.1 NZS 3603 subject to the following modifications:

Amend 11 Aug 2011

a) Actions must be determined in accordance with AS/NZS 1170. All references to NZS 4203 are replaced by equivalent references to AS/NZS 1170.

Amend 11 Aug 2011

b) Delete Clause 2.2.1.2 and replace with:

"Machine stress-grading shall be in accordance with AS/NZS 1748 as modified by NZS 3622. Machine stress-graded timber shall have its properties verified, and be identified, in accordance with the requirements of NZS 3622."

Amend 7 Apr 2007

Amend 8 Dec 2008

7.0 Aluminium

7.1 AS/NZS 1664.1 subject to the following modifications:

Amend 11 Aug 2011

a) Actions must be determined in accordance with AS/NZS 1170. All references to NZS 4203 are replaced by equivalent references to AS/NZS 1170.

Amend 8 Dec 2008

b) The terms "capacity factor" and "strength limit state" are to be read as "*strength reduction factor*" and "ultimate limit state" respectively.

c) Where this Standard has provisions that are in non-specific or unquantified terms then these do not form part of the *Verification Method* and the proposed details must be submitted to the *territorial authority* for approval as part of the *building consent* application. This includes, but is not limited to, special studies and manufacturer's advice.

d) All stages of *construction* of a structure or part of a structure to which this Standard is applied shall be adequately reviewed by a person who, on the basis of experience or qualifications, is competent to undertake the review.

Amend 8 Dec 2008

e) The extent of the review to be undertaken shall be nominated by the design engineer, taking into account those materials and workmanship factors which are likely to influence the ability of the finished *construction* to perform in the predicted manner.

Amend 8 Dec 2008

f) Clause 1.2 to read "**MATERIALS** This Standard applies to aluminium alloys listed in Table 3.3(A) that comply with AS 1734, AS 1865, AS 1866, AS 1867 and AS 2748.1."

Amend 8 Dec 2008

g) At the end of the first paragraph of Clause 1.4 add the words "Unless noted otherwise a document referred to below shall be the version of that document current at the date of issue of this Standard or if amendments are cited to this Standard in the "References" pages of the Acceptable Solutions and Verification Methods at the latest date of those amendments."

Amend 12 Feb 2014

8.0 Earth Buildings

8.1 NZS 4297 subject to the following modifications:

Actions must be determined in accordance with AS/NZS 1170. All references to NZS 4203 are replaced by equivalent references to AS/NZS 1170.

Amend 11 Aug 2011

9.0 Foundations

See B1/VM4.

Amend 12 Feb 2014

10.0 Siteworks

10.1 NZS 4431

11.0 Drains

11.1 AS/NZS 3725 subject to the following modifications:

Amend 20 Nov 2021

Clause 3 Add to the list of reference documents:

"NZS 3101 The design of concrete structures.

NZS 4402 Methods of testing soils for civil engineering purposes: Tests 2.4, 2.8, 4.1.1, 4.2.1, 4.2.2, 4.2.3 and 5.1.1.

New Zealand Geotechnical Society, Field Description of Soil and Rock – Guidelines for the field description of soils and rocks in engineering purposes.

Clause 4 In the paragraph headed "(c) Select fill", after the words "given in Table 1" add "or the New Zealand Geotechnical Society Guidelines.

Clause 5 In definition of Pt, replace "AS 4058" with "AS/NZS 4058"

Clause 6.4 Replace the word "may" with "shall". Delete the words "Superimposed concentrated dead loads should be avoided."

Clause 6.5.3.1 Delete the words "The appropriate road vehicle loading shall be specified by the relevant highway authority or owner".

Clause 6.5.3.2.2.2 Replace the word "may" with "shall".

Clause 6.5.4.3 Delete the words "unless otherwise specified by the Relevant Authority".

Clause 6.5.5 Delete the first words "For" and after the words "for aircraft types" add the words "is outside the scope of this Standard but..."

Clause 7 Replace the word "should" with "shall".

Clause 10.3 After the words "the test load" add "or proof load".

Appendix A Delete "Normative" and replace with "Informative"

Appendix B Delete "Normative" and replace with "Informative"

Amend 9 Sep 2010

12.0 Windows

12.1 NZS 4211 subject to the following modification:

Amend 12 Feb 2014

References to air leakage, water leakage and operational effectiveness of opening sashes in NZS 4211, are non-structural considerations and do not apply to this document.

Amend 18 Jun 2019

Amend 19 Nov 2019
Amend 11 Aug 2011

13.0 Seismic Performance of Engineering Systems in Buildings

Amend 11 Aug 2011

13.1 NZS 4219 subject to the following modifications in the *Canterbury earthquake region:*

The zone factor Z shall be determined from the Standard but shall not be less than 0.3.

14.0 Ductile Steel Mesh

14.1 Grade 500E welded steel mesh

Amend 20 Nov 2021
Amend 14 Nov 2016

Where Grade 500E welded steel mesh is specified, it shall meet the requirements of AS/NZS 4671.

Acceptable Solution B1/AS1 General

Amend 12 Feb 2014

1.0 Explanatory Note

1.1 B1/AS1 contains Acceptable Solutions for Masonry (Paragraph 2.0), Timber (Paragraph 3.0), Earth Buildings (Paragraph 4.0), Stucco (Paragraph 5.0), Drains (Paragraph 6.0), Glazing (Paragraph 7.0) and Steel (Paragraph 9.0).

Amend 18 Jun 2019

Amend 19 Nov 2019
Amend 11 Aug 2011

1.2 B1/AS3 is an Acceptable Solution for small *chimneys* (referred to in Paragraph 8.0).

1.3 Modifications to the Standards, necessary for compliance with the New Zealand Building Code, are given against the relevant clause number of each Standard.

1.4 Consequential changes due to 2010/11 Canterbury earthquakes

Amend 11 Aug 2011

COMMENT:
Raising the seismic hazard factor Z in NZS 1170 Part 5 (Table 3.3) for the *Canterbury earthquake region* through amendments to B1/VM1 requires consequential amendments to NZS 4229, NZS 3604 and NZS 4299 referenced in B1/AS1.

2.0 Masonry

2.1 NZS 4229 subject to the following modifications:

2.1.0 Referenced Documents

Amend 20 Nov 2021

Replace reference to AS/NZS 4671: 2001, in NZS 4229 with the 2019 version that is referenced in the Verification Method B1/VM1.

2.1.1 NZS 4229 Clause 7.8.3

Delete clause 7.8.3.

Replace with:

"All slab-on-ground reinforcing shall extend to within 75 mm of the outside edge of the slab (including the foundation wall) and shall consist of a minimum 2.27kg/m^2 welded Grade 500E reinforcing mesh sheets (1.14 kg/m^2 in each direction), which shall be lapped at sheet joints such that the overlap measurement between the outermost cross wires of each fabric sheet is equal to the greater of one of the following:

Amend 12 Feb 2014

- the spacing of cross wires plus 50 mm;

- 150 mm; or

- the manufacturer's requirements.

Slabs shall have a maximum dimension of 18 m between free joints."

Amend 11 Aug 2011
Amend 12 Feb 2014

2.1.2 NZS 4229 Foundations where good ground has not been established.

Amend 20 Nov 2021

Amend 19 Nov 2019

COMMENT:
Foundations for houses built on ground that has the potential for liquefaction or lateral spread are outside the scope of B1/AS1.

The MBIE/MfE guidance document "Planning and engineering guidance for potentially liquefaction-prone land"outlines a risk-based process to identify and manage liquefaction-related risk in land use planning and development decision-making.

For houses built in areas that have the potential for liquefaction, the MBIE guidance document "Repairing and rebuilding houses affected by the Canterbury earthquakes" may be appropriate. This guidance provides a range of potential foundation solutions depending on expected ground movement and available bearing capacity. These parameters also determine the required degree of involvement of structural and geotechnical engineers and the extent of specific engineering design.

Amend 19 Nov 2019

2.1.3 NZS 4229 Grade 500E welded steel mesh

Amends 11 and 12

Where Grade 500E welded steel mesh is specified, it shall meet the requirements of Paragraph 14.0 in B1/VM1.

Amend 14 Nov 2016

3.0 Timber

Amend 12 Feb 2014

3.1 NZS 3604 subject to the following modifications:

Amend 20 Nov 2021

3.1.0 Referenced Documents
Replace reference to AS/NZS 4671: 2001, in NZS 3604 with the 2019 version that is referenced in the Verification Method B1/VM1.

3.1.1 NZS 3604 Paragraph 1.3 Definitions
Add (in the definition for Good Ground): "liquefaction, lateral spread," after "subsidence" in subparagraph (c).

Amend 19 Nov 2019

Amend 11 Aug 2011

3.1.2 NZS 3604 Section 5 Bracing Design

Amend 10 May 2011

Make the following amendments:

Amend Figure 5.4, Earthquake zones, so that all the area within the Christchurch City Council boundary is within Zone 2.

Amend Figure 5.4 Earthquake zones, so that the lowest zone within the Selwyn or Waimakariri District Council boundaries is within Zone 2. Areas within Selwyn District that are designated as Zone 1 in NZS 3604 shall become Zone 2.

3.1.2A NZS 3604 Clause 7.4.1.3

Amend 11 Aug 2011

Delete Subclause 7.4.1.3 (c).

Amend 15 Jan 2017

3.1.2B NZS 3604 Figure 7.10(b)

On the plan view replace the text "2/M12 x 250 mm coach screws at 140 crs" with "2/M12 x 240 mm coach screws at 140 crs vertically."

On the plan view replace "2/M12 at 400 crs" twice with "2 M12 bolts at 140crs vertically to capture end joist laminations and blocking, and boundary joist laminations and blocking, at post centrelines."

Add to Note 3: "All coach screws to have 50 x 50 washers."

3.1.2C NZS 3604 Figure 7.10(c)

On the plan view insert the text "At each strap location (at joist ends and nogging), 2/M12 x 240 mm long coach screws are required."

On the plan view, replace the text " 2/M12 x 250 mm coach screws at 140 crs vertically" with " 2/M12 x 200mm coach screws at 140 crs vertically."

On the section view, replace the text "M12 x 200 mm coach screws at 400 crs vertically" with M12 x 240 mm coach screws at 140 crs vertically.

Delete "2/M12 bolts at 400crs" which tie laminations together along edge joists and along boundary joists.

Amend 15 Jan 2017

3.1.3 NZS 3604 Clause 7.5.2.3
Delete: Clause 7.5.2.3

Replace with: "Clause 7.5.2.3 The combined foundation and edge details shall be constructed as shown in Figures 7.13(B), 7.14(B) or (C) (and Figures 7.15(B) and 7.16(B) or (C) for foundations supporting a masonry veneer)."

3.1.4 NZS 3604 Figure 7.13
Delete: Figure 7.13(A) – Foundation edge details – In situ concrete – Dimensions & reinforcing for single storey.

Amend 11 Aug 2011

Amend title of Figure 7.13(B) to "Dimensions & reinforcing for 1 or 2 storeys".

Amend 11 Aug 2011

3.1.5 NZS 3604 Figure 7.14
Delete: Figure 7.14(A) – Foundation edge details – Concrete masonry – Single storey

Amend title of Figure 7.14(B) to "1 or 2 storeys", and add a note: "for a single storey foundation, 15 Series masonry may be used and the minimum footing width may be 190 mm".

Amend 11 Aug 2011

COMMENT:
Unreinforced and untied slab to footing single storey option removed.

3.1.6 NZS 3604 Figure 7.15

Delete: Figure 7.15(A) – Masonry veneer foundation edge details – Dimensions and reinforcement for single storeys.

Amend 11 Aug 2011

Amend 10 May 2011

COMMENT:
Unreinforced and untied slab to footing single storey options removed.

3.1.7 NZS 3604 Figure 7.16
Delete: Figure 7.16 (A) – Masonry veneer foundation edge details – Concrete masonry – Single storey.

COMMENT:
Unreinforced and untied slab to footing single storey option removed.

3.1.8 NZS 3604 Clause 7.5.8.1
Delete: Clause 7.5.8.1

Replace with: "Clause 7.5.8.1 All slab-on-ground floors shall be reinforced concrete in accordance with Clauses 7.5.8.3, 7.5.8.4 and 7.5.8.6.4. All reinforcing steel, including welded mesh, shall be Ductility Class E in accordance with AS/NZS 4671."

Where Grade 500E welded steel mesh is specified, it shall meet the requirements of Paragraph 14.0 in B1/VM1.

3.1.9 NZS 3604 Clause 7.5.8.3
Delete: Clause 7.5.8.3

Replace with: "Clause 7.5.8.3 All slab-on-ground reinforcing shall extend to within 75 mm of the outside edge of the slab (including the foundation wall) and shall consist of a minimum 2.27 kg/m^2 welded reinforcing mesh sheets (1.14 kg/m^2 in each direction), which shall be lapped at sheet joints such that the overlap measurement between the outmost cross wires of each fabric sheet is equal to the greater of one of the following:

- the spacing of cross wires plus 50 mm,
- 150 mm or
- the manufacturer's requirements.

Slabs shall have a maximum dimension of 24 m between free joints."

3.1.10 NZS 3604 Clause 7.5.8.6.2
Delete: Clause 7.5.8.6.2

3.1.11 NZS 3604 Figure 7.18
Delete title: Figure 7.18 – Irregular slab (plan view) (see 7.5.8.6.2)

Replace with: "Figure 7.18 – Irregular slab (plan view) (see 7.5.8.6.4)".

3.1.12 NZS 3604 Clause 7.5.8.6.3
Delete: Clause 7.5.8.6.3.

3.1.13 NZS 3604 New Clause
Add new: "Clause 7.5.8.8 Free Joints.

At free joints, slab reinforcement shall be terminated and there shall be no bonding between vertical concrete faces (prevented by using building paper or a bituminous coating). R12 dowel bars 600 mm long shall be placed at 300 mm centres along the free joint and lapped 300 mm with slab reinforcement on both sides of the joint. All dowel bars on one side of the joint shall have a bond breaker applied, e.g. by wrapping dowel bars for 300 mm with petrolatum tape. Joint dowel bars must be installed in a single plane, in true alignment and parallel."

3.1.14 NZS 3604 Foundations where good ground has not been established

COMMENT:
Foundations for houses built on ground that has the potential for liquefaction or lateral spread are outside the scope of B1/AS1.

The MBIE/MfE guidance document "Planning and engineering guidance for potentially liquefaction-prone land"outlines a risk-based process to identify and manage liquefaction-related risk in land use planning and development decision-making.

For houses built in areas that have the potential for liquefaction, the MBIE guidance document "Repairing and rebuilding houses affected by the Canterbury earthquakes" may be appropriate. This guidance provides a range of potential foundation solutions depending on expected ground movement and available bearing capacity. These parameters also determine the required degree of involvement of structural and geotechnical engineers and the extent of specific engineering design.

3.2 Slab-on-ground in expansive soils

3.2.1 NZS 3604 Clause 1.1.2 Buildings covered by this Standard

Amend 1.1.2(a) to read:

"Buildings founded on good ground or on expansive soils where the requirements of 1.1.5 are met"

3.2.2 NZS 3604 New Clause

Add new: "**Clause 1.1.5 Buildings on expansive soils**

Buildings on expansive soils shall be supported on slab-on-ground foundations complying with 7.5.13 and in addition to 1.1.2 shall be limited as follows:

(a) single storey, stand-alone household unit, and

(b) maximum length or width of floor of 24.0 m including any attached garage, and

(c) simple plan shapes such as rectangular, L, T or boomerang, and

(d) concrete slab-on-ground with a minimum thickness of 100 mm and a minimum concrete compressive strength of 20 MPa, and

(e) simple roof forms, incorporating hips, valleys, gables or mono pitches, and

(f) maximum overall height of 7.0 m to roof apex from lowest cleared ground level, and

(g) maximum roof height of 3.0 m, and

(h) roof slope between 10° and 35° from the horizontal, and

(i) maximum span of roof truss 12.0 m, and

(j) external walls maximum of 2.4 m height studs, other than gable end walls and walls to mono-pitched roofs, which shall not exceed 4.0 m.

COMMENT:

Floor plans

Where floor plans incorporate re-entrant corners then continuity of the exterior ground beam shall be maintained by continuing it as an internal beam, with the exterior beam details continued for a length of at least 1.0 m into the internal beam. This is only applicable where internal beams are specified in Tables 7.4A and 7.4B. This is aimed to bring the solution in NZS 3604 in line with Clause 5.3.8 of AS 2870:2011.

Amend 19
Nov 2019

Ground movement

Provision for the additional ground movement effects from trees near to foundations in expansive soils should be considered. Trees remove moisture from the soil for a radius equal to the height of the tree. This causes expansive soils to shrink to varying degrees, and when near houses leads to differential settlement occurring under foundations. Movement of the foundations may lead to cracks in the building and door jamming.

Where existing trees (including trees that have been recently removed) are located closer to the foundations than 1.5 times the mature height of a tree, then additional geotechnical advice should be obtained. Planting of new trees should be avoided near foundations of new buildings or neighbouring buildings on sites with expansive soils.

3.2.3 NZS 3604 Clause 7.5.1

Add the following paragraph at the end of Clause 7.5.1:

"Slabs on expansive soils for buildings meeting the requirements of 1.1.5 shall, in addition to meeting the requirements of 7.5.1 to 7.5.12, meet the requirements of 7.5.13. Where there is conflict the requirements of 7.5.13 shall apply."

3.2.4 NZS 3604 New clause, tables and figures

Add new: **Clause 7.5.13 Slab-on-ground in expansive soils**

7.5.13.1 Identification of expansive soils

7.5.13.1.1 Should reasonable enquiry as outlined in 3.1.3 show any signs of expansive soils, the expansive soil class, as defined in AS 2870, shall be established by one or all of:

(a) enquiry to the local territorial authority, and/or

(b) reference to the certificate of suitability issued in terms of NZS 4431, and/or

(c) a soil test undertaken by a suitably qualified soils engineer.

7.5.13.1.2 Expansive soil class shall be defined as:

(a) Slightly 'S', having an I_{SS} range of 0–1.9%, and a 500 year design characteristic surface movement return (y_S) of 22 mm, or

(b) Moderately 'M', having an I_{SS} range of 2.0–3.7% and a 500 year design characteristic surface movement return (y_S) of 44 mm, or

Amend 19
Nov 2019

(c) Highly 'H', having an I_{SS} range of 3.8–6.5% and a 500 year design characteristic surface movement return (y_S) of 78 mm, or

(d) Extremely 'E', having an I_{SS} range of 6.6–7.5% and a 500 year design characteristic surface movement return (y_S) of 90 mm.

7.5.13.2 Maximum aspect ratio of concrete slabs

The aspect ratio of the concrete slabs or bays of concrete slabs, such as in the case of L, T or boomerang concrete slab shapes, shall not exceed 5 to 1 (length to width).

7.5.13.3 Foundation details

7.5.13.3.1 For the identified expansive soil class the foundation details, external and internal thickenings shall be as follows.

(a) For light wall claddings refer to Table 7.4A and Figure 7.22.

(b) For medium wall or heavy wall claddings refer to Table 7.4B and Figure 7.23.

7.5.13.3.2 Situations where no internal thickenings shall be required are limited to a rectangular slab with long side not exceeding 17.0 m. Where this limit is exceeded, add additional internal thickenings across the slab with the same cross section dimensions and reinforcing as the external footing, so that the centre to centre spacing of thickenings is always less than 17.0 m.

COMMENT:

Design constraints:

a) The characteristic surface movements and the corresponding expansivity classifications have been calculated based on design for ultimate limit state (ULS) conditions for a 1 in 1000 year "extreme" drought event, and the serviceability limit state (SLS) conditions for a 1 in 500 year drought event.

b) Maximum soil movements are calculated to be based on a 500 year return period for SLS, and a 1000 year return period for ULS*;

(*NB: *This differed from the recommendations contained within BRANZ Study Report 120A (BSR120A) which used a 300 year return period for the design level drought conditions)*

Amend 19 Nov 2019

c) Climate parameters adopted from BSR120A of Δu = 1.2 pF, Hs = 1.5 m, and a crack depth of 0.5 Hs

d) The I_{SS} (shrink swell index) ranges attributed to the expansivity classifications as defined in 3.2.4 above have been calculated using the parameters presented in BSR120A and Equation 2.3.1 of AS 2870:2011. Amend 20 Nov 2021

e) Sites subject to parameters that differ from those mentioned above, in particular sites where the crack depth is less than 0.75 m, such as cut natural ground or clay backfill, require specific engineering assessment to confirm their appropriate site classification.

f) The effects of nearby trees (whether existing, recently removed, or future planting) are not considered in these solutions. It is recommended that specific geotechnical engineering advice is obtained where a tree is within a lateral distance of 1.5 times its mature height of the foundations.

Maintenance of foundations in expansive soils

Normal maintenance is that work generally recognised as necessary to achieve the expected performance over time of the foundation located on expansive soils. Unless otherwise specified by the designer and noted on the drawings, basic normal maintenance tasks should ensure that:

a) the drainage and wetting of the site is controlled so that extremes of wetting and drying of the soils are prevented, and

b) the position and operation of gardens adjacent to the dwelling are controlled, and the planting of trees near to foundations is suitably restricted, and

c) any leaks which develop in plumbing, storm water or sanitary sewage systems are repaired promptly.

Amend 19 Nov 2019

Table 7.4A **Reinforced concrete foundations in expansive soils for light wall claddings**
Clause 7.5.13 and Figure 7.22

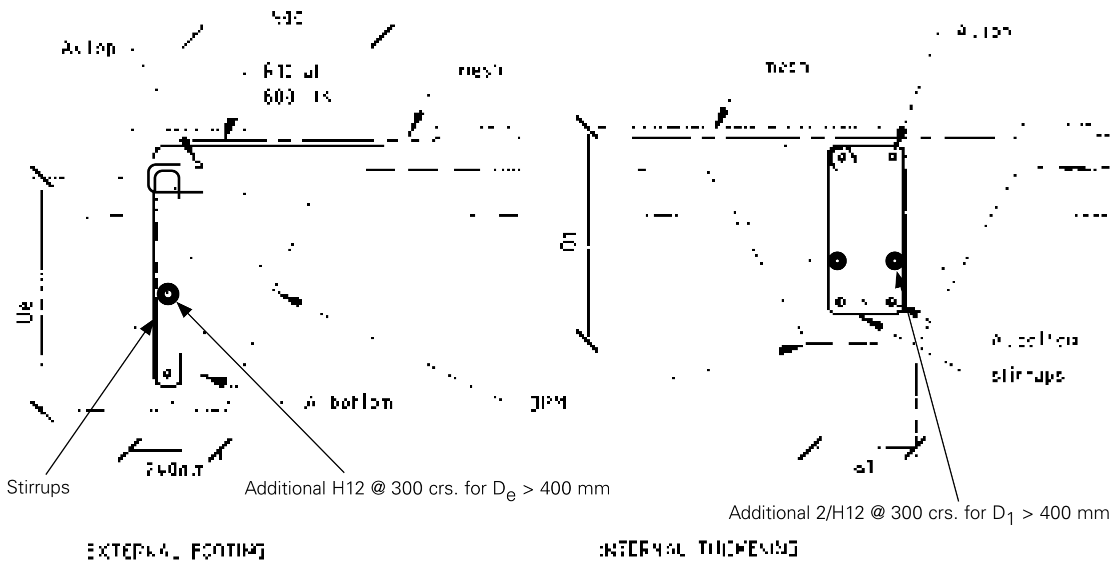
Expansive soil class	Slightly 'S'	Moderately 'M'	Highly 'H'	Extremely 'E'
Soil embedment (De)	375 mm	525 mm	575 mm	625 mm
Top steel (A_S top)	2/D 16	2/ D16	2/ D16	2/ D16
Bottom steel (A_S bottom)	1/ D16	1/ D25	1/ D20	1/ D25
Stirrups	R6/ 125 crs.	R6/ 125 crs.	R6/ 300 crs.	R6/ 300 crs.
Maximum spacing of internal thickenings	no internal thickening	no internal thickening	2.5 m crs.	2.5 m crs.
Depth of thickening (D1)	–	–	400 mm	450 mm
Base width (B1)	–	–	300 mm	350 mm
Top steel (A_S top)	–	–	2/ D20	2/ D20
Bottom steel (A_S bottom)	–	–	2/ D16	2/ D20
Stirrups	–	–	R6/ 150 crs.	R6/ 150 crs.

Table 7.4B **Reinforced concrete foundations in expansive soils for medium wall and heavy wall claddings**
Clause 7.5.13 and Figure 7.23

Expansive soil class	Slightly 'S'	Moderately 'M'	Highly 'H'	Extremely 'E'
Soil embedment (De)	500 mm	550 mm	775 mm	800 mm
Top steel (A_S top)	2/ D16	2/ D20	2/ D20	3/ D20
Bottom steel (A_S bottom)	2/ D16	2/ D16	2/ D20	2/ D20
Stirrups	R6/ 125 crs.	R6/ 250 crs.	R6/ 300 crs.	R6/ 300 crs.
Maximum spacing of internal thickenings	–	2.5 m crs.	2.5 m crs.	2.5 m crs.
Depth of thickening (D1)	–	350 mm	450 mm	500 mm
Base width (B1)	–	300 mm	300 mm	350 mm
Top steel (A_S top)	–	2/ D16	3/ D20	3/ D20
Bottom steel (A_S bottom)	–	2/ D16	2/ D16	2/ D20
Stirrups	–	R6/ 125 crs.	R6/ 150 crs.	R6/ 150 crs.

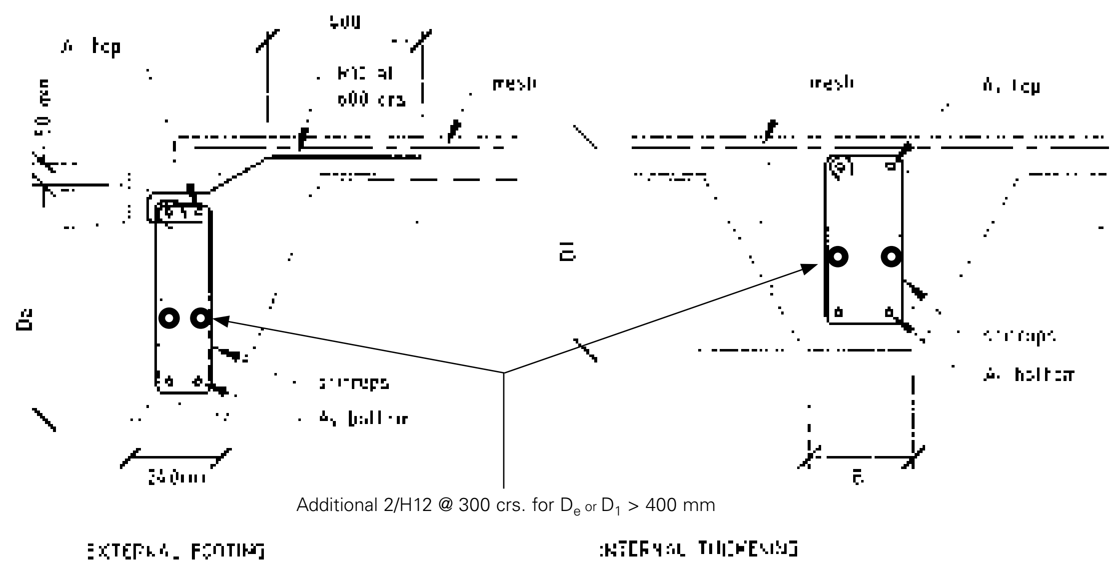
Amend 19
Nov 2019

Figure 7.2.2 **Reinforced concrete foundations in expansive soils for light wall claddings**
Clause 7.5.13 and Table 7.4A



Note: It would be considered good practice to construct corner junctions with the longitudinal reinforcing lapping around the corners and to construct internal beams with longitudinal bars at standard 90° hooked into the perimeter beams to provide adequate anchorage

Figure 7.2.3 **Reinforced concrete foundations in expansive soils for medium wall and heavy wall claddings**
Clause 7.5.13 and Table 7.4B



Note: It would be considered good practice to construct corner junctions with the longitudinal reinforcing lapping around the corners and to construct internal beams with longitudinal bars at standard 90° hooked into the perimeter beams to provide adequate anchorage

Amend 11 Aug 2011

4.0 Earth Buildings

4.1 NZS 4299 subject to the following modifications:

Amend 11 Aug 2011

4.1.1 NZS 4299, Paragraph 1.3 Definitions
Add (in the definition for Good Ground): "liquefaction, lateral spread," after "subsidence" in subparagraph (c).

Amend 19 Nov 2019

Amend 11 Aug 2011

4.1.2 NZS 4299, Clause 2.3 Earthquake zones
Add to the end of Clause 2.3:

"The earthquake zone factor > 0.6 shall apply to the *Canterbury earthquake region*."

Amend 11 Aug 2011

4.1.3 NZS 4299, Figure 2.1 Earthquake zones
On the map shown in NZS 4299 Figure 2.1 Earthquake zones, the *Canterbury earthquake region* shall be interpreted as having an earthquake zone factor of > 0.6.

Amend 11 Aug 2011

4.1.4 NZS 4299, Clause 4.8.6.
Delete: Clause 4.8.6

Replace with: "Clause 4.8.6 The thickness and reinforcement and detail of concrete slabs shall comply with the requirements of NZS 3604 as modified in B1/AS1 Paragraph 3.1."

Amend 10 May 2011

Amend 19 Nov 2019

Amend 11 Aug 2011

4.1.5 NZS 4299 Foundations where good ground has not been established

Amend 12 Feb 2014

COMMENT:
Foundations for houses built on ground that has the potential for liquefaction or lateral spread are outside the scope of B1/AS1.

The MBIE/MfE guidance document "Planning and engineering guidance for potentially liquefaction-prone land" outlines a risk-based process to identify and manage liquefaction-related risk in land use planning and development decision-making.

For houses built in areas that have the potential for liquefaction, the MBIE guidance document "Repairing and rebuilding houses affected by the Canterbury earthquakes" may be appropriate. This guidance provides a range of potential foundation solutions depending on expected ground movement and available bearing capacity. These parameters also determine the required degree of involvement of structural and geotechnical engineers and the extent of specific engineering design.

Amend 19 Nov 2019

5.0 Stucco

5.1 NZS 4251

Amend 10 May 2011

6.0 Drains

6.1 AS/NZS 2566.1, including Amendment 1

6.2 AS/NZS 2566.2, including Amendments 1, 2 and 3

6.3 AS/NZS 2032

6.4 AS/NZS 2033

Amend 9
Sep 2010

Amend 9
Sep 2010

Amends 9, 11, 15

7.0 Glazing

7.1 NZS 4223.1

7.2 NZS 4223.2

7.3 NZS 4223.3

7.3.1 Clause 22.4.3 modified

Delete clause 22.4.3

Replace with:

"22.4.3 Structural glass barriers

Structural glass barriers use glass as a structural element and are normally classified by the following types. Glass design for these types shall comply with the following tables (see note 1):

Table 14 - Structural balustrade – cantilevered glass;

Table 15 - Structural balustrade – two-edge point fixed;

Table 16 - Structural balustrade – two-edge support;

Table 17 - Structural balustrade – three-edge support.

Design types and glass types not shown in Tables 14 to 17 require specific design.

All structural glass barriers safeguarding a fall of 1000 mm or more shall have interlinking rails, which in the event a glass pane breaks, spans the broken pane at the required barrier height and,

i) resists Line and Concentrated design loads (SLS) specified in Tables 14 to 17, and

ii) does not deflect more than 100 mm, in any direction, under the design loads.

Interlinking rails are not required for a heat-strengthened or toughened laminated safety glass barrier that:

(a) has a top capping, corner brackets or a proprietary system and will, when both panes of the laminate are fractured, resist a 0.2 kN concentrated load and not deflect more than 250 mm (see note 2), or

(b) has two or three edges supported by structural sealant joints or continuous clamps, and will, when both panes of the laminate are fractured, resist a 0.2 kN concentrated load and not deflect more than 250 mm (see note 2), or

(c) has a stiff interlayer and will, when both panes of the laminate are fractured, resist a 0.2 kN concentrated load and not deflect more than 250 mm (see note 2). Physical testing must be undertaken to demonstrate compliance with the load and deflection requirements for laminated glass barriers with a stiff interlayer (see note 3).

Physical testing of glass barriers must include all components of the barrier system, including all structural connections. Loads and deflections must be applied and measured horizontally, at midspan, at the required barrier height. The concentrated load shall be applied over an area of 100 mm x 100 mm and for at least one minute.

NOTE –

(1) The design of structural connections, fasteners and mounting hardware, that are part of the glass barrier, is outside the scope of this Standard and must be specifically designed.

(2) Laminated glass is susceptible to minor edge delamination, depending on the interlayer type and laminating process. Normally this will not affect the mechanical properties but can be noticeable on exposed edges.

(3) Test results for dual pane fracture of laminated glass barriers with stiff interlayers are not applicable to barriers that have narrower glass panes than that tested"

Amend 15 Jan 2017

7.4 NZS 4223.4

Amend 13 Jun 2016

8.0 Small Chimneys

Amend 11 Aug 2011

See Acceptable Solution B1/AS3.

Amend 12 Feb 2014

9.0 Steel

9.1 NASH Standard Part 2 Light Steel Framed Buildings

Amend 18 Jun 2019

Verification Method B1/VM2 Timber Barriers

No specific test methods have been adopted for verifying compliance of timber barriers with NZBC Performance B1.

Acceptable Solution B1/AS2 Timber Barriers

No specific Acceptable Solution has been adopted for compliance of timber barriers with NZBC Performance B1. The previous Acceptable Solution for Timber barriers has been removed. It is intended that the Department's Barrier Guide will provide design guidance for several barrier types.

Pages 28–34 deleted by Amendment 11

Amend 11
Aug 2011

Amend 11
Aug 2011

Verification Method B1/VM3 Small Chimneys

No specific test methods have been adopted for verifying compliance of small chimneys with NZBC Performance B1.

Acceptable Solution B1/AS3 Small Chimneys

Scope

This acceptable solution applies to small *chimneys* and to supporting *hearth* slabs for solid fuel burning domestic appliances. It is to be read in conjunction with Acceptable Solution C/AS1 Part 7, which has additional requirements to prevent outbreak of *fire*.

1.0 Chimney Construction

1.1 General

1.1.1 Type

The acceptable solutions described in this document are for *chimneys* built of brickwork, concrete or precast pumice concrete, that are connected to timber frame or masonry *buildings* complying with NZS 3604 or NZS 4229.

1.1.2 Height

The height of any *chimney* measured from the top of the *chimney* foundation slab to the top of the *chimney* stack shall not exceed 9 m. *Chimneys* shall not cantilever more than 2.4 m above the fixing at roof level (refer Paragraph 1.7).

1.1.3 Size

The width (measured along the *building* line) and depth (measured perpendicular to the *building line*) shall not exceed:

a) For the foundation and *chimney base*

– precast pumice concrete	1600 mm wide x 1050 mm deep
– brickwork or concrete	1200 mm wide x 1050 mm deep

b) For a brick *chimney* stack

– single skin (see Figure 2)	500 mm wide x 500 mm deep
– double skin (see Figure 3)	1200 mm wide x 680 mm deep

c) For a concrete or precast pumice concrete *chimney* stack — 1200 mm wide x 700 mm deep

1.1.4 Chimney liners

Where *chimney* liners are used they are to be separated from the *chimney* to ensure free thermal movement. This shall be achieved by coating the liner with a suitable debonding agent or by wrapping it in a *combustible* material no less than 0.25 mm thick.

1.2 Chimney wall thickness

1.2.1 *Chimney* wall thicknesses shall be no less than:

a) Brick

– single skin (see Figure 2)	155 mm
– double skin (see Figure 3)	245 mm

b) Concrete 170 mm

c) Precast pumice concrete 85 mm

These thicknesses apply to the *chimney* stack, *gather* and *chimney base*.

1.3 Foundations

1.3.1 *Chimneys* shall be built on a foundation comprising walls and slab for suspended floors (see Figure 1(a)), or on a thickened slab for floor slabs on ground (see Figure 1(b)).

1.3.2 The *chimney* foundation slab shall be constructed in reinforced concrete, founded on *good ground*, and have:

a) A thickness of no less than 200 mm, and be placed at a depth of no less than 300 mm below surrounding ground level.

b) Reinforcement as shown in Figure 1.

c) D12 starters at 400 mm maximum centres, to match vertical steel locations in the *chimney*. Amends 5 and 15

1.3.3 The *chimney* foundation walls shall be 150 mm thick reinforced concrete, 190 mm thick concrete masonry, or brick *construction* complying with Figures 2 or 3. Vertical and horizontal reinforcing steel shall be as given in Paragraph 1.6.

1.4 Hearths

1.4.1 *Hearth* slabs shall be of concrete no less than 75 mm thick, reinforced with D10 bars located centrally at 225 mm centres each way. See Figure 1.

1.5 Chimney breasts

1.5.1 The widths of openings in *chimney breasts*, and their supporting lintels, shall comply with Table 1.

Table 1: Chimney Breast Openings and Lintels
Paragraph 1.5.1 and Figure 4

Opening width	Lintel reinforcing
Brick	
1.0 m maximum	65 x 10 mm m.s. flat or 80 x 60 x 5 mm m.s. angle
Concrete	
Up to 900 mm	Two D10 rods
900 – 1500 mm	D12 upper rod D16 lower rod
Precast pumice	
1.0 m maximum	Two D10 rods

Note:
Horizontal reinforcing rods to concrete and precast pumice are to be placed one above the other at a spacing of 75 mm, and have R6 ties at 150 mm maximum centres.

1.6 Reinforcing

1.6.1 Reinforcing of foundation walls, *chimney bases* (including the *gathers*) and *chimney* stacks (see Figures 2 to 5 inclusive) shall comprise:

a) D12 bars at 400 mm maximum centres vertically. Laps in bars shall be no less than 300 mm.

b) R6 bars at 200 mm centres horizontally. These will be in the form of closed stirrups in the stack and U bars elsewhere.

c) Double horizontal reinforcing at any change in direction of the vertical steel (e.g. at the *gather*/stack intersection).

1.6.2 Bars which do not extend for the full height of the *chimney* shall be stopped in the *gather*:

a) In reinforced concrete and brick, by continuing these bars through to the far face of the *gather* and terminating with a 200 mm leg.

b) In precast pumice concrete, by anchoring the last 200 mm of the bar in a high strength cementitious grout. (See Figure 5.) Refer Paragraph 1.8.3 g) for grout details.

1.7 Chimney restraint

1.7.1 *Chimneys* which are not constructed integrally with the *building* shall be secured by floor and roof brackets. An acceptable alternative for brick and precast pumice concrete *chimneys* is that they be restrained by a roof tie used in conjunction with closely spaced wall ties. (Refer Paragraphs 1.7.5 to 1.7.16.)

1.7.2 Where a packer (see Figures 2, 3, 6 and 7(b)) is shown between the *chimney* and *building* it shall be:

a) Concrete, brick, steel (angle, channel or Z section), or any insulating material which has a long term operating temperature of no less than 150°C,

b) Secured in place to prevent it dislodging, and

c) Capable of withstanding a compressive force of 10 kN without shortening by more than 1.5 mm.

COMMENT:
C/AS1 Part 7 requires a 50 mm separation between the *chimney* and any *combustible* material. Where the *chimney* fixing described does not prevent the *chimney* moving within this gap, a packer is shown. Amends 5 and 15

1.7.3 Floor and roof brackets

The brackets shall comprise a 50 mm x 4 mm hot dip galvanised steel strap placed around the *chimney*. Each leg of the strap shall be horizontal and shall be bolted to the joists with three M12 bolts at 75 mm centres as shown in Figure 6.

1.7.4 Brackets shall be located so that the distance between the top of the *chimney* foundation slab and the first bracket, and the distance between adjacent brackets does not exceed 3.0 m. Where a *chimney* foundation wall is integral with a *building* foundation wall, then the height to the first bracket may be measured from the top of the *building* foundation wall.

1.7.5 Alternative fixing using roof tie and closely spaced wall ties

This alternative *chimney* fixing shall apply only from the *gather* to roof level. It requires that either the top of the *chimney* foundation slab or a floor bracket complying with Paragraph 1.7.3 be located within a distance of 2.5 m below the first of the closely spaced wall ties. (See Figures 2 and 3.) If the latter applies, the *chimney* below this bracket shall be fixed by floor brackets spaced in accordance with Paragraph 1.7.4.

1.7.6 Brick chimneys

Brick *chimneys* shall be restrained at roof level by a zinc coated 50 x 1.0 mm mild steel 'U' strap used in conjunction with closely spaced wall ties. The strap shall be:

a) Cast into the grout and wrap around the reinforcing steel (see Figures 2 and 3),

b) Placed at no more than 20° from the horizontal,

c) Used in conjunction with a packer (complying with Paragraph 1.7.2) placed at the same level, and

d) Fixed with twelve 30 x 3.15 mm galvanised nails to roof or ceiling framing.

1.7.7 Wall ties (see Figure 7(a)) shall be located in mortar joints at 225 mm maximum centres up each side of the *chimney*, except that pairs of ties shall be used for *chimneys* wider than 600 mm.

1.7.8 Wall ties shall be constructed from either 4 mm diameter galvanised bar or 25 x 1.5 mm zinc coated steel strip capable of withstanding a load of 1.2 kN without elongating or shortening by more than 1.5 mm.

1.7.9 Where zinc coating of components is required it shall be no less than 300 g/m^2 in accordance with AS 1397. Amend 9 Sep 2010

1.7.10 Nails used to fix straps to roof or ceiling framing shall be spaced at no less than 35 mm in Radiata Pine, and 70 mm in other timbers.

1.7.11 Acceptable alternatives to the cast-in 'U' strap are:

a) Any proprietary bracing strip system of equal durability to the 'U' strap described in Paragraph 1.7.6, and capable of carrying a seismic force of 12 kN without elongating by more than 1.5 mm, or

b) A cast-in hot dip galvanised, deformed 6.0 mm reinforcing bar bent to a 'U' shape, with each end fixed to the roof or ceiling framing with six 50 x 4.0 mm galvanised fencing staples.

1.7.12 The 'U' strap or either of the acceptable alternatives may be wrapped around the outside of the *chimney* rather than be cast-in, provided that if strap is used it shall be painted with a zinc rich primer.

1.7.13 Precast pumice concrete chimneys

Precast pumice concrete *chimneys* shall be restrained at roof level either by a 50 x 1 mm 'U' strap wrapped around the *chimney*, or by a hot dip galvanised deformed 6 mm reinforcing bar placed into the grout around the reinforcing steel, together with either fixing brackets or fixing ties (see Figure 7(b)). Straps and bars shall satisfy the relevant requirements of Paragraphs 1.7.6 to 1.7.12.

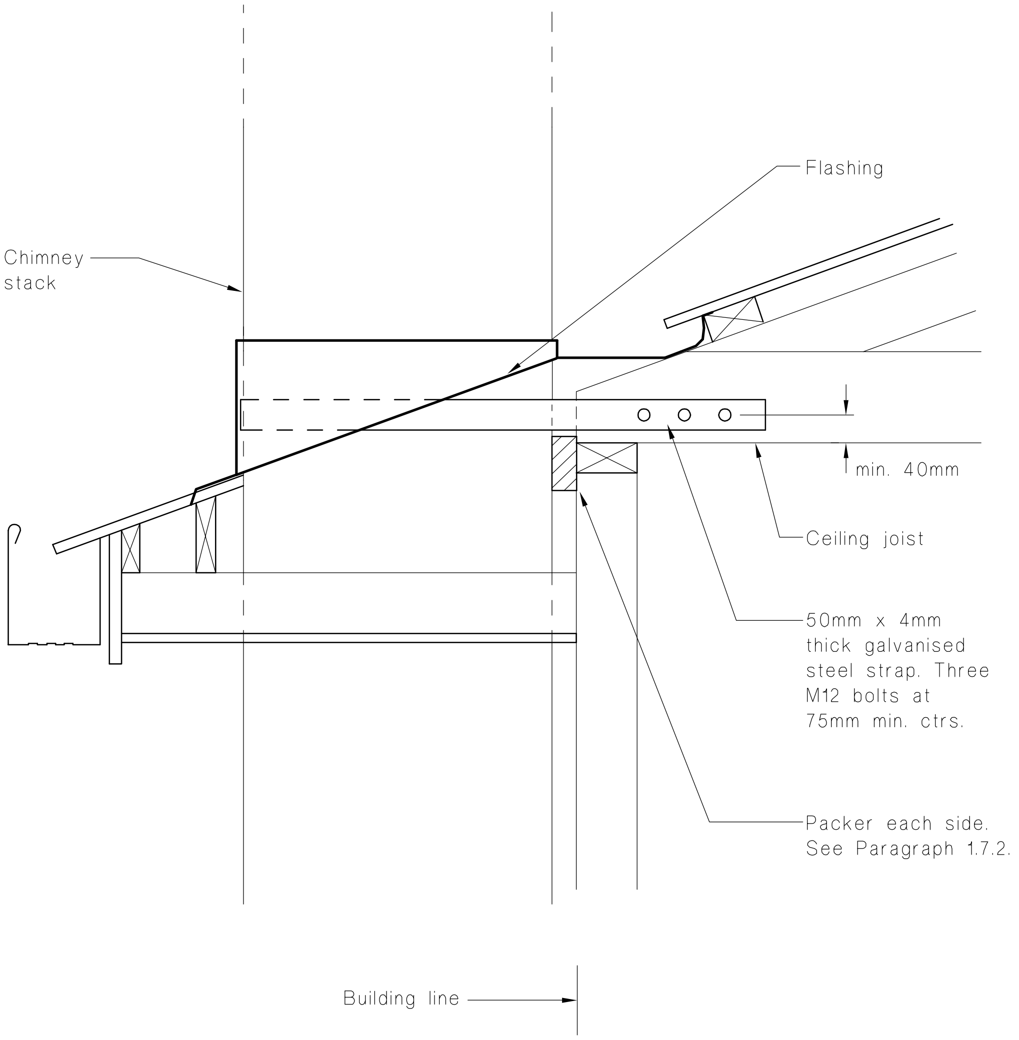
1.7.14 Fixing brackets (see Figure 7(b)) shall be made from 5.0 mm thick mild steel angle and drilled with:

a) A 50 mm diameter hole to suit the reinforcing duct location, and

b) A 14 mm diameter hole for the 12 mm diameter coach screw fixing to the double stud.

1.7.15 Fixing brackets shall be located in mortar joints between the units, and be spaced at no less than 480 mm centres for stacks up to 600 mm wide, and no less than 320 mm centres for stacks wider than 600 mm.

Figure 6: **Chimney Restraint – Floor and Roof Brackets Drawn for Roof Restraint**
Paragraphs 1.7.2 and 1.7.3



Sectional elevation

Note:
Although drawn for a chimney on an exterior wall, the bracket details also apply to an interior chimney.

1.7.16 Fixing ties shall comprise 4 mm galvanised wire hairpins, which are hooked behind the reinforcing ducts and secured to the required adjacent double studding with four heavy duty fencing staples. The ties shall be located in mortar joints between the units and be at no less than 320 mm centres for stacks up to 600 mm wide, and no less than 160 mm centres for stacks wider than 600 mm.

1.8 Materials and construction

1.8.1 Brickwork

Brick *chimney* construction shall conform to the relevant sections of NZS 4210.

1.8.2 Concrete

Chimneys, foundations and *hearth* slabs of reinforced concrete, shall comply with the relevant clauses of NZS 3109 for ordinary grade concrete.

1.8.3 Precast pumice concrete

Pumice concrete units for use in precast *chimneys* shall:

a) Have pumice aggregate which:
   i) is free of *combustible* and organic matter, and
   ii) has a maximum aggregate size of no greater than 19 mm, with at least 40% but not more than 60% of the aggregate retained by a 4.75 mm standard test sieve, and

b) Have a mix ratio by volume of no more than five parts of mixed pumice aggregate to one part of cement,

c) Have a compressive strength of no less than 7 MPa at 28 days when cured and tested in accordance with NZS 3112: Part 2,

d) After adequate curing, be air dried and kept under cover during storage, transport and on the site,

e) Be laid dry. (Work left unfinished should be protected from rain.)

f) Be joined with mortar which complies with NZS 4210, and

g) Have ducts filled with grout complying with NZS 4210, except over the last 200 mm where bars are anchored in the *gather* (refer Paragraph 1.6.2 b)). At these locations a non-shrinking cement-based grout, which attains a minimum compressive strength of 30 MPa at 7 days, shall be used.

1.8.4 Concrete masonry

Concrete masonry *construction* for *chimney* foundation walls shall conform to the relevant sections of NZS 4229.

1.8.5 Reinforcing steel

Reinforcing used in *chimneys* is to conform to AS/NZS 4671, and shall: Amend 9 Sep 2010

a) For brick, be embedded centrally in the thickness of the grout,

b) For in-situ concrete, have cover to the steel in accordance with NZS 3109,

c) For precast pumice concrete, be placed with grout in the preformed ducts in the units.

1.8.6 Hot dip galvanising

Hot dip galvanising shall comply with AS/NZS 4680. Amend 9 Sep 2010

1.9 Systems to resist horizontal earthquake loadings

1.9.1 The bracing described in Paragraphs 1.9.2 to 1.9.6 shall be provided in those *buildings* where one or more of the following apply:

a) The area of the room containing the *chimney* exceeds 24 m^2,

b) The length of the wall on which the *chimney* is located exceeds 3.5 m between supporting braced walls which are perpendicular to it. This length may be increased to 6.5 m where the wall is supported, at each floor level and at the roof or ceiling level, by either a structural diaphragm which conforms with the relevant requirements of NZS 3604 or by dragon ties. The dragon ties shall:

i) consist of a continuous length of 100 x 50 mm timber fixed in accordance with NZS 3604 clauses 8.3.3.3 and 8.3.3.4,

Amend 5 Jul 2001

ii) be run as a pair, with one dragon tie going from the wall on which the *chimney* is located, back to each of the supporting braced walls. The enclosed angle between the wall on which the *chimney* is located and each dragon tie shall be 60°, and

iii) be located no more than 1.5 m out from each supporting braced wall.

c) The floor area on any level of the *building*, for a given *chimney* type (see Table 2), is less than:

i) 50 m^2 for *chimney* Type 1,

ii) 75 m^2 for *chimney* Types 2, 3 and 4,

iii) 150 m^2 for *chimney* Types 5, 6 and 7.

1.9.2 The *building* supporting the *chimney* shall contain bracing elements to resist earthquake loads from the *chimney*. These loads are applied at roof level and at each floor to which the *chimney* is connected. The bracing elements necessary are additional to those required by NZS 3604 or NZS 4229.

1.9.3 The number of bracing units to be provided for each *chimney* connection (see Paragraph 1.9.4) is given in Table 2. The number of bracing units to be provided at any level shall be the sum of the bracing units required at each of the *chimney* connections above the level being considered. The earthquake bracing units at roof and floor connections required for chimneys constructed in accordance with B1/AS3 shall be determined for the *Canterbury earthquake region* from Table 2 for Earthquake zone A.

Amend 10 May 2011

COMMENT:

As an example: for a standard precast pumice concrete *chimney* in a two storey *building* in Zone A, that is connected to the *building* by a roof bracket and by floor brackets at ground and first floor, the number of bracing units required are:

Location	Bracing units required
– Just below roof level	60
– Just below first floor level	60 + (60% of 60) = 96
– Just below ground floor level	60 + (60% of 60) + 60 = 156

1.9.4 A *chimney* shall be considered as connected to the *building* when:

a) At roof level: it is held either by a roof bracket or by a roof tie,

b) At ground floor level: it is held by a floor bracket or the *chimney base* is integral with the *building* foundation wall,

Table 2: Bracing Units Required for Each Chimney Connection to Resist Earthquake Loadings
Paragraphs 1.9.1c) and 1.9.3

Chimney construction	Type	Max size of chimney: Stack	Base	Number of bracing units required at the roof connection and at each floor connection according to earthquake zone: (See Note 1) Zone A	Zone B	Zone C
Precast pumice						
– standard	1	500 x 400	1600 x 1050	60	50	40
– large	2	1100 x 400	1600 x 1050	110	90	70
Brick						
– single skin	3	500 x 500	1200 x 1050	90	70	60
– double skin	4	590 x 590	1200 x 1050	130	100	80
	5	1200 x 680	1200 x 1050	240	200	160
Concrete	6	590 x 590	1200 x 1050	210	170	140
	7	1200 x 700	1200 x 1050	390	320	260

Note:

1. The number of bracing units required at floor connections other than the ground floor shall be taken as 60% of the value given in the table.

c) At an intermediate floor level: it is held either by a floor bracket or by closely spaced wall ties spanning the floor.

1.9.5 For earthquake ground movement in the direction perpendicular to the wall on which the *chimney* is located, structural diaphragms shall be provided at roof/ceiling level and at each floor level to which the *chimney* is connected. The diaphragms shall comply with all relevant clauses of NZS 3604 and NZS 4229.

1.9.6 For earthquake in the direction parallel to the wall on which the *chimney* is located, the bracing units required as determined from Paragraph 1.9.3 shall be provided solely by that wall.

2.0 Solid Fuel Burning Domestic Appliances

2.1 Chimneys

2.1.1 *Chimneys* for solid fuel burning appliances shall comply with Paragraph 1.0 or with the relevant sections of AS/NZS 3869 and AS/NZS 2918 for sheetmetal *chimneys*.

Amend 9 Sep 2010

2.2 Hearth slab

2.2.1 Solid fuel burning domestic appliances weighing no more than 130 kg shall be supported on a 65 mm thick *hearth* slab that is:

a) Reinforced with 665 mesh, or D10 rods at 300 mm centres each way, placed centrally in the slab thickness,

b) Supported on a timber or concrete floor, or integral with a concrete floor. (The floor supporting the *hearth* slab shall comply with NZS 3604 or NZS 4229 as appropriate), and

c) Comprised of ordinary grade concrete complying with the relevant clauses of NZS 3109.

2.2.2 *Hearth* slabs on a timber floor shall be held in position by supporting members on all four sides of the *hearth*. These members shall each be held by four screws with a minimum shank diameter of 4.88 mm that penetrate the floor framing by 50 mm.

2.2.3 *Hearth* slabs on concrete floors shall be secured in position by four D10 starter rods. The rods shall be located in each corner of the *hearth* slab and they shall terminate each end with standard hooks complying with NZS 3109.

Spread of fire

Amend 2 Aug 1994

2.2.4 Paragraphs 2.2.1 to 2.2.3 provide an acceptable structural solution, but depending on the particular installation, different *hearth* dimensions may be necessary to meet the spread of *fire* requirements of NZBC Clause C2.2. *Hearth* slabs for solid fuel burning appliances shall comply with AS/NZS 2918.

Amend 15 Jan 2017
Amend 9 Sep 2010
Amend 5 Jul 2001

Verification Method B1/VM4 Foundations

(Revised by Amendment 4)

1.0 Scope and Limitations

1.0.1 This document covers the ultimate limit state design of foundations, including those of earth retaining structures. Methods are given for determining ultimate bearing and lateral sliding strengths.

1.0.2 This document does not describe a means of determining the value of the soil parameters used in the document (e.g. c^{l}, ϕ^{l} and s_u). The derivation of these parameters, which must be based on the most adverse moisture and groundwater conditions likely to occur, is outside of the scope of this verification method.

COMMENT:
Appendix A contains information on the types of investigations that may need to be conducted to determine the soil parameters.

1.0.3 Serviceability limit state deformations are not covered in this document. The determination of such deformations and their acceptability to the design in question needs to be considered but is outside the scope of this document.

COMMENT:
Appendix B contains information which may be of assistance in designing for serviceability limit state deformations.

It is intended that design provisions to cover serviceability limit state deformations be added to the document in the future.

1.0.4 This document assumes general ground or slope stability and provides methods only for ensuring against local failure of the foundation. Overall ground stability needs to be verified before this document can be applied; this is outside the scope of this verification method.

1.0.5 This document must not be used to design foundations on loose sands, saturated dense sands or on cohesive soils having a sensitivity greater than 4.

Amend 8
Dec 2008

COMMENT:
Saturated sands may be subject to liquefaction during earthquake loading and sensitive clays exhibit a rapid decrease in undrained shear strength once the peak strength has been mobilised. The design of foundations on these materials needs special considerations which are not covered in this verification method.

1.0.6 This document shall not be used for foundations subject to continuous vibration.

COMMENT:
Although this document covers foundations subject to vibration from earthquake loading it does not cover those applications where foundations are subject to continuous vibration such as from the operation of certain machinery.

1.0.7 The "Comments" and "Informative Appendices" of this document provide comment, background or general information but do not form part of this verification method.

COMMENT:
Appendix C contains a worked example showing how some of the provisions of this document are used.

2.0 General

2.0.1 Foundations must be designed for the load combinations given in AS/NZS 1170 Part 0, as amended by B1/VM1. *Strength reduction factors* given in this document must be used to determine the design strength of the foundation. The design loadings must not cause the foundation's design strength to be exceeded.

Amend 8
Dec 2008

2.0.2 The design procedures of this document must be performed by a person who, on the basis of experience or qualifications, is competent to apply them.

2.0.3 The *building's* foundation elements or the elements of earth retaining structures shall be designed in accordance with the appropriate material Standards, as given in B1/VM1.

2.0.4 Foundations may be shallow or deep. A shallow foundation is one in which the depth from the ground surface to the underside of the foundation is less than five times the width of the foundation. All other foundations are considered to be deep.

2.0.5 In assigning values for soil parameters the worst groundwater condition shall be considered.

COMMENT:
For cohesive soils the fully saturated condition will generally give the lowest strength and stiffness.

2.0.6 Foundation strength for cohesive soil depends on loading duration and whether consolidation can occur. For this reason the distinction is made between short term (e.g. initial load application, earthquake actions or wind gusts) and long term loading (e.g. permanent loads such as foundation dead load). For the short term case no consolidation occurs and the calculations shall be in terms of undrained shear strength (i.e. shear strength of the soil s_u) and total stress. For long term loading, full consolidation occurs and the calculations shall be in terms of drained shear strength and effective stress (i.e. soil parameters being cohesion, c^{l}, and the angle of shearing resistance ϕ^{l}).

2.0.7 For cohesionless soils consolidation occurs very quickly so drained strength shall be used in all cases.

2.0.8 Supervision and verification of soil parameters

Design assumptions and soil parameters shall be verified during *construction*. The designer shall nominate what supervision, including verification of soil parameters, will be undertaken during the *construction* period.

3.0 Shallow Foundations

3.1 General Provisions

3.1.1 The ultimate bearing strength shall be based on the most adverse moisture and groundwater conditions likely to occur.

3.1.2 Founding depths in clay soils known to exhibit swelling and shrinking behaviour shall be chosen so that the underside of the foundation is beneath the zone of soil affected by shrinking and swelling caused by seasonal weather changes, and the root systems of nearby trees and shrubs.

3.1.3 Consideration shall be given to the possibility of any surcharge adjacent to a shallow foundation being removed during the life of the foundation, so reducing the available ultimate bearing strength.

3.1.4 Foundations subject to moment loading shall not be proportioned such that the point of application of the reaction force on the underside of the foundation is closer to the edge than B/6, for a rectangular foundation, or r/2, for a circular foundation.

3.2 Ultimate and design bearing strength and design bearing pressure

3.2.1 The design bearing pressure q_d shall be determined by dividing the design vertical forces (derived from combinations of factored vertical loads) by the effective area of the foundation. See Paragraph 3.3 for notation and the definition of effective area.

3.2.2 The ultimate bearing strength q_u is that pressure, exerted on the ground by the *building* foundation, which causes the ground to fail by mobilisation of all available shear strength. It shall be evaluated using the provisions of Paragraph 3.3.

3.2.3 The design bearing strength q_{dbs} shall be determined by multiplying the ultimate bearing strength by the appropriate *strength reduction factor* (see Paragraph 3.5.1).

3.2.4 The design bearing pressure shall not exceed the design bearing strength.

3.3 Ultimate limit state bearing strength for shallow foundations

3.3.1 The procedures specified in the following text apply to foundations of any size. The formulae are limited to soil profiles that for a depth beneath the underside of the foundation of at least two times the foundation width can be represented with single values for the density, angle of shearing resistance, cohesion, and if appropriate, undrained shear strength.

Notation:

A^I effective foundation area (m^2). For a rectangular foundation $A^I = B^I L^I$. For a circular foundation see Figure 2.

B foundation breadth (m).

B^I the smaller of $2(X + e_b)$ and $2(B – X – e_b)$ (see Figure 1) (m).

D_e minimum horizontal distance from the edge of the underside of the foundation to the face of an adjacent downward slope (m).

D_f depth to the underside of the foundation (m).

H design horizontal load, the resultant of the factored horizontal forces applied to the foundation (kN).

H_{uf} unfactored horizontal foundation load (kN).

L foundation length (m).

L^I the smaller of $2(Y + e_l)$ and $2(L – Y – e_l)$ (see Figure 1) (m).

M_b design moment applied about an axis parallel to the breadth direction of the foundation (kNm).

M_c design moment applied to a circular footing (kNm).

M_l design moment applied about an axis parallel to the length direction of the foundation (kNm).

N_c, N_q, $N\gamma$ bearing strength factors.

P_p ultimate lateral resistance derived from passive earth pressure (kN).

R reaction on underside of foundation = $q_d A^I$ (kN).

S ultimate shear strength between the base of the foundation and the ground (kN).

V design factored vertical foundation load (kN).

V_{uf} unfactored vertical foundation load (kN).

V^I effective design factored vertical load = $V – u_f A^I$ (kN).

X the distance from the edge of the foundation, along the x axis, to the point of application of the design vertical foundation load V (m).

Y the distance from the edge of the foundation, along the y axis, to the point of application of the design vertical foundation load V (m).

Z the distance from the edge of a circular foundation, along the z axis, to the point of application of the design vertical foundation load V (m).

c cohesion (kPa).

c^I effective stress cohesion (kPa).

e_b M_l/V (positive when R is further along the x axis than V, see Figure 1) (m).

e_c M_c/V (positive when R is further along the z axis than V, see Figure 2) (m).

e_l M_b/V (positive when R is further along the y axis than V, see Figure 1) (m).

q vertical total stress in ground adjacent to the foundation at depth D_f (kPa).

q^I vertical effective stress (σ^I_v) in ground adjacent to the foundation at depth D_f (kPa).

q_d design bearing pressure = V/A^I (kPa).

q_u ultimate bearing strength (kPa).

q_{dbs} design bearing strength = $\Phi_{bc} q_u$ (kPa).

r radius of a circular foundation (m).

s_u undrained shear strength (kPa).

u pore water pressure at a given position in the soil profile (kPa).

u_f pore water pressure at depth D_f (kPa).

x axis through design vertical foundation load V in direction of foundation breadth. The axis starts at the foundation edge and is positive in the direction towards V.

y axis through design vertical foundation load V in direction of foundation length. The axis starts at the foundation edge and is positive in the direction towards V.

z axis through the centre of a circular foundation and the design vertical foundation load V. The axis starts at the foundation edge and is positive in the direction towards V.

γ soil unit weight (kN/m^3).

γ' soil unit weight required for effective stress analysis for soil beneath the water table = $\gamma - \gamma_w$ (kN/m^3).

Γ γ when the water table is deeper than 2B beneath the underside of the foundation and γ' when the water table is above this.

γ_w water unit weight (kN/m^3).

Φ_{bc} *strength reduction factor* for bearing strength (see Paragraph 3.5.1).

Φ_{pp} *strength reduction factor* for resistance derived from passive earth pressure (see Paragraph 3.5.1).

Φ_{sl} *strength reduction factor* for sliding resistance (see Paragraph 3.5.1).

ϕ angle of shearing resistance (degrees).

ϕ' effective stress angle of shearing resistance (degrees).

σ'_v vertical effective stress at a given depth in the soil profile = $\Sigma\gamma_i T_i - u$ where γ_i is the unit weight and T_i is the thickness of the ith soil layer above the depth at which σ'_v is required (kPa).

ω slope, below horizontal, of the ground adjacent to the edge of the foundation (degrees).

3.3.2 Ultimate bearing strength

The general expression for the ultimate bearing strength for a shallow foundation subject to vertical, shear, and moment loading is:

$$q_u = c\lambda_{cs}\lambda_{cd}\lambda_{ci}\lambda_{cg}N_c + q\lambda_{qs}\lambda_{qd}\lambda_{qi}\lambda_{qg}N_q + \tfrac{1}{2}\Gamma B'\lambda_{\gamma s}\lambda_{\gamma d}\lambda_{\gamma i}\lambda_{\gamma g}N_\gamma$$

For undrained analysis ($\phi = 0$) use the following form of the general equation:

$$q_u = s_u\lambda_{cs}\lambda_{cd}\lambda_{ci}\lambda_{cg}N_c + \lambda_{qg}q$$

For drained analysis use the following form of the general equation:

$$q_u = c'\lambda_{cs}\lambda_{cd}\lambda_{ci}\lambda_{cg}N_c + q'\lambda_{qs}\lambda_{qd}\lambda_{qi}\lambda_{qg}N_q + \tfrac{1}{2}\gamma' B'\lambda_{\gamma s}\lambda_{\gamma d}\lambda_{\gamma i}\lambda_{\gamma g}N_\gamma$$

The bearing strength factors are obtained from Figure 3 or the following equations:

$$N_q = e^{\pi\tan\phi}\tan^2\left(45 + \frac{\phi}{2}\right)$$

where e is the mathematical constant = 2.7183

$N_c = (N_q - 1)\cot\phi$ for $\phi > 0$, but has a value of 5.14 for $\phi = 0$

$$N_\gamma = 2(N_q - 1)\tan\phi$$

The λ factors in the above equation are:

a) Shape factors: λ_{cs}, λ_{qs} and $\lambda_{\gamma s}$

where:

$$\lambda_{cs} = 1 + \left(\frac{B'}{L'}\right)\left(\frac{N_q}{N_c}\right)$$

$$\lambda_{qs} = 1 + \left(\frac{B'}{L'}\right)\tan\phi$$

$$\lambda_{\gamma s} = 1 - 0.4\left(\frac{B'}{L'}\right)$$

b) Depth factors: λ_{cd}, λ_{qd} and $\lambda_{\gamma d}$

where:

- for $\phi = 0$ and $\frac{D_f}{B'} \le 1$:

$$\lambda_{cd} = 1 + 0.4\left(\frac{D_f}{B'}\right)$$

Amend 15
Jan 2017

- for $\phi = 0$ and $\frac{D_f}{B'} > 1$:

$\lambda_{cd} = 1 + 0.4\tan^{-1}\left(\frac{D_f}{B'}\right)$, where $\tan^{-1}$ is in radians

- for $\phi > 0$:

  $$\lambda_{cd} = \lambda_{qd} - \frac{(1 - \lambda_{qd})}{N_q \tan\phi}$$

  – for $\frac{D_f}{B^I} \leq 1$:

  $$\lambda_{qd} = 1 + 2\tan\phi(1 - \sin\phi)^2\left(\frac{D_f}{B^I}\right)$$

  – for $\frac{D_f}{B^I} > 1$:

  $$\lambda_{qd} = 1 + 2\tan\phi(1 - \sin\phi)^2\tan^{-1}\left(\frac{D_f}{B^I}\right),$$

  where $\tan^{-1}$ is in radians

- for all cases

  $\lambda_{\gamma d} = 1$

c) Load inclination factors: λ_{ci}, λ_{qi} and $\lambda_{\gamma i}$

where:

- for $\phi = 0$

  $$\lambda_{ci} = 0.5\left(1 + \sqrt{1 - \frac{H}{A^I s_u}}\right)$$

  $$\lambda_{qi} = 1$$

- for $\phi > 0$

  – for horizontal loading parallel to L^I

  $$\lambda_{qi} = \lambda_{\gamma i} = 1 - \frac{H_{uf}}{(V_{uf} + A^I c^I \cot\phi^I)}$$

  $$\lambda_{ci} = \frac{\lambda_{qi} N_q - 1}{N_q - 1}$$

  – for horizontal loading parallel to B^I

  $$\lambda_{qi} = \left(1 - \frac{0.7 H_{uf}}{V_{uf} + A^I c^I \cot\phi^I}\right)^3$$

  $$\lambda_{\gamma i} = \left(1 - \frac{H_{uf}}{V_{uf} + A^I c^I \cot\phi^I}\right)^3$$

  $$\lambda_{ci} = \frac{\lambda_{qi} N_q - 1}{N_q - 1}$$

d) Ground inclination factors: λ_{cg}, λ_{qg} and $\lambda_{\gamma g}$

For horizontal ground $\lambda_{cg} = \lambda_{qg} = \lambda_{\gamma g} = 1$

For inclined ground, the permitted slope (angle ω below the horizontal) depends on soil angle of shearing resistance ϕ and the distance D_e between the foundation and the slope face:,

- where $\phi \geq 0$ (drained analysis)

  v shall not be > ϕ

- where $\phi = 0$ (undrained analysis)

  ω shall not be > 45°

The ground inclination factors shall be:

- for $D_e \geq 2B$ Amend 16 Apr 2018

  $\lambda_{cg} = \lambda_{qg} = \lambda_{\gamma g} = 1$

- for $D_e < 2B$

  $\lambda_{cg} = 1 - \omega(1 - D_e/2B)/150$

  $\lambda_{qg} = \lambda_{\gamma g} = (1 - \tan(\omega(1 - D_e/2B)))^2$

3.3.3 Local shear

For sands with relative densities less than 40% and clays having liquidity indices greater than 0.7, the bearing strength shall be evaluated using 0.67c for cohesion and $\tan^{-1}(0.67\tan\phi)$ for the angle of shearing resistance.

COMMENT:

The formulae in Paragraph 3.3.2 assume a general shear failure of the soil but for the soils specified in this Paragraph a local shear failure is likely.

4.1 Ultimate vertical strength of single piles

4.1.1 Notation

A_b area of pile base (m^2).

B_G width (between pile extremities) of a pile group (m).

C circumference of the pile shaft (m).

D_b diameter of the pile base (m).

D_s diameter of the pile shaft (m).

H design horizontal load applied to the pile head (factored applied loads) (kN).

H_u ultimate lateral strength of a pile (kN).

K_o the coefficient of earth pressure at rest $= 1 - \sin\phi^I$ for loose sand and normally consolidated clay, and $(1 - \sin\phi^I)\sqrt{OCR}$ for over-consolidated soils.

K_p coefficient of passive earth pressure $= (1 + \sin\phi^I)/(1 - \sin\phi^I)$.

K_s factor that expresses the horizontal effective stress at the pile/soil interface in terms of the vertical effective stress (see Table 2).

L length of the pile shaft (m).

L_G length (between pile extremities) of a pile group (m).

M design moment applied to the pile head (factored applied moments) (kNm).

M_{ult} ultimate moment strength of the pile shaft (kNm).

OCR over-consolidation ratio being the previous maximum effective stress/current effective stress.

R_d relative density as measured in accordance with Test 4.2.3 of NZS 4402.

V_1 ultimate strength of an individual pile in the group (kN).

V_B ultimate strength of the block of soil enclosed within the pile group (kN).

V_G ultimate strength of the group (kN).

V_{bu} ultimate base resistance (kN).

V_{su} ultimate shaft resistance (kN).

V_u vertical pile strength (kN).

W pile weight (part of the dead load) (kN).

c_a the undrained adhesion (total stress) at the soil/shaft interface in a clay soil, or the adhesion at the boundary of a pile group $= \alpha s_u$ (kPa).

c^I_a drained (effective stress) adhesion at the soil/shaft interface in a cohesive soil, or the adhesion at the boundary of a pile group (kPa).

f for a free head pile, the distance above the ground surface at which the horizontal shear is applied (= M/H); and for a restrained head pile, the distance above the ground surface at which the restraint is applied (m).

f_o length of pile shaft assumed to be unsupported in cohesive soil $= 1.5D_s$ (m).

g_c, g_l, g_s position along the pile shaft at which yielding occurs for piles in over-consolidated clay, normally consolidated clay, and sand respectively (m).

n number of piles in the group.

Table 2: Values of δ^I and K_s for Pile Shafts
Paragraphs 4.1.1 and 4.1.4 b) and c)

Pile material	δ^I	K_s	
		$R_d < 40\%$	$R_d > 40\%$
Steel	20°	0.5	1.0
Concrete	$3\phi^I/4$	1.0	2.0
Timber	$2\phi^I/3$	1.5	4.0

q vertical stress in the soil at a depth equal to the base of the pile shaft, total stress for undrained analysis and effective stress for drained analysis (kPa).

s_u undrained shear strength (kPa).

Φ_{pc} *strength reduction factor* for pile strength (for both vertical and lateral strength) (see Paragraph 4.7.1).

α adhesion factor (see Figure 5).

γ unit weight of the soil in which the pile is embedded, chosen to give the total stresses for undrained loading in cohesive soil and effective stresses for drained loading (γ^I beneath the water table) (kN/m³).

Γ γ when the water table is deeper than 2B beneath the underside of the foundation and γ^I when the water table is above this.

δ^I drained angle of shearing resistance at the soil/shaft interface (see Table 2) (degrees).

ϕ angle of shearing resistance (degrees).

ϕ^I effective stress angle of shearing resistance (degrees).

χ rate of increase in undrained shear strength with depth (kPa/m).

$(\;)_{average}$ the average value of the parameter in the brackets taken over the length of the pile shaft.

4.1.2 Vertical strength

The vertical pile strength is:

$$V_u = V_{su} + V_{bu}$$

4.1.3 Base resistance

The undrained base resistance of piles in cohesive soil is:

$$V_{bu} = (9s_u + q)\,A_b$$

The drained base resistance, when the soil is sufficiently uniform to be represented by single values of c^I, ϕ^I, s_u and γ for a distance of three pile shaft diameters above and below the pile base, shall be:

$$V_{bu} = (9c^I + q^I N_q + 0.6\,D_b\,\Gamma N_\gamma)\,A_b$$

The values of N_q are taken from Figure 4 and N_γ from Figure 3.

4.1.4 Shaft resistance

a) For undrained loading of piles in cohesive soils:

$$V_{su} = (c_a)_{average}\,CL$$

where $c_a = \alpha s_u$ and values for α are given in Figure 5 for both driven and bored piles.

b) For drained loading of piles in cohesive soils:

$$V_{su} = \left\{(c^I{}_a)_{average} + (\sigma^I{}_v K_o \tan\delta^I)_{average}\right\} CL$$

The value of δ^I is taken from Table 2.

c) For drained loading of driven piles in cohesionless soils:

$$V_{su} = (\sigma^I{}_v K_s \tan\delta^I)_{average}\,CL$$

Values for K_s are given in Table 2.

4.2 Column action

4.2.1 Piles which stand unbraced in ground, water, or other material incapable of providing lateral support, shall be designed as columns.

4.2.2 For a column partly embedded in the ground, the effective length is dependent upon the position of end restraint, which in turn is dependent upon the nature of the ground. End restraint shall be assumed at a depth of no less than:

a) 3 times the *nominal pile width* in very stiff soil. (For clays an undrained shear strength greater than or equal to 100 kPa, and for sands a relative density greater than or equal to 50% shall be regarded as very stiff soil.)

b) 6 times the *nominal pile width* in firm soil. (For clays an undrained shear strength between 50 and 100 kPa, and for sands a relative density between 30 and 50% shall be regarded as stiff soil.)

c) 9 times the *nominal pile width* in other soil conditions.

Figure 4: **N_q Values for Pile Foundations**
Paragraph 4.1.3

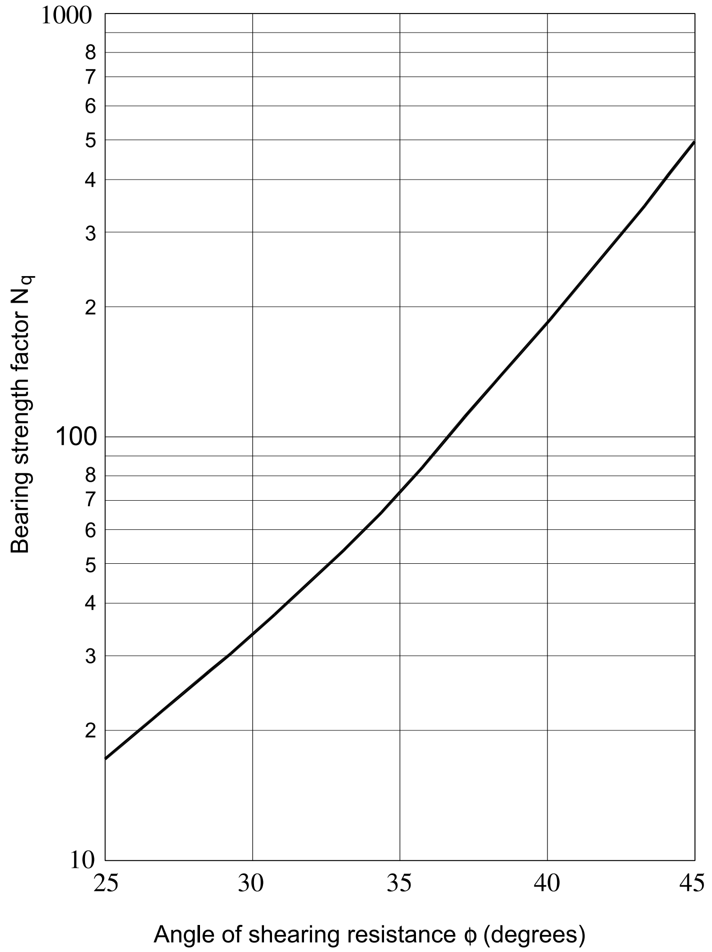
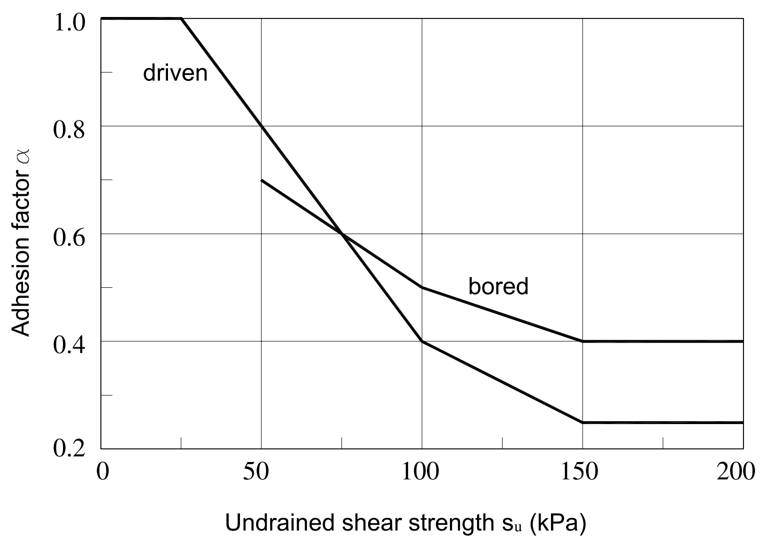


Figure 5: **Adhesion Factor for Piles in Cohesive**
Paragraphs 4.1.1 and 4.1.4 a)



4.3 Ultimate lateral strength of single piles

4.3.1 In the following paragraphs the terms "free head" and "restrained head" pile are used. Free head piles are classified as short and long. Restrained head piles are classified as short, intermediate and long. These terms are explained as follows:

a) A free head pile has no restriction against head rotation when lateral displacement occurs. For a short free head pile the magnitude of the maximum bending moment in the embedded shaft is less than the ultimate moment strength of the pile shaft, and the ultimate strength is controlled by the embedment length of the pile shaft. The strength of a long free head pile is controlled by the ultimate moment strength of the pile shaft and not by the embedded length.

b) For a restrained head pile subject to lateral displacement, the head rotation is constrained at the pile head by a fixing moment. A short pile is one in which the head moment and the maximum pile shaft moment are less than the ultimate moment strength of the pile section. For an intermediate length restrained head pile the head moment is equal to the ultimate strength of the pile shaft and elsewhere the shaft moments are less than M_{ult}. For a long restrained head pile the head moment and the maximum pile shaft moment each have a magnitude of M_{ult}.

4.3.2 Undrained lateral strength of piles in cohesive soil having a constant undrained shear strength with depth

a) **Free head piles**

i) short free head piles

The ultimate lateral strength of a short free head pile is given by:

$$H_u = 9s_uD_s\left[\sqrt{2[(f + L)^2 + (f + f_o)^2]} - (L + 2f + f_o)\right]$$

Amend 9
Sep 2010

The location, measured from the ground surface, of the maximum pile shaft moment is:

$$g_c = \frac{H_u}{9s_uD_s} + f_o$$

The maximum moment in the pile shaft is:

$$M_{max} = H_u\left(f + f_o + \frac{H_u}{18s_uD_s}\right)$$

Amend 5
Jul 2001

If M_{max} is greater than M_{ult} the strength must be evaluated as for a long free head pile.

ii) long free head piles

The ultimate lateral strength of a long free head pile

$$H_u = 3s_uD_s\left[\sqrt{9(f + f_o)^2 + \frac{2M_{ult}}{s_uD_s}} - 3(f + f_o)\right]$$

The location of the maximum pile shaft moment (M_{ult}) is obtained from the same equation as for the short pile.

b) **Restrained head piles**

i) short restrained head piles

The ultimate lateral strength of a short restrained head pile is:

$$H_u = 9s_uD_s\,(L - f_o)$$

The pile head moment is:

$$M_{max} = 0.5H_u\,(L + 2f + f_o)$$

If M_{max} is greater than M_{ult} then the intermediate length case, ii) below, is appropriate.

ii) intermediate restrained head piles

The ultimate lateral strength of an intermediate length restrained head pile is:

$$H_u = 9s_uD_s\left[\sqrt{(L+2f+f_o)^2+(L-f_o)^2+\frac{4M_{ult}}{9s_uD_s}} - (L+2f+f_o)\right]$$

The location, measured from the ground surface, of the maximum pile shaft moment is:

$$g_c = \frac{H_u}{9s_uD_s} + f_o$$

The pile shaft moment at this depth is:

$$M_{max} = H_u\left[\frac{H_u}{18s_uD_s} + f + f_o\right] - M_{ult}$$

If M_{max} calculated from this equation is greater than M_{ult} then the long case, iii) below, is appropriate.

iii) long restrained head piles

The ultimate lateral strength of a long restrained head pile is:

$$H_u = 9s_uD_s\left[\sqrt{(f+f_o)^2+\frac{4M_{ult}}{9s_uD_s}} - (f+f_o)\right]$$

The location of the maximum pile shaft (M_{ult}) is obtained from the same equation as for the intermediate length pile.

4.3.3 Undrained lateral strength of piles in normally consolidated cohesive soil

Normally consolidated cohesive soils have a linear increase in undrained shear strength with depth, starting with a value of zero at ground surface level.

COMMENT:
Only the long free head pile and intermediate and long restrained head piles are considered. Short piles are not normally used in such material.

The rate of increase in undrained shear strength with depth is denoted by χ (kPa/m).

a) **Long free head pile**

The ultimate lateral strength of a long free head pile is obtained by solving:

$$H_u\left[\frac{2}{3}\sqrt{\frac{2H_u}{9D_s\chi}} + f\right] - M_{ult} = 0$$

The location, measured from the ground surface, of the maximum pile shaft moment (M_{ult}) is:

$$g_l = \sqrt{\frac{2H_u}{9D_s\chi}}$$

b) **Restrained head pile**

i) intermediate restrained head piles

The ultimate lateral strength of an intermediate length restrained head pile is:

$$H_u = \frac{3D_sL^3\chi}{2(f+L)} + \frac{M_{ult}}{f+L}$$

The location of the maximum pile shaft moment (M_{ult}) is obtained from the same equation as for the long free head pile.

The pile shaft moment at this depth is:

$$M_{max} = H_u\left[\frac{2}{3}\sqrt{\frac{2H_u}{9D_s\chi}} + f\right] - M_{ult}$$

If M_{max} calculated from this equation is greater than M_{ult} then the long case, ii) below, is appropriate.

ii) long restrained head piles

The ultimate lateral strength of a long restrained head pile is obtained by solving:

$$H_u\left[\frac{2}{3}\sqrt{\frac{2H_u}{9D_s\chi}} + f\right] - 2M_{ult} = 0$$

The location of the maximum pile shaft moment is obtained from the same equation as for the long free head pile.

4.3.4 Drained lateral strength of piles in cohesionless soil

a) **Free head piles**

i) short free head piles

The ultimate lateral strength of a short free head pile is:

$$H_u = \frac{K_pD_sL^3\gamma}{2(f + L)}$$

The location, measured from the ground surface, of the maximum pile shaft moment is:

$$g_s = \sqrt{\frac{2H_u}{3K_p\gamma D_s}}$$

The maximum pile shaft moment is:

$$M_{max} = H_u\left[\frac{2}{3}\sqrt{\frac{2H_u}{3K_pD_s\gamma}} + f\right]$$

ii) long free head piles

The ultimate lateral strength of a long free head pile is obtained by solving the following equation:

Amend 16 Apr 2018

$$H_u\left[\frac{2}{3}\sqrt{\frac{2H_u}{3K_pD_s\gamma}} + f\right] - M_{ult} = 0$$

The location of the maximum pile shaft moment (M_{ult}) is obtained from the same equation as for the short pile.

b) **Restrained head piles**

i) short restrained head piles

The ultimate lateral strength of a short restrained head pile is:

$$H_u = 1.5K_pD_sL^2\gamma$$

The magnitude of the maximum pile head moment is:

$$M_{max} = H_u\left(\frac{2}{3}L + f\right)$$

If M_{max} is greater than M_{ult} then the intermediate length case, ii) below, is appropriate.

ii) intermediate restrained head piles

The ultimate lateral strength of an intermediate length restrained head pile is:

$$H_u = \frac{K_pD_sL^3\gamma}{2(f + L)} + \frac{M_{ult}}{f + L}$$

The location, measured from the ground surface, of the maximum pile shaft moment is:

$$g_s = \sqrt{\frac{2H_u}{3K_pD_s\gamma}}$$

The pile shaft moment at this depth is:

$$M_{max} = H_u\left[\frac{2}{3}\sqrt{\frac{2H_u}{3K_pD_s\gamma}} + f\right] - M_{ult}$$

If M_{max} calculated from this equation is greater than M_{ult} then the long case, iii) below, is appropriate.

iii) long restrained head piles

The ultimate lateral strength of a long restrained head pile is obtained by solving:

$$H_u \left[\frac{2}{3} \sqrt{\frac{2H_u}{3K_p D_s \gamma}} + f \right] - 2M_{ult} = 0$$

The location of the maximum pile shaft moment is obtained from the same equation as is used for the intermediate length case.

4.4 Pile groups

4.4.1 Ultimate vertical strength of pile groups

The undrained vertical strength of a pile group considered as a single block in a cohesive soil is:

$$V_B = (9s_u + q)\ B_G\ L_G + 2\ (B_G + L_G)\ L\ (c_a)_{average}$$

The drained strength of a pile group considered as a single block of soil is given by:

$$V_B = (c' + q'\ N_q + 0.6\ B_G\ \Gamma N_\gamma)\ B_G\ L_G + 2\ (B_G + L_G)\ L\ \{(c'_a)_{average} + (\sigma'_v\ K_o\ \tan\delta')_{average}\}$$

The ultimate vertical strength of the group is determined from:

$$\frac{1}{V_G^2} = \frac{1}{n^2 V_1^2} + \frac{1}{V_B^2}$$

4.4.2 If only part of an embedded friction pile length is in satisfactory material, the surface area calculated as providing frictional resistance shall be limited to the surface areas in contact with that material.

4.5 Downdrag

4.5.1 Downdrag may be generated when a pile shaft passes through a compressible soil layer. Downdrag shall be considered as dead load applied to the parts of the pile below the compressible layer. It shall be added to the imposed loadings and factored accordingly.

4.6 Ultimate lateral strength of pile groups

4.6.1 If piles are spaced at centre to centre intervals of less than 4.0 times the *nominal pile width*, the ultimate lateral pile strength shall be reduced. The reduced value shall be calculated as a percentage of the ultimate lateral pile strength for an isolated pile by linear interpolation between the two values given in Table 3.

4.7 Strength reduction factors

4.7.1 *Strength reduction factors* for design of ultimate vertical and lateral strengths in pile foundations shall be within the range given in Table 4.

The designer shall nominate in the design the *strength reduction factors* chosen along with substantiation as to why the values chosen are considered appropriate. The values chosen shall be to the approval of the *territorial authority*.

COMMENT:
The value of the *strength reduction factor* used in design will depend on the designer's knowledge of the site and the investigations undertaken. As a guide the lower end of the range will generally be appropriate when a limited site investigation is undertaken, average geotechnical properties are used, published correlations are used to obtain design parameters or there will be minimal *construction* control. The upper end of the range will generally be appropriate when a comprehensive site investigation and laboratory testing is undertaken, geotechnical properties are chosen conservatively, site specific correlations are used for design parameters and there will be careful *construction* control.

5.0 Pile Types

5.1 Concrete piles

5.1.1 Precast concrete piles, including prestressed piles, shall withstand without damage or significant cracking, the stresses arising from manufacture, handling and transportation, in addition to those arising from driving and imposed loadings.

5.1.2 Belled bases of cast-in-situ concrete piles shall be no less than 100 mm thick at the edge of the required base and, unless the bell is reinforced, the conical surfaces shall slope at an angle from the horizontal of no less than 60°.

5.2 Steel piles

5.2.1 The design of steel piles shall be based on the nett steel section after deducting an appropriate thickness for future loss by corrosion.

This verification method does not describe a means of determining the amount of corrosion and proposals must be submitted to the *territorial authority* for approval.

COMMENT:
The amount deducted needs to take account of the aggressiveness of the soil. Further guidance can be found in AS 2159 Section 6.3 or the HERA Design and Construction Bulletin No 46.

5.2.2 Allowance for corrosion loss need not be made for steel encased in concrete provided cover to the steel is no less than:

a) 30 mm for prestressed concrete,

b) 50 mm for precast concrete,

c) 75 mm for cast-in-situ concrete.

5.3 Timber piles

5.3.1 Timber piles shall comply with NZS 3605 or NZS 3603 as applicable, and be naturally durable or treated to the appropriate hazard level as recommended by NZS 3640.

5.3.1.1 NZS 3605 shall be subject to the following modification:

Clause 4.2.4.1 after "limitations for" add the word "verified"

Amend 9
Sep 2010

Table 3: Closely Spaced Piles, Design Lateral Resistance
Paragraph 4.6.1

Pile spacing	% of isolated pile lateral resistance
4.0 x nominal pile width	100
1.0 x nominal pile width (palisade type wall)	25

Table 4: Strength Reduction Factors for Deep Foundation Design
Paragraph 4.7.1

Method of assessment of ultimate geotechnical strength for load combinations not involving earthquake overstrength	Range of values of Φ_{pc}
Static load testing to failure	0.65 – 0.85
Static proof (not to failure) load testing	0.70 – 0.90
Static analysis using CPT (Cone Penetrometer Test) data	0.45 – 0.65
Static analysis using SPT (Standard Penetrometer Test) data in cohesionless soils	0.40 – 0.55
Static analysis using laboratory data for cohesive soils	0.45 – 0.55
Method of assessment of ultimate geotechnical strength for load combinations including earthquake overstrength	0.80 – 0.90

Appendix A (Informative)

A1.0 Site Investigation

A1.1 General

A1.1.1 No specific site investigation procedures are given in this document. The following information is provided for guidance only.

A1.1.2 The ground conditions at the *building* site should be investigated to the extent considered necessary, by a person with appropriate expertise and experience, to provide essential site data for design of the proposed *building*. Both preliminary and detailed investigations may need to be undertaken.

A1.2 Preliminary investigation

A1.2.1 The preliminary site assessment may include investigation of:

a) General land form, geology and any conditions likely to facilitate landslip, soil creep, shrinkage and expansion, or subsidence.

b) Information available from records of previous *constructions*, excavations, fillings, *drains* and concealed works, on and adjacent to the site.

c) History and behaviour of neighbouring *buildings* and details of their foundation types, depths and loadings.

d) Potential for flooding (see also NZBC E1) and seasonal changes of soil characteristics.

e) Seasonal, tidal or other natural groundwater changes.

f) Presence of corrosive soil, groundwater and effluents (see also F1/VM1).

A1.3 Detailed investigation

A1.3.1 Detailed investigation may include:

a) Test bores and excavations.

b) Visual inspection.

c) Laboratory and field testing of soil and rock samples.

d) Advice from other people with relevant expertise.

A1.4 Recording information

A1.4.1 The description of the foundation material should be recorded. A suitable method for describing soil and rock is contained in "Guidelines for the field description of soils and rocks in engineering use" published by the New Zealand Geotechnical Society.

A1.4.2 The site investigation record should include a site plan showing the locations of the test bores and excavations.

Appendix B (Informative)

B1.0 Serviceability Limit State Deformations (Settlement)

B1.0.1 No specific method is given for determining foundation settlement. The following information is provided for guidance only.

B1.0.2 Foundation design should limit the probable maximum differential settlement over a horizontal distance of 6 m to no more than 25 mm under serviceability limit state load combinations of AS/NZS 1170 Part 0, unless the structure is specifically designed to prevent damage under a greater settlement.

Amend 8 Dec 2008

B1.0.3 The basis for analysing settlement should be stated in the design. The analysis shall pay due consideration to:

a) Size, shape and depth of the foundations,

b) Proximity and influence of proposed and existing foundations,

c) Variability of the ground,

d) The presence of compressive or expansive materials,

e) Rate of consolidation,

f) Groundwater level,

g) Extent of fill placed and ground removed when constructing the foundation, and

h) Likelihood of liquefaction, internal erosion, soil collapse or other special feature.

Appendix C (Informative) Design Example – Retaining Wall Foundation

C1.0 Description of Wall, Limit States and Soil Properties

A gravity retaining wall backfilled with dry sand and founded on clay. In addition to static loading the effect of a horizontal earthquake acceleration of 0.20g is considered (there is no vertical acceleration component to the earthquake). The additional active thrust generated by the earthquake loading is assumed to act 0.6 times the height of the wall above foundation level. The proportions of the wall and the various soil properties are given in Figure C1.

There are six ultimate limit states to be considered:

1st Short term bearing capacity failure of the foundation beneath the wall,

2nd Short term sliding at foundation level,

3rd Short term bearing capacity failure under earthquake loading,

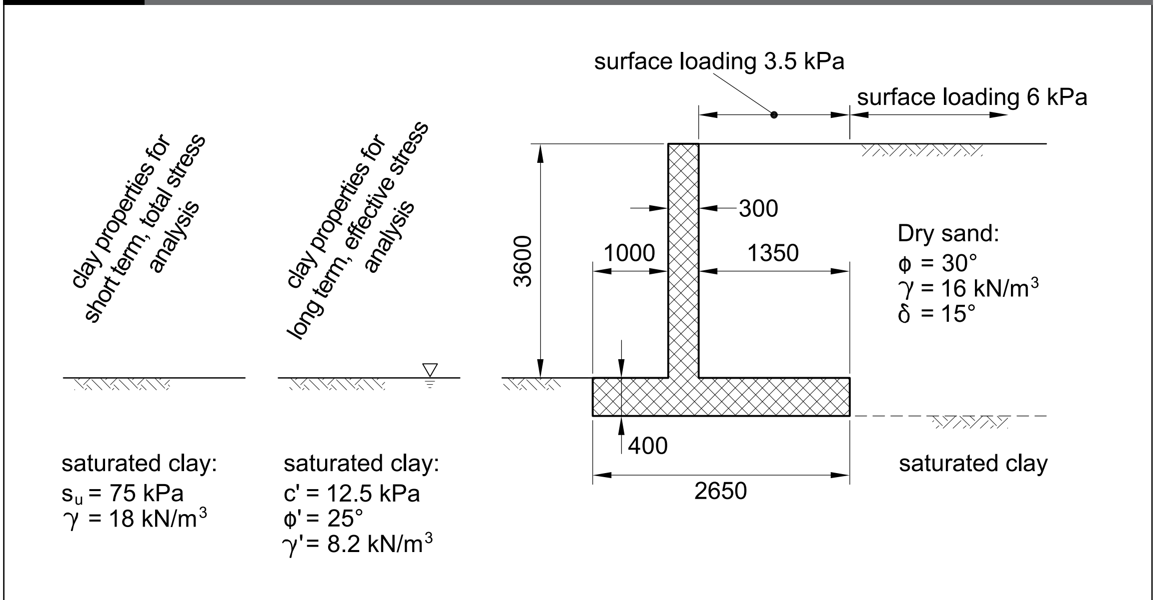
4th Short term sliding under earthquake loading,

5th Long term bearing capacity failure of the foundation beneath the wall,

6th Long term sliding at foundation level.

Short term analysis (both for the initial static loading of the foundation and the earthquake loading) is performed in terms of total stress and uses the undrained shear strength (s_u) of the clay whilst the long term analysis is done using effective stresses and uses the strength parameters c' and ϕ' for the clay (see Paragraph 2.0.6). The thrust from the sand backfill is based on effective stresses and is the same for all cases (see Paragraph 2.0.7).

Figure C1: Wall Details and Soil Properties for the Short Term, Long Term, and Earthquake Loading Cases



C2.0 Earth Pressure Coefficients

Active pressure coefficient for the sand backfill ($\delta = \phi/2$) 0.30

Active pressure coefficient for the sand backfill under EQ (0.20g) 0.45

Passive earth pressure coefficient for clay ($\phi = 25^{o}$ and $\delta = \phi/2$) 3.50

C3.0 Load Factors and Strength Reduction Factors

Load factor for dead loads that improve stability 1.0

Load factor for static active earth thrusts 1.6

Load factor for active earth thrusts under earthquake 1.0

Strength reduction factor for static and EQ bearing failure (Φ_{bc}) 0.45

Strength reduction factor for passive earth pressure (Φ_{pp}) 0.45

Strength reduction factor for static and EQ sliding failure (Φ_{sl}) 0.80

C4.0 Notation

The notation in Figure C2 is used to identify the weights and active thrusts on the wall, whilst in Figure C3 the actions on the foundation are shown.

Figure C2: Notation for the Wall Loads

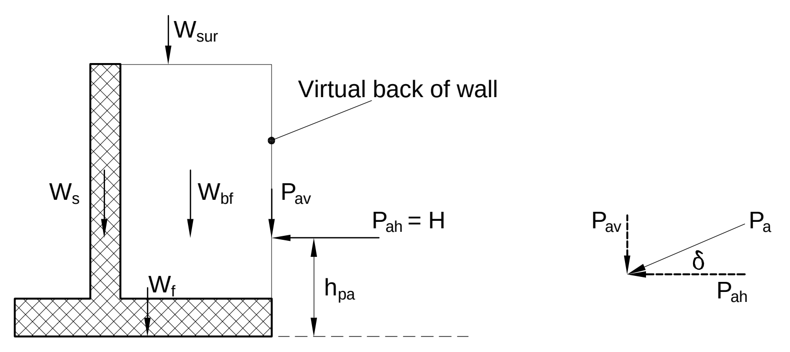
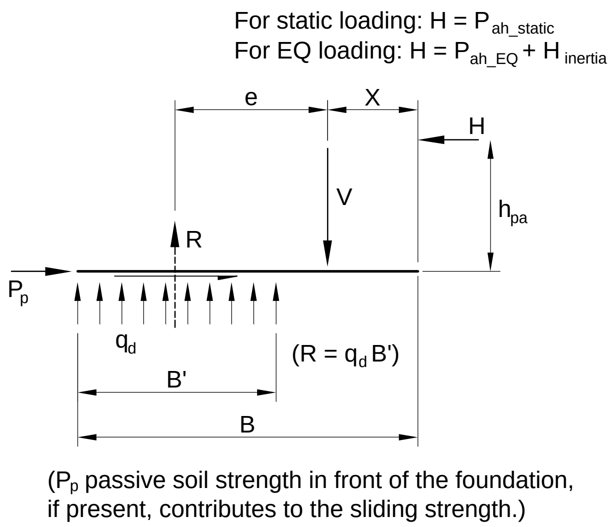


Figure C3: **Actions on the Wall Foundation**



C5.0 Loadings

C5.1 Active thrusts

Unfactored active thrusts:

Static active thrust per metre from backfill (kN/m) . . . . $0.3 \times 16 \times 4^2/2$ = 38.40
Static active thrust per metre from surcharge . . . . 0.3 x 6 x 4 = 7.20
Total static active thrust per metre of wall. . . . . 38.4 + 7.2 = 45.60

EQ active thrust per metre from backfill . . . . $0.45 \times 16 \times 4^2/2$ = 57.60
EQ active thrust per metre from surcharge . . . . 0.45 x 6 x 4 = 10.80
Total EQ active thrust per metre of wall . . . . 57.60 + 10.80 = 68.40

Difference between static and EQ active thrust from backfill . . . . 57.60 – 38.40 = 19.20

Factor static active thrusts and find location of resultant:

Factored static active thrust from backfill (kN/m). . . . . 38.40 x 1.6 = 61.44
Factored static active thrust from surcharge . . . . 7.2 x 1.6 = 11.52
Total factored active thrust per metre of wall . . . . 61.44 + 11.52 = 72.96

Take moments about heel to get location of active thrust (m)

h_{pa_static} = (38.40/3.0 + 7.20 x 0.5) x 4/45.60 = 1.44

Horizontal component of static thrust (kN/m) . . . . H = P_{ah_static} = 72.96 x cos15 = 70.47
Vertical component of static thrust (kN/m). . . . . P_{av_static} = 72.96 x sin15 = 18.88

Factor EQ active thrusts and find location of resultant:

Factored EQ active thrust. . . . . 57.60 x 1 + 10.80 x 1 = 68.40

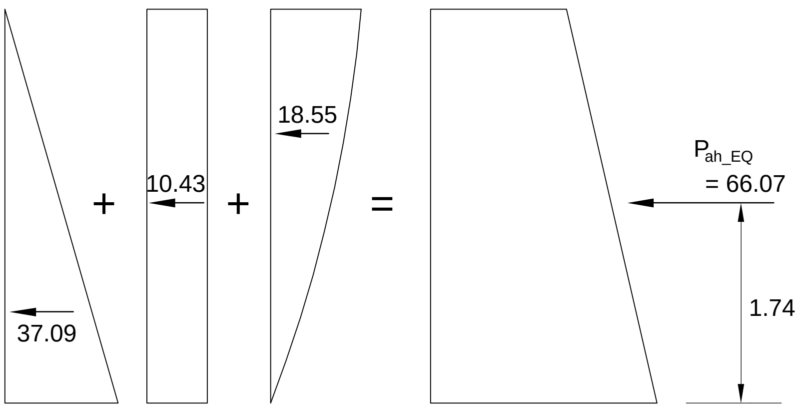
Take moments about heel to get location of active thrust (m)

h_{pa_EQ} = (38.40/3.0 + 10.80 x 0.5 + 19.20 x 0.6) x 4/68.40 = 1.74

Horizontal component of EQ thrust (kN/m) . . . . P_{ah_EQ} = 68.40 x cos15 = 66.07

Vertical component of EQ thrust (kN/m) . . . . .P_{av_EQ} = 68.40 x sin15 = 17.70

Figure C4: **Horizontal Components of the Active Thrust During Earthquake Loading**



38.40cos(15) = 37.09; 10.80cos(15) = 10.43; 19.20cos(15) = 18.55

C5.2 Weights (load factor 1.0) and resultant vertical forces on the wall

Weight of wall stem . . . . W_s = 3.6 x 0.3 x 25 = 27.00
Weight of wall foundation . . . . W_f = 2.65 x 0.4 x 25 = 26.50
Weight of backfill above the heel of the wall . . . . W_{bf} = 3.6 x 1.35 x 16 = 77.76
Vertical force from surcharge above heel . . . . W_{sur} = 3.5 x 1.35 = 4.73

Static vertical force on foundation (kN/m)

V = $V_{\_static}$ = 18.88 + 27.00 + 26.50 + 77.76 + 4.73 = 154.87

EQ vertical force on foundation (k_h = 0.2 and k_v = 0) (kN/m)

V = V_{EQ} = 17.71 + 27.00 + 26.50 + 77.76 + 4.73 = 153.69

C5.3 Horizontal forces applied to the foundation

For the first, second, fifth and sixth ultimate limit states the horizontal force is:

$H = P_{ah\_static}$ = 70.47 kN/metre length of wall

For the third and fourth ultimate limit states the inertia of the wall is added to the active thrust to determine H:

Horizontal inertia force on the weight of the wall stem (W_s)	27.00 x 0.20	=	5.40
Horizontal inertia force on the weight of the wall foundation (W_f).	26.50 x 0.20	=	5.30
Horizontal inertia force on the weight of fill over heel (W_{bf}).	77.76 x 0.20	=	15.55
Horizontal inertia force on the surcharge over heel (W_{sur})	4.73 x 0.20	=	0.95

$H_{inertia}$ = 5.40 + 5.30 + 15.55 + 0.95 = 27.20

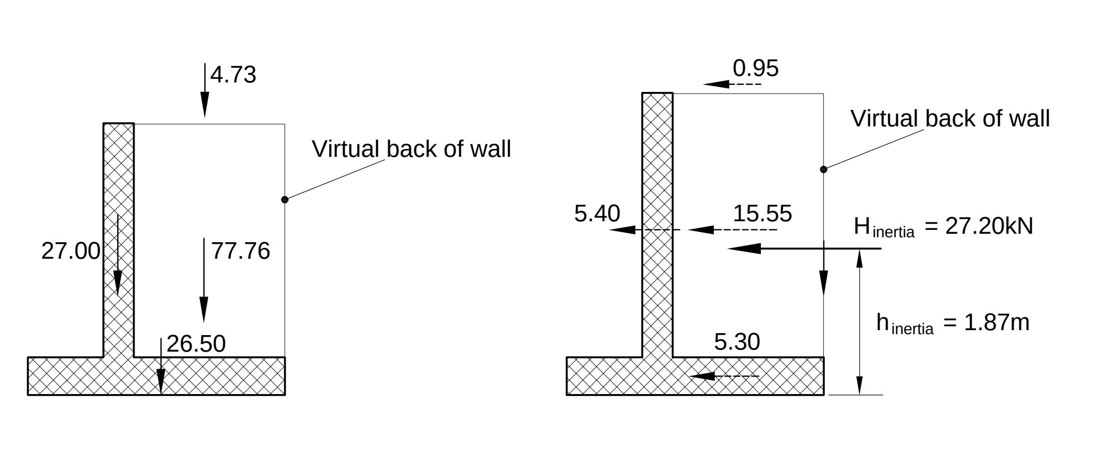
Take moments about heel to get location of resultant inertia force (m):

$h_{inertia}$ = [(15.55 + 5.40) x (0.4 + 3.6/2) + 5.30 x 0.2 + 0.94 x 4]/27.20 = 1.87

$H_{EQ} = P_{ah\_EQ} + H_{inertia}$ = 66.07 + 27.20 = 93.27 kN/metre of wall

The weights of the various components of the wall and the horizontal inertia forces generated by the earthquake horizontal acceleration of 0.20g are given in Figure C5.

Figure C5: Weights of the Wall Components, Horizontal 0.20g Inertia Forces and the Location of the Resultant Inertia Force



C6.0 Surcharge Pressures at Toe

Total stress surcharge pressure in front of wall (kPa)	$q = \gamma_{clay}D_f$ = 18 x 0.4	=	7.2
Effective stress surcharge pressure in front of wall (kPa)	$q' = \gamma'_{clay}D_f$ = 8.2 x 0.4	=	3.3

C7.0 First Ultimate Limit State (short term static foundation bearing failure)

Find X (location of V) by taking moments about heel.

Moment of the vertical forces:

(77.76 x 1.35/2 + 4.73 x 1.35/2 + 27.00 x (1.35 + 0.15) + 26.50 x 2.65/2) = 131.29

X = 131.29/154.87 = 0.848

Eccentricity: e = 70.47 x 1.44/154.87 = 0.655

$B^{I}1$ = 2 x (0.848 + 0.655) = 3.01
$B^{I}2$ = 2 x (2.65 – 0.848 – 0.655) = 2.29

B^{I} is the smaller of $B^{I}1$ and $B^{I}2$:

B^{I} = 2.29 (Distance from R to foundation edge = $B^{I}/2$ = 1.15 > B/6 $\therefore$ ok (Paragraph 3.1.4))

Design bearing pressure: $q_d = V/B^{I}$ = 154.87/2.29 = 67.6 kPa

Determine ultimate bearing strength $q_u = s_u\lambda_{cs}\lambda_{cd}\lambda_{ci}\lambda_{cg}N_c + \lambda_{qg}q$

For this case $\phi = 0$, so $N_c = 5.14$. λ_{cs} shall be taken as 1.0 as foundation is assumed to be long compared to its width. Also $\lambda_{cg} = \lambda_{qg} = 1.0$ as the foundation is horizontal. Thus we need only to evaluate λ_{cd} and λ_{ci}.

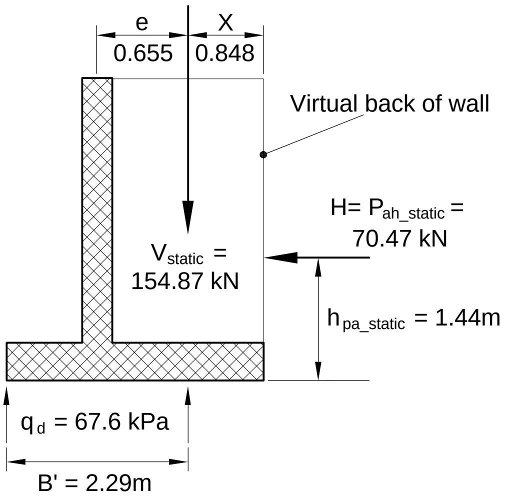
$\lambda_{cd} = 1 + 0.4 \times D_f/B^{I} = 1 + 0.4 \times 0.4/2.29 = 1.07$

$\lambda_{ci} = 0.5(1 + =(1 - H/B^{I}s_u)) = 0.5 \times (1 + =(1 - 70.47/2.29 \times 75)) = 0.88$

$q_u = s_uN_c\lambda_{cd}\lambda_{ci} + q = 75 \times 5.14 \times 1.07 \times 0.88 + 7.2 = 370.19$

$q_{dbs} = q_u\Phi_{bc} = 370.19 \times 0.45 = 166.6$ $q_d = 67.6$ **Thus OK as $q_{dbs} > q_d$**

Figure C6: **Wall and Foundation Loads for the First and Second Ultimate Limit States**



C8.0 Second Ultimate Limit State (short term static foundation sliding failure)

The design sliding resistance is derived from the shear strength on the base and the passive resistance from the clay in front of the embedded part.

Ultimate shear strength: $S = s_u B^I = 75 \times 2.29 = 171.75$

Passive resistance: $P_p = 2\, s_u T_f + 0.5\, \gamma_{clay} T_f^2$ where T_f is the foundation thickness

$= 2 \times 75 \times 0.4 + 0.5 \times 18 \times 0.4^2 = 61.44$

Design sliding resistance: $S\Phi_{sl} + P_p\Phi_{pp} = 171.75 \times 0.8 + 61.44 \times 0.45 = 165.1$

$H = 70.5$ **Thus OK as $S\Phi_{sl} + P_p\Phi_{pp} > H$**

C9.0 Third Ultimate Limit State (short term foundation bearing failure under EQ)

Find X (location of V) by taking moments of vertical forces about heel.

Moment, as for the first ultimate limit state = 131.29

X = 131.29/153.69 = 0.854

To get eccentricity we need to add the moment of the horizontal inertia forces to that of the lateral thrust from the backfill:

e = (66.07 x 1.74 + 27.20 x 1.87)/153.69 = 1.079

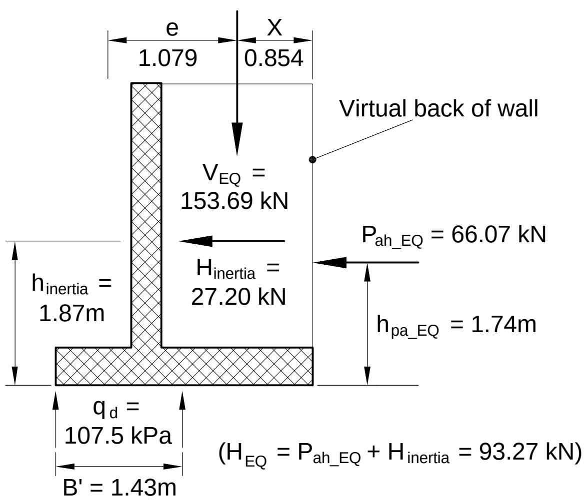
B^I1 = 2 x (0.854 + 1.079) = 3.87
B^I2 = 2 x (2.65 – 0.854 – 1.079) = 1.43

B^I is the smaller of B^I1 and B^I2:

B^I = 1.43 (Distance from R to foundation edge = $B^I/2$ = 0.72 > B/6 ∴ ok (Paragraph 3.1.4)

Design bearing pressure: $q_d = V/B^I$ = 153.69/1.43 = 107.46 kPa

Figure C7: Wall and Foundation Loads for the Third and Fourth Ultimate Limit States



Determine ultimate bearing strength:

For this case $\phi = 0$, so $N_c = 5.14$. λ_{cs} shall be taken as 1.0 as foundation is assumed to be long compared to its width. Also $\lambda_{cg} = \lambda_{qg} = 1.0$ as the foundation is horizontal. Thus we need only to evaluate λ_{cd} and λ_{ci}.

λ_{cd} $= 1 + 0.4 \times D_f/B^l = 1 + 0.4 \times 0.4/1.43 = 1.11$

λ_{ci} $= 0.5(1 + \sqrt{(1 - H/B^l s_u)}) = 0.5 \times (1 + \sqrt{(1 - 93.29/1.43 \times 75)}) = 0.68$

q_u $= s_u N_c \lambda_{cd} \lambda_{ci} + q = 75 \times 5.14 \times 1.11 \times 0.68 + 7.2 = 298.17$

$_{dbs}$ $= q_u \Phi_{bc} = 298.17 \times 0.45 = 134.2$ $q_d = 107.5$ **Thus OK as $q_{dbs} > q_d$**

C10.0 Fourth Ultimate Limit State (short term foundation sliding failure under EQ)

The design sliding resistance is derived from the shear strength on the base and the passive resistance from the clay in front of the embedded part.

Ultimate shear strength: $S = s_u B^l = 75 \times 1.43 = 107.25$

Passive resistance: $P_p = 2\, s_u T_f + 0.5\, \gamma_{clay} T_f^2 = 2 \times 75 \times 0.4 + 0.5 \times 18 \times 0.4^2 = 61.44$

Design sliding resistance: $S\Phi_{sl} + P_p\Phi_{pp} = 107.25 \times 0.8 + 61.44 \times 0.45 = 113.5$

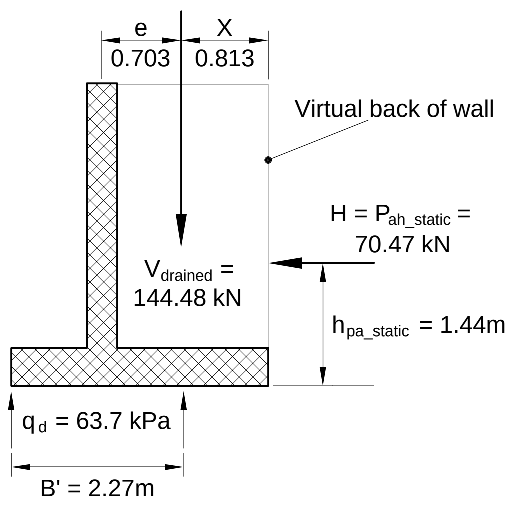
$H = 93.3$ **Thus OK as $S\Phi_{sl} + P_p\Phi_{pp} > H$**

C11.0Fifth Ultimate Limit State (long term foundation bearing failure)

For this case we work in terms of effective stress.

The strength parameters for the clay become: $c^l = 12.5$ kPa and $\phi^l = 25^o$. Furthermore the water table is at the ground surface in front of the wall so the buoyant density ($18 - 9.81 = 8.2$ kN/m^3) controls the effective stresses.

Figure C8: Wall and Foundation Loads for the Fifth and Sixth Ultimate Llimit States



In addition there is a small positive water pressure acting on the underside of the wall which reduces the vertical load applied to the foundation.

$u = 0.4 \times 9.81 = 3.92$ and $V_{drained} = 154.87 - 3.92 \times 2.65 = 144.48$

This has the effect of changing slightly X and e, hence B^I and q_d. We have from the first ultimate limit state the moment about the heel of the wall of the vertical forces = 131.29 kNm per metre length of the wall, so:

$X = (131.29 - 3.92 \times 2.65 \times 2.65/2)/144.48 = 0.813$

Eccentricity of load: $e = 70.47 \times 1.44/144.48 = 0.703$

$B^I = 2 \times (2.65 - 0.813 - 0.703) = 2.27$

Design bearing pressure: $q_d = V_{drained}/B^I = 144.5/2.27 = 63.7$ kPa

For ϕ equal to 25^O the bearing capacity factors are: $N_c = 21$, $N_q = 11$ and $N_\gamma = 9$.

Determine ultimate bearing strength:

$q_{u\_drained} = c^I\lambda_{cs}\lambda_{cd}\lambda_{ci}\,\lambda_{cg}N_c + q^I\,\lambda_{qs}\lambda_{qd}\lambda_{qi}\lambda_{qg}N_q + 0.5B^I\gamma^I\lambda_{\gamma s}\lambda_{\gamma d}\lambda_{\gamma i}\lambda_{\gamma g}N_\gamma$

Shape factors λ_{cs}, λ_{qs} and $\lambda_{\gamma s}$ shall be taken as 1.0 as foundation is assumed to be long compared to its width. Also ground inclination factors λ_{cg},λ_{qg} and $\lambda_{\gamma g}$ = 1.0 as the foundation is horizontal. Thus we need only to evaluate depth and load inclination factors.

Depth factors:

$\lambda_{qd} = 1 + 2\tan\phi^I(1 - \sin\phi^I)^2(D_f/B) = 1 + 2\tan(25)(1 - \sin(25))^2(0.4/2.27) = 1.05$

$\lambda_{cd} = \lambda_{qd} - (1 - \lambda_{qd})/N_q\tan\phi^I = 1.05 - (1 - 1.05)/11\tan(25) = 1.06$ Amend 12 Feb 2014

$\lambda_{\gamma d} = 1$

Load inclination factors:

$\lambda_{qi} = (1 - 0.7H/(V_{drained} + c^IB^I\cot\phi^I))^3 = (1 - 0.7 \times 70.47/(144.48 + 12.5 \times 2.27 \times \cot(25)))^3 = 0.46$

$\lambda_{ci} = (\lambda_{qi}N_q - 1)/(N_q - 1) = 0.40$

$\lambda_{\gamma i} = (1 - H/(V_{drained} + c^IB^I\cot\phi^I))^3 = (1 - 70.47/(144.48 + 12.5 \times 2.27 \times \cot(25)))^3 = 0.28$

$q_{u\_drained} = c^IN_c\lambda_{cd}\lambda_{ci} + q^IN_q\lambda_{qd}\lambda_{qi} + 0.5B^I\gamma^IN_\gamma\lambda_{\gamma d}\lambda_{\gamma i}$

$= 12.5 \times 21 \times 1.06 \times 0.40 + 3.3 \times 11 \times 1.05 \times 0.46 + 0.5 \times 9 \times 2.27 \times 8.2 \times 1 \times 0.28 = 152.29$

$q_{dbs\_drained} = q_{u\_drained}\Phi_{bc} = 152.29 \times 0.45 = 68.5$ $\quad q_d = 63.7$ Amend 12 Feb 2014

Thus OK as $q_{dbs—drained} > q_d$

C12.0 Sixth Ultimate Limit State (long term foundation sliding failure)

The design sliding strength is derived from the sliding resistance on the base and the passive resistance from the clay in front of the embedded part.

Sliding resistance: $S_{drained} = c^IB^I + V_{drained}\tan\phi^I = 12.5 \times 2.27 + 144.48 \times \tan(25) = 95.75$

Passive resistance: $P_{p\_drained} = 0.5K_p\gamma^IT_f^2 + 2c^IT_f\sqrt{K_p}$

$= 0.5 \times 3.5 \times 8.2 \times 0.4^2 + 2 \times 12.5 \times 0.4 \times \sqrt{3.5} = 21.00$

Design sliding strength: $S\Phi_{sl} + P_p\Phi_{pp} = 95.75 \times 0.8 + 21.00 \times 0.45 = 86.05$

$H = 70.5$ **Thus OK as $S\Phi_{sl} + P_p\Phi_{pp} > H$**

C13.0 Comments

The above calculations reveal that, for static loading, it is the long term case that is critical. Also for the short term cases the sliding strength derived from passive earth pressure in front of the embedded foundation is significant.

If the horizontal earthquake acceleration is increased much above 0.2g the third ultimate limit state becomes the limiting case as bearing failure is initiated. However, as explained in clauses 4.11.2.4 and C4.11.2.4 of NZS 4402: 1992, controlled sliding and tilting of the foundation during the passage of an earthquake is possible if the resulting post-earthquake permanent displacements are acceptable. The procedures and criteria for this approach are beyond the scope of this document.

Acceptable Solution B1/AS4 Foundations

(Revised by Amendment 4)

No specific acceptable solution for foundations has been adopted for complying with the Performances of NZBC B1.

Index B1/VM1/VM2/VM3/VM4 & AS1/AS2/AS3/AS4 (Revised by Amendment 4)

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Amend 11
Aug 2011

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 12), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 28 November 2019 and supersedes all previous versions of this document.

The previous version of this document (Amendment 11) will cease to have effect on 31 March 2020.

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.building.govt.nz

B2: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	September 1993	p. 3, Table 1	
Second Edition	28 February 1998	Document revised – second edition issued	
Amendment 2	1 December 2000	p. ii, Document History p. v, Contents p. vi, References	p. 5, 3.2.2, 3.3, 3.4 p. 9, Index
Amendment 3	1 July 2001	p. 2, Document History, Status p. 7, References	p. 8, 5.0.1
Amendment 4	1 April 2004	p. 2, Document History p. 7, References pp. 9–10, Definitions	p. 15, 3.2.1 Comment pp. 17–22 Table 1 p. 23 Index
Amendment 5	1 April 2004	p. 7, References p. 9, Definitions	p. 15, 3.2.1, 3.2.2, 3.2.3
Amendment 5 regarding timber treatment is subject to a transitional provision.			
Reprinted incorporating Amendments 3, 4 and 5	April 2004		
Amendment 6	Effective 30 September 2010 until 1 July 2011	p. 2, Document History, Status p. 5, Contents p. 7, References	pp. 9–10, Definitions pp. 13–15, B2/AS1 1.1, 3.1.1, 3.2.1, 3.2.2
Reprinted incorporating Amendment 6	30 June 2010		
Amendment 7	Effective 4 April 2011 until 14 August 2014	p. 2, Document History, Status p. 5, Contents	p. 7, References pp. 15–15F, 3.2.1, 3.2.2, 3.2.3
Amendment 8	14 February 2014 until 30 May 2017	p. 2A, Document History, Status p. 5, Contents p. 7, References	p. 9, Definitions pp. 13, 15, 15D–15F B2/AS1 3.2, 3.2.2, 3.2.2.3, 3.2.3, 3.2.3.1, 3.2.3.2,
Amendment 9	Effective 1 January 2017 until 31 March 2019	p. 5 Contents p. 7 References	p. 15F B2/AS1 3.5 p. 23 Index
Amendment 10	Effective from 30 November 2018 until 31 October 2019	p. 5 Contents p. 7 References	p. 15F B2/AS1 3.6 p. 23 Index

B2: Document History			
	Date	**Alterations**	
Amendment 11	Effective 27 June 2019 until 31 March 2020	p. 7 References p. 15F B2/AS1 3.6.2, 3.6.3	p. 23 Index
Amendment 12	Effective 28 November 2019	p. 14 B2/AS1 2.2.1	
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

New Zealand Building Code Clause B2 Durability

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992 and amended by the Building Regulations 1997.

FIRST SCHEDULE–*continued*

Clause B2–DURABILITY

Provisions	Limits on application
OBJECTIVE **B2.1** The objective of this provision is to ensure that a *building* will throughout its life continue to satisfy the other objectives of this code.	
FUNCTIONAL REQUIREMENT **B2.2** *Building* materials, components and construction methods shall be sufficiently durable to ensure that the *building*, without reconstruction or major renovation, satisfies the other functional requirements of this code throughout the life of the *building*.	
PERFORMANCE **B2.3.1** *Building elements* must, with only normal maintenance, continue to satisfy the performance requirements of this code for the lesser of the *specified intended life* of the *building*, if stated, or: (a) The life of the building, being not less than 50 years, if: (i) Those *building elements* (including floors, walls, and fixings) provide structural stability to the building, or (ii) Those *building elements* are difficult to access or replace, or (iii) Failure of those *building elements* to comply with the *building code* would go undetected during both normal use and maintenance of the *building*. (b) 15 years if: (i) Those *building elements* (including the *building* envelope, exposed plumbing in the subfloor space, and in-built chimneys and flues) are moderately difficult to access or replace, or	Performance B2.3.1 applies from the time of issue of the applicable *code compliance certificate*. *Building elements* are not required to satisfy a durability performance which exceeds the *specified intended life* of the *building*.

FIRST SCHEDULE–*continued*

Provisions	Limits on application
(ii) Failure of those *building* elements to comply with the *building code* would go undetected during normal use of the *building*, but would be easily detected during normal maintenance. (c) 5 years if: (i) The *building elements* (including services, linings, renewable protective coatings, and *fixtures*) are easy to access and replace, and (ii) Failure of those *building elements* to comply with the *building code* would be easily detected during normal use of the *building*. **B2.3.2** Individual *building elements* which are components of a *building* system and are difficult to access or replace must either: (a) All have the same durability, or (b) Be installed in a manner that permits the replacement of *building elements* of lesser durability without removing *building elements* that have greater durability and are not specifically designed for removal and replacement.	

Contents

Amends 6 and 8

Amend 8 Feb 2014

Amend 7 Apr 2011

Amend 2 Dec 2000

Amend 9 Jan 2017

Amend 10 Nov 2018

References

Amend 7 Apr 2011

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 6 Sep 2010

		Where Quoted
Standards New Zealand		
NZS 3101:-	Concrete structures standard	
Part 1: 2006	The design of concrete structures *Amend: 1, 2*	AS1 3.1.1
SNZ TS 3404: 2018 (Amend 10 Nov 2018)	Durability requirements for steel structures and components	AS1 3.6
NZS 3602:- (Amend 7 Apr 2011)		
Part 1: 2003 (Amend 5 Apr 2004)	Timber and wood-based products for use in building	AS1 3.2.1, 3.2.2 (Amend 5 Apr 2004)
NZS 3604: 2011 (Amend 3 Jul 2001; Amends 2 and 8)	Timber framed buildings	AS1 3.2.3 (Amend 5 Apr 2004)
NZS 3640: 2003 (Amends 7 and 8)	Chemical Preservation of round and sawn timber *Amend: 1, 2, 3, 4, 5*	AS1 3.2.1, 3.2.2.1, 3.2.3
NZS 4223: (Amend 9 Jan 2017)	Glazing in buildings	
Part 2: 2016	Insulating glass units	AS1 3.5
NZS 4251:-	Solid plastering	
Part 1: 2007 (Amend 6 Sep 2010)	Cement plaster for walls, ceilings and soffits	AS1 3.3.1
NZS 4297: 1998	Engineering design for earth buildings	AS1 3.4.1
NZS 4299: 1998 (Amend 2 Dec 2000)	Earth buildings not requiring specific design *Amend: 1*	AS1 3.4.1
New Zealand publications (Amend 11 Jun 2019)		
NASH Standard Part 2: May 2019	Light Steel Framed Buildings	AS1 3.6.2, 3.6.3

Definitions

Amend 6 Sep 2010

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

Amend 8 Feb 2014

Adequate ***Adequate*** to achieve the objectives of the *building code*.

Baluster A post providing the support for the top and bottom rails of a barrier.

Balustrade The infill parts of a barrier (typically between floor and top rail).

Amend 4 Apr 2004

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

Amend 6 Sep 2010

Building Code means the regulations made under section 400 of the *Building Act 2004*.

Amend 4 Apr 2004

Building element Any structural and non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.

Cladding The exterior weather-resistant surface of a *building*.

Amend 4 Apr 2004

Code compliance certificate means a certificate issued by a *building consent authority* under section 95 of the *Building Act 2004*.

Amend 5 Apr 2004

Amend 6 Sep 2010

Damp-proof course (DPC) A narrow strip (generally up to 300 mm wide) of *durable vapour barrier* placed between *building elements* to prevent the passage of moisture from one element to another.

Damp-proof membrane (DPM) A sheet material, coating or vapour barrier, having a low water vapour transmission, and used to prevent water and water vapour movement through concrete in contact with the ground. (Also known as a concrete underlay.)

Durable Resistant to wear and decay.

Amend 4 Apr 2004

External wall Any exterior face of a *building* within 30° of vertical, consisting of *primary* and/or *secondary elements* intended to provide protection against the outdoor environment, but which may also contain *unprotected areas.*

Amend 4 Apr 2004

Fixture An article intended to remain permanently attached to and form part of a *building*.

Flue The passage through which the products of combustion are conveyed to the outside.

Handrail A rail to provide support to, or assist with the movement of a *person*.

Amend 4 Apr 2004

Hazardous Creating an unreasonable risk to people of bodily injury or deterioration of health.

Intended use in relation to a *building*,

(a) includes any or all of the following:

(i) any reasonably foreseeable occasional use that is not incompatible with the *intended use*:

(ii) normal maintenance:

(iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but

(b) does not include any other maintenance and repairs or rebuilding.

Amend 6 Sep 2010

Person includes the Crown, a corporation sole, and also a body of *persons*, whether corporate or unincorporated.

Primary element A *building element* providing the basic load bearing capacity to the structure, and which if affected by *fire* may initiate instability or premature structural collapse.

Secondary element A *building element* not providing load bearing capacity to the structure and if affected by *fire*, instability or collapse of the *building* structure will not occur.

Amend 4 Apr 2004

Amend 6 Sep 2010

Specified intended life has the meaning given to it by section 113(3) of the Building Act 2004.

Section 113(3) states:

> "(3) In subsection (2), **specified intended life**, in relation to a building, means the period of time, as stated in an application for a building consent or in the consent itself, for which the building is proposed to be used for its intended use."

Unprotected area in relation to an *external wall* of a *building*, means any part of the *external wall* which is not *fire* rated or has less than the required *FRR*.

COMMENT:
Unprotected area includes non-*fire* rated windows, doors, or other openings, and non-*fire* rated *external wall construction.*

Vapour barrier Sheet material or coating having a low water-vapour transmission, and used to minimise water-vapour penetration in *buildings*. (*Vapour barriers* are sometimes referred to as *damp-proof membranes.*)

Amend 4 Apr 2004

Water heater A device for heating water.

Verification Method B2/VM1

1.0 Durability Evaluation

1.0.1 Verification that the durability of a *building element* complies with the NZBC B2.3.1 and B2.3.2 will be by proof of performance and shall take into account the expected in-service exposure conditions by one or more of the following:

a) In-service history,

b) Laboratory testing,

c) Comparable performance of similar *building elements.*

1.1 In-service history

1.1.1 Verification of durability based on in-service history of a *building element*, including materials, components and systems shall take into account but not be limited to:

a) Length of service,

b) Environment of use,

c) Intensity of use,

d) Any reaction with adjacent materials,

e) Limitations in performance,

f) Degree of degradation, and

g) Changes in formulation.

1.2 Laboratory testing

1.2.1 Verification of durability based on successful performance in a laboratory test shall be accompanied by an assessment of the tests performed, their relevance to field and service conditions, and in particular:

a) Types of degradation mechanisms likely to be induced by testing,

b) The degradation mechanisms likely in service,

c) Details of methods of assessment,

d) Variability of results, and

e) The relevance of the test to the *building element* under study.

1.3 Similar materials

1.3.1 For the purposes of evaluation, a *building element* may be considered as similar to another *building element* with proven performance, if both are subject to the same controls for composition and overall performance. Examples of such controls are Approved Documents or Standards. Where such a direct comparison is not possible, the *building element* shall be independently assessed to determine the degree of similarity.

1.3.2 Assessment shall take into account but not be limited to:

a) Product composition,

b) Method and quality assurance of manufacture,

c) Degradation mechanisms,

d) Local environment,

e) Conditions of use,

f) Required maintenance, and

g) Performance in use.

COMMENT:
Environment

1. To be acceptable, any opinion in support of the assessed durability for a *building element* shall clearly identify the conditions of use and the environment under which that durability will be achieved. If the *building element* can be reasonably expected to be used in circumstances which will reduce the durability, any limitations in use shall be clearly identified and evaluated.

2. Circumstances which need to be considered include, but are not limited to:

   a) Maintenance required to achieve the required durability (e.g. painting, cleaning, replacing high wear items such as washers),

   b) Installation details of the total system (e.g. fixings, flashings, jointing materials),

   c) Compatibility with other materials (e.g. galvanic corrosion, plasticiser migration),

d) Locality or macroclimatic effects (e.g. coastal or thermal areas, wet or damp ground conditions),

e) Microclimatic effects (e.g. sheltered areas on *buildings* such as eaves),

f) External environment influences (e.g. local industrial operations such as fertiliser works), and

g) Internal environment (e.g. swimming pools, chemical processing areas, sauna rooms).

Acceptable Solution B2/AS1

1.0 Durability Applications

1.0.1 This acceptable solution applies to materials and components required to satisfy the performances specified in other NZBC clauses.

COMMENT:
All *building* work shall comply with the NZBC. This means that *building elements*, both individually and as part of a system, shall meet all the performances required by the applicable NZBC clauses and shall continue to do so for the required durability period. In some cases, *building elements* (e.g. decorative coatings and trim) are not required to satisfy an NZBC performance criterion. Such *building elements* will then have no B2 durability requirement. However, where a *building element* serves two purposes, only one of which must satisfy the NZBC, it shall have the durability appropriate to its location and use. For example, a decorative finish applied to a *building element* required by the NZBC to have an impervious easily cleaned surface will need to satisfy the 5 year durability performance.

1.1 Acceptable Solutions and Verification Methods

1.1.1 *Building elements*, including materials, components and systems, complying with a publication referenced in the Acceptable Solutions and Verification Methods, satisfy B2 requirements only when the conditions of use stated in the publication and Acceptable Solutions and Verification Methods prevail.

COMMENT:
It is not practicable within the Acceptable Solutions and Verification Methods to cover all possible combinations, uses and conditions which may be applied to a *building element*. In special circumstances and where elements are called up but are used outside the scope of the application in the Acceptable Solution or Verification Method, durability shall be verified by B2/VM1.

Amends 6 and 8

1.2 Assessing required durability

1.2.1 Evaluation of *building elements* shall be based on the following concepts:

a) **Difficult to access or replace** – applies to *building elements* where access or replacement involves significant removal or alteration of other *building elements*. Examples are works involving the removal of masonry or concrete *construction*, or structural elements or repair of buried tanking membranes. A 50 year durability is required.

b) **Moderately difficult to access or replace** – applies to *building elements* where access or replacement involves the removal or alteration of other *building elements*. Examples are the replacement of services reticulation in wall cavities and skillion roofs, or of plant and hotwater cylinders built into roof spaces without adequately sized access openings. A 15 year durability is required.

c) **Easy to access and replace** – applies to *building elements* where access or replacement involves little alteration or removal of other *building elements*. Examples are linings, trim, light fittings, hotwater cylinder elements and door hardware, or where specific provision for removal has been made. A 5 year durability is required.

d) **Failure to comply with the NZBC would go undetected during both normal use and maintenance of the building** – applies where the *building elements* are hidden from view with no provision for inspection access, and failure would not be apparent until significant damage had occurred to other *building elements*. Examples are building paper behind a masonry veneer cladding, and insulation in a skillion roof. A 50 year durability is required.

e) **Failure to comply with the NZBC would go undetected during normal use of the building but would be easily detected during normal maintenance** – applies where normal maintenance will identify faults unlikely to be observed by *building* occupants until significant damage has occurred. Examples are degradation of exterior claddings on roofs and walls, sealant filled joints, flashings, services with specific provision for inspection access, chimneys and flues. A 15 year durability is required.

f) **Failure to comply with the NZBC would be easily detected during normal use of the building** – applies where the failure is obvious to the *building* occupants. Examples are exposed *building elements* which are damaged or inoperative such as protective finishes, essential signs, sticking doors, slip resistant surfaces, stair treads and surface-run *building* services equipment. A 5 year durability is required.

1.2.2 Figure 1 provides a means of assessing the durability requirements for *building elements*.

1.3 Examples of durability requirements

1.3.1 Table 1 is an acceptable solution establishing durability requirements of nominated *building elements*.

2.0 Maintenance

2.1 Normal maintenance

2.1.1 Normal maintenance is that work generally recognised as necessary to achieve the expected durability for a given *building element*. The extent and nature of that maintenance will depend on the material, or system, its geographical location and position within the *building*, and can involve the replacement of components subject to accelerated wear.

2.1.2 It is the responsibility of the person specifying the *building element* to determine normal maintenance requirements. These may be based on the manufacturer's recommendations and may also include periodic inspections of elements not readily observable without a specific effort (e.g. access to roof or subfloor spaces).

2.1.3 Basic normal maintenance tasks shall include but not be limited to:

a) Where applicable, following manufacturers' maintenance recommendations,

b) Washing down surfaces, particularly exterior *building elements* subject to wind driven salt spray,

c) Re-coating interior and exterior protective finishes,

d) Replacing sealant, seals and gaskets in joints,

e) Replacing valves, washers and similar high wear components in easily accessed service equipment and other *building elements*,

f) Cleaning and replacing filters in *building* services systems,

g) The regular servicing of boilers, cooling towers, lifts, escalators, emergency lighting and *fire* protection equipment, and

h) The maintenance of signs for access, *escape routes*, emergency equipment and *hazardous* areas.

COMMENT:
Maintenance does not include such things as upgrading *building elements* to meet the demands of new technology or the increased environmental expectations of users.

2.2 Scheduled maintenance

2.2.1 Scheduled maintenance comprises the inspection, maintenance and reporting procedures for *building elements* required to have a *compliance schedule* in terms of section 100 of the Building Act. By those procedures the *building elements* concerned are effectively deemed to have a durability of the life of the *building* because they are required to perform as designed at all times. The relevant maintenance procedures may include total replacement. Amend 12 Nov 2019

3.0 Generic Materials

3.1 Concrete

3.1.1 NZS 3101: Part 1 Section 3 is an acceptable solution for meeting the durability requirements of concrete building elements subject to the following modification:

Provisions in this Standard that are in non-specific or unquantified terms do not form part of the Acceptable Solution. Non-specific Amend 6 Sep 2010 or unquantified terms include, but are not limited to, special studies, manufacturer's advice and references to methods that are appropriate, adequate, suitable, relevant, satisfactory, acceptable, applicable, or the like. Such provisions must be treated as the basis of an alternative solution proposal.

Amend 6
Sep 2010

3.2 Timber and wood-based building products

3.2.1 The following Standards form an *Acceptable Solution* for B2/AS1 meeting the durability requirements of timber and wood-based *building elements*,

a) NZS 3602 Part 1 as modified by Paragraph 3.2.2.

b) NZS 3640 as modified by Paragraph 3.2.3.

c) NZS 3604, with reference to NZS 3602 (and NZS 3640), as modified by Paragraph 3.2.1 a) and b) above.

Amend 8
Feb 2014

COMMENT:
The use of different timbers or timber treatments to those referred to in NZS 3602 are outside the scope of this *Acceptable Solution*. Where the use of a different timber or timber treatment is proposed, it shall be separately assessed for compliance with the *Building Code*. For example, if imported hard-wood is to be used to surface a deck, evidence that the timber was *durable* for a minimum of 15 years in the expected exposure conditions is required.

Amend 8
Feb 2014

3.2.2 Modification to NZS 3602

3.2.2.1 Level of treatment references to radiata pine and Douglas fir solid timber in Table 1 categories 'C', 'D' and 'E' and Table 2 category 'B' shall be replaced by Tables 1A and 2A below. Table 1A and Table 2A are to be read with NZS 3602 sections 108 to 111 inclusive, with the amendments in Paragraph 3.2.2.3 below.

Other references to radiata pine, Douglas fir solid timber and engineered wood products in NZS 3602, including Table 1 categories 'A', & 'B'; Table 2 category 'A'; and Table 3 are unaltered.

Amend 8
Feb 2014

Amend 7
Apr 2011

Laminated veneer lumber (LVL) treated using LOSP borne azoles as specified for H3.1 in NZS 3640 Table 6.2 satisfies the minimum treatment requirement of H 1.2.

Amend 8
Feb 2014

Table 1A **Requirements for radiata pine and Douglas fir solid timber to achieve a (minimum) 50 year durability performance**

Ref No.	Wood-based building components	Species or type	Level of treatment (2) to NZS 3640
C – Members protected from the weather but exposed to ground atmosphere (see section 108 of NZS 3602)			
1C.1	Jackstuds, subfloor braces, bearers, wall plates, floor joists to the subfloor, blocking, subfloor wall studs, wailings and battens, wall studs and nogs, diagonal boards	Radiata pine Douglas fir	H1.2
1C.3	Interior flooring, suspended ground floors	Radiata pine Douglas fir	H1.2

NOTE

(2) Throughout Table 1A, timber treated to a higher level than the minimum satisfies the minimum requirements

D – Members protected from the weather but with a risk of moisture penetration conducive to decay (see section 109 of NZS 3602)			
Roof members (in or associated with)			
1D.1	Sarking and framing not protected from solar driven moisture through absorbent cladding materials(8)	Radiata pine Douglas fir	H1.2
1D.2	Enclosed flat roof framing and associated roof members	Radiata pine Douglas fir	H1.2
1D.3	Enclosed skillion roof framing and associated roof members	Radiata pine Douglas fir	H1.2
1D.4	Valley boards and boards supporting flashings or box gutters and flashings to roof penetrations and upstands to roof decks (10)	Radiata pine Douglas fir	H1.2
Wall members (in or associated with)			
1D.5	Framing and other members within or beneath a parapet	Radiata pine Douglas fir	H1.2
1D.6	Framing, and other members within enclosed decks or balconies	Radiata pine Douglas fir	H1.2
1D.7	Cantilevered enclosed deck joists and associated framing including joist trimmers, nogs, and blocking(5)	Radiata pine Douglas fir	H3.2
1D.8	Framing and other members supporting enclosed decks (including enclosed cantilevered decks) or balconies	Radiata pine Douglas fir	H1.2
1D.10	Battens used behind cladding to form a cavity	Radiata pine Douglas fir	H3.1
1D.14	All other exterior wall framing and other members including exterior and boundary joist (9) (11)	Radiata pine Douglas fir(14)	H1.2

NOTE

(5) H3.2 refers to preservative treatments outlined in NZS 3640.

(8) Timber shakes and shingles, and similar absorbent claddings, absorb moisture that can be driven in frame cavities by evaporation. Unless the cavities are adequately drained and ventilate, continuing condensation caused by solar driven transfer increases the moisture content in the cavities and timber framing requiring a higher level of timber treatment to resist decay.

(9) Such as joists, lintels, wall plate and double top plates, studs, together with parapets, enclosed balustrades, boxed columns and chimneys

(10) Any metal flashing shall be separated from the treated timber with building paper.

(11) Exposed ends of joists shall be protected by a boundary joist.

Amend 7
Apr 2011

Table 1A (continued) **Requirements for radiata pine and Douglas fir solid timber to achieve a (minimum) 50 year durability performance**

Ref No.	Wood-based building components	Species or type	Level of treatment (2) to NZS 3640
E – Members not exposed to weather or ground atmosphere and in dry conditions (see section 110 of NZS 3602)			
1E.1	All roof trusses, including gable end trusses, roof framing, ceiling and eaves framing, purlins and battens	Radiata pine Douglas fir(14)	H1.2
1E.2	All midfloor framing including boundary joists, ceiling framing, ceiling battens, and double top plates	Radiata pine Douglas fir(14)	H1.2
1E.3	Wall framing and roof framing (including trusses) protected from the weather, in unlined and unoccupied farm buildings and outbuildings except those not allowed in 110.2(f) of NZS 3602	Radiata pine Douglas fir	None
1E.5	Internal walls	Radiata pine Douglas fir(14)	H1.2
1E.7	Interior flooring	Pinus species Douglas fir(14)	H1.2

NOTE

(14) Exceptions to the levels of treatment for Douglas fir are provided in Paragraph 3.2.2.2 of this *Acceptable Solution* B2/AS1.

Table 2A **Requirements for radiata pine and Douglas fir solid timber to achieve a 15-year durability performance**

Ref No.	Wood-based building components	Species or type	Level of treatment(2)
B – Members protected from the weather and dampness (see section 111 of NZS 3602)			
2B.1	Non-load bearing interior wall framing	Radiata pine Douglas fir(9)	H1.2
2B.2	Stair treads, risers and handrails	Radiata pine Douglas fir(9)	None

NOTE

(2) Throughout Table 2A, timber treated to a higher level than the minimum satisfies the minimum requirements

(9) Exceptions to the levels of treatment for Douglas fir are provided in Paragraph 3.2.2.2 of this *Acceptable Solution* B2/AS1.

Amend 7
Apr 2011

Amend 8
Feb 2014

3.2.2.3 Modifications to to NZS 3602 sections 109, and 110

Table 1A and Table 2A are to be read with NZS 3602 sections 109 and 110 including amendments below.

109.2 (a) (iii)	Delete and replace with: Members supporting enclosed cantilevered decks having increased risk of failure due to there being single points of support.
109.2 (b)	Delete and replace with: Timber framed elements exposed to exterior weather conditions on both faces such as parapets and balustrades, or exterior boxed beams columns or chimneys.
109 (c) (vi)	Delete
109 (c) (vii)	Delete and replace with: Framing and other members in exterior walls including boundary joists.
Figure 1	Delete
Figure 2	Delete
Figure 3	Delete
110.2 (b)	Delete
110.2 (c)	Delete and replace with: Internal walls
110.3.1	Delete and replace with: Floor coverings in 'wet areas' such as laundries, bathrooms, kitchens and toilets shall be as set out in E3/AS1. Where maintenance of an impervious coating cannot be assured in wet areas, plywood flooring treated to minimum H3, or solid pinus species or Douglas fir flooring treated to minimum H1.2, shall be used.

Amend 7
Apr 2011

Amend 8
Feb 2014

3.2.3 Amendments to NZS 3640.

3.2.3.1 Delete comment C3.1 and replace with the following as normative text:

3.1.1 NZBC clause B2.3.1 refers to minimum durability requirements for building elements. Timber used for structural purposes is required to be durable in-service for the life of the building, being not less than 50 years unless the building has a specified intended life. This is applicable to hazard classes H1.2, H3.2, H4, H5, and H6. Structural timber refers to timber that has been graded to characteristic strength and stiffness properties.

The minimum requirement for a H1.2 treatment for timber framing is to provide protection in-service but the preservative treatment is not designed for extended exposure to elevated moisture content.

Timber used for non-structural purposes, such as H1.1 and H3.1 is required to be durable in-service for a minimum of 5 years and 15 years respectively.

3.2.3.2 Delete clause 6.3.1.1 and replace with:

6.3.1.1 Complete sapwood penetration shall be achieved.

Amends 7 and 8

Amends 7 and 8

3.3 Solid plastering

3.3.1 NZS 4251: Part 1 is an acceptable solution for meeting the durability requirements of cement plasters for walls, ceilings and soffits within its scope.

3.4 Earth buildings

3.4.1 NZS 4297 and NZS 4299 are acceptable solutions for meeting the durability requirements of earth *buildings* within their scope.

Amend 2 Dec 2000

3.5 Insulating Glass Units

3.5.1 NZS 4223.2 is an Acceptable Solution for meeting the durability requirements of insulating glass units, within its scope.

3.5.2 Modifications to NZS 4223.2

Delete clause 5.3.

Replace with

"5.3 Marking

Insulating glass units shall be permanently and clearly marked. As a minimum, marking shall include the following:

(a) The name or registered trademark of the manufacturer or supplier;

(b) The date of manufacture (use the year as the minimum), and

(c) Complies with NZS 4223.2:2016.

Marking shall be visible after the IGU has been installed, and must be legible and durable for the life of the unit.

Amend 9 Jan 2017

NOTE -

(1) Etching and permanent laser marking are acceptable means for marking insulating glass units. Externally affixed adhesive labels are not acceptable.

(2) Additional marking may be used by the manufacturer."

Amend 9 Jan 2017

3.6 Steel

3.6.1 SNZ TS 3404: SNZ TS 3404 is an Acceptable Solution for meeting the durability requirements of steel *building elements* within its scope.

Amend 10 Nov 2018

3.6.2 Light steel framing

Clause 3 of NASH Standard Part 2 as modified by Paragraph 3.6.3 is an Acceptable Solution for meeting the *durability* requirements of light steel framing *building elements* used within the Standard's scope.

3.6.3 Modifications to NASH Standard Part 2

Delete clause 3.1.

Replace with:

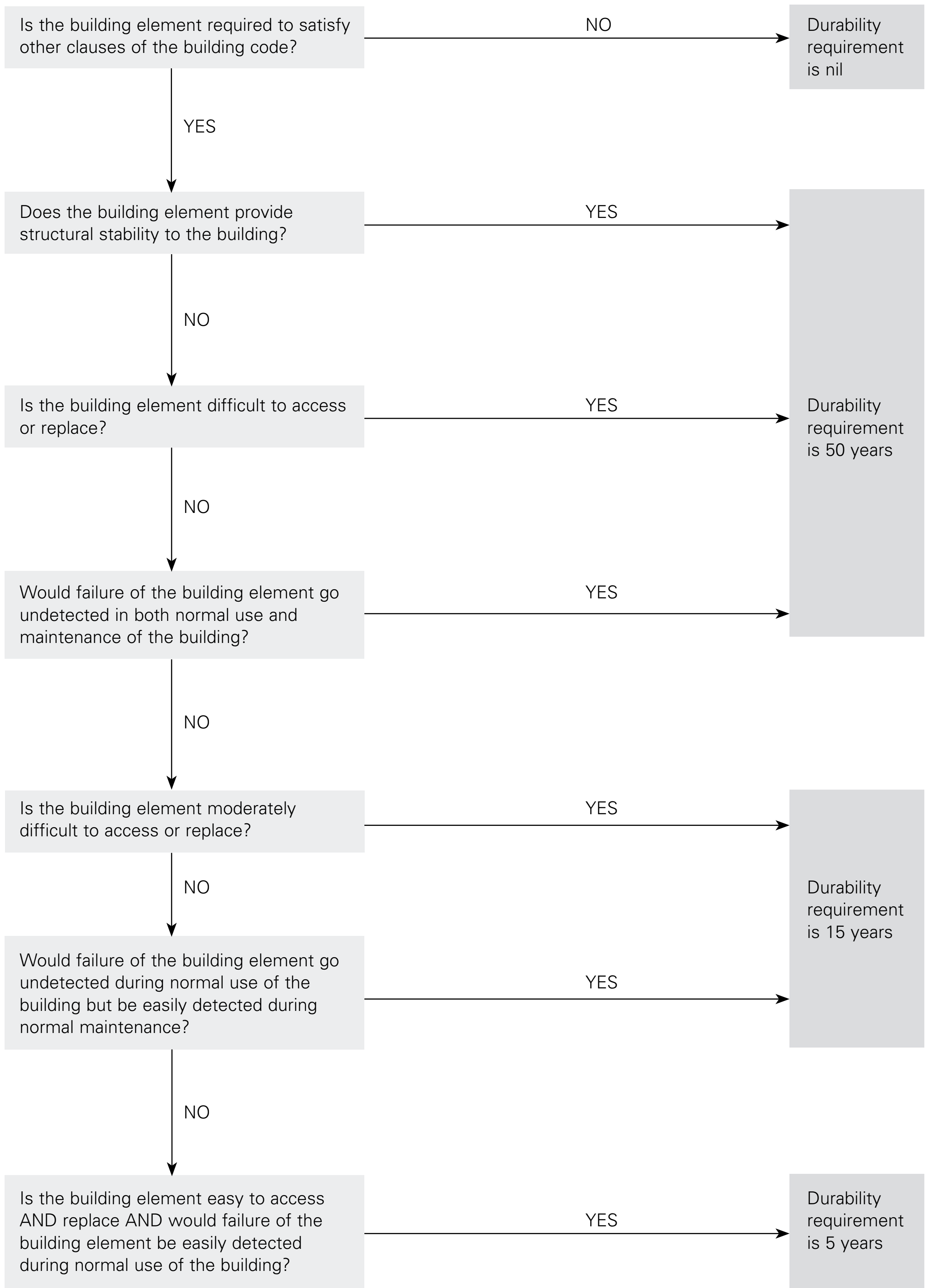
3.1 GENERAL

Steel framing, brackets and fixings used for wall framing, roof framing, and mid floors shall be within a closed building envelope that provides at least the same level of performance as a building envelope that conforms to Acceptable Solution E2AS1.

Eaves shall be lined.

Amend 11 Jun 2019

Figure 1: Assessment of Durability Requirement
Paragraph 1.2.2



Note:
Building elements shall not be required to satisfy a durability performance which exceeds the *specified intended life* of the *building*

Table 1: Durability Requirements of Nominated Building Elements

Note: Clause B2.3.2 requires that all hidden elements have at least the same durability as that of the element that covers it (i.e. must have the same expected life) which may be more than the requirement in clause B2.3.1. For example, the reason that a brick tie has a requirement of not less than 50 years in this table, instead of the 15 year requirement for *cladding*, is that the brick veneer that hides it has an expected durability of 50 years or more.

Building Element	Component	Situation/Function	Not less than 50 years	Not less than 15 years	Not less than 5 years
Acoustic elements		Covered by or integral with structural elements or bracing panels	✓		
		Behind non-structural *claddings* or linings	✓		
		Surface mounted		✓	
Balustrade	(Refer to safety barrier)				
Battens (Cavity battens for wall	Battens	Where wall *cladding* durability requirement is 15 years		✓	
cladding systems) *(See note at top of table)*		Where wall *cladding* provides bracing	✓		
Bracing Elements		All – includes the bracing element and fixings	✓		
Building wraps (See also wind barriers)	Roof underlay	Access requires removal of roof tiles or structural elements	✓		
(See note at top of table)		Where roof *cladding* durability requirement is 15 years		✓	
	Wall underlay	Where wall *cladding* durability requirement is not less than 50 years (e.g. providing bracing, or where the *cladding* is very durable e.g. brick veneer)	✓		
		Where wall *cladding* durability requirement is 15 years		✓	
	Wind barriers	Providing bracing (i.e. rigid wind barriers)	✓		
		Not providing bracing (non-rigid wind barriers)		✓	
Cladding	Roof	Structural	✓		
(including jointing systems)		Non-structural		✓	
	Wall	Structural including bracing elements	✓		
		Non-structural		✓	
Curtain walling	Frames and fixings	All *buildings*	✓		
	Gaskets, glazing or panelling and beads			✓	
	Internal hardware				✓
Damp-proof course (DPC)	*DPCs* under timber members	Under structural framing	✓		
		Under non-structural framing		✓	
Damp-proof membranes (DPM) *(See note at top of table)*	Damp-proofing generally	*DPMs* under concrete floor slabs	✓		

Amend 4 Apr 2004

Table 1: Durability Requirements of Nominated Building Elements (cont'd)

Building Element	Component	Situation/Function	Not less than 50 years	Not less than 15 years	Not less than 5 years
Damp-proof membranes (DPM) (Continued)	Damp-proofing generally	*DPMs* applied to the top of concrete slabs		✓	
		DPMs behind retaining walls used for landscaping		✓	
		DPMs designed for ready access and replacement		✓	
		DPM behind tiles	Same durability as the tile covering it		
	Water-proofing of basements	Tanking, except those designed for ready access	✓		
		Tanking designed for ready access		✓	
Decking (timber)	Decking	Structural (e.g. bracing diaphragm)	✓		
		Non-structural strip decking		✓	
	Sub-floor structure	All	✓		
Demountable Partitions	Partition including frame, fixings, and linings	All			✓
Doors (including frame)	Non fire rated doors	Internal			✓
		External		✓	
		Furniture and hardware			✓
	Fire rated doors	Internal		✓	
		External		✓	
		Furniture and hardware			✓
Electrical work *(See note at top of table)*	Wiring	Buried in or under concrete slabs or behind structural linings without ducts	✓		
		Concealed behind linings or in complex ducts or conduit, or surface mounted in conduit		✓	
		Wires in easy to access ducts			✓
	Fittings	Concealed and moderately difficult to access or replace	✓		
		Surface mounted			✓
	Ducting or conduit	Difficult to access or replace	✓		
		Moderately difficult to access or replace		✓	
Fire rated walls		Structural walls including bracing elements	✓		
		All others		✓	
Fixings	Nails and screws	Used to fix structural or difficult to replace *building elements*	✓		
		Under water-proof membranes	✓		
		Under roofing membranes	✓		
		Used to fix non-structural or moderately difficult to replace *building elements*		✓	
	Bolts	Used to fix structural or difficult to access or replace *building elements* including structural elements of decks and barriers	✓		

Amend 4
Apr 2004

Table 1: Durability Requirements of Nominated Building Elements (cont'd)

Building Element	Component	Situation/Function	Not less than 50 years	Not less than 15 years	Not less than 5 years
Fixings (Continued)	Bolts	Used to fix non-structural or moderately difficult to replace *building elements*		✓	
	Brick ties and fixings	All	✓		
	Proprietary fixings	Used to fix structural or difficult to replace *building elements*	✓		
		Used to fix non-structural or moderately difficult to replace *building elements*		✓	
	Adhesives	Used to fix structural or difficult to replace *building elements*	✓		
		Used to fix non-structural or moderately difficult to replace *building elements*		✓	
	Face fixings	Used to fix accessories, door furniture and hardware			✓
Flashings *(See note at top of table)*	Roof, wall or window	All flashings to roof *cladding*, *flues* and other roof penetrations		✓	
		Requires the removal of *cladding* above the roof to be replaced	✓		
		Hidden flashings such as behind brick veneer, stucco or spandrel panels	✓		
		Visible and does not require the removal of the *cladding* to be replaced		✓	
		Requires the removal of the *cladding* to be replaced	✓		
Flooring – sheet or strip *(See note at top of table)*		Floor bracing diaphragm	✓		
		Flooring laid under bottom plates	✓		
		Flooring laid between bottom plates		✓	
Floor coverings		Protective or acoustic coverings			✓
Flue systems	All *flue* systems	Those built into the floor, wall, ceiling or roof		✓	
		Those exposed to view or penetrating the floor, wall, ceiling or roof through a sleeve			✓
Framing	(refer to wall framing or to roof framing as appropriate)				
Guttering and downpipes *(See note at top of table)*		Gutters or downpipes incorporated within the structure (e.g. down-pipes cast into a column or boxed in behind *claddings*), or secret gutters (e.g. hidden verge or valley gutters)	✓		
		Internal or valley gutters, fascia gutters or built-in downpipes		✓	
		External gutters and downpipes			✓
Heating Appliances	Solid fuel	Freestanding			✓
		Inbuilt		✓	
	Gas	Freestanding			✓
		Inbuilt		✓	
	Electric	Permanently wired			✓

Amend 4
Apr 2004

Table 1: Durability Requirements of Nominated Building Elements (cont'd)

Building Element	Component	Situation/Function	Not less than 50 years	Not less than 15 years	Not less than 5 years
Insulation	Sub-floor		✓		
	Walls		✓		
	Ceiling or roof	Skillion roof	✓		
		Accessible ceiling or roof space	✓		
Interior wall linings		Structural linings (e.g. bracing elements)	✓		
		Shower linings (excluding behind tiled showers)		✓	
		Linings behind tiled showers	Same durability as tile covering it		
		Easy to access and replace			✓
Lintels	Steel angle (brick veneer)	All situations	✓		
	Flat steel	All situations	✓		
Plumbing and piping	Piping and fittings	Cast into concrete	✓		
		Under slabs	✓		
		Installed in a masonry cavity and not ducted or provided with maintenance access	✓		
		Concealed behind wall linings or installed in maintenance ducting		✓	
		Surface mounted and easy to replace			✓
	Valves	Concealed or moderately difficult to replace		✓	
		Surface mounted and easy to replace			✓
	Fixtures				✓
	Outlets				✓
Protective Coatings		Paint systems that are difficult to access or replace	✓		
		Roofing membranes		✓	
		Paint systems that are easy to access and replace			✓
Roof framing including trusses, purlins, tile battens and bracing members			✓		
Roofing tile battens			✓		
Safety barrier (balustrade, baluster, and handrail)	Support posts, *handrails*		✓		
	Balusters			✓	
Septic tanks		Built into or under the structure of a *building*	✓		
		Easy to access units (e.g. in-ground but accessible)		✓	
		Effluent field		✓	

Amend 4
Apr 2004

Table 1: Durability Requirements of Nominated Building Elements (cont'd)

Building Element	Component	Situation/Function	Not less than 50 years	Not less than 15 years	Not less than 5 years
Stairs and ladders	Stringers		✓		
(for *balustrades* refer	Treads	Difficult to replace	✓		
to safety barriers)		Moderately difficult to replace		✓	
	Ladders including rungs			✓	
Tiling	Walls and floors (including showers)	Tiling in wet areas		✓	
	Walls and floors	Decorative finish only	No durability requirement under the *building code*		
Under-floor heating	Heating coils	Buried in concrete slabs	✓		
		Accessible coils		✓	
	Cables and fittings	Buried in concrete slabs	✓		
		Accessible cables and fittings		✓	
Vapour barriers		Behind structural elements or difficult to access and replace	✓		
		Behind non-structural internal linings		✓	
		High gloss paint finish			✓
Ventilation	Plant	All		✓	
	Ducting	Built-in ducting		✓	
		Easy to access and replace			✓
	Fittings				✓
Vermin proofing		Built into structure	✓		
		Moderately difficult to access or replace		✓	
		To drained ventilated cavity	Same durability as the *cladding* covering it		
Water heaters	Continuous flow heaters	Moderately difficult to access or replace (e.g. installed in cupboard)		✓	
		Easy to access or replace (e.g. on internal or *external wall*)			✓
	Storage water heaters	Moderately difficult to access or replace (e.g. installed in cupboard)		✓	
		Easy to access but moderately difficult to replace		✓	
Wall framing including dwangs or nogging	Timber or steel	Load-bearing framing	✓		
		Easy to access lined, non-load-bearing partitions		✓	
		Easy to access unlined, non-structural partitions or non-load-bearing demountable partitions			✓
	Structural Steel	All	✓		
Windows	Frame and interior	Structural units	✓		
	reveals	External window/door joinery		✓	
		Internal window joinery			✓

Amend 4
Apr 2004

Table 1: Durability Requirements of Nominated Building Elements (cont'd)

Building Element	Component	Situation/Function	Not less than 50 years	Not less than 15 years	Not less than 5 years
Windows (Continued)	Gaskets, glazing and glazing beads	Moderately difficult to access or replace		✓	
	Hardware				✓

Amend 4 Apr 2004

Index B2/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Status of BCH/AS1

This Acceptable Solution for Backcountry Huts provides a means of compliance with the New Zealand Building Code. It is issued under section 22 of the Building Act 2004 as an Acceptable Solution.

This Acceptable Solution is one way that can be used to show compliance with the New Zealand Building Code. Other ways of complying with the Building Code are described, in general terms, in the preface of the New Zealand Building Code Handbook.

When can you use BCH/AS1

This Acceptable Solution is effective from 1 July. It can be used to show compliance with the Building Code. It does not apply to building consent applications submitted before 1 July 2014.

The previous version of this Acceptable Solution can be used to show compliance with the Building Code until 18 June 2014. It can be used for building consent applications submitted before 19 June 2014.

Backcountry huts: **Document History**		
	Date	**Alterations**
First published	Effective from July 2009 until 18 June 2014	
Amendment 1	Effective from 1 July 2014	p. 07 2.0.1, 2.0.9

Contents

References

For the purposes of New Zealand Building Code compliance, the acceptable New Zealand and other Standards, and other documents referred to in this Compliance Document (primary reference documents) shall be the editions, along with their specific amendments, listed below. Where the primary reference documents refer to other Standards or other documents (secondary reference documents), which in turn may also refer to other Standards or other documents, and so on (lower order reference documents), then the applicable version of these secondary and lower order reference documents shall be the version in effect at the date this Compliance Document was published.

	Where quoted
Department of Conservation	
Hut Procurement Manual for Backcountry Huts (QD code VC 1414, March 2009, Version 4.0)	BCH/AS1

Comment:
The Hut Procurement Manual for Backcountry Huts is available from www.doc.govt.nz

Definitions

This is an abbreviated list of definitions for words or terms particularly relevant to this Compliance Document. The definitions for any other words may be found in the New Zealand Building Code Handbook.

backcountry hut means a *building* that—

(a) is located on land that is administered by the *Department of Conservation* for conservation, recreational, scientific, or other related purposes, including any land administered under any of the following:

(i) the Conservation Act 1987;

(ii) the National Parks Act 1980;

(iii) the Reserves Act 1977; and

(b) is intended to provide overnight shelter to any person who may visit and who carries his or her own food, bedding, clothing, and outdoor equipment; and

(c) contains only basic facilities, which may include (but are not limited to) any or all of the following:

(i) sleeping platforms or bunks;

(ii) mattresses;

(iii) food preparation surfaces;

(iv) appliances for heating;

(v) appliances for cooking;

(vi) toilets; and

(d) has been certified by the *Director-General* as being in a location that wheelchair users are unlikely to be able to visit; and

(e) is intended to be able to sleep—

(i) no more than 20 people in its *backcountry hut sleeping area*; and

(ii) no more than 40 people in total; and

(f) does not contain any connection, except by *radiocommunications*, to a *network utility operator.*

backcountry hut sleeping area means the area of a *backcountry hut* that contains sleeping platforms, bunks, or beds that are—

(a) within the same room as a food preparation or eating area; or

(b) in a fully-enclosed room that is separate from any food preparation or eating area and has—

(i) internal walls that limit the spread of fire; and

(ii) the means of direct egress to outside the hut.

Department of Conservation means the department of State established by section 5 of the Conservation Act 1987.

Director-General has the same meaning as in section 2(1) of the Conservation Act 1987.

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, 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

(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.

radiocommunications has the same meaning as in section 2(1) of the Radiocommunications Act 1989.

Acceptable Solution BCH/AS1

1.0 Scope

This Acceptable Solution applies to *backcountry huts*. Using this Acceptable Solution establishes compliance with all the relevant Building Code clauses for the design and construction of *backcountry huts.*

2.0 Backcountry Huts

Amend 1 Jul 2014

2.0.1 The Hut Procurement Manual for Backcountry Huts as amended by Paragraph 2.0.9 is an Acceptable Solution for the design and *construction* of *backcountry huts*.

2.0.2 The Hut Procurement Manual for Backcountry Huts is divided into seven parts:

Part A: 2 Bunk Huts
Part B: 4-12 Bunk Huts
Part C: Larger Huts
Part D: Fire Safety
Part E: Construction Details
Part F: Toilets and Grey Water
Part G: Specifications

2.0.3 Dependent on the size of the hut, detailed information is included in parts A, B and C on the process to be followed and the compilation of the necessary information for the design, documentation and procurement of the hut.

2.0.4 For 2 bunk huts, in addition to Part A, the following parts are to be used –

- Part F for toilets and grey water

2.0.5 For 4 -12 bunk huts, in addition to Part B, the following parts are to be used –

- Part E for construction details
- Part F for toilets and grey water
- Part G for specifications

2.0.6 For larger huts with a sleeping capacity of more than 12, in addition to Part C, the following parts are to be used –

- Part D for fire safety
- Part E for construction details
- Part F for toilets and grey water
- Part G for specifications

2.0.7 The process that is followed for larger huts, in particular the application of Part D, will also be applicable for:

- huts with a sleeping capacity of 12 or less that are not derived from the base drawings included in the manual
- huts that include staff quarters.

2.0.8 A certificate from the Director-General of the Department of Conservation, or their delegated representative, must be provided with the building consent application stating that the proposed hut is in a location that wheelchair users are unlikely to be able to visit.

2.0.9 Replace the Hut Procurement Manual paragraph D2.3.3i) with:

2.3.3 Interior Surface Finishes

i) The interior surface finishes for walls and ceilings of huts shall be plywood or other wood-based products either left natural or finished with a water-based coating. If other materials are used their surface finish shall have a Group Number of no greater than 3.

Comment:
Users of this Acceptable Solution and the Hut Procurement Manual should note that the requirements specified are deemed to comply with the requirements of the Building Code, particularly in the case of Code Clauses C1 to C6.

Amend 1 Jul 2014

Index BCH/AS1

Version
as at 15 November 2021

Building Regulations 1992

(SR 1992/150)

Building Regulations 1992: revoked (with regulation 3 and Schedule 1 continued in force), on 31 March 2005, by regulation 8(1) of the Building (Forms) Regulations 2004 (SR 2004/385).

Catherine A Tizard, Governor-General

Order in Council

At Wellington this 8th day of June 1992

Present:
Her Excellency the Governor-General in Council

Pursuant to the Building Act 1991, Her Excellency the Governor-General, acting by and with the advice and consent of the Executive Council, hereby makes the following regulations.

Contents

Note

The Parliamentary Counsel Office has made editorial and format changes to this version using the powers under subpart 2 of Part 3 of the Legislation Act 2019.

Note 4 at the end of this version provides a list of the amendments included in it.

These regulations are administered by the Ministry of Business, Innovation, and Employment.

1 Title and commencement

[Revoked]

Regulation 1: revoked, on 31 March 2005, by regulation 8(1) of the Building (Forms) Regulations 2004 (SR 2004/385).

2 Interpretation

[Revoked]

Regulation 2: revoked, on 31 March 2005, by regulation 8(1) of the Building (Forms) Regulations 2004 (SR 2004/385).

3 Building code

(1) In accordance with Part 6 of the Act, the building code shall be the building code set out in Schedule 1.

(2) Except as otherwise provided by the Act, each building shall achieve the performance criteria specified in the building code for the classified use of that building, and, if the building has more than 1 classified use, any part of it used for more than 1 classified use shall achieve the performance criteria for each such classified use.

(3) The classified use or uses of a building or part of a building shall be the ones that most closely correspond to the intended use or uses of that building or part of that building.

Regulation 3: continued in force, on 31 March 2005, by regulation 8(2)(a) of the Building (Forms) Regulations 2004 (SR 2004/385).

4 Forms

[Revoked]

Regulation 4: revoked for all purposes, on 31 May 2006, by regulation 8(2)(b) of the Building (Forms) Regulations 2004 (SR 2004/385).

5 Project information memorandum

[Revoked]

Regulation 5: revoked, on 31 March 2005, by regulation 8(1) of the Building (Forms) Regulations 2004 (SR 2004/385).

6 Building consent

[Revoked]

Regulation 6: revoked, on 31 March 2005, by regulation 8(1) of the Building (Forms) Regulations 2004 (SR 2004/385).

7 Notice that building work is ready for inspection

[Revoked]

Regulation 7: revoked, on 31 March 2005, by regulation 8(1) of the Building (Forms) Regulations 2004 (SR 2004/385).

8 Inspection reports by building certifiers

[Revoked]

Regulation 8: revoked, on 31 March 2005, by regulation 8(1) of the Building (Forms) Regulations 2004 (SR 2004/385).

9 Charges by Building Industry Authority

[Revoked]

Regulation 9: revoked, on 31 March 2005, by regulation 8(1) of the Building (Forms) Regulations 2004 (SR 2004/385).

10 Territorial authority records

[Revoked]

Regulation 10: revoked, on 31 March 2005, by regulation 8(1) of the Building (Forms) Regulations 2004 (SR 2004/385).

11 Transitional provisions and savings

[Revoked]

Regulation 11: revoked, on 31 March 2005, by regulation 8(1) of the Building (Forms) Regulations 2004 (SR 2004/385).

Schedule 1
The building code

r 3

Table of Contents

F7	Warning systems
F8	Signs
F9	Means of restricting access to residential pools

Services and facilities

G1	Personal hygiene
G2	Laundering
G3	Food preparation and prevention of contamination
G4	Ventilation
G5	Interior environment
G6	Airborne and impact sound
G7	Natural light
G8	Artificial light
G9	Electricity
G10	Piped services
G11	Gas as an energy source
G12	Water supplies
G13	Foul water
G14	Industrial liquid waste
G15	Solid waste

Energy efficiency

H1	Energy efficiency

Clause A1—Classified Uses

1.0 Explanation

1.0.1 For the purposes of this building code *buildings* are classified according to type, under seven categories.

1.0.2 A *building* with a given classified use may have one or more *intended uses* as defined in the Act.

2.0 Housing

2.0.1 Applies to *buildings* or use where there is self care and service (internal management). There are three types:

2.0.2 Detached dwellings

Applies to a *building* or use where a group of people live as a single household or family. Examples: a holiday cottage, boarding house accommodating fewer than 6 people, dwelling or hut.

2.0.3 Multi-unit dwelling

Applies to a *building* or use which contains more than one separate household or family. Examples: an attached dwelling, flat or multi-unit apartment.

2.0.4 Group dwelling

Applies to a *building* or use where groups of people live as one large extended family. Examples: within a commune or marae.

3.0 Communal residential

3.0.1 Applies to *buildings* or use where assistance or care is extended to the *principal users*. There are two types:

3.0.2 Community service

Applies to a residential *building* or use where limited assistance or care is extended to the *principal users*. Examples: a boarding house, hall of residence, holiday cabin, *backcountry hut*, hostel, hotel, motel, nurses' home, retirement village, time-share accommodation, a work camp, or camping ground.

3.0.3 Community care

Applies to a residential *building* or use where a large degree of assistance or care is extended to the *principal users*. There are two types:

(a) **Unrestrained**; where the *principal users* are free to come and go. Examples: a hospital, an old people's home or a health camp.

(b) **Restrained**; where the *principal users* are legally or physically constrained in their movements. Examples: a borstal or drug rehabilitation centre, an old people's home where substantial care is extended, a prison or hospital.

Schedule 1 clause A1 3.0.2: amended, on 31 October 2008, by regulation 4 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

4.0 Communal non-residential

4.0.1 Applies to a *building* or use being a meeting place for people where care and service is provided by people other than the *principal users*. There are two types:

4.0.2 Assembly service

Applies to a *building* or use where limited care and service is provided. Examples: a church, cinema, clubroom, hall, museum, public swimming pool, stadium, theatre, or whare runanga (the assembly house).

4.0.3 Assembly care

Applies to a *building* or use where a large degree of care and service is provided. Examples: an early childhood education and care centre, college, day care institution, centre for handicapped persons, kindergarten, school or university.

Schedule 1 clause A1 4.0.3: amended, on 1 December 2008, by section 60(2) of the Education Amendment Act 2006 (2006 No 19).

5.0 Commercial

5.0.1 Applies to a *building* or use in which any natural resources, goods, services or money are either developed, sold, exchanged or stored. Examples: an amusement park, auction room, bank, car-park, catering facility, coffee bar, computer centre, fire station, funeral parlour, hairdresser, library, office (commercial or government), Police station, post office, public laundry, radio station, restaurant, service station, shop, showroom, storage facility, television station or transport terminal.

6.0 Industrial

6.0.1 Applies to a *building* or use where people use material and physical effort to:

(a) extract or convert natural resources,

(b) produce goods or energy from natural or converted resources,

(c) repair goods, or

(d) store goods (ensuing from the industrial process).

Examples: an agricultural building, agricultural processing facility, aircraft hangar, factory, power station, sewage treatment works, warehouse or utility.

7.0 Outbuildings

7.0.1 Applies to a *building* or use which may be included within each classified use but are not intended for human habitation, and are accessory to the principal use of associated *buildings*. Examples: a carport, farm *building*, garage, greenhouse, machinery room, private swimming pool, public toilet, or shed.

8.0 Ancillary

8.0.1 Applies to a *building* or use not for human habitation and which may be exempted from some amenity provisions, but which are required to comply with structural and safety-related aspects of the *building code*. Examples: a bridge, derrick, fence, free-standing outdoor fireplace, jetty, mast, path, platform, pylon, retaining wall, tank, tunnel or dam.

Clause A2—Interpretation

In this building code unless the context otherwise requires, words shall have the meanings given under this clause. Meanings given in the Building Act 1991 apply equally to the building code.

access route a continuous route that permits people and goods to move between the apron or *construction* edge of the *building* to spaces within a *building*, and between spaces within a *building*

accessible having features to permit use by *people with disabilities*

accessible route an *access route* usable by *people with disabilities*. It shall be a continuous route that can be negotiated unaided by a wheelchair user. The route shall extend from street boundary or carparking area to those spaces within the *building* required to be *accessible* to enable *people with disabilities* to carry out normal activities and processes within the *building*

adequate means *adequate* to achieve the objectives of the building code

adjacent building a nearby *building*, including an adjoining *building*, whether or not erected on *other property*

allotment has the meaning ascribed to it by section 4 of the Act as follows: meaning of allotment—

(1) In this Act, the term "*allotment*" means any parcel of land that is a continuous area of land and whose boundaries are shown on a survey plan that is:

 (a) subject to the Land Transfer Act 1952 and is comprised in one certificate of title or for which one certificate of title could be issued under that Act; or

 (b) not subject to that Act and was acquired by its owner under one instrument of conveyance.

(2) For the purpose of subsection (1), the subdivision shown on the survey plan referred to in that subsection is:

 (a) the subdivision approved by way of a subdivision consent granted under the Resource Management Act 1991; or

 (b) the subdivision allowed or granted under any other Act.

(3) For the purposes of subsection (1), an *allotment* shall be deemed to be a continuous area of land notwithstanding that part of it is physically separated from any other part by a road or in any other manner whatsoever, unless the division of the *allotment* into such parts has been allowed by a subdivision consent granted under the Resource Management Act 1991 or a subdivision approval under any former enactment relating to the subdivision of land

alter, in relation to a *building*, includes to rebuild, re-erect, repair, enlarge and extend; and **alteration** has a corresponding meaning

amenity means an attribute of a *building* which contributes to the health, physical independence, and well being of the *building's* users but which is not associated with disease or a specific illness

approved temperature data means the temperature data contained in A I Tomlinson and J Sansom, *Temperature Normals for New Zealand for the period 1961 to 1990* (NIWA, ISBN 0478083343)

backcountry hut means a *building* that—

(a) is located on land that is administered by the *Department of Conservation* for conservation, recreational, scientific, or other related purposes, including any land administered under any of the following:

(i) the Conservation Act 1987:

(ii) the National Parks Act 1980:

(iii) the Reserves Act 1977; and

(b) is intended to provide overnight shelter to any person who may visit and who carries his or her own food, bedding, clothing, and outdoor equipment; and

(c) contains only basic facilities, which may include (but are not limited to) any or all of the following:

(i) sleeping platforms or bunks:

(ii) mattresses:

(iii) food preparation surfaces:

(iv) appliances for heating:

(v) appliances for cooking:

(vi) toilets; and

(d) has been certified by the *Director-General* as being in a location that wheelchair users are unlikely to be able to visit; and

(e) is intended to be able to sleep—

(i) no more than 20 people in its *backcountry hut sleeping area*; and

(ii) no more than 40 people in total; and

(f) does not contain any connection, except by *radiocommunications*, to a *network utility operator*

backcountry hut sleeping area means the area of a *backcountry hut* that contains sleeping platforms, bunks, or beds that are—

(a) within the same room as a food preparation or eating area; or

(b) in a fully enclosed room that is separate from any food preparation or eating area and has—

(i) internal walls that limit the spread of fire; and

(ii) the means of direct egress to outside the hut

boundary means any boundary that is shown on a survey plan that is approved by the Surveyor-General and deposited with the Registrar-General of Land, whether or not a new title has been issued

building has the meaning ascribed to it by section 3 of the Act as follows: meaning of *building*—

(1) In this Act, unless the context otherwise requires, the term "*building*" means any temporary or permanent movable or immovable structure (including any structure intended for occupation by people, animals, machinery, or chattels); and includes any mechanical, electrical, or other systems, and any utility systems, attached to and forming part of the structure whose proper operation is necessary for compliance with the *building code*; but does not include:

(a) systems owned or operated by a *network utility operator* for the purpose of reticulation of *other property*; or

(b) cranes, including any cranes as defined in any regulations in force under the Health and Safety in Employment Act 1992; or

(c) cablecars, cableways, ski tows, and other similar stand alone machinery systems, whether or not incorporated within any other structure; or

(d) any description of vessel, boat, ferry, or craft used in navigation, whether or not it has any means of propulsion, and regardless of that means; nor does it include—

(i) a barge, lighter, or other like vessel:

(ii) a hovercraft or other thing deriving full or partial support in the atmosphere from the reactions of air against the surface of the water over which it operates:

(iii) a submarine or other thing used in navigation while totally submerged; or

(e) vehicles and motor vehicles (including vehicles and motor vehicles as defined in section 2(1) of the Transport Act 1962 and section 2(1) of the Transport (Vehicle and Driver Registration and

Licensing) Act 1986), but not including vehicles and motor vehicles, whether movable or immovable, which are used exclusively for permanent or long-term residential purposes; or

(ea) aircraft, including any machine that can derive support in the atmosphere from the reactions of the air otherwise than by the reactions of the air against the surface of the earth; or

(f) containers as defined in section 2(1) of the Hazardous Substances and New Organisms Act 1996; or

(g) magazines as defined in section 2 of the Explosives Act 1957; or

(h) scaffolding used in the course of the *construction* process; or

(i) falsework used in the course of the *construction* process.

(2) For the purposes of Part 9 of this Act, a *building consent,* a *code compliance certificate*, and a *compliance schedule* the term *building* also includes—

(a) any part of a *building*; and

(b) any 2 or more *buildings* which, on completion of any *building work*, are intended to be managed as 1 *building* with a common use and a common set of ownership arrangements.

(3) For the purposes of subclause (2) of this definition, where any utility system or any part of any utility system—

(a) is external to the *building*; and

(b) is also connected to or is intended to be connected to—

(i) a network under the control of a *network utility operator*; or

(ii) some other facility which is able to provide for the successful functioning of the utility system in accordance with its intended design—

that utility system or that part of the utility system shall be deemed to be part of a *building*.

(4) Notwithstanding the provisions of subclause (3) of this definition, where a septic tank is connected to a *building* utility system the septic tank shall be deemed to form part of that *building* utility system

building certifier means a person approved as a *building certifier* by the *Authority* under Part 7 of the Act

building code means the *building code* made under Part 6 of the Act

building consent means a consent to carry out *building work* granted by a *territorial authority* under Part 5 of the Act; and includes all conditions to which the consent is subject

building element any structural or non-structural component and assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports

building height means the vertical distance between the floor level of the lowest occupied space above the ground and the top of the highest occupied floor, but not including spaces located within or on the roof that enclose stairways, lift shafts, or machinery rooms

building performance index (BPI), in relation to a *building*, means the *heating energy* of the *building* divided by the product of the *heating degrees total* and the sum of the *floor area* and the *total wall area*, and so is calculated in accordance with the following formula:

$$\text{BPI} = \frac{\textit{heating energy}}{\textit{heating degrees total} \times (\textit{floor area} + \textit{total wall area})}$$

building work work for or in connection with the *construction*, *alteration*, demolition, or removal of a *building*; and includes *sitework*

burnout means exposure to *fire* for a time that includes fire growth, full development, and decay in the absence of intervention or automatic suppression, beyond which the *fire* is no longer a threat to *building elements* intended to perform loadbearing or *fire separation* functions, or both

clearly visible, for the purposes of clause F8.3.1, means visible, under the worst likely conditions and at the maximum distance from which the sign in question needs to be viewed, by a person who either does not have a visual impairment or uses corrective lenses

code compliance certificate means a certificate to that effect issued by a *territorial authority* or a *building certifier* pursuant to section 43 of the Act

combustible building materials means building materials that are deemed combustible according to AS 1530.1

compliance schedule means a *compliance schedule* issued under section 44 of the Act

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

contaminant has the meaning ascribed to it by the Resource Management Act 1991

Department of Conservation means the department of State established by section 5 of the Conservation Act 1987

Director-General has the same meaning as in section 2(1) of the Conservation Act 1987

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

drinking water standards means the standards made under section 47 of the Water Services Act 2021

electrical fixed appliance an electrical appliance which is fixed-wired to the *electrical installation*, or intended to remain permanently attached and form part of the *building*

electrical installation any *electrical fixed appliances*, and components used in the reticulation of electricity, which are intended to remain permanently attached to and form part of the *building*

electrical supply system the source of electricity external to the *electrical installation*

escape route a continuous unobstructed route from any *occupied space* in a *building* to a *final exit* to enable occupants to reach a *safe place*, and shall comprise one or more of the following: *open paths*, *protected paths* and *safe paths*

essential service in the context of an *electrical installation* means emergency lighting, firemen's lifts, alarms, water pumps, sprinklers, detectors, ventilation systems and public address systems necessary for the safety of people in *buildings*

estimated value the value of building work shall be the aggregate of the values, determined in accordance with section 10 of the Goods and Services Tax Act 1985, of all goods and services to be supplied for that building work

evacuation time means the time between the ignition of a *fire* affecting a *building* and the time when all the occupants of the *building* have reached a *place of safety*

exitway all parts of an *escape route* protected by *fire* or *smoke separations*, or by distance when exposed to open air, and terminating at a *final exit*

external wall any exterior face of a *building* within 30° of vertical, consisting of primary and/or secondary elements intended to provide protection against the outdoor environment, but which may also contain *unprotected areas*

final exit the point at which an *escape route* terminates by giving direct access to a *safe place*

fire the state of combustion during which flammable materials burn producing heat, toxic gases, or smoke or flame or any combination of these

firecell any space including a group of contiguous spaces on the same or different levels within a *building*, which is enclosed by any combination of *fire separations*, *external walls*, roofs, and floors

fire load the sum of the net calorific values of the combustible contents which can reasonably be expected to burn within a *firecell*, including furnishings, built-in and removable materials, and *building elements*. The calorific values shall be determined at the ambient moisture content or humidity. (The unit of measurement is MJ or TJ)

fire resistance rating (FRR) the term used to classify *fire* resistance of primary and secondary elements as determined in the standard test for fire resistance, or in accordance with a specific calculation method verified by experimental data from standard *fire* resistance tests. It comprises three numbers giving the time in minutes for which each of the criteria *stability*, *integrity* and *insulation* are satisfied, and is presented always in that order

fire safety system means the combination of all active and passive protection methods used in a *building* to—

(a) warn people of an emergency; and

(b) provide for safe evacuation; and

(c) provide for access by, and the safety of, firefighters; and

(d) restrict the spread of *fire*; and

(e) limit the impact of *fire* on structural stability

fire separation any *building element* which separates *firecells* or *firecells* and *safe paths*, and provides a specific *fire resistance rating*

fire source means the combination of the ignition source and the item first ignited within a room, space, or *firecell*, which combination is considered to be the origin of the *fire* for the purposes of design

fixture an article intended to remain permanently attached to and form part of a *building*

floor area, in relation to a *building*, means the floor area (expressed in square metres) of all interior spaces used for activities normally associated with domestic living

foul water the discharge from any *sanitary fixtures* or *sanitary appliances*

foul water drainage system *drains* joints and fittings normally laid underground and used specifically for the conveyance of water from the *plumbing system* to an *outfall*

fractional effective dose means the fraction of the dose that would render a person of average susceptibility incapable of escape

habitable space a space used for activities normally associated with domestic living, but excludes any bathroom, laundry, water-closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods

handrail a rail to provide both support to, or assist with the movement of a person

hard-standing means a hard-surfaced area that is sufficiently stable to carry a fire truck, and includes a road

hazardous creating an unreasonable risk to people of bodily injury or deterioration of health

hazardous substance has the meaning ascribed to it by the Fire Service Act 1975

heating degrees, in relation to a location and a heating month, means the degrees obtained by subtracting from a base temperature of 14°C the mean (calculated using the approved temperature data) of the outdoor temperatures at that location during that month

heating degrees total, in relation to a location and a year, means whichever is the greater of the following:

(a) the value of 12; and

(b) the sum of all the heating degrees (calculated using the approved temperature data) for all of the heating months of the year

heating energy, in relation to a *building*, means the energy from a *network utility operator* or a depletable resource (expressed in kilowatt-hours, and calculated using the Building Research Association of New Zealand's *ALF 3*, *The 'Annual Loss Factor Method', A design tool for energy efficient houses* (3rd edition, April 2000) or some other method that can be correlated with that manual) needed to maintain the building at all times within a year at a constant internal temperature under the following standard conditions:

(a) a continuous temperature of 20°C throughout the building:

(b) an air change rate of 1 change per hour or the actual air leakage rate, whichever is the greater:

(c) a heat emission contribution arising from internal heat sources for any period in the year of 1 000 kilowatt-hours for the first 50 m^2 of *floor area*, and 10 kilowatt-hours for every additional square metre of *floor area*:

(d) no allowance for—

 (i) carpets; or

 (ii) blinds, curtains, or drapes, on windows:

(e) windows to have a shading coefficient of 0.6 (made up of 0.8 for windows and recesses and 0.75 for site shading)

heating month, in relation to a location, means a month in which a base temperature of 14°C is greater than the mean (calculated using the approved temperature data) of the outdoor temperatures at that location during that month

household unit means any *building* or group of *buildings*, or part of any *building* or group of *buildings*, used or intended to be used solely or principally for residential purposes and occupied or intended to be occupied exclusively as the home or residence of not more than one household; but does not include a hostel or boardinghouse or other specialised accommodation

HVAC system, for the purposes of performance H1.3.6 and in relation to a *building*, means a mechanical, electrical, or other system for modifying air temperature, modifying air humidity, providing ventilation, or doing all or any of those things, in a space within the *building*

illuminance the luminous flux falling onto a unit area of surface

impact insulation class (IIC) a single number rating derived from measured values of normalised sound pressure impact levels in accordance with Method ASTM E492, Annex A1. Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine. It provides an estimate of the impact sound insulating performance of a floor-ceiling assembly

impervious that which does not allow the passage of moisture

insulation in the context of *fire* protection, the time in minutes for which a prototype specimen of a *fire separation*, when subjected to the *standard test* for *fire* resistance, has limited the transmission of heat through the specimen

integrity in the context of *fire* protection, the time in minutes for which a prototype specimen of a *fire separation*, when subjected to the *standard test* for *fire* resistance, has prevented the passage of flame or hot gases

intended use of a *building* includes—

(a) any reasonably foreseeable occasional other use that is not incompatible with the *intended use*; and

(b) normal maintenance; and

(c) activities taken in response to *fire* or any other reasonably foreseeable emergency—but does not include any other maintenance and repairs or rebuilding

network utility operator means a person who—

(a) undertakes the distribution or transmission by pipeline of natural or manufactured gas, petroleum, or geothermal energy; or

(b) is an electricity operator or an electricity distributor as defined by section 2(1) of the Electricity Act 1992 for the purposes of any works as defined by that Act; or

(c) undertakes the piped distribution of potable water for supply; or

(d) is the operator of a sewerage system or a stormwater drainage system

occupied space any space within a *building* in which a person will be present from time to time during the *intended use* of the *building*

open space means land on which there are, and will be, no *buildings* and which has no roof over any part of it other than overhanging eaves

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

outdoor air air as typically comprising by volume. (i) oxygen 20.94% (ii) carbon dioxide 0.03% (iii) nitrogen and other inert gases 79.03%

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 *sewer* or a septic tank. For *surface water*, the *outfall* may include a natural water course, kerb and channel, or soakage system

people with disabilities people whose ability to use *buildings* is affected by mental, physical, hearing or sight impairment

place of safety means either—

(a) a *safe place*; or

(b) a place that is inside a *building* and meets the following requirements:

  (i) the place is constructed with *fire separations* that have fire resistance sufficient to withstand *burnout* at the point of the *fire source*; and

  (ii) the place is in a *building* that is protected by an automatic fire sprinkler system that complies with NZS 4541 or NZS 4515 as appropriate to the *building's* use; and

  (iii) the place is designed to accommodate the intended number of persons; and

  (iv) the place is provided with sufficient means of escape to enable the intended number of persons to escape to a *safe place* that is outside a *building*

plumbing system pipes, joints and fittings laid above ground and used for the conveyance of *foul water* to the *foul water drain*, and includes *vent pipes*

potable water means water that—

(a) is safe to drink; and

(b) complies with the drinking water standards

principal user a member of the primary group for which a *building* was constructed, and therefore explicitly excludes persons or groups of persons providing care or control of that *principal user* group

radiocommunications has the same meaning as in section 2(1) of the Radiocommunications Act 1989

reasonably visible, in relation to a *specified feature*, and for the purposes of Clause F6, means that the *specified feature* is visible to a person who—

(a) is 10 metres from it, or the greatest distance from it that it is possible to go in the open space surrounding it, whichever is the lesser; and

(b) has sight that is not defective, or is corrected (for example, by an optical appliance)

relevant boundary means the *boundary* of an *allotment* that is *other property* in relation to the *building* in question and from which is measured the separation between the *building* and that *other property*; and for the external wall of any *building*, the *relevant boundary* is the nearest of—

(a) a *boundary* of a freehold *allotment*, except that if the *other property* is a road, railway line, or public *open space*, the *relevant boundary* is the *boundary* on the far side of that *other property*; or

(b) a *boundary* of a cross-lease or a company lease or a licence, except that if the *other property* is *open space* to which the lessee or licensee of the *building* in question has an exclusive right of access and occupation or to which 2 or more occupiers of the *building* in question have rights of access and occupation, the *relevant boundary* is the *boundary* on the far side of that *other property*; or

(c) a *boundary* shown on a unit plan (but excluding a *boundary* between a principal unit and its accessory unit), except that if the *other property* is *open space* and is common property, the *relevant boundary* is the *boundary* on the far side of that *other property*

risk group A, for the purposes of performance F6.3.4 and performance F6.3.5, means *buildings*—

(a) whose occupants are required to remain in the *building* until the main lighting system is restored; or

(b) whose *evacuation time* is longer than 90 minutes

risk group B, for the purposes of performance F6.3.4 and performance F6.3.5, means *buildings*—

(a) whose *evacuation time* is 30 minutes or longer but not longer than 90 minutes; or

(b) whose occupant load is more than 1 000

risk group C, for the purposes of performance F6.3.4, means *buildings* not in *risk group A* or *risk group B*

safe place a place of safety in the vicinity of a *building*, from which people may safely disperse after escaping the effects of a *fire*. It may be a place such as a street, open space, public space or an *adjacent building*

sanitary appliance an appliance which is intended to be used for *sanitation*, but which is not a *sanitary fixture*. Included are machines for washing dishes and clothes

sanitary fixture any *fixture* which is intended to be used for *sanitation*

sanitation the term used to describe the activities of washing and/or excretion carried out in a manner or condition such that the effect on health is minimised, with regard to dirt and infection

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*

sound transmission class (STC) a single number rating derived from measured values of transmission loss in accordance with classification ASTM E413, Determination of Sound Transmission Class. It provides an estimate of the performance of a partition in certain common sound insulation situations

specified features, for the purposes of Clause F6, means the following:

(a) *building elements* that may act as obstructions:

(b) safety features required under clauses of this code other than Clause F6 (for example, *handrails* required under Clause D1):

(c) changes in direction:

(d) stairs and ramps:

(e) escape doors:

(f) entries to a *safe place*

specified intended life has the meaning ascribed to it by subsection (2) of section 39 of the Act as follows: "*Specified intended life*", in relation to a *building*, means the period of time, as stated in an application for a *building consent* or in the consent itself, for which the *building* is proposed to be used for its *intended use*

stability in the context of *fire* protection, the time in minutes for which a prototype specimen of a *primary element*, when subjected to the *standard test* for fire resistance, has continued to carry its *fire* design load without failure

standard year for the purposes of determining natural lighting, the hours between 8 am and 5 pm each day with an allowance being made for daylight saving

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

territorial authority has the meaning ascribed to it by section 2 of the Local Government Act 1974; and includes any organisation which is authorised to permit structures pursuant to section 12(1)(b) of the Resource Management Act 1991

thermal resistance the resistance to heat flow of a given component of a *building element*. It is equal to the air temperature difference (°C) needed to produce unit heat flux (W/m^2) through unit area (m^2) under steady conditions. The units are $°Cm^2/W$

total wall area, in relation to a *building*, means the sum (expressed in square metres) of the following:

(a) the *wall area* of the *building*; and

(b) the area (expressed in square metres) of all vertical glazing in *external walls* of the *building*

travel distance the length of the *escape route* as a whole or the individual lengths of its parts, namely: (a) *open paths*; (b) *protected paths*; and (c) *safe paths*

wall area, in relation to a *building*, means the area (expressed in square metres) of internally exposed external walls, including any door openings, of the *building*

water main a water supply pipe that is under the control of, or maintained by a *network utility operator*

water supply system pipes, fittings and tanks used or intended to be used for the storage and reticulation of water from a *water main* or other water source, to *sanitary fixtures*, *sanitary appliances* and fittings within a *building*.

Schedule 1 clause A2 **approved temperature data**: inserted, on 31 October 2007, by regulation 4(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **backcountry hut**: inserted, on 31 October 2008, by regulation 5 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Schedule 1 clause A2 **backcountry hut sleeping area**: inserted, on 31 October 2008, by regulation 5 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Schedule 1 clause A2 **boundary**: inserted, on 10 April 2012, by regulation 4(2) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **building** (1)(b): substituted, on 22 December 1994, by regulation 3(1)(a) of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Schedule 1 clause A2 **building** (1)(d): substituted, on 22 December 1994, by regulation 3(1)(b) of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Schedule 1 clause A2 **building** (1)(ea): inserted, on 22 December 1994, by regulation 3(1)(c) of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Schedule 1 clause A2 **building** (1)(f): amended, on 2 July 2001, pursuant to section 150(1) of the Hazardous Substances and New Organisms Act 1996 (1996 No 30).

Schedule 1 clause A2 **building** (2): amended, on 22 December 1994, by regulation 3(1)(d) of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Schedule 1 clause A2 **building** (3): amended, on 22 December 1994, by regulation 3(1)(e) of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Schedule 1 clause A2 **building** (4): amended, on 22 December 1994, by regulation 3(1)(f) of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Schedule 1 clause A2 **building height**: replaced, on 10 April 2012, by regulation 4(2) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **building performance index**: revoked, on 31 October 2007, by regulation 4(1) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **building performance index (BPI)**: inserted, on 31 October 2007, by regulation 4(1) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **burnout**: inserted, on 10 April 2012, by regulation 4(2) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **clearly visible**: inserted, on 10 April 2012, by regulation 4(2) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **climate zone 1**: revoked, on 30 September 2008, by regulation 7(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **climate zone 2**: revoked, on 30 September 2008, by regulation 7(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **climate zone 3**: revoked, on 30 September 2008, by regulation 7(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **combustible building materials**: inserted, on 10 April 2012, by regulation 4(2) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **combustion appliance**: revoked, on 10 April 2012, by regulation 4(1) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **concealed space**: revoked, on 10 April 2012, by regulation 4(1) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **cool location**: revoked, on 30 September 2008, by regulation 7(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **degree-day**: revoked, on 30 September 2008, by regulation 7(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **degree-day total**: revoked, on 30 September 2008, by regulation 7(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **Department of Conservation**: inserted, on 31 October 2008, by regulation 5 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Schedule 1 clause A2 **Director-General**: inserted, on 31 October 2008, by regulation 5 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Schedule 1 clause A2 **drinking water standards**: inserted, on 15 November 2021, by section 206(2) of the Water Services Act 2021 (2021 No 36).

Schedule 1 clause A2 **evacuation time**: replaced, on 10 April 2012, by regulation 4(2) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **fire hazard**: revoked, on 10 April 2012, by regulation 4(1) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **fire intensity**: revoked, on 10 April 2012, by regulation 4(1) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **fire load**: amended, on 10 April 2012, by regulation 4(3) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **fire resisting closure**: revoked, on 10 April 2012, by regulation 4(1) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **fire safety system**: replaced, on 10 April 2012, by regulation 4(2) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **fire source**: inserted, on 10 April 2012, by regulation 4(2) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **floor area**: inserted, on 31 October 2007, by regulation 4(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **fractional effective dose**: inserted, on 10 April 2012, by regulation 4(2) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **hard-standing**: inserted, on 10 April 2012, by regulation 4(2) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **heating degrees**: inserted, on 31 October 2007, by regulation 4(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **heating degrees total**: inserted, on 31 October 2007, by regulation 4(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **heating energy**: inserted, on 31 October 2007, by regulation 4(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **heating month**: inserted, on 31 October 2007, by regulation 4(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **HVAC system**: inserted, on 1 February 2009, by regulation 4 of the Building (Building Code: Energy Efficiency of Temperature, Humidity, and Ventilation Systems) Amendment Regulations 2008 (SR 2008/97).

Schedule 1 clause A2 **network utility operator** paragraph (b): substituted, on 29 December 2000, by regulation 3(3) of the Building Amendment Regulations 2000 (SR 2000/119).

Schedule 1 clause A2 **old measure building performance index**: revoked, on 30 September 2008, by regulation 7(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **open path**: revoked, on 10 April 2012, by regulation 4(1) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **open space**: inserted, on 10 April 2012, by regulation 4(2) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **place of safety**: inserted, on 10 April 2012, by regulation 4(2) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **potable water**: inserted, on 15 November 2021, by section 206(2) of the Water Services Act 2021 (2021 No 36).

Schedule 1 clause A2 **protected path**: revoked, on 10 April 2012, by regulation 4(1) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **purpose group**: revoked, on 10 April 2012, by regulation 4(1) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **radiocommunications**: inserted, on 31 October 2008, by regulation 5 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Schedule 1 clause A2 **reasonably visible**: inserted, on 21 June 2007, by regulation 6(2) of the Building Amendment Regulations 2007 (SR 2007/124).

Schedule 1 clause A2 **relevant boundary**: inserted, on 10 April 2012, by regulation 4(2) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **risk group A**: inserted, on 21 June 2007, by regulation 6(2) of the Building Amendment Regulations 2007 (SR 2007/124).

Schedule 1 clause A2 **risk group B**: inserted, on 21 June 2007, by regulation 6(2) of the Building Amendment Regulations 2007 (SR 2007/124).

Schedule 1 clause A2 **risk group C**: inserted, on 21 June 2007, by regulation 6(2) of the Building Amendment Regulations 2007 (SR 2007/124).

Schedule 1 clause A2 **safe path**: revoked, on 10 April 2012, by regulation 4(1) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **smoke separation**: revoked, on 10 April 2012, by regulation 4(1) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **specified features**: inserted, on 21 June 2007, by regulation 6(2) of the Building Amendment Regulations 2007 (SR 2007/124).

Schedule 1 clause A2 **thermal resistance**: amended, on 29 December 2000, by regulation 3(4) of the Building Amendment Regulations 2000 (SR 2000/119).

Schedule 1 clause A2 **total wall area**: inserted, on 31 October 2007, by regulation 4(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **unprotected area**: revoked, on 10 April 2012, by regulation 4(1) of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Schedule 1 clause A2 **wall area**: inserted, on 31 October 2007, by regulation 4(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **warm location**: revoked, on 30 September 2008, by regulation 7(2) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause A2 **water supply system**: amended, on 22 December 1994, by regulation 3(2)(e) of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Schedule 1 clause A2 **water supply system**: amended, on 22 December 1994, by regulation 3(2)(f) of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Clause A3—Building importance levels

For the purposes of clause C, a *building* has one of the importance levels set out below:

Importance level	**Description of *building* type**	**Specific structure**
Importance level 1	*Buildings* posing low risk to human life or the environment, or a low economic cost, should the *building* fail. These are typically small non-habitable *buildings*, such as sheds, barns, and the like, that are not normally occupied, though they may have occupants from time to time.	• Ancillary *buildings* not for human habitation • Minor storage facilities • Backcountry huts
Importance level 2	*Buildings* posing normal risk to human life or the environment, or a normal economic cost, should the *building* fail. These are typical residential, commercial, and industrial *buildings*.	• All *buildings* and facilities except those listed in importance levels 1, 3, 4, and 5
Importance level 3	*Buildings* of a higher level of societal benefit or importance, or with higher levels of risk-significant factors to *building* occupants. These *buildings* have increased performance requirements because they may house large numbers of people, vulnerable populations, or occupants with other risk factors, or fulfil a role of increased importance to the local community or to society in general.	• *Buildings* where more than 300 people congregate in 1 area • *Buildings* with primary school, secondary school, or daycare facilities with a capacity greater than 250 • *Buildings* with tertiary or adult education facilities with a capacity greater than 500 • Health care facilities with a capacity of 50 or more residents but not having surgery or emergency treatment facilities • Jails and detention facilities • Any other *building* with a capacity of 5 000 or more people • *Buildings* for power generating facilities, water treatment for potable water, wastewater treatment facilities, and other

Importance level	Description of *building* type	Specific structure
		public utilities facilities not included in importance level 4 • *Buildings* not included in importance level 4 or 5 containing sufficient quantities of highly toxic gas or explosive materials capable of causing acutely hazardous conditions that do not extend beyond property boundaries
Importance level 4	*Buildings* that are essential to post-disaster recovery or associated with hazardous facilities.	• Hospitals and other health care facilities having surgery or emergency treatment facilities • *Fire*, rescue, and police stations and emergency vehicle garages • *Buildings* intended to be used as emergency shelters • *Buildings* intended by the owner to contribute to emergency preparedness, or to be used for communication, and operation centres in an emergency, and other facilities required for emergency response • Power generating stations and other utilities required as emergency backup facilities for importance level 3 structures • *Buildings* housing highly toxic gas or explosive materials capable of causing acutely hazardous conditions that extend beyond property boundaries • Aviation control towers, air traffic control centres, and emergency aircraft hangars • *Buildings* having critical national defence functions • Water treatment facilities required to maintain water pressure for *fire* suppression • Ancillary *buildings* (including, but not limited to, communication towers, fuel storage tanks or other structures housing or supporting water or other *fire* suppression material or equipment) required for operation of importance level 4 structures during an emergency
Importance level 5	*Buildings* whose failure poses catastrophic risk to a large area	• Major dams

Importance level	Description of *building* type	Specific structure
	(eg, 100 km^2) or a large number of people (eg, 100 000).	• Extremely hazardous facilities

Schedule 1 clause A3: inserted, on 10 April 2012, by regulation 5 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Clause B1—Structure

Provisions	Limits on application

Objective

B1.1 The objective of this provision is to:

(a) safeguard people from injury caused by structural failure,

(b) safeguard people from loss of *amenity* caused by structural behaviour, and

(c) protect *other property* from physical damage caused by structural failure.

Functional requirement

B1.2 *Buildings*, *building elements* and *sitework* shall withstand the combination of loads that they are likely to experience during *construction* or *alteration* and throughout their lives.

Performance

B1.3.1 *Buildings*, *building elements* and *sitework* shall have a low probability of rupturing, becoming unstable, losing equilibrium, or collapsing during *construction* or *alteration* and throughout their lives.

B1.3.2 *Buildings*, *building elements* and *sitework* shall have a low probability of causing loss of *amenity* through undue deformation, vibratory response, degradation, or other physical characteristics throughout their lives, or during *construction* or *alteration* when the *building* is in use.

B1.3.3 Account shall be taken of all physical conditions likely to affect the stability of *buildings*, *building elements* and *sitework*, including:

(a) self-weight,

(b) imposed gravity loads arising from use,

(c) temperature,

(d) earth pressure,

(e) water and other liquids,

(f) earthquake,

Provisions	**Limits on application**
(g) snow,	
(h) wind,	
(i) *fire*,	
(j) impact,	
(k) explosion,	
(l) reversing or fluctuating effects,	
(m) differential movement,	
(n) vegetation,	
(o) adverse effects due to insufficient separation from other *buildings*,	
(p) influence of equipment, services, non-structural elements and contents,	
(q) time dependent effects including creep and shrinkage, and	
(r) removal of support.	
B1.3.4 Due allowance shall be made for:	
(a) the consequences of failure,	
(b) the intended use of the *building*,	
(c) effects of uncertainties resulting from *construction* activities, or the sequence in which *construction* activities occur,	
(d) variation in the properties of materials and the characteristics of the site, and	
(e) accuracy limitations inherent in the methods used to predict the stability of *buildings*.	
B1.3.5 The demolition of *buildings* shall be carried out in a way that avoids the likelihood of premature collapse.	
B1.3.6 *Sitework*, where necessary, shall be carried out to:	
(a) provide stability for *construction* on the site, and	
(b) avoid the likelihood of damage to *other property*.	

Provisions	Limits on application
B1.3.7 Any *sitework* and associated supports shall take account of the effects of: (a) changes in ground water level, (b) water, weather and vegetation, and (c) ground loss and slumping.	

Clause B2—Durability

Provisions	Limits on application
Objective	
B2.1 The objective of this provision is to ensure that a *building* will throughout its life continue to satisfy the other objectives of this code.	
Functional requirement	
B2.2 *Building* materials, components and *construction* methods shall be sufficiently durable to ensure that the *building*, without reconstruction or major renovation, satisfies the other functional requirements of this code throughout the life of the *building*.	
Performance	
B2.3 *[Revoked]*	
B2.3.1 *Building elements* must, with only normal maintenance, continue to satisfy the performance requirements of this code for the lesser of the *specified intended life* of the *building*, if stated, or:	Performance B2.3.1 applies from the time of issue of the applicable *code compliance certificate*. *Building elements* are not required to satisfy a durability performance which exceeds the *specified intended life* of the *building*.
(a) the life of the building, being not less than 50 years, if:	
(i) those *building elements* (including floors, walls, and fixings) provide structural stability to the *building*, or	
(ii) those *building elements* are difficult to access or replace, or	
(iii) failure of those *building elements* to comply with the *building code* would go undetected during both normal use and maintenance of the *building*.	
(b) 15 years if:	
(i) those *building elements* (including the *building* envelope,	

Provisions	Limits on application
exposed plumbing in the subfloor space, and in-built chimneys and flues) are moderately difficult to access or replace, or (ii) failure of those *building elements* to comply with the *building code* would go undetected during normal use of the *building*, but would be easily detected during normal maintenance. (c) 5 years if: (i) the *building elements* (including services, linings, renewable protective coatings, and *fixtures*) are easy to access and replace, and (ii) failure of those *building elements* to comply with the *building code* would be easily detected during normal use of the *building*.	
B2.3.2 Individual *building elements* which are components of a *building* system and are difficult to access or replace must either: (a) all have the same durability, or (b) be installed in a manner that permits the replacement of *building elements* of lesser durability without removing *building elements* that have greater durability and are not specifically designed for removal and replacement.	

Schedule 1 clause B2.3: revoked, on 11 September 1997, by regulation 2 of the Building Amendment Regulations 1997 (SR 1997/156).

Schedule 1 clause B2.3.1: added, on 11 September 1997, by regulation 2 of the Building Amendment Regulations 1997 (SR 1997/156).

Schedule 1 clause B2.3.2: added, on 11 September 1997, by regulation 2 of the Building Amendment Regulations 1997 (SR 1997/156).

Clause C1—Objectives of clauses C2 to C6 (protection from fire)

Provision	Limit on application
The objectives of clauses C2 to C6 are to:	
(a) safeguard people from an unacceptable risk of injury or illness caused by *fire*,	
(b) protect *other property* from damage caused by *fire*, and	
(c) facilitate firefighting and rescue operations.	

Schedule 1 clause C1: replaced, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Clause C2—Prevention of fire occurring

Provision	Limit on application
Functional requirement	
C2.1 Fixed appliances using controlled combustion and other fixed equipment must be designed, constructed, and installed in *buildings* in a way that reduces the likelihood of illness or injury due to *fire* occurring.	
Performance	
C2.2 The maximum surface temperature of *combustible building materials* close to fixed appliances using controlled combustion and other fixed equipment when operating at their design level must not exceed 90°C.	
C2.3 Fixed appliances using controlled combustion and other fixed equipment must be designed, constructed and installed so that there is a low probability of explosive or hazardous conditions occurring within any spaces in or around the *building* that contains the appliances.	

Schedule 1 clause C2: replaced, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Clause C3—Fire affecting areas beyond the fire source

Provision	Limit on application
Functional requirement	
C3.1 *Buildings* must be designed and constructed so that there is a low probability of injury or illness to persons not in close proximity to a *fire source*.	
C3.2 *Buildings* with a *building height* greater than 10 m where upper floors contain sleeping uses or *other property* must be designed and constructed so that there is a low probability of external vertical fire spread to upper floors in the *building*.	Clause C3.2 does not apply to importance level 1 *buildings*.
C3.3 *Buildings* must be designed and constructed so that there is a low probability of *fire* spread to *other property* vertically or horizontally across a *relevant boundary*.	
Performance	

		Provision	**Limit on application**
C3.4	(a)	materials used as internal surface linings in the following areas of *buildings* must meet the performance criteria specified below:	Clause C3.4 does not apply to *detached dwellings*, within *household units* in *multi-unit dwellings*, or *outbuildings* and *ancillary buildings*.

Area of *building*	**Performance determined under conditions described in ISO 9705: 1993**	
	***Buildings* not protected with an automatic *fire* sprinkler system**	***Buildings* protected with an automatic *fire* sprinkler system**
Wall/ceiling materials in sleeping areas where care or detention is provided	Material Group Number 1-S	Material Group Number 1 or 2
Wall/ceiling materials in exitways	Material Group Number 1-S	Material Group Number 1 or 2
Wall/ceiling materials in all *occupied spaces* in importance level 4 *buildings*	Material Group Number 1-S	Material Group Number 1 or 2
Internal surfaces of ducts for *HVAC systems*	Material Group Number 1-S	Material Group Number 1 or 2
Ceiling materials in crowd and sleeping uses except *household units* and where care or detention is provided	Material Group Number 1-S or 2-S	Material Group Number 1 or 2
Wall materials in crowd and sleeping uses except *household units* and where care or detention is provided	Material Group Number 1-S or 2-S	Material Group Number 1, 2, or 3
Wall/ceiling materials in occupied spaces in all other locations in *buildings*, including *household units*	Material Group Number 1, 2, or 3	Material Group Number 1, 2, or 3
External surfaces of ducts for HVAC systems	Material Group Number 1, 2, or 3	Material Group Number 1, 2, or 3
Acoustic treatment and pipe insulation within airhandling plenums in sleeping uses	Material Group Number 1, 2, or 3	Material Group Number 1, 2, or 3

(b) floor surface materials in the following areas of *buildings* must meet the performance criteria specified below:

Area of *building*	**Minimum critical radiant flux when tested to ISO 9239-1: 2010**	
	***Buildings* not protected with an automatic *fire* sprinkler system**	***Buildings* protected with an automatic *fire* sprinkler system**

Provision		Limit on application
Sleeping areas and exitways in *buildings* where care or detention is provided	4.5 kW/m^2	2.2 kW/m^2
Exitways in all other *buildings*	2.2 kW/m^2	2.2 kW/m^2
Firecells accommodating more than 50 persons	2.2 kW/m^2	1.2 kW/m^2
All other occupied spaces except *household units*	1.2 kW/m^2	1.2 kW/m^2

(c) suspended flexible fabrics and membrane structures used in the construction of *buildings* must have properties resulting in a low probability of injury or illness to persons not in close proximity to a *fire source*.

C3.5 *Buildings* must be designed and constructed so that *fire* does not spread more than 3.5 m vertically from the *fire source* over the external cladding of multi-level *buildings*.

C3.6 *Buildings* must be designed and constructed so that in the event of *fire* in the *building* the received radiation at the *relevant boundary* of the property does not exceed 30 kW/m^2 and at a distance of 1 m beyond the *relevant boundary* of the property does not exceed 16 kW/m^2.

C3.7 External walls of *buildings* that are located closer than 1 m to the *relevant boundary* of the property on which the *building* stands must either:

(a) be constructed from materials which are not *combustible building materials*, or

(b) for *buildings* in importance levels 3 and 4, be constructed from materials that, when subjected to a radiant flux of 30 kW/m^2, do not ignite for 30 minutes, or

(c) for *buildings* in Importance Levels 1 and 2, be constructed from materials that, when subjected to a radiant flux of 30 kW/m^2, do not ignite for 15 minutes.

C3.8 *Firecells* located within 15 m of a *relevant boundary* that are not protected by an automatic *fire* sprinkler system, and that contain a *fire load* greater than 20 TJ or that have a floor area greater than 5,000 m^2 must be designed and constructed so that at the time that firefighters first apply water to the *fire*, the maximum radiation flux at 1.5 m above the floor is no greater than 4.5 kW/m^2 and the smoke layer is not less than 2 m above the floor.

C3.9 *Buildings* must be designed and constructed with regard to the likelihood and consequence of failure of any *fire safety system* intended to control *fire* spread.

Schedule 1 clause C3: replaced, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Clause C4—Movement to place of safety

Provision		Limit on application
Functional requirement		
C4.1	*Buildings* must be provided with: (a) effective means of giving warning of *fire*, and (b) visibility in *escape routes* complying with clause F6.	
C4.2	*Buildings* must be provided with means of escape to ensure that there is a low probability of occupants of those *buildings* being unreasonably delayed or impeded from moving to a *place of safety* and that those occupants will not suffer injury or illness as a result.	
Performance		
C4.3	The *evacuation time* must allow occupants of a *building* to move to a *place of safety* in the event of a *fire* so that occupants are not exposed to any of the following: (a) *fractional effective dose* of carbon monoxide greater than 0.3: (b) a *fractional effective dose* of thermal effects greater than 0.3: (c) conditions where, due to smoke obscuration, visibility is less than 10 m except in rooms of less than 100 m^2 where visibility may fall to 5 m.	
C4.4	Clause C4.3(b) and (c) do not apply where it is not possible to expose more than 1 000 occupants in a *firecell* protected with an automatic *fire* sprinkler system.	
C4.5	Means of escape to a *place of safety* in *buildings* must be designed and constructed with regard to the likelihood and consequence of failure of any *fire safety systems*.	

Schedule 1 clause C4: replaced, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Clause C5—Access and safety for firefighting operations

Provision		Limit on application
Functional requirement		
C5.1	*Buildings* must be designed and constructed so that there is a low probability of firefighters or other emergency services personnel being delayed in or impeded from assisting in rescue operations and performing firefighting operations.	
C5.2	*Buildings* must be designed and constructed so that there is a low probability of illness or injury to firefighters or other emergency services personnel during rescue and firefighting operations.	
Performance		

	Provision	Limit on application
C5.3	*Buildings* must be provided with access for fire service vehicles to a *hard-standing* from which there is an unobstructed path to the *building* within 20 m of: (a) the firefighter access into the *building*, and (b) the inlets to automatic fire sprinkler systems or fire hydrant systems, where these are installed.	Performance requirements in clauses C5.3 to C5.8 do not apply to *backcountry huts*, *detached dwellings*, within *household units* in *multi-unit dwellings*, or to *outbuildings*, and *ancillary buildings*.
C5.4	Access for fire service vehicles in accordance with clause C5.3 must be provided to more than 1 side of *firecells* greater than 5,000 m^2 in floor area that are not protected by an automatic fire sprinkler system.	
C5.5	*Buildings* must be provided with the means to deliver water for firefighting to all parts of the *building*.	
C5.6	*Buildings* must be designed and constructed in a manner that will allow firefighters, taking into account the firefighters' personal protective equipment and standard training, to: (a) reach the floor of fire origin, (b) search the general area of fire origin, and (c) protect their means of egress.	
C5.7	*Buildings* must be provided with means of giving clear information to enable firefighters to: (a) establish the general location of the *fire*, (b) identify the *fire safety systems* available in the *building*, and (c) establish the presence of *hazardous substances* or process in the *building*.	
C5.8	Means to provide access for and safety of firefighters in *buildings* must be designed and constructed with regard to the likelihood and consequence of failure of any *fire safety systems*.	

Schedule 1 clause C5: inserted, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Clause C6—Structural stability

	Provision	Limit on application
Functional requirement		
C6.1	Structural systems in *buildings* must be constructed to maintain structural stability during *fire* so that there is: (a) a low probability of injury or illness to occupants, (b) a low probability of injury or illness to *fire* service personnel during rescue and firefighting operations, and (c) a low probability of direct or consequential damage to adjacent *household units* or *other property*.	
Performance		

	Provision	Limit on application
C6.2	Structural systems in *buildings* that are necessary for structural stability in *fire* must be designed and constructed so that they remain stable during *fire* and after *fire* when required to protect *other property* taking into account: (a) the *fire* severity, (b) any automatic fire sprinkler systems within the *buildings*, (c) any other active *fire safety systems* that affect the *fire* severity and its impact on structural stability, and (d) the likelihood and consequence of failure of any *fire safety systems* that affect the *fire* severity and its impact on structural stability.	
C6.3	Structural systems in *buildings* that are necessary to provide firefighters with safe access to floors for the purpose of conducting firefighting and rescue operations must be designed and constructed so that they remain stable during and after *fire*.	
C6.4	Collapse of building elements that have lesser *fire* resistance must not cause the consequential collapse of elements that are required to have a higher *fire* resistance.	

Schedule 1 clause C6: inserted, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Clause D1—Access routes

Provisions	Limits on application
Objective	
D1.1 The objective of this provision is:	
(a) safeguard people from injury during movement into, within and out of *buildings*,	Objective D1.1(c) shall apply only to those *buildings* to which section 47A of the Act applies.
(b) safeguard people from injury resulting from the movement of vehicles into, within and out of *buildings*, and	
(c) ensure that *people with disabilities* are able to enter and carry out normal activities and functions within *buildings*.	
Functional requirement	
D1.2.1 *Buildings* shall be provided with reasonable and adequate access to enable safe and easy movement of people.	Requirement D1.2.1 shall not apply to *ancillary buildings* or *outbuildings*.
D1.2.2 Where a *building* is provided with loading or parking spaces, they shall be constructed to permit safe and easy unloading and movement of vehicles, and to avoid conflict between vehicles and pedestrians.	

Provisions	Limits on application
Performance	
D1.3.1 *Access routes* shall enable people to: (a) safely and easily approach the main entrance of *buildings* from the apron or *construction* edge of a *building*, (b) enter *buildings*, (c) move into spaces within *buildings* by such means as corridors, doors, stairs, ramps and lifts, (d) manoeuvre and park cars, and (e) manoeuvre and park delivery vehicles required to use the loading space.	
D1.3.2 At least one *access route* shall have features to enable *people with disabilities* to: (a) approach the *building* from the street boundary or, where required to be provided, the *building* car park, (b) have access to the internal space served by the principal access, and (c) have access to and within those spaces where they may be expected to work or visit, or which contain facilities for personal hygiene as required by Clause G1 **Personal hygiene**.	Performance D1.3.2 shall not apply to *housing*, *outbuildings*, *backcountry huts*, *ancillary buildings*, and to *industrial buildings* where no more than 10 people are employed.
D1.3.3 Access routes shall: (a) have *adequate* activity space, (b) be free from dangerous obstructions and from any projections likely to cause an obstruction, (c) have a safe cross fall, and safe slope in the direction of travel, (d) have *adequate* slip-resistant walking surfaces under all conditions of normal use,	Performance D1.3.3(h) shall not apply within *industrial buildings*, *outbuildings* and *ancillary buildings*.

Provisions	Limits on application
(e) include stairs to allow access to upper floors irrespective of whether an escalator or lift has been provided,	Performance D1.3.3(i) shall not apply with *detached dwellings* or within *household units* of *multi-unit dwellings*, or to *outbuildings* and *ancillary buildings*.
(f) have stair treads, and ladder treads or rungs which: (i) provide *adequate* footing, and (ii) have uniform rise within each flight and for consecutive flights,	Performance D1.3.3(j) shall not apply to isolated steps.
(g) have stair treads with a leading edge that can be easily seen,	
(h) have stair treads which prevent children falling through or becoming held fast between treads, where open risers are used,	
(i) not contain isolated steps,	
(j) have smooth, reachable and graspable *handrails* to provide support and to assist with movement along a stair or ladder,	
(k) have *handrails* of *adequate* strength and rigidity as required by Clause B1 **Structure**,	
(l) have landings of appropriate dimensions and at appropriate intervals along a stair or ramp to prevent undue fatigue,	
(m) have landings of appropriate dimensions where a door opens from or onto a stair, ramp or ladder so that the door does not create a hazard, and	
(n) have any automatically controlled doors *constructed* to avoid the risk of people becoming caught or being struck by moving parts.	
D1.3.4 An *accessible route*, in addition to the requirement of Clause D1.3.3, shall:	

Provisions	Limits on application
(a) be easy to find, as required by Clause F8 **Signs**,	
(b) have *adequate* activity space to enable a person in a wheelchair to negotiate the route while permitting an ambulant person to pass,	
(c) include a lift complying with Clause D2 **Mechanical installations for access** to upper floors where:	
(i) *buildings* are four or more storeys high,	
(ii) *buildings* are three storeys high and have a total design occupancy of 50 or more persons on the two upper floors,	
(iii) *buildings* are two storeys high and have a total design occupancy of 40 or more persons on the upper floor, or	
(iv) an upper floor, irrespective of design occupancy, is to be used for the purposes of public reception areas of banks, central, regional and local government offices and facilities, hospitals, medical and dental surgeries, and medical, paramedical and other primary health care centres,	
(d) contain no thresholds or upstands forming a barrier to an unaided wheelchair user,	
(e) have means to prevent the wheel of a wheelchair dropping over the side of the *accessible route*,	

Provisions	Limits on application
(f) have doors and related hardware which are easily used,	
(g) not include spiral stairs, or stairs having open risers,	
(h) have stair treads with leading edge which is rounded, and	
(i) have *handrails* on both sides of the *accessible route* when the slope of the route exceeds 1 in 20. The *handrails* shall be continuous along both sides of the stair, ramp and landing except where the *handrail* is interrupted by a doorway.	
D1.3.5 Vehicle spaces and circulation routes shall have:	
(a) dimensions appropriate to the *intended use*,	
(b) appropriate crossfall, and slope in the direction of travel,	
(c) *adequate* queuing and circulation space, and	
(d) *adequate* sight distances.	
D1.3.6 Vehicle spaces for use by *people with disabilities*, shall, in addition to the requirements of Clause D1.3.5, be:	
(a) provided in sufficient numbers,	
(b) located to avoid conflict between vehicles and people using or moving to or from the space, and	
(c) easy to find as required by Clause F8 **Signs**.	

Schedule 1 clause D1.1(c) limit on application: amended, on 29 December 2000, by regulation 4(1) of the Building Amendment Regulations 2000 (SR 2000/119).

Schedule 1 clause D1.3.2 limit on application: amended, on 31 October 2008, by regulation 7 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Clause D2—Mechanical installations for access

Provisions	Limits on application
Objective	
D2.1 The objective of this provision is to:	
(a) safeguard people from injury and loss of amenity while using mechanical installations for movement into, within and out of *buildings*,	
(b) safeguard maintenance personnel from injury while servicing mechanical installations for access, and	
(c) ensure that *people with disabilities* are able to carry out normal activities and processes within *buildings*.	Objective D2.1(c) shall apply only to those *buildings* to which section 47A of the Act applies.
Functional requirement	
D2.2 Mechanical installations for access into, within and out of *buildings* shall provide for the safe and easy movement of people, and for the safety of maintenance personnel.	

Provisions	**Limits on application**
Performance	
D2.3.1 Mechanical installations for access shall: (a) move people safely, and stop and hold as required for the normal use of the installation, for all loads up to and including 25% in excess of the rated load, (b) not produce excessive acceleration or deceleration, (c) be constructed to avoid the likelihood of people falling, tripping, becoming caught, being able to touch or be struck by moving parts, sharp edges or projections, under both normal and reasonably foreseeable abnormal conditions of use, (d) be constructed to prevent collision between components, or between components and the *building*, (e) have a control system that ensures safe abnormal operation in the event of overloading or failure of any single component, and (f) be capable of being isolated for inspection, testing and maintenance.	
D2.3.2 Mechanical installations for access shall be provided with: (a) *adequate* control over normal use, to ensure people's safety throughout any operation involving starting, stopping or changing the direction of travel, (b) notification of position, where people are fully enclosed and the installation serves more than two levels,	

Provisions	Limits on application
(c) *adequate* lighting and ventilation for both normal and emergency use, and	
(d) signs as required by Clause F8 **Signs**.	
D2.3.3 Mechanical installations for access shall, for emergency purposes, be provided with a means of:	
(a) calling outside help,	Performance D2.3.3(d) shall not apply to installations travelling less than 15 m vertically.
(b) releasing people safely,	
(c) safeguarding people from exposure to *hazardous* situations, and	
(d) allowing authorised personnel to override the normal running procedure and take exclusive control of the installation.	
D2.3.4 Potentially dangerous equipment shall be located in spaces which:	
(a) are secure from unauthorised entry and contain only equipment associated with the installation,	
(b) are appropriately sized and suitably guarded to provide *adequate* safe working areas for maintenance personnel,	
(c) are provided with *adequate* power and lighting for maintenance, and	
(d) have an environment that ensures the safe operation of the equipment under all likely conditions of use.	
D2.3.5 Mechanical installations on *accessible routes* shall:	
(a) where the passenger conveyor is manually controlled, provide:	
(i) controls which are easily identifiable and easy to use,	
(ii) *adequate* notification that the passenger	

Provisions	Limits on application
conveyor has registered a summoning call, and (iii) *adequate* notification that the passenger conveyor has arrived, and of its future direction of travel, (b) where the passenger conveyor is fully enclosed and serves more than two levels, provide an *adequate* means of informing occupants of their location, (c) where appropriate, have doors which: (i) are power operated, (ii) are readily distinguishable from their surroundings, and (iii) where automatic, remain open sufficiently long to enable *people with disabilities* to pass through, and (d) have *handrails* within the passenger conveyor.	

Schedule 1 clause D2.1(c) limit on application: amended, on 29 December 2000, by regulation 4(1) of the Building Amendment Regulations 2000 (SR 2000/119).

Clause E1—Surface water

Provisions	Limits on application
Objective	
E1.1 The objective of this provision is to:	
(a) safeguard people from injury or illness, and *other property* from damage, caused by *surface water*, and	
(b) protect the *outfalls* of drainage systems.	
Functional requirement	
E1.2 *Buildings* and *sitework* shall be constructed in a way that protects people and *other property* from the adverse effects of *surface water*.	
Performance	
E1.3.1 Except as otherwise required under the Resource Management Act 1991 for the protection of other property, *surface water*, resulting from an event having a 10% probability of occurring annually and which is collected or concentrated by *buildings* or *sitework*, shall be disposed of in a way that avoids the likelihood of damage or nuisance to *other property*.	
E1.3.2 *Surface water*, resulting from an event having a 2% probability of occurring annually, shall not enter *buildings*.	Performance E1.3.2 shall apply only to *housing*, *communal residential* and *communal non-residential buildings*.
E1.3.3 Drainage systems for the disposal of *surface water* shall be constructed to:	
(a) convey *surface water* to an appropriate *outfall* using gravity flow where possible,	
(b) avoid the likelihood of blockages,	
(c) avoid the likelihood of leakage, penetration by roots, or the entry of ground water where pipes or lined channels are used,	
(d) provide reasonable access for maintenance and clearing blockages,	

Provisions	Limits on application
(e) avoid the likelihood of damage to any *outfall*, in a manner acceptable to the *network utility operator*, and	
(f) avoid the likelihood of damage from superimposed loads or normal ground movements.	

Schedule 1 clause E1.3.1: amended, on 3 January 2002, by regulation 3(7) of the Building Amendment Regulations 2001 (SR 2001/374).

Schedule 1 clause E1.3.1: amended, on 22 December 1994, by regulation 4 of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Schedule 1 clause E1.3.2: amended, on 3 January 2002, by regulation 3(8) of the Building Amendment Regulations 2001 (SR 2001/374).

Clause E2—External moisture

Provisions	Limits on application
Objective	
E2.1 The objective of this provision is to safeguard people from illness or injury that could result from external moisture entering the *building*.	
Functional requirement	
E2.2 *Buildings* must be constructed to provide *adequate* resistance to penetration by, and the accumulation of, moisture from the outside.	Requirement E2.2 does not apply to *buildings* (for example, certain bus shelters, and certain *buildings* used for horticulture or for equipment for washing motor vehicles automatically) if moisture from the outside penetrating them, or accumulating within them, or both, is unlikely to impair significantly all or any of their *amenity*, durability, and stability.
Performance	
E2.3.1 Roofs must shed precipitated moisture. In locations subject to snowfalls, roofs must also shed melted snow.	
E2.3.2 Roofs and exterior walls must prevent the penetration of water that could cause undue dampness, damage to *building elements*, or both.	
E2.3.3 Walls, floors, and structural elements in contact with, or in close proximity to, the ground must not absorb or transmit moisture in quantities that could cause undue dampness, damage to *building elements*, or both.	
E2.3.4 *Building elements* susceptible to damage must be protected from the adverse effects of moisture entering the space below suspended floors.	
E2.3.5 *Concealed spaces* and cavities in *buildings* must be constructed in a way that prevents external moisture being accumulated or transferred and causing condensation, fungal growth, or the degradation of *building elements*.	
E2.3.6 Excess moisture present at the completion of *construction* must be capable of being dissipated without permanent damage to *building elements*.	

Provisions	Limits on application
E2.3.7 *Building elements* must be constructed in a way that makes due allowance for the following: (a) the consequences of failure: (b) the effects of uncertainties resulting from *construction* or from the sequence in which different aspects of *construction* occur: (c) variation in the properties of materials and in the characteristics of the site.	

Schedule 1 clause E2: substituted, on 21 June 2007, by regulation 4 of the Building Amendment Regulations 2007 (SR 2007/124).

Clause E3—Internal moisture

Provisions	Limits on application
Objective	
E3.1 The objective of this provision is to— (a) safeguard people against illness, injury, or loss of *amenity* that could result from accumulation of internal moisture; and (b) protect *household units* and *other property* from damage caused by free water from another *household unit* in the same *building*.	
Functional requirement	
E3.2 *Buildings* must be constructed to avoid the likelihood of— (a) fungal growth or the accumulation of *contaminants* on linings and other *building elements*; and (b) free water overflow penetrating to an adjoining *household unit*; and (c) damage to *building elements* caused by the presence of moisture.	
Performance	
E3.3.1 An *adequate* combination of *thermal resistance*, ventilation, and space temperature must be provided to all *habitable spaces*, bathrooms, laundries, and other spaces where moisture may be generated or may accumulate.	Performance E3.3.1 does not apply to *communal non-residential*, *commercial*, *industrial*, *outbuildings*, or *ancillary buildings*.
E3.3.2 Free water from accidental overflow from *sanitary fixtures* or *sanitary appliances* must be disposed of in a way that avoids loss of *amenity* or damage to *household units* or *other property*.	
E3.3.3 Floor surfaces of any space containing *sanitary fixtures* or *sanitary appliances* must be *impervious* and easily cleaned.	

Provisions	Limits on application
E3.3.4 Wall surfaces adjacent to *sanitary fixtures* or *sanitary appliances* must be *impervious* and easily cleaned.	
E3.3.5 Surfaces of *building elements* likely to be splashed or become contaminated in the course of the *intended use* of the building, must be *impervious* and easily cleaned.	
E3.3.6 Surfaces of *building elements* likely to be splashed must be constructed in a way that prevents water splash from penetrating behind linings or into *concealed spaces*.	

Schedule 1 clause E3: substituted, on 14 October 2004, by regulation 3 of the Building Amendment Regulations 2004 (SR 2004/317).

Clause F1—Hazardous agents on site

Provisions	**Limits on application**
Objective	
F1.1 The objective of this provision is to safeguard people from injury or illness caused by *hazardous* agents or *contaminants* on a site.	
Functional requirement	
F1.2 *Buildings* shall be constructed to avoid the likelihood of people within the *building* being adversely affected by *hazardous* agents or *contaminants* on the site.	
Performance	
F1.3.1 Sites shall be assessed to determine the presence and potential threat of any *hazardous* agents or *contaminants*.	
F1.3.2 The likely effect of any *hazardous* agent or *contaminant* on people shall be determined taking account of:	
(a) the *intended use* of the *building*,	
(b) the nature, potency or toxicity of the *hazardous* agent or *contaminant*, and	
(c) the protection afforded by the *building* envelope and *building* systems.	

Clause F2—Hazardous building materials

Provisions	Limits on application
Objective	
F2.1 The objective of this provision is to safeguard people from injury and illness caused by exposure to *hazardous building* materials.	
Functional requirement	
F2.2 *Building* materials which are potentially *hazardous*, shall be used in ways that avoid undue risk to people.	
Performance	
F2.3.1 The quantities of gas, liquid, radiation or solid particles emitted by materials used in the *construction* of *buildings*, shall not give rise to harmful concentrations at the surface of the material where the material is exposed, or in the atmosphere of any space.	
F2.3.2 Transparent panels capable of being mistaken for an unimpeded path of travel shall be marked to make them visible.	Performance F2.3.2 does not apply to *housing*
F2.3.3 Glass or other brittle materials with which people are likely to come into contact shall: (a) if broken on impact, break in a way which is unlikely to cause injury, or (b) resist a reasonably foreseeable impact without breaking, or (c) be protected from impact.	

Clause F3—Hazardous substances and processes

Provisions	Limits on application
Objective	
F3.1 The objective of this provision is to safeguard people from injury or illness, and *other property* from damage, caused by *hazardous substances* or processes in *buildings*.	
Functional requirement	
F3.2 *Buildings* where *hazardous substances* are stored and *hazardous* processes undertaken, shall be constructed to provide *adequate* protection to people and to *other property*.	
Performance	
F3.3 Spaces in *buildings* where *hazardous substances* are stored, handled or used, or where *hazardous* processes are undertaken, shall be located and constructed to protect people, and *other property*, under both normal and reasonably foreseeable abnormal conditions, and shall be provided with:	
(a) means of restricting unauthorised access,	
(b) means of preventing *hazardous substances*, or other materials unacceptable to the *network utility operator*, from entering *sewers* or public *drains*,	
(c) means of allowing the harmless release of pressure where there is a significant risk of explosion occurring,	
(d) protected ignition sources where flammable or explosive goods are stored,	
(e) means of rendering harmless by ventilation, containment, dilution, or chemical or biological action, any radioactive, toxic or flammable vapours, gases or materials which may escape	

Provisions		Limits on application
	from pipes, vessels or containers,	
(f)	impervious, easily cleaned surface finishes on *building elements* likely to be splashed or become contaminated in the course of the *intended use* of the *building*, and	
(g)	signs as required by Clause F8 **Signs**.	

Clause F4—Safety from falling

Provisions	Limits on application
Objective	
F4.1 The objective of this provision is to safeguard people from injury caused by falling.	
Functional requirement	
F4.2 *Buildings* shall be constructed to reduce the likelihood of accidental fall.	
Performance	
F4.3.1 Where people could fall 1 metre or more from an opening in the external envelope or floor of a *building*, or from a sudden change of level within or associated with a *building*, a barrier shall be provided.	Performance F4.3.1 shall not apply where such a barrier would be incompatible with the *intended use* of an area, or to temporary barriers on *construction* sites where the possible fall is less than 3 metres, or to *buildings* providing pedestrian access in remote locations where the route served presents similar natural hazards.
F4.3.2 Roofs with permanent access shall have barriers provided.	
F4.3.3 *[Revoked]*	
F4.3.4 Barriers shall:	
(a) be continuous and extend for the full extent of the hazard,	
(b) be of appropriate height,	
(c) be constructed with *adequate* rigidity,	Performance F4.3.4(h) does not apply to *housing*.
(d) be of *adequate* strength to withstand the foreseeable impact of people and, where appropriate, the static pressure of people pressing against them,	
(e) be constructed to prevent people from falling through them, and	
(f) *[Revoked]*	
(g) restrict the passage of children under 6 years of age when provided to guard a change of level in areas likely to be frequented by them.	
(h) be constructed so that they are not readily able to be used as seats.	

Provisions	Limits on application
F4.3.5 *[Revoked]*	

Schedule 1 clause F4.3.1 limit on application: amended, on 3 January 2002, by regulation 3(9) of the Building Amendment Regulations 2001 (SR 2001/374).

Schedule 1 clause F4.3.3: revoked, on 1 January 2017, by section 20 of the Building (Pools) Amendment Act 2016 (2016 No 71).

Schedule 1 clause F4.3.4(f): revoked, on 1 January 2017, by section 20 of the Building (Pools) Amendment Act 2016 (2016 No 71).

Schedule 1 clause F4.3.4(g): added, on 22 December 1994, by regulation 5(2)(c) of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Schedule 1 clause F4.3.4(h): added, on 21 June 2007, by regulation 5 of the Building Amendment Regulations 2007 (SR 2007/124).

Schedule 1 clause F4.3.5: revoked, on 1 January 2017, by section 20 of the Building (Pools) Amendment Act 2016 (2016 No 71).

Clause F5—Construction and demolition hazards

Provisions	Limits on application

Objective

F5.1 The objective of this provision is to safeguard people from injury, and *other property* from damage, caused by *construction* or demolition site hazards.

Functional requirement

F5.2 *Construction* and demolition work on *buildings* shall be performed in a manner that avoids the likelihood of:

(a) objects falling onto people on or off the site,

(b) objects falling on property off the site,

(c) other hazards arising on the site affecting people off the site and *other property*, and

(d) unauthorised entry of children to hazards on the site.

Performance

F5.3.1 Suitable *construction* methods shall be used to avoid the likelihood of tools or materials falling onto places where people might be present.

F5.3.2 Where *construction* or demolition work presents a hazard in places to which the public has access, barriers shall be provided and shall:

(a) be of appropriate height and *construction* to prevent site hazards from harming traffic or passersby,

(b) be difficult to climb,

(c) have no opening other than those approved by the *territorial authority* for access and viewing,

(d) have no gates or doors which project beyond the site when opened,

(e) contain no projection that would be a hazard to traffic or people, and

Provisions	Limits on application
(f) be clearly marked where the barrier itself may otherwise present a hazard to traffic or passersby.	
F5.3.3 Where a *construction* or demolition site contains any hazard which might be expected to attract the unauthorised entry of children, the hazard shall be enclosed to restrict access by children.	
F5.3.4 Suitable barriers shall be constructed to provide a safe route for people where lifting equipment creates a risk of accident from objects falling on a place of public access, or where a similar risk results from the height at which *construction* or demolition work is being carried out.	

Schedule 1 second clause F5 number: revoked, on 22 December 1994, by regulation 6 of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Schedule 1 clause F5.2 number: inserted, on 22 December 1994, by regulation 6 of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Clause F6—Visibility in escape routes

Provisions	Limits on application
Objective	
F6.1 The objective of this provision is to help safeguard people from injury in *escape routes* during failure of the main lighting.	
Functional requirement	
F6.2 *Specified features* in *escape routes* must be made *reasonably visible* by lighting systems, other systems, or both, during failure of the main lighting.	Requirement F6.2 does not apply to *detached dwellings, household units* within *multi-unit dwellings, outbuildings*, *backcountry huts*, or *ancillary buildings*.
Performance	
F6.3.1 *Specified features* in *escape routes* must, when the systems for visibility are at their design level, be *reasonably visible*.	Performance F6.3.1 does not apply to *specified features* in the initial 20 metres of an *escape route* if the risk of injury, or impediment to movement of people, due to the *specified features* not being visible is low (for example, because people are familiar with the *escape route*, the *escape route* is level, and people do not require assistance to escape).
F6.3.2 The systems for visibility must operate to the following percentages of their design levels within the following times after failure of the main lighting: (a) 80% in 0.5 seconds in locations (examples of which are given by performance F6.3.3) where there is a high risk of injury due to delay in operation of the systems for visibility; and (b) 10% in 0.5 seconds, and 80% in 30 seconds, in stairs and in locations that are unfamiliar to users; and (c) 10% in 20 seconds, and 80% in 60 seconds, in all other locations.	
F6.3.3 Examples of locations (referred to in performance F6.3.2(a)) where there is a high risk of injury due to delay in operation of the systems for visibility include:	

Provisions	Limits on application
(a) areas where dangerous machinery is installed:	
(b) areas where hazardous processes take place:	
(c) clinical areas of hospitals:	
(d) prisons and other *buildings* in which people are detained:	
(e) any part of an *escape route* designed for use at any time by more than 250 people.	
F6.3.4 The systems for visibility must operate continuously in *buildings* or parts of *buildings* in the following risk groups for the following periods after failure of the main lighting:	
(a) *risk group A*, until restoration of the main lighting system:	
(b) *risk group B*, 90 minutes:	
(c) *risk group C*, 30 minutes.	
F6.3.5 Despite performance F6.3.4, if a *building* or part of a *building* falls into both *risk group A* and *risk group B*, the systems for visibility must operate for whichever is the longer of the periods specified in performance F6.3.4(a) and (b).	
F6.3.6 Signs to indicate escape routes must be provided as required by Clause F8 **Signs**.	

Schedule 1 clause F6: substituted, on 21 June 2007, by regulation 6(1) of the Building Amendment Regulations 2007 (SR 2007/124).

Schedule 1 clause F6.2 limit on application: amended, on 31 October 2008, by regulation 8 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Clause F7—Warning systems

Provisions	Limits on application
Objective	
F7.1 The objective of this provision is to safeguard people from injury or illness due to lack of awareness of an emergency.	
Functional requirement	
F7.2 *Buildings* shall be provided with appropriate means of warning people to escape to a *safe place* in an emergency.	
Performance	
F7.3 *[Revoked]*	
F7.3.1 A means of warning must alert people to the emergency in *adequate* time for them to reach a *safe place*.	Performance F7.3 does not apply to *outbuildings*, *backcountry huts*, or *ancillary buildings*.
F7.3.2 Appropriate means of detection and warning for fire must be provided within each *household unit*.	
F7.3.3 Appropriate means of warning for fire and other emergencies must be provided in *buildings* as necessary to satisfy the other performance requirements of this code.	

Schedule 1 clause F7.2: amended, on 24 April 2003, by regulation 3(1) of the Building Amendment Regulations 2003 (SR 2003/61).

Schedule 1 clause F7.3: revoked, on 24 April 2003, by regulation 3(2) of the Building Amendment Regulations 2003 (SR 2003/61).

Schedule 1 clause F7.3.1: added, on 24 April 2003, by regulation 3(2) of the Building Amendment Regulations 2003 (SR 2003/61).

Schedule 1 clause F7.3.1 limit on application: amended, on 31 October 2008, by regulation 9 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Schedule 1 clause F7.3.2: added, on 24 April 2003, by regulation 3(2) of the Building Amendment Regulations 2003 (SR 2003/61).

Schedule 1 clause F7.3.3: added, on 24 April 2003, by regulation 3(2) of the Building Amendment Regulations 2003 (SR 2003/61).

Clause F8—Signs

Provision | **Limit on application**

Objective

F8.1 The objective of this provision is to:

(a) safeguard people from injury or illness resulting from inadequate identification of *escape routes*, or of hazards within or about the *building*,

(b) safeguard people from loss of *amenity* due to inadequate direction, and

(c) ensure that *people with disabilities* are able to carry out normal activities and processes within *buildings*.

Limit on application: Objective F8.1(c) applies only to those *buildings* to which section 118 of the Building Act 2004 applies.

Functional requirement

F8.2 Signs must be provided in and about *buildings* to identify:

(a) *escape routes*,

(b) emergency-related safety features,

(c) potential hazards, and

(d) *accessible routes* and facilities for *people with disabilities*.

Limit on application: Requirement F8.2 does not apply to *detached dwellings*, or within *household units* in *multi-unit dwellings*.

Performance

F8.3.1 Signs must be *clearly visible* and readily understandable under all conditions of foreseeable use, including emergency conditions.

F8.3.2 Signs identifying potential hazards must be provided and located so that people encounter the signs before encountering the potential hazard.

F8.3.3 Signs to facilitate escape to a *place of safety* must be provided and

(a) be located to identify the *escape routes*, and

(b) continue to meet the performance requirements in clause F8.3.1 during failure of the main lighting for the period required by performance F6.3.4 and performance F6.3.5.

F8.3.4 Signs must be provided and located to identify *accessible routes* and facilities provided for *people with disabilities*.

F8.3.5 *Accessible route*s must be identified with the International Symbol of Access.

Schedule 1 clause F8: replaced, on 10 April 2012, by regulation 7 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

Clause F9—Means of restricting access to residential pools

Provisions	Limits on application
Objective	
F9.1 The objective of this provision is to prevent injury or death to young children involving *residential pools*.	
Functional requirement	
F9.2 *Residential pools* with a maximum depth of water of 400 mm or more that are filled or partly filled with water must have means of restricting access that prevents unsupervised access by a child under 5 years of age.	
Performance	
F9.3.1 *Residential pools* must have or be provided with physical barriers that restrict access to the *pool* or the *immediate pool area* by unsupervised young children (ie, under 5 years of age).	In the case of a *small heated pool*, the means of restricting access referred to in Performance F9.3.1 need only restrict access to the *pool* when the *pool* is not in use.
F9.3.2 Barriers must either— (a) surround the *pool* (and may enclose the whole or part of the *immediate pool area*); or (b) in the case of a *small heated pool*, cover the *pool* itself.	Performance F9.3.2(b) applies only to those *small heated pools* where the top surface of every wall of the *pool* is at all points not less than 760 mm above the adjacent floor or ground and the walls of the *pool* inhibit climbing.
F9.3.3 A barrier surrounding a *pool* must have no permanent objects or projections on the outside that could assist children in negotiating the barrier. Any gates must— (a) open away from the *pool*; and (b) not be able to be readily opened by children; and (c) automatically return to the closed position after use.	
F9.3.4 Where a *building* forms all or part of an *immediate pool area* barrier,— (a) doors between the *building* and the *immediate pool area* must not be able to be	

Provisions	Limits on application
readily opened by children, and must either— (i) emit an audible warning when the door is open; or (ii) close automatically after use: (b) windows opening from a building into the *immediate pool area* must be constructed or positioned to restrict the passage of children.	
F9.3.5 Where a cover is provided as a barrier to a *small heated pool*, it must— (a) restrict the entry of children when closed; and (b) be able to withstand a reasonably foreseeable load; and (c) be able to be readily returned to the closed position; and (d) have signage indicating its child safety features.	

Schedule 1 clause F9: inserted, on 1 January 2017, by section 20 of the Building (Pools) Amendment Act 2016 (2016 No 71).

Clause G1—Personal hygiene

Provisions	Limits on application
Objective	
G1.1 The objective of this provision is to:	
(a) safeguard people from illness caused by infection or contamination,	
(b) safeguard people from loss of *amenity* arising from the absence of appropriate personal hygiene facilities, and	
(c) ensure *people with disabilities* are able to carry out normal activities and processes within *buildings*.	Objective G1.1(c) shall apply only to those *buildings* to which section 47A of the Act applies.
Functional requirement	
G1.2 *Buildings* shall be provided with appropriate spaces and facilities for personal hygiene.	
Performance	
G1.3.1 *Sanitary fixtures* shall be provided in sufficient number and be appropriate for the people who are intended to use them.	
G1.3.2 *Sanitary fixtures* shall be located, constructed and installed to:	
(a) facilitate *sanitation*,	
(b) avoid risk of food contamination,	
(c) avoid harbouring dirt or germs,	
(d) provide appropriate privacy,	
(e) avoid affecting occupants of adjacent spaces from the presence of unpleasant odours, accumulation of offensive matter, or other source of annoyance,	
(f) allow effective cleaning,	
(g) discharge to a plumbing and drainage system as required by Clause G13 **Foul water** when water-borne disposal is used, and	

Provisions	Limits on application
(h) provide a healthy safe disposal system when non-water-borne disposal is used.	
G1.3.3 Facilities for personal hygiene shall be provided in convenient locations.	
G1.3.4 Personal hygiene facilities provided for *people with disabilities* shall be *accessible*.	Performance G1.3.4 shall not apply to *housing, outbuildings, backcountry huts, ancillary buildings*, and to *industrial buildings* where no more than 10 people are employed.

Schedule 1 clause G1.1(c) limit on application: amended, on 29 December 2000, by regulation 4(1) of the Building Amendment Regulations 2000 (SR 2000/119).

Schedule 1 clause G1.3.4 limit on application: amended, on 31 October 2008, by regulation 10 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Clause G2—Laundering

Provisions	Limits on application
Objective	
G2.1 The objective of this provision is to ensure:	
(a) *adequate amenities* for people to do laundering, and	
(b) that *people with disabilities* are able to carry out normal activities and processes within *buildings*.	Objective G2.1(b) shall apply to those *buildings* to which section 47A of the Act applies.
Functional requirement	
G2.2 *Buildings* shall be provided with *adequate* space and facilities for laundering.	Requirement G2.2 shall apply only to *housing*, old people's homes, early childhood centres, camping grounds and work camps.
Performance	
G2.3.1 Facilities shall have capacity for the *intended use*, and consist of *fixtures*, or space and services for appliances.	
G2.3.2 Space shall be *adequate* in size to provide for the installation and use of *fixtures* or appliances.	
G2.3.3 Space and facilities shall be provided within each accommodation unit or may be grouped elsewhere in a convenient location.	
G2.3.4 *Accessible* facilities shall be provided for *people with disabilities*.	Performance G2.3.4 shall apply only to camping grounds.

Schedule 1 clause G2.1(b) limit on application: amended, on 29 December 2000, by regulation 4(1) of the Building Amendment Regulations 2000 (SR 2000/119).

Clause G3—Food preparation and prevention of contamination

Provisions	Limits on application
Objective	
G3.1 The objective of this provision is to:	
(a) safeguard people from illness due to contamination,	
(b) enable hygienic food preparation without loss of *amenity*, and	Objective G3.1(c) shall apply only to those *buildings* to which section 47A of the Act applies.
(c) ensure that *people with disabilities* are able to carry out normal activities and processes within *buildings*.	
Functional requirement	
G3.2.1 *Buildings* shall be provided with space and facilities for the hygienic storage, preparation and cooking of food, that are *adequate* for the *intended use* of the *building*.	Requirement G3.2.1 shall apply to *housing*, work camps, old people's homes and early childhood centres, and where appropriate shall also apply to *commercial* and *industrial buildings* whose *intended uses* include the manufacture, preparation, packaging or storage of food.
G3.2.2 *Buildings* used for the storage, manufacture or processing of food, including animal products, shall be constructed to safeguard the contents from contamination.	
G3.2.3 *Buildings* used for the medical treatment of humans or animals, or the reception of dead bodies, shall be constructed to avoid the spread of contamination from the *building* contents.	

Provisions	Limits on application
Performance	
G3.3.1 Food preparation facilities shall be hygienic and include: (a) space for a refrigerator, or a perishable food storage area capable of being cooled and protected from vermin and insects, (b) means for food rinsing, utensil washing and waste water disposal, (c) means for cooking food, and (d) space and a surface for food preparation.	Performance G3.3.1(a) and (b) shall apply to *housing*, work camps, old people's homes, early childhood centres and *commercial* or *industrial buildings* whose *intended uses* include the handling of perishable food. Performance G3.3.1(c) shall apply to *housing*, work camps, old people's homes and early childhood centres. Performance G3.3.1(d) shall apply to *housing*, work camps, old people's homes and early childhood centres.
G3.3.2 Spaces for food preparation and utensil washing shall have: (a) interior linings and work surfaces shall be *impervious* and easily cleaned, (b) all *building elements* constructed with materials which are free from *hazardous substances* which could cause contamination to the *building* contents, and (c) exposed *building elements* located and shaped to avoid the accumulation of dirt.	Performance G3.3.2(b) shall apply to *housing*, work camps, old people's homes and early childhood centres, and where appropriate shall also apply to *commercial* and *industrial buildings* whose *intended uses* include the manufacture, preparation, packaging or storage of food. Performance G3.3.2(c) shall not apply to *housing*.
G3.3.3 An *adequate* energy supply shall be provided, appropriately located for use by cooking and refrigeration appliances.	
G3.3.4 Space and facilities shall be provided within each *household unit*, or grouped elsewhere in a convenient location.	
G3.3.5 Where facilities are provided for *people with disabilities* they shall be *accessible*.	Performance G3.3.5 shall apply only to camping grounds and *accessible* accommodation units in *communal residential buildings*.
G3.3.6 Spaces in *buildings* shall be protected from the likelihood of contamination or vermin entering areas used for the storage, processing or preparation of food, and shall have	Performance G3.3.6 shall apply to *commercial* or *industrial buildings* whose *intended uses* include the handling of perishable food, the medical treatment of humans or animals, the slaughter of animals or the reception of dead bodies.

Provisions	Limits on application
a means of preventing contamination spreading from these areas to other spaces.	

Schedule 1 clause G3.1(c) limit on application: amended, on 29 December 2000, by regulation 4(1) of the Building Amendment Regulations 2000 (SR 2000/119).

Schedule 1 second clause G3.2.2 number: revoked, on 22 December 1994, by regulation 9 of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Schedule 1 G3.2.3 number: inserted, on 22 December 1994, by regulation 9 of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Clause G4—Ventilation

Provisions	Limits on application
Objective	
G4.1 The objective of this provision is to safeguard people from illness or loss of *amenity* due to lack of fresh air.	
Functional requirement	
G4.2 Spaces within *buildings* shall be provided with *adequate* ventilation consistent with their maximum occupancy and their intended use.	
Performance	
G4.3.1 Spaces within *buildings* shall have means of ventilation with *outdoor air* that will provide an *adequate* number of air changes to maintain air purity.	
G4.3.2 Mechanical air-handling systems shall be constructed and maintained in a manner that prevents harmful bacteria, pathogens and allergens from multiplying within them.	
G4.3.3 *Buildings* shall have a means of collecting or otherwise removing the following products from the spaces in which they are generated: (a) cooking fumes and odours, (b) moisture from laundering, utensil washing, bathing and showering, (c) odours from sanitary and waste storage spaces, (d) gaseous by-products and excessive moisture from commercial or industrial processes, (e) poisonous fumes and gases, (f) flammable fumes and gases, (g) airborne particles, (h) bacteria, viruses or other pathogens, or (i) products of combustion.	
G4.3.4 Contaminated air shall be disposed of in a way which avoids creating a nuisance or hazard to people and *other property*.	

Provisions	Limits on application
G4.3.5 The quantities of air supplied for ventilation shall meet the additional demands of any fixed *combustion appliances*.	

Schedule 1 clause G4.2: amended, on 11 September 1997, by regulation 3(1) of the Building Amendment Regulations 1997 (SR 1997/156).

Schedule 1 clause G4.3.3(b): amended, on 11 September 1997, by regulation 3(2) of the Building Amendment Regulations 1997 (SR 1997/156).

Clause G5—Interior environment

Provisions	Limits on application
Objective	
G5.1 The objective of this provision is to:	
(a) safeguard people from illness caused by low air temperature,	
(b) safeguard people from injury or loss of *amenity* caused by inadequate activity space,	Objective G5.1(d) shall apply to those *buildings* to which section 47A of the Act applies.
(c) safeguard people from injury caused by unsafe installations, and	
(d) ensure that *people with disabilities* are able to carry out normal activities and processes within *buildings*.	
Functional requirement	
G5.2.1 *Buildings* shall be constructed to provide:	
(a) an *adequate*, controlled interior temperature,	Requirement G5.2.1(a) shall apply only to *habitable spaces*, bathrooms and recreation rooms in old people's homes and early childhood centres.
(b) *adequate* activity space for the *intended use*, and	Requirement G5.2.1(b) shall apply only to old people's homes.
(c) *accessible* spaces and facilities.	Requirement G5.2.1(c) shall apply only to *communal residential*, *communal non-residential*, and *commercial buildings*.
G5.2.2 Heating appliances in *buildings* shall be installed in a way that reduces the likelihood of injury.	

Provisions	Limits on application
Performance	
G5.3.1 *Habitable spaces*, bathrooms and recreation rooms shall have provision for maintaining the internal temperature at no less than 16°C measured at 750 mm above floor level, while the space is *adequately* ventilated.	Performance G5.3.1 shall apply only to old people's homes and early childhood centres.
G5.3.2 Heating appliances, and any attached cables, pipes or other fittings shall be securely fixed in place.	Performance G5.3.2 shall apply only to old people's homes and early childhood centres.
G5.3.3 *Habitable spaces* shall have sufficient space for activity, furniture, and sanitary and mobility aids.	Performance G5.3.3 shall apply only to old people's homes.
G5.3.4 Where reception counters or desks are provided for public use, at least one counter or desk shall be *accessible*.	Performance G5.3.4 applies only to *communal residential, communal non-residential*, and *commercial buildings*.
G5.3.5 *Buildings* shall be provided with listening systems which enable enhanced hearing by people with hearing aids.	Performance G5.3.5 applies only to: (a) *communal non-residential* assembly spaces occupied by more than 250 people, and (b) any theatre, cinema, or public hall, and (c) assembly spaces in old people's homes occupied by more than 20 people.
G5.3.6 Enhanced listening systems shall be identified by signs complying with Clause F8 **Signs**.	

Schedule 1 clause G5.1(d) limit on application: amended, on 29 December 2000, by regulation 4(1) of the Building Amendment Regulations 2000 (SR 2000/119).

Schedule 1 clause G5.2.1(b) limit on application: amended, on 22 December 1994, by regulation 10 of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Clause G6—Airborne and impact sound

Provisions	Limits on application
Objective	
G6.1 The objective of this provision is to safeguard people from illness or loss of *amenity* as a result of undue noise being transmitted between abutting occupancies.	
Functional requirement	
G6.2 *Building elements* which are common between occupancies, shall be constructed to prevent undue noise transmission from other occupancies or common spaces, to the *habitable spaces* of *household units*.	
Performance	
G6.3.1 The *Sound Transmission Class* of walls, floors and ceilings, shall be no less than 55.	
G6.3.2 The *Impact Insulation Class* of floors shall be no less than 55.	

Clause G7—Natural light

Provisions	Limits on application
Objective	
G7.1 The objective of this provision is to safeguard people from illness or loss of *amenity* due to isolation from natural light and the outside environment.	
Functional requirement	
G7.2 *Habitable spaces* shall provide *adequate* openings for natural light and for a visual awareness of the outside environment.	Requirement G7.2 shall apply only to *housing*, old people's homes and early childhood centres.
Performance	
G7.3.1 Natural light shall provide an *illuminance* of no less than 30 lux at floor level for 75% of the *standard year*.	
G7.3.2 Openings to give awareness of the outside shall be transparent and provided in suitable locations.	

Clause G8—Artificial light

Provisions	Limits on application
Objective	
G8.1 The objective of this provision is to safeguard people from injury due to lack of *adequate* lighting.	
Functional requirement	
G8.2 Spaces within *buildings* used by people, shall be provided with *adequate* artificial lighting which, when activated in the absence of sufficient natural light, will enable safe movement.	Requirement G8.2 shall apply to: (a) all *exitways* in *multi-unit dwellings, group dwellings and communal residential* (except *backcountry huts*), *communal non-residential, commercial* and *industrial buildings*, (b) all *access routes* except those in *outbuildings*, *backcountry huts*, and *ancillary buildings*, and (c) all common spaces within *multi-unit dwellings*, *group dwellings*, and *communal residential* (except *backcountry huts*) and *communal non-residential buildings*.
Performance	
G8.3 *Illuminance* at floor level shall be no less than 20 lux.	Performance G8.3 does not apply during a failure of the main lighting, when the requirements in Clause F6 **Visibility in escape routes** apply.

Schedule 1 clause G8.2 limit on application (a): amended, on 31 October 2008, by regulation 11(1) of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Schedule 1 clause G8.2 limit on application (b): amended, on 31 October 2008, by regulation 11(2) of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Schedule 1 clause G8.2 limit on application (c): amended, on 31 October 2008, by regulation 11(3) of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Schedule 1 clause G8.3 limit on application: substituted, on 21 June 2007, by regulation 6(5) of the Building Amendment Regulations 2007 (SR 2007/124).

Clause G9—Electricity

Provisions	Limits on application
Objective	
G9.1 The objective of this provision is to ensure that:	
(a) in *buildings* supplied with electricity, the *electrical installation* has safeguards against outbreak of *fire* and personal injury, and	Objective G9.1(b) shall apply only to those *buildings* to which section 47A of the Act applies.
(b) *people with disabilities* are able to carry out normal activities and processes within *buildings*.	
Functional requirement	
G9.2 Where provided in a *building*, *electrical installations* shall be safe for their *intended use*.	
Performance	
G9.3.1 The *electrical installation* shall incorporate systems to:	
(a) protect people from contact with parts of the installation which are live during normal operation, and to prevent parts of the installation or other *building elements* becoming live during fault conditions,	
(b) permit the safe isolation of the installation and of electrical fittings and appliances,	
(c) safeguard people from excessive temperatures resulting from either normal operation of electrical equipment, or from currents which could exceed the installation rating,	
(d) safeguard people from injury which may result from electromechanical stress in electrical components caused by currents in excess of the installation rating,	
(e) protect *building elements* from risk of ignition, impairment of	

Provisions	Limits on application
their physical or mechanical properties, or function, due to temperature increases resulting from heat transfer or electric arc,	
(f) operate safely in its intended environment, and	
(g) safeguard against ignition of the surrounding atmosphere where it is potentially flammable or explosive.	
G9.3.2 An *electrical installation* supplying an *essential service* shall:	
(a) maintain the supply for a time appropriate to that service, and	
(b) be capable of being isolated from the supply system, independently of the remainder of the installation.	
G9.3.3 An *electrical installation* connected to an *electrical supply system*, shall contain safeguards which protect the safety features of the external supply.	
G9.3.4 In *buildings* intended for use by *people with disabilities*, light switches and plug socket outlets shall be *accessible* and usable.	Performance G9.3.4 shall not apply to *housing*, *outbuildings*, *ancillary buildings*, and to *industrial buildings* where no more than 10 people are employed.

Schedule 1 clause G9.1(b) limit on application: amended, on 29 December 2000, by regulation 4(1) of the Building Amendment Regulations 2000 (SR 2000/119).

Clause G10—Piped services

Provisions	Limits on application

Objective

G10.1 The objective of this provision is to safeguard people from injury or illness caused by extreme temperatures or *hazardous substances* associated with *building* services.

Functional requirement

G10.2 In *buildings* provided with potentially *hazardous* services containing hot, cold, flammable, corrosive or toxic fluids, the installations shall be constructed to provide *adequate* safety for people.

Performance

G10.3.1 Piping systems shall be constructed to avoid the likelihood of:

(a) significant leakage or damage during normal or reasonably foreseeable abnormal conditions,

(b) detrimental contamination of the contents by other substances,

(c) adverse interaction between services, or between piping and electrical systems, and

(d) people having contact with pipes which could cause them harm.

G10.3.2 Provision shall be made for the ready removal of moisture or condensate in gas pipes.

G10.3.3 Pipes shall be protected against corrosion in the environment of their use.

G10.3.4 Piping systems shall be identified with markings if the contents are not readily apparent from the location or associated equipment.

G10.3.5 Enclosed spaces shall be constructed to avoid the likelihood of accumulating vented or leaking gas.

G10.3.6 Piped systems shall have isolation devices which permit the installation

Provisions	Limits on application
or individual items of apparatus to be isolated from the supply system, for maintenance, testing, fault detection and repair.	

Clause G11—Gas as an energy source

Provisions	Limits on application
Objective	
G11.1 The objective of this provision is to:	
(a) safeguard people from injury arising from the use of gas as an energy source,	
(b) safeguard people and *other property* from the risk of *fire* or explosion, and	
(c) safeguard people from loss of *amenity* due to the gas supply being inadequate for the *intended use*.	
Functional requirement	
G11.2 In *buildings* where gas is used as an energy source, the supply system shall be safe and *adequate* for its *intended use*.	
Performance	
G11.3.1 Supply systems shall be constructed to maintain a safe pressure range appropriate to the appliances and the type of gas used.	
G11.3.2 The gas supply to all appliances in a single ventilated space, shall be fitted with an automatic cut-off activated by failure of any continuous forced ventilation system used for combustion, ventilation or safe operation of a fixed gas appliance.	
G11.3.3 A flued fixed gas appliance shall have no adverse interaction with any other flued appliance.	
G11.3.4 Supply systems shall have isolation devices which permit the whole installation, or individual items of apparatus, to be isolated from the supply for maintenance, testing, fault detection or repair.	
G11.3.5 Where gas is supplied from an external source, the supply system within *buildings* shall be constructed to avoid the likelihood of:	
(a) contamination of the external supply from other gas sources within the *building*,	

Provisions	Limits on application
(b) adverse effects on the pressure of the external supply, and (c) the external supply pipe acting as an earthing conductor. **G11.3.6** The location and installation of meters and service risers shall meet the requirements of the *network utility operator*.	

Clause G12—Water supplies

Provisions	Limits on application
Objective	
G12.1 The objective of this provision is to—	
(a) safeguard people from illness or injury caused by contaminated water:	
(b) safeguard people from injury caused by hot water system explosion, or from contact with excessively hot water:	Objective G12.1(d) applies only to those *buildings* to which section 47A of the Act applies.
(c) safeguard people from loss of *amenity* arising from—	
(i) a lack of hot water for personal hygiene; or	
(ii) water for human consumption that is offensive in appearance, odour, or taste:	
(d) ensure that *people with disabilities* are able to carry out normal activities and functions within *buildings*.	

Provisions	Limits on application
Functional requirement	
G12.2 *Buildings* provided with water outlets, *sanitary fixtures*, or *sanitary appliances* must have safe and *adequate* water supplies.	
Performance	
G12.3.1 Water intended for human consumption, food preparation, utensil washing, or oral hygiene must be potable.	Performance G12.3.1 does not apply to *backcountry huts*.
G12.3.2 A potable *water supply system* must be— (a) protected from contamination; and (b) installed in a manner that avoids the likelihood of contamination within the system and the *water main*; and (c) installed using components that will not contaminate the water.	
G12.3.3 A non-potable *water supply system* used for personal hygiene must be installed in a manner that avoids the likelihood of illness or injury being caused by the system.	
G12.3.4 Water pipes and outlets provided with non-potable water must be clearly identified.	
G12.3.5 *Sanitary fixtures and sanitary appliances* must be provided with hot water when intended to be used for— (a) utensil washing; and (b) personal washing, showering, or bathing.	Performance G12.3.5(b) applies to only *housing*, retirement homes, and early childhood centres.
G12.3.6 If hot water is provided to *sanitary fixtures* and *sanitary appliances* used for personal hygiene, it must be delivered at a temperature that avoids the likelihood of scalding.	
G12.3.7 *Water supply systems* must be installed in a manner that— (a) pipes water to *sanitary fixtures* and *sanitary*	

Provisions	Limits on application
appliances at flow rates that are *adequate* for the correct functioning of those *fixtures* and *appliances* under normal conditions; and	
(b) avoids the likelihood of leakage; and	
(c) allows reasonable access to components likely to need maintenance; and	
(d) allows the system and any backflow prevention devices to be isolated for testing and maintenance.	
G12.3.8 Vessels used for producing or storing hot water must be provided with safety features that—	
(a) relieve excessive pressure during both normal and abnormal conditions; and	
(b) limit temperatures to avoid the likelihood of flash steam production in the event of rupture.	
G12.3.9 A *hot water system* must be capable of being controlled to prevent the growth of legionella bacteria.	
G12.3.10 Water supply taps must be *accessible* and usable for *people with disabilities*.	Performance G12.3.10 applies only to those *buildings* to which section 47A of the Act applies.

Schedule 1 clause G12: substituted, on 3 January 2002, by regulation 3(10) of the Building Amendment Regulations 2001 (SR 2001/374).

Schedule 1 clause G12.3.1 limit on application: inserted, on 31 October 2008, by regulation 12 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Clause G13—Foul water

Provisions	Limits on application
Objective	
G13.1 The objective of this provision is to:	
(a) safeguard people from illness due to infection or contamination resulting from personal hygiene activities, and	
(b) safeguard people from loss of *amenity* due to the presence of unpleasant odours or the accumulation of offensive matter resulting from *foul water* disposal.	
Functional requirement	
G13.2 *Buildings* in which *sanitary fixtures* and *sanitary appliances* using water-borne waste disposal are installed must be provided with—	
(a) an *adequate* plumbing and drainage system to carry *foul water* to appropriate outfalls; and	
(b) if no *sewer* is available, an *adequate* system for the storage, treatment, and disposal of *foul water*.	

Provisions	Limits on application
Performance	
G13.3.1 The *plumbing system* shall be constructed to: (a) convey *foul water* from *buildings* to a drainage system, (b) avoid the likelihood of blockage and leakage, (c) avoid the likelihood of foul air and gases entering *buildings*, and (d) provide reasonable access for maintenance and clearing blockages.	
G13.3.2 The drainage system shall: (a) convey *foul water* to an appropriate *outfall*, (b) be constructed to avoid the likelihood of blockage, (c) be supported, jointed and protected in a way that will avoid the likelihood of penetration of roots or the entry of ground water, (d) be provided with reasonable access for maintenance and clearing blockages, (e) be ventilated to avoid the likelihood of foul air and gases accumulating in the drainage system and *sewer*, and (f) be constructed to avoid the likelihood of damage from superimposed loads or normal ground movement.	
G13.3.3 Where a *sewer* connection is available, the drainage system shall be connected to the *sewer*, and the connection shall be made in a manner that avoids damage to the *sewer* and is to the approval of the *network utility operator*.	
G13.3.4 If no *sewer* is available, facilities for the storage, treatment, and	

Provisions	Limits on application
disposal of *foul water* must be constructed— (a) with *adequate* capacity for the volume of *foul water* and the frequency of disposal; and (b) with *adequate* vehicle access for collection if required; and (c) to avoid the likelihood of contamination of any potable water supplies in compliance with Clause G12 **Water supplies**; and (d) to avoid the likelihood of contamination of soils, ground water, and waterways except as permitted under the Resource Management Act 1991; and (e) from materials that are impervious both to the *foul water* for which disposal is required, and to water; and (f) to avoid the likelihood of blockage and leakage; and (g) to avoid the likelihood of foul air and gases accumulating within or entering into *buildings*; and (h) to avoid the likelihood of unauthorised access by people; and (i) to permit easy cleaning and maintenance; and (j) to avoid the likelihood of damage from superimposed loads or normal ground movement; and (k) if those facilities are buried underground, to resist hydrostatic uplift pressures.	

Schedule 1 clause G13.2: substituted, on 21 June 2007, by regulation 7(1) of the Building Amendment Regulations 2007 (SR 2007/124).

Schedule 1 clause G13.3.4: substituted, on 21 June 2007, by regulation 7(2) of the Building Amendment Regulations 2007 (SR 2007/124).

Clause G14—Industrial liquid waste

Provisions	Limits on application

Objective

G14.1 The objective of this provision is to safeguard people from injury or illness caused by infection or contamination resulting from industrial liquid waste.

Functional requirement

G14.2 *Buildings*, in which industrial liquid waste is generated shall be provided with *adequate* spaces and facilities for the safe and hygienic collection, holding, treatment and disposal of the waste.

Performance

G14.3.1 Industrial liquid waste shall be conveyed to storage containers and within disposal systems in a way which will:

(a) transfer wastes from *buildings* safely and hygienically,

(b) avoid the likelihood of blockage and leakage,

(c) avoid the likelihood of foul air and gases entering *buildings*, and

(d) provide reasonable access for clearing of blockages.

G14.3.2 Facilities for the storage, treatment, and disposal of industrial liquid waste must be constructed—

(a) with *adequate* capacity for the volume of waste and the frequency of disposal; and

(b) with *adequate* vehicle access for collection if required; and

(c) to avoid the likelihood of contamination of any potable water supplies in compliance with Clause G12 **Water supplies**; and

(d) to avoid the likelihood of contamination of soils, ground water, and waterways except

Provisions		Limits on application
	as permitted under the Resource Management Act 1991; and	
(e)	from materials that are impervious both to the waste for which disposal is required, and to water; and	
(f)	to avoid the likelihood of blockage and leakage; and	
(g)	to avoid the likelihood of foul air and gases accumulating within or entering into *buildings*; and	
(h)	to avoid the likelihood of unauthorised access by people; and	
(i)	to permit easy cleaning and maintenance; and	
(j)	to avoid the likelihood of damage from superimposed loads or normal ground movement; and	
(k)	if those facilities are buried underground, to resist hydrostatic uplift pressures.	

Schedule 1 clause G14.3.2: substituted, on 21 June 2007, by regulation 8 of the Building Amendment Regulations 2007 (SR 2007/124).

Clause G15—Solid waste

Provisions	Limits on application
Objective	
G15.1 The objective of this provision is to safeguard people from injury or illness caused by infection or contamination from solid waste.	
Functional requirement	
G15.2 *Buildings* shall be provided with space and facilities for the collection, and safe hygienic holding prior to disposal, of solid waste arising from the *intended use* of the *buildings*.	Requirement G15.2 shall not apply to *detached dwellings*, *household units* of *multi-unit dwellings*, *outbuildings* or *ancilliary buildings* if there is independent access or private open space at ground level.
Performance	
G15.3.1 Where provision is made within *buildings* for the collection and temporary holding of solid waste, the spaces provided shall be: (a) of sufficient size for the volume of waste and frequency of disposal, (b) provided with reasonable access for the depositing and collection of the waste, (c) capable of maintaining sanitary conditions having regard to the types of waste and storage containers, and (d) capable of maintaining the appropriate temperature for the type of waste stored.	
G15.3.2 Where a rubbish chute is provided, it shall be located and constructed to: (a) convey the solid waste to an appropriate storage container, (b) avoid the likelihood of blockage or leakage, (c) permit easy cleaning and maintenance, (d) avoid the likelihood of foul air or gases accumulating or entering the *building*, (e) avoid the likelihood of the spread of *fire* beyond the refuse chute,	

Provisions	Limits on application
(f) have openings that allow waste to be safely deposited in the chute, and	
(g) restrict access by children, animals and vermin.	
G15.3.3 Where it is acceptable to the *network utility operator*, solid waste which has been suitably treated for disposal to a *sewer* may be discharged via a *foul water drain* complying with Clause G13 **Foul Water**.	

Schedule 1 clause G15.3.2(f): amended, on 22 December 1994, by regulation 13 of the Building Regulations 1992, Amendment No 1 (SR 1994/263).

Clause H1—Energy efficiency provisions

Provisions	Limits on application
Objective	
H1.1 The objective of this provision is to facilitate efficient use of energy.	Objective H1.1 applies only when the energy is sourced from a *network utility operator* or a depletable energy resource.
Functional requirement	
H1.2 *Buildings* must be *constructed* to achieve an *adequate* degree of energy efficiency when that energy is used for—	
(a) modifying temperature, modifying humidity, providing ventilation, or doing all or any of those things; or	Requirement H1.2(a) does not apply to *assembly service buildings*, *industrial buildings*, *outbuildings*, or *ancillary buildings*.
(b) providing hot water to and from *sanitary fixtures* or *sanitary appliances*, or both; or	
(c) providing artificial lighting.	Requirement H1.2(c) applies only to *commercial buildings* and *communal non-residential buildings* whose floor area is greater than 300 m^2.

Provisions	Limits on application
Performance	
H1.3.1 The *building* envelope enclosing spaces where the temperature or humidity (or both) are modified must be constructed to— (a) provide *adequate thermal resistance*; and (b) limit uncontrollable airflow.	
H1.3.2 *[Revoked]*	
H1.3.2A *[Revoked]*	
H1.3.2B *[Revoked]*	
H1.3.2C *[Revoked]*	
H1.3.2D *[Revoked]*	
H1.3.2E *Buildings* must be constructed to ensure that their *building performance index* does not exceed 1.55.	Performance H1.3.2E applies only to *housing*.
H1.3.3 Account must be taken of physical conditions likely to affect energy performance of *buildings*, including— (a) the thermal mass of *building elements*; and (b) the building orientation and shape; and (c) the airtightness of the building envelope; and (d) the heat gains from services, processes and occupants; and (e) the local climate; and (f) heat gains from solar radiation.	
H1.3.4 Systems for the heating, storage, or distribution of hot water to and from *sanitary fixtures* or *sanitary appliances* must, having regard to the energy source used,— (a) limit the energy lost in the heating process; and (b) be constructed to limit heat losses from storage vessels and from distribution systems; and	Performance H1.3.4(b) does not apply to individual storage vessels that are greater than 700 litres in capacity. Performance H1.3.4(c) applies only to *housing*.

Provisions	Limits on application
(c) be constructed to facilitate the efficient use of hot water.	
H1.3.5 Artificial lighting fixtures must— (a) be located and sized to limit energy use, consistent with the *intended use* of space; and (b) be fitted with a means to enable light intensities to be reduced, consistent with reduced activity in the space.	Performance H1.3.5 does not apply to lighting provided solely to meet the requirements of Clause F6.
H1.3.6 *HVAC systems* must be located, constructed, and installed to— (a) limit energy use, consistent with the *intended use* of space; and (b) enable them to be maintained to ensure their use of energy remains limited, consistent with the *intended use* of space.	Performance H1.3.6 applies only to *commercial buildings*.

Schedule 1: continued in force, on 31 March 2005, by regulation 8(2)(a) of the Building (Forms) Regulations 2004 (SR 2004/385).

Schedule 1 clause H1: substituted, on 29 December 2000, by regulation 5 of the Building Amendment Regulations 2000 (SR 2000/119).

Schedule 1 clause H1.2(a): substituted, on 1 February 2009, by regulation 5 of the Building (Building Code: Energy Efficiency of Temperature, Humidity, and Ventilation Systems) Amendment Regulations 2008 (SR 2008/97).

Schedule 1 clause H1.2(b): amended, on 1 February 2009, by regulation 4 of the Building (Building Code: Energy Efficiency of Domestic Hot Water Systems) Amendment Regulations 2008 (SR 2008/256).

Schedule 1 clause H1.3.2: revoked, on 31 October 2007, by regulation 5 of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause H1.3.2A: revoked, on 30 June 2008, by regulation 6 of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause H1.3.2B: revoked, on 30 June 2008, by regulation 6 of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause H1.3.2C: revoked, on 30 September 2008, by regulation 7(1) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause H1.3.2D: revoked, on 30 September 2008, by regulation 7(1) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause H1.3.2E: inserted, on 30 September 2008, by regulation 7(1) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause H1.3.4: substituted, on 1 February 2009, by regulation 5 of the Building (Building Code: Energy Efficiency of Domestic Hot Water Systems) Amendment Regulations 2008 (SR 2008/256).

Schedule 1 clause H1.3.6: added, on 1 February 2009, by regulation 6 of the Building (Building Code: Energy Efficiency of Temperature, Humidity, and Ventilation Systems) Amendment Regulations 2008 (SR 2008/97).

Schedule 2
[Revoked]

r 4

Schedule 2: revoked for all purposes, on 31 May 2006, by regulation 8(2)(b) of the Building (Forms) Regulations 2004 (SR 2004/385).

Marie Shroff,
Clerk of the Executive Council.

Issued under the authority of the Legislation Act 2019.
Date of notification in *Gazette*: 11 June 1992.

Building (Forms) Regulations 2004

(SR 2004/385)

Silvia Cartwright, Governor-General

Order in Council

At Wellington this 8th day of November 2004

Present:
Her Excellency the Governor-General in Council

Pursuant to section 402 of the Building Act 2004, Her Excellency the Governor-General, acting on the advice and with the consent of the Executive Council and on the recommendation of the Minister for Building Issues, makes the following regulations.

Regulations

1 Title

These regulations are the Building (Forms) Regulations 2004.

2 Commencement

(1) These regulations (except regulations 5 and 8 and Part 2 of the Schedule) come into force on 30 November 2004.

(2) Regulations 5 and 8 and Part 2 of the Schedule come into force on 31 March 2005.

Revocation

8 Revocation

(1) The Building Regulations 1992 (SR 1992/150) are revoked.

(2) However, despite the revocation of the Building Regulations 1992,—

(a) regulation 3 and Schedule 1 of those regulations continue in force: and

(b) so much of regulation 4 and Schedule 2 of those regulations as relate to forms 16 (application for approval as an individual building certifier) and 17 (application for approval as a corporate building certifier) continue in force and apply for the purposes of section 441 of the Act until 31 May 2006.

Diane Morcom,
Clerk of the Executive Council.

Date of notification in *Gazette*: 11 November 2004.

Building Amendment Regulations (No 2) 2007

(SR 2007/226)

Dame Sian Elias, Administrator of the Government

Order in Council

At Wellington this 13th day of August 2007

Present:
The Right Hon Helen Clark presiding in Council

Pursuant to section 400 of the Building Act 2004, Her Excellency the Administrator of the Government, acting on the advice and with the consent of the Executive Council, and on the recommendation of the Minister (as defined by section 7 of that Act) made, as required by section 403(2) of that Act, after he or she became satisfied that the chief executive (as so defined) has consulted in accordance with section 403(3) and (4) of that Act, makes the following regulations.

Regulations

1 Title

These regulations are the Building Amendment Regulations (No 2) 2007.

2 Commencement

(1) These regulations (other than regulations 6 and 7) come into force on 31 October 2007.

(2) Regulation 6 comes into force on 30 June 2008.

(3) Regulation 7 comes into force on 30 September 2008.

8 Saving: building work not affected by amendments

(1) The building code set out in Schedule 1 of the principal regulations applies to the following building work as if these regulations had not been made:

(a) building work that is in climate zone 1, climate zone 2, or climate zone 3, is building work for which a building consent is required, and is covered by an application—

(i) for a building consent or a certificate of acceptance; and

(ii) made before the close of 30 October 2007:

(b) building work that is in climate zone 1 or climate zone 2, is building work for which a building consent is required, and is covered by an application—

(i) for a building consent or a certificate of acceptance; and

(ii) made after the close of 30 October 2007 and before the close of 29 June 2008:

(c) building work that is in climate zone 1, is building work for which a building consent is required, and is covered by an application—

(i) for a building consent or a certificate of acceptance; and

(ii) made after the close of 29 June 2008 and before the close of 29 September 2008.

(2) For the purpose of subclause (1)(b), building work partly in climate zone 3 and partly in climate zone 2 must be treated as if it were building work in climate zone 2.

(3) For the purpose of subclause (1)(c), building work partly in climate zone 2 and partly in climate zone 1 must be treated as if it were building work in climate zone 1.

Diane Morcom,
Clerk of the Executive Council.

Date of notification in *Gazette*: 16 August 2007.

Building (Building Code: Energy Efficiency of Temperature, Humidity, and Ventilation Systems) Amendment Regulations 2008

(SR 2008/97)

Anand Satyanand, Governor-General

Order in Council

At Wellington this 7th day of April 2008

Present:
His Excellency the Governor-General in Council

Pursuant to section 400 of the Building Act 2004, His Excellency the Governor-General, acting on the advice and with the consent of the Executive Council, and on the recommendation of the Minister (as defined by section 7 of that Act) made, as required by section 403(2) of that Act, after he or she became satisfied that the chief executive (as so defined) has consulted in accordance with section 403(3) and (4) of that Act, makes the following regulations.

Regulations

1 Title

These regulations are the Building (Building Code: Energy Efficiency of Temperature, Humidity, and Ventilation Systems) Amendment Regulations 2008.

2 Commencement

These regulations come into force on 1 February 2009.

7 Saving: building work not affected by amendments

The building code set out in Schedule 1 of the principal regulations applies as if these regulations had not been made to building work covered by an application—

(a) for a building consent or a certificate of acceptance; and

(b) made before the close of 31 January 2009.

Diane Morcom,
Clerk of the Executive Council.

Date of notification in *Gazette*: 10 April 2008.

Building (Building Code: Energy Efficiency of Domestic Hot Water Systems) Amendment Regulations 2008

(SR 2008/256)

Rt Hon Dame Sian Elias, Administrator of the Government

Order in Council

At Wellington this 11th day of August 2008

Present:
Her Excellency the Administrator of the Government in Council

Pursuant to section 400 of the Building Act 2004, Her Excellency the Administrator of the Government, acting on the advice and with the consent of the Executive Council, and on the recommendation of the Minister (as defined by section 7 of that Act) made, as required by section 403(2) of that Act, after he or she became satisfied that the chief executive (as so defined) has consulted in accordance with section 403(3) and (4) of that Act, makes the following regulations.

Regulations

1 Title

These regulations are the Building (Building Code: Energy Efficiency of Domestic Hot Water Systems) Amendment Regulations 2008.

2 Commencement

These regulations come into force on 1 February 2009.

6 Saving: building work not affected by amendments

The building code set out in Schedule 1 of the principal regulations applies as if these regulations had not been made, to building work covered by an application that is—

(a) for a building consent or certificate of acceptance; and

(b) made before the close of 31 January 2009.

Rebecca Kitteridge,

Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012

(SR 2012/33)

Jerry Mateparae, Governor-General

Order in Council

At Wellington this 5th day of March 2012

Present:
His Excellency the Governor-General in Council

Pursuant to section 400 of the Building Act 2004, His Excellency the Governor-General, acting on the advice and with the consent of the Executive Council and on the recommendation of the Minister for Building and Construction, makes the following regulations.

Regulations

1 Title

These regulations are the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012.

2 Commencement

These regulations come into force on 10 April 2012.

3 Principal regulations

These regulations amend the Building Regulations 1992 (the **principal regulations**), regulation 3 and Schedule 1 of which continue in force in accordance with—

(a) section 415(2)(a) of the Building Act 2004; and

(b) regulation 8(2)(a) of the Building (Forms) Regulations 2004.

8 Transitional provision

(1) For the period of 12 months following the commencement of these regulations, compliance with clauses C1 to C4 of Schedule 1 in force immediately before amendment by these regulations is deemed to be compliance with clauses C1 to C6 of Schedule 1 as amended by these regulations.

(2) For the period of 3 months following the commencement of these regulations, compliance with clause F8 of Schedule 1 in force immediately before amendment by these regulations is deemed to be compliance with clause F8 of Schedule 1 as amended by these regulations.

(3) For the purposes only of deemed compliance under subclause (1) or (2), any definition that is revoked by regulation 4(1) continues to apply.

Rebecca Kitteridge,
Clerk of the Executive Council.

Date of notification in *Gazette*: 8 March 2012.

Notes

1 General

This is a consolidation of the Building Regulations 1992 that incorporates the amendments made to the legislation so that it shows the law as at its stated date.

2 Legal status

A consolidation is taken to correctly state, as at its stated date, the law enacted or made by the legislation consolidated and by the amendments. This presumption applies unless the contrary is shown.

Section 78 of the Legislation Act 2019 provides that this consolidation, published as an electronic version, is an official version. A printed version of legislation that is produced directly from this official electronic version is also an official version.

3 Editorial and format changes

The Parliamentary Counsel Office makes editorial and format changes to consolidations using the powers under subpart 2 of Part 3 of the Legislation Act 2019. See also PCO editorial conventions for consolidations.

4 Amendments incorporated in this consolidation

Water Services Act 2021 (2021 No 36): section 206(2)

Building (Pools) Amendment Act 2016 (2016 No 71): section 20

Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33)

Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358)

Building (Building Code: Energy Efficiency of Domestic Hot Water Systems) Amendment Regulations 2008 (SR 2008/256)

Building (Building Code: Energy Efficiency of Temperature, Humidity, and Ventilation Systems) Amendment Regulations 2008 (SR 2008/97)

Building Amendment Regulations (No 2) 2007 (SR 2007/226)

Building Amendment Regulations 2007 (SR 2007/124)

Education Amendment Act 2006 (2006 No 19): section 60(2)

Building (Forms) Regulations 2004 (SR 2004/385): regulation 8

Building Amendment Regulations 2004 (SR 2004/317)

Building Amendment Regulations 2003 (SR 2003/61)

Building Amendment Regulations 2001 (SR 2001/374)

Building Amendment Regulations 2000 (SR 2000/119)

Building Amendment Regulations 1997 (SR 1997/156)

Hazardous Substances and New Organisms Act 1996 (1996 No 30): section 150(1)

Building Regulations 1992, Amendment No 1 (SR 1994/263)

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington.
Telephone 0800 242 243
Fax 04 494 0290
Email: info@dbh.govt.nz

Verification Methods and Acceptable Solutions are available from www.dbh.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 13), 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 12) 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 this handbook at any time. Up-to-date versions of this handbook are available from www.dbh.govt.nz

Handbook: Document History		
	Date	**Alterations**
First published	July 1992	
Third edition	25 May 2007	
Amendment 11	Published 31 July 2010 Effective 30 September 2010	pp. 6–8, 11 Preface pp. 17–78, Code Clauses – amended and reformatted pp. 79–104A, References – amended and reprinted pp. 105–148f, Definitions – amended and reprinted pp. 150–158, 161–164, 168–170, 172, 176–178, 181, 184–185 187, 189, 191, 193, 196–199, 201, 204–208, Index
Amendment 12	Effective from 10 October 2011 until 14 August 2014	p. 6, Preface pp. 80–100, 102–104A, References pp. 108, 113 –115, 119–120, 122, 125 128, 136, 138, 144, 146–147, 148d–f, Definitions pp. 149–208, Index
Amendment 13	14 February 2014	p. 2A, Document history status pp. 3–16, Preface pp. 17, 22–22B, 27–33C, 58 Code Clause Contents, A3, C1–C6, F8 pp. 79–104B, References pp. 105–148h, Definitions pp. 151–204 Index
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.		

Preface

1.0 INTRODUCTION

1.1 This preface provides an introduction to building controls in New Zealand. This section shows the relationship between the New Zealand Building Code (the Building Code) and various other Provisions that ensure buildings in New Zealand are safe and healthy to use.

1.2 The preface provides a convenient user reference. However, legal interpretation must be based on the actual wording of the Building Act 2004 (the Building Act), and amendments and respective Building Regulations.

2.0 BUILDING CONTROL FRAMEWORK

The regulation and performance of buildings sits under the following three-part framework.

- The **Building Act,** which contains the provisions for regulating building work.
- The various **Building Regulations,** which contain prescribed forms, list specified systems, define 'change the use' and 'moderate earthquake', and set out the rate of levy and fees for determinations.
- The **Building Code,** contained in Schedule 1 of the Building Regulations 1992, which sets performance standards all new building work must meet, and covers aspects such as stability, protection from fire, access, moisture, safety of users, services and facilities, and energy efficiency. Amend 13 Feb 2014

The pyramid below illustrates the legislation that forms the building control framework governed by the Building Act.

2.1 The Building Act 2004

The Building Act provides the mandatory framework for the building control system to be followed when undertaking building work in New Zealand. It applies to all:

- buildings including Crown buildings, except those which may be exempt for reasons of national security
- components in a building, including plumbing, electrical and mechanical installations.

The Building Act should be read taking into account the changes under the Building Amendment Act 2005 and any subsequent amendments (copies are on www.legislation.govt.nz).

2.1.1 Purpose

The Building Act aims to improve control of and encourage better practices in building design and construction to provide greater assurance to consumers.

This means:

- more clarity on the standards we expect buildings to meet
- more guidance on how these standards can be met
- more certainty that capable people are undertaking building design, construction and inspection
- more scrutiny in the building consent and inspection process
- better protection for homeowners through the introduction of mandatory warranties.

The purpose of the Building Act is:

- to provide for regulation of building work
- to ensure that people can use buildings safely without endangering their health
- to ensure people can escape a building in case of fire
- to ensure buildings have attributes that contribute appropriately to the health, physical independence and wellbeing of the people who use them
- to ensure buildings are designed, constructed and able to be used in ways that promote sustainable development.

2.1.2 Principles

The Building Act does not contain an equivalent to section 47 of the Building Act 1991 (the former Act), which contained guidance on how a territorial authority should exercise its powers.

Under section 4 of the Building Act (section 6 under the former Act), principles to be applied in performing functions or duties, or exercising powers under the Building Act, now have greater importance. Section 4 should be taken into account when performing functions, duties or exercising powers relating to the granting of waivers or modifications of the Building Code, and the adoption and review of policies on dangerous, earthquake-prone or insanitary buildings.

The Building Act re-states many of the principles outlined in the former Act, and makes explicit some of the implied principles of that legislation (for example, that innovation is important). However, some significant new concepts have been introduced, including a particular focus on the household unit, as well as considering the whole-of-life costs of building work.

The following is a summary of the Building Act principles.

- Household units have an important role in the lives of the people who use them, and are accorded a special focus.
- The Building Code as it relates to household units is important, and household units need to comply with the Building Code.
- Maintenance requirements of household units need to be reasonable, and owners of household units need to be aware of the maintenance requirements of their household units.
- Harmful effects on human health resulting from the use of building methods, products, design or building work need to be prevented or minimised.

- Buildings need to be durable.
- Special traditional and cultural aspects of the intended use of a building need to be recognised.
- The whole-of-life costs of a building need to be considered.
- Standards are important in achieving compliance with the Building Code for building design and construction.
- Innovation in methods of building design and construction is important.
- People who undertake a rescue operation or firefighting in a building need to be able to expect a reasonable level of protection from injury or illness while doing so.
- The extent and effects of the spread of fire need to be limited to protect other household units and other property.
- Other property needs to be protected from physical damage resulting from the construction, use and demolition of a building.
- People with disabilities need to be able to enter and carry out normal activities and processes in a building.
- Buildings of significant cultural, historical or heritage value need to be preserved.
- Energy use in buildings needs to be efficient.
- The use of renewable sources of energy needs to be encouraged.
- Material use in buildings needs to be efficient and sustainable.
- Water use in buildings needs to be efficient and promote water conservation.
- Waste generated during the construction process needs to be reduced.
- Owners, designers, builders and building consent authorities each need to be accountable for their role in obtaining consents and approvals, ensuring plans and specifications for building work will meet the Building Code, and ensuring work complies with the building consent or, where a building consent is not required, complies with the Building Code.

Amend 13 Feb 2014

2.1.3 Application

The Building Act applies to:

- building construction, alteration, demolition or removal
- maintenance of a building's specified systems, such as lifts and fire protection installations.

The Building Act does not cover:

- planning and resource management
- occupational safety and health.

2.1.4 Structure

The Building Act has five parts.

Part 1: Contains the purpose and principles of the Building Act, together with an overview, commencement dates for various Provisions and definitions. These sections provide an important reference when reading and interpreting the Building Act.

Part 2 (and Schedules 1 and 2): Outlines matters relating to the Building Code and building control (such as building consents), including requirements of building work, requirements for the use of buildings, Provisions for certain categories of buildings and Provisions for the safety of dams.

Part 3: Sets out the functions, duties and powers of the Chief Executive of the Department of Building and Housing (the Department), territorial authorities, regional authorities and building consent authorities. It also deals with the accreditation and registration of building consent authorities, accreditation of dam owners, and product certification.

Part 4 (and Schedule 3): Covers matters relating to the licensing and disciplining of building practitioners.

Part 5 (and Schedule 4): Describes miscellaneous matters, including offences and criminal proceedings, implied terms of contracts, regulation-making powers, amendments to other enactments and the repeal of the former Act, and the transitional Provisions from the former Act to the Building Act.

2.2 Building Regulations

Building Regulations are made under and in accordance with the Building Act.

A number of regulations have been made under the Building Act. Currently (as at May 2007) there are seven sets of regulations.

1. **Building Regulations 1992,** made under the former Act and which include the Building Code. These regulations have been amended by the Building (Forms) Regulations 2004 so that only certain parts remain in force. Parts still in force are: Schedule 1 (Building Code), Regulation 3, Forms 16 & 17 (and Regulation 4 and Schedule 2 where they relate to these forms).
2. **Building (Forms) Regulations 2004,** as amended by the Building (Forms) Amendment Regulations 2005, which prescribes forms to be used under the Building Act.
3. **Building (Specified Systems, Change the Use, and Earthquake-prone Buildings) Regulations 2005**, as amended by the Building (Specified Systems, Change the Use, and Earthquake-Prone Buildings) Amendment Regulations 2005. These regulations outline and define the following terms.
   - Specified systems – the building systems that must be listed on compliance schedules and are subject to specific inspection and maintenance procedures. Schedule 1 provides the list of specified systems.
   - Change the use – to determine when a change in a building's use will require upgrading to meet certain requirements of the Building Act. Schedule 2 determines the use of all or parts of buildings.
   - Moderate earthquake – to define a moderate earthquake in relation to a building.
4. **Building (Fee for Determinations) Regulations 2005**
5. **Building Levy Order 2005**
6. **Building (Accreditation of Building Consent Authorities) Regulations 2006**
7. **Building (Consent Authority Accreditation Fees) Regulations 2007**
8. **Building (Designation of Building work Licence Classes) Order 2007**
9. **Building (Design Work Declared to be Building Work) Order 2007**
10. **Building Practitioners (Licensing Fees and Levy) Regulations 2007**
11. **Building (Registration of Building Consent Authorities) Regulations 2007**
12. **Building (Infringement Offences, Fees, and Forms) Regulations 2007**
13. **Building Practitioners (Register of Licensed Building Practitioners) Regulations 2008**
14. **Building (Dam Safety) Regulations 2008**
15. **Building Practitioners (Complaints and Disciplinary Procedures) Regulations 2008**
16. **Building (Product Certification) Regulations 2008**
17. **Building (Building Consent Authority Transition) Order 2008**
18. **Building (National Multiple-use Approval) Regulations 2009**
19. **Building (Minor Variations) Regulations 2009**
20. **Building (Designation of Building Work Licensing Classes) Order 2010**
21. **Building Practitioners (Licensing Fees and Levy) Regulations 2010**
22. **Building Practitioners (Register of Licensed Building Practitioners) Regulations 2010** Amend 11 Sep 2010
23. **Canterbury Earthquake (Building Act)) Order 2010**
24. **Building (National Multiple-use Approval) Regulations 2011** Amend 12 Oct 2011
25. **Building (Definition of Restricted Building Work) Order 2011**
26. **Canterbury Earthquake (Building Act) Order 2013.** Amend 13 Feb 2014

Note: these regulations can be found at www.legislation.govt.nz

2.3 The New Zealand Building Code

The Building Code is contained in Schedule 1 of the Building Regulations 1992. The Building Code contains compulsory rules for all new building work.

2.3.1 Content

The Building Code sets out performance criteria that building work must meet. It covers aspects such as structural stability, fire safety, access, moisture control, durability, services and facilities, and energy efficiency.

The Building Code does not prescribe how work should be done, but states how completed building work and its parts must perform.

An advantage of a performance-based Building Code is flexibility. It contains no prescriptive requirements stipulating that certain products or designs must be used. This flexibility allows developments and innovation in building design, technology and systems.

2.3.2 Structure

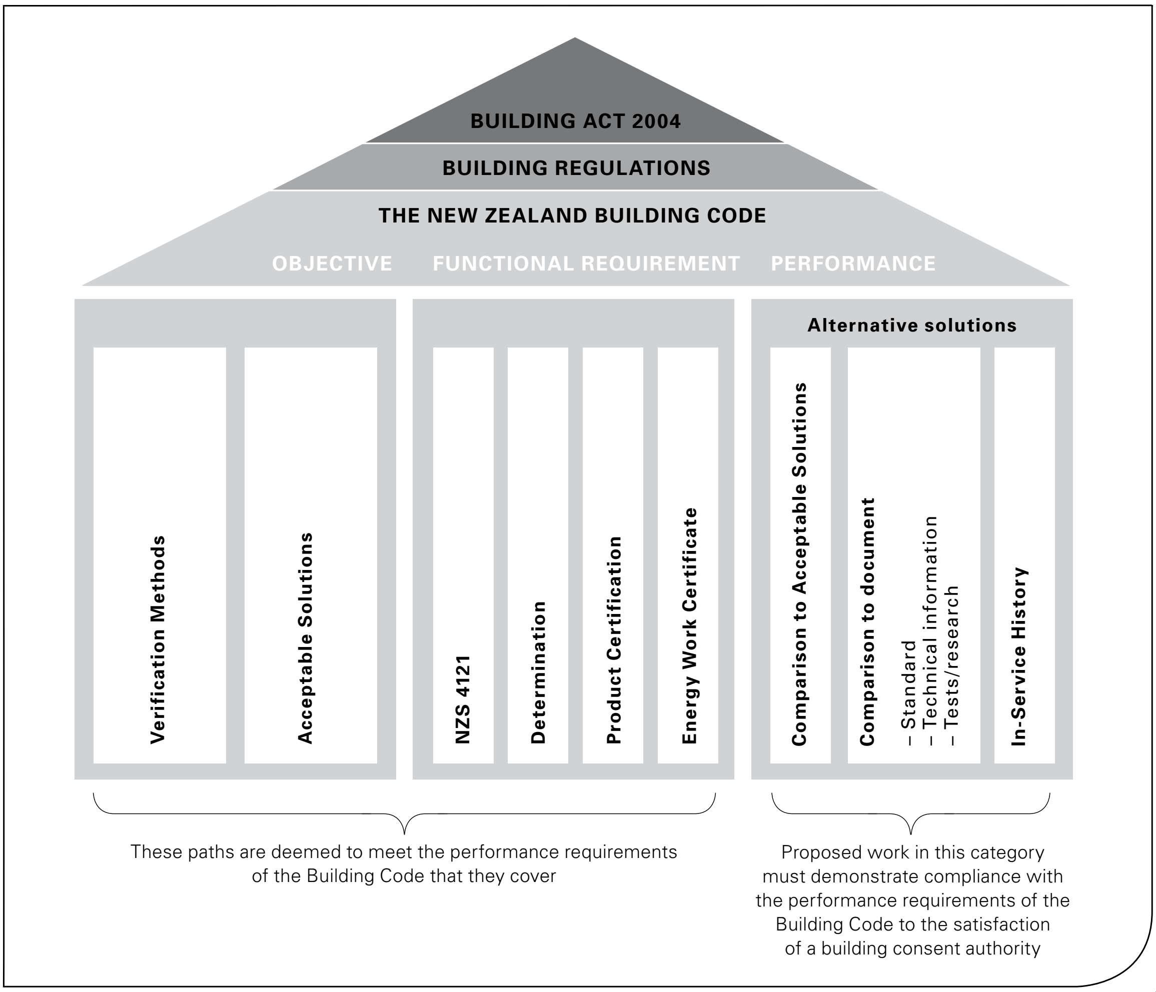
Amend 13 Feb 2014

The Building Code consists of two preliminary clauses and 37 technical clauses. Each technical clause has three levels that describe the requirements for the clause and is listed below.

1. **Objective** Social objectives the building must achieve.
2. **Functional requirement** Functions the building must perform to meet the Objective.
3. **Performance** The performance criteria the building must achieve. By meeting the performance criteria, the Objective and Functional requirement can be achieved.

Amend 11 Sep 2010

Amend 13 Feb 2014



Amend 13 Feb 2014

3.0 COMPLIANCE PATHS

Compliance with the Building Code can be demonstrated using various pathways. Understanding the New Zealand building control framework will help a building consent applicant decide which path is most suitable when designing and constructing building work.

The diagram below illustrates the hierarchy of New Zealand building controls, including the various compliance paths.

The top three tiers of the pyramid (the Building Act and Building Regulations) show mandatory building legislation that must be followed, as explained in the previous section.

The rest of the diagram shows various paths that may be used to demonstrate compliance with the Building Code. Compliance with the Building Code must be demonstrated using one or more of the paths. The applicant can choose which path(s) to follow.

With the exception of **alternative solutions**, the paths illustrated on the previous page must be accepted by the building consent authority as meeting the performance requirements of the Building Code. These pathways are discussed below.

3.1 Acceptable Solitions and Verification Methods

Acceptable Solutions and Verification Methods provide details for construction that, if followed, result in compliance with the Building Code. They are published by the Ministry of Business, Innovation and Employment.

A design that complies with an Acceptable Solution or Verification Method must be accepted by a building consent authority as complying with the Building Code.

There is at least one Acceptable Solution or Verification Method for compliance with each of the Building Code clauses.

For example, for Clause B1 of the Building Code there are two Verification Methods and three Acceptable Solutions.

Amend 13 Feb 2014

Acceptable Solutions and Verification Methods are usually referred to by their Building Code clauses and unique identification numbers. Some examples are listed below.

Amend 13 Feb 2014

- The Acceptable Solutions for Clause E2 **External Moisture** are known as **E2/AS1**, **E2/AS2** and **E2/AS3**.

Amend 11 Sep 2010

Amend 12 Oct 2011

- The Acceptable Solution for Clause G4 **Ventilation** is known as **G4/AS1**.
- The Acceptable Solution for Clause G1 **Personal Hygiene** is known as **G1/AS1**.
- The Verification Methods for Clause B1 **Structure** are known as **B1/VM1** and **B1/VM4**.

Amend 11 Sep 2010

3.1.1 Verification Methods

Verification Methods are tests or calculation methods that prescribe one way to comply with the Building Code. Verification Methods can include:

- calculation methods: using recognised analytical methods and mathematical models
- laboratory tests: using tests (sometimes to destruction) on prototype components and systems
- tests-in-situ: which may involve examination of plans and verification by test, where compliance with specified numbers, dimensions or locations is required (non-destructive tests, such as pipe pressure tests, are also included).

3.1.2 Acceptable Solutions

These are simple step-by-step instructions that show one way to comply with the Building Code.

3.2 Product certification

The Building Act contains provisions for a voluntary product certification scheme that will enable product manufacturers to have their products certified as meeting nominated Performance requirements of the Building Code.

Building products or methods that are used in accordance with a product certificate as provided by section 269 of the Building Act must be accepted as complying with the Building Code.

3.3 Energy work certificate

Energy work is defined as gasfitting work or prescribed electrical work. An energy work certificate certifies that energy work complies with either the Electricity Act 1992 or the Gas Act 1992.

An energy work certificate must be accepted as establishing compliance with the relevant Performance requirements of the Building Code.

3.4 New Zealand Standard NZS 4121

Section 119 of the Building Act specifies that NZS 4121, the code of practice for design for access and use of buildings by persons with disabilities (and any modification of that Standard), is to be taken as an Acceptable Solution. Amend 13 Feb 2014

3.5 Determinations

A determination is a binding decision made by the Department. It provides a way of solving disputes or answering questions relating to the Building Code and territorial authority/building consent authority/regional authority decisions under the Building Act.

A range of matters can be determined, including:

- whether a building or building work complies with the Building Code
- a building consent authority's decision on a building consent, a notice to fix, a code compliance certificate (CCC) or a compliance schedule
- a territorial authority's decision to issue a building consent subject to a waiver or modification
- a territorial authority's decision on a certificate of acceptance, a compliance schedule, a notice to fix, or a certificate for public use
- a regional authority's or territorial authority's exercise or failure to exercise its powers under the Building Act.

3.6 Alternative solutions

An alternative solution is a building solution that differs, in part or wholly, from the solutions offered by the Acceptable Solution or Verification Method, but achieves compliance with the performance requirements of the Building Code to the satisfaction of the building consent authority. Amend 13 Feb 2014

There may be a number of reasons for the use of an alternative solution.

- There may not be a Acceptable Solution or Verification Method for the proposed construction. Amend 13 Feb 2014
- The building work may incorporate unusual design features that fall outside the scope of an Acceptable Solution or Verification Method. Amend 13 Feb 2014

Whatever the reason for using an alternative solution, the Building Code, being performance-based, allows for innovation and applicants have the freedom to propose an innovative solution. Refer to 2.3 'The New Zealand Building Code'.

3.7 Producer statements

A producer statement is a statement supplied by or on behalf of an applicant for a building consent, or by or on behalf of a person who has been granted a building consent. It is a statement that certain work will be, or has been, carried out in accordance with certain technical specifications.

Producer statements were introduced by the former Act and are no longer expressly referred to in the Building Act. A building consent authority may, at their discretion, accept and consider a producer statement as part of the plans or specifications for a building consent. This will assist the building consent authority in deciding whether it is satisfied on reasonable grounds the provisions of the Building Code will be met if the building work is completed in accordance with the plans and specifications. A building consent authority should have a formal procedure or policy in place for the use and consideration of producer statements, especially if a producer statement(s) will be required to prove building work complies with a building consent.

4.0 THE PARTIES AND THEIR RESPONSIBILITIES

Five principal parties are responsible for ensuring that buildings are safe and sanitary in line with the Building Act.

4.1 The Ministry of Business, Innovation and Employment (the Ministry)

Amend 13 Feb 2014

The Ministry has a range of statutory responsibilities for building and housing, and administers New Zealand's building legislation. The Ministry's building control functions include:

- advising the Minister for Building and Construction on matters relating to building control
- administering and reviewing the Building Code
- producing and maintaining Acceptable Solutions and Verification Methods that specify a means of complying with the Building Code (Amend 13 Feb 2014)
- providing information, guidance, and advice on building controls to all sectors of the building industry and consumers
- implementing, administering and monitoring a system of regulatory controls for a vibrant sector with skilled building professionals
- making determinations, or technical rulings, on matters of interpretation, doubt or dispute.

4.2 Territorial authorities

Territorial authorities are responsible for enforcing the Building Act, Regulations and the Building Code in their areas of jurisdiction.

They are responsible for:

- gaining accreditation as a building consent authority
- registering as a building consent authority
- performing the functions of a building consent authority
- issuing project information memoranda
- granting waivers or modifications of the Building Code (not including waivers or modifications relating to access and facilities for people with disabilities)
- issuing certificates of acceptance
- issuing certificates for public use
- determining the extent to which buildings must comply with the Building Code if they are altered, or their use is changed or where there is a specified intended life change
- enforcing the provisions relating to annual building warrants of fitness
- issuing certain notices provided for under the Building Act
- keeping records
- ensuring dangerous, insanitary and earthquake prone buildings are identified and appropriate action taken to remove any danger or insanitary condition
- amending compliance schedules
- carrying out other functions and duties specified in the Building Act.

4.3 Building consent authorities

Building consent authorities are responsible for:

- issuing building consents
- inspecting building work for which they granted a building consent
- issuing notices to fix
- issuing code compliance certificates
- issuing compliance schedules and amending them where the specified systems are affected by building work
- carrying out other functions and duties specified in the Building Act.

4.4 Regional authorities

Regional authorities are responsible for:

- performing the functions of a building consent authority to the extent that those functions relate to dams
- considering and approving dam classifications
- considering and approving dam safety assurance programmes
- administering the Building Act, relating to dam classifications, dam safety assurance programmes and dam compliance certificates
- enforcing provisions of the Building Code and the Building Act and regulations that relate to dams
- adopting a policy on dangerous dams.

4.5 Building owners

Building owners are responsible for:

- detailing work proposals on plans and specifications, including proposals for the inspection and routine maintenance of the specified systems for the purposes of the compliance schedule (if applicable)
- applying for building consents (and amendments to building consents) and project information memoranda
- constructing buildings in accordance with the 'approved plans and specifications'
- organising inspections at given stages as building work progresses
- collecting energy work certificates
- applying for a code compliance certificate as soon as any work carried out under a building consent granted to them is completed
- maintaining buildings in a safe and sanitary manner
- ensuring any specified systems in their building are performing and will continue to perform to the performance standards
- supplying the annual building warrant of fitness, if applicable
- notifying the territorial authority if a change of use, extension of life, or subdivision is proposed
- paying any fees as required by the Building Act.

4.6 Licensed building practitioners

The Building Act set up a licensed building practitioners (LBP) scheme to promote, recognise and support professional skills and behaviour in the building industry. The scheme has seven licence classes covering designers, site supervisors and trades people, such as carpenters, roofers, plasterers and bricklayers.

To become licensed, building practitioners must show they meet the standard for the licence class appropriate for them. Details of LBPs are held on a public register at **www.dbh.govt.nz/lbp-register**

Once licensed, LBPs are responsible for notifying territorial authorities of breaches of building consents.

Since March 2012, restricted building work on houses and small-medium sized apartment buildings has only been able to be carried out or supervised by LBPs. Restricted building work is design and building work that is critical to the integrity of a house or small-medium sized apartment building. It covers aspects of the primary structure, external moisture management and fire design.

Amend 13 Feb 2014

Amend 13 Feb 2014

From March 2012:

- any plans and specifications containing restricted building work (relating to design work) must be accompanied by a memorandum issued by the LBP who carried out or supervised the design work, stating that the design work complies with the Building Code

Amend 11 Sep 2010

- if an application for a building consent relates to restricted building work, the names of the LBPs carrying out or supervising that work must be given to the building consent authority in the application (if known) or once the work commences, or when the application for the code compliance certificate is made.

Amend 11 Sep 2010

The most up-to-date information on the LBP scheme is at **www.dbh.govt.nz/lbp**

4.7 Past building control parties

4.7.1 The Building Industry Authority

The Building Industry Authority (the Authority) was a Crown entity, established under the former Act as the sole regulatory authority for building controls in New Zealand. The introduction of the Building Act 2004 has seen the dissolution of the Authority and transfer of its responsibilities to the Department of Building and Housing (now the Ministry of Business, Innovation and Employment).

Amend 13 Feb 2014

4.7.2 Building certifier

A building certifier was a person approved by the Authority under the former Act to issue building certificates with respect to specific provisions of the Building Code. A building certifier may have been employed by a building owner as an alternative to using the territorial authority for checking technical proposals and performing inspections. Building certifiers are not provided for under the Building Act except for certain transitional arrangements.

5.0 BUILDING COMPLIANCE PROVISIONS

5.1 Project information memoranda (sections 31 to 39)

A project information memorandum (PIM) provides information known to the territorial authority/regional authority about land, and requirements of the Building Act and other Acts that might be relevant to proposed building work. A PIM is specific to the site and project.

A PIM is a legal document and may have a notice attached to it requiring the owner to obtain other approvals or consents required by other legislation, such as the Resource Management Act 1991, prior to any work commencing on the project. For example, a PIM might include the fact that the height of a building may contravene a rule in the District Plan, meaning that before work commences, a separate resource consent is required from the territorial authority planning unit.

An application for a building consent is deemed to include an application for a PIM, unless one has been previously issued for the project and this is supplied with the building consent application. In most cases, PIMs and building consents are applied for in a single application. They will be processed as separate applications, but may be issued separately or jointly.

If the application for a PIM affects a registered historic place, historic area, wahi tapu, or wahi tapu area, and a PIM has not been issued for the building work to which the application applies, then the territorial authority must notify the New Zealand Historic Places Trust within five days after receiving the application.

If the territorial authority considers a development contribution under the Local Government Act 2002 is payable by the owner, it may attach a notice (Form 3) that advises the applicant that a code compliance certificate will not be issued until the development contribution is paid.

5.2 Building consents (sections 40 to 52)

A building consent is the formal approval, under section 49 of the Building Act, permitting an applicant to undertake building work in accordance with the plans and specifications approved by the building consent authority. Building work is the construction, alteration, demolition or removal of a building and includes sitework.

A person cannot carry out building work except in accordance with a building consent. There are some exemptions (see sections 41 and 43 and Schedule 1 of the Building Act), but section 17 still requires building work to be carried out in accordance with the Building Code, even if no building consent is required.

5.2.1 Alterations (Section 112)

Where proposed building work involves an alteration to an existing building, the consent must not be granted unless the building consent authority is satisfied that all new building work complies with the Building Code and:

- the altered building will comply as nearly as is reasonably practicable with the Building Code provisions for means of escape from fire and access and facilities for people with disabilities, and
- the altered building will continue to comply with the other provisions of the Building Code to at least the same extent as before the alteration.

However, a territorial authority may allow the alteration of an existing building without complying with provisions of the Building Code specified by the territorial authority, if the territorial authority is satisfied that:

- if the building were required to comply with the relevant provisions of the Building Code, the alterations would not take place, and
- the alteration will result in improvements to attributes of the building that relate to means of escape from fire or access and facilities for persons with disabilities, and
- the improvements mentioned above outweigh any detriment that is likely to arise as a result of the building not complying with the relevant provisions of the Building Code.

5.2.2 Change of use (sections 114 and 115)

Uses of buildings are defined in Schedule 2 of the Building (Specified Systems, Change the Use, and Earthquake-Prone Buildings) Regulations 2005.

A change of use arises when two criteria are met. The first criterion is that a building's use must change from one use in Schedule 2 to a different use in Schedule 2. The second criterion is the result of that change (first criterion) means the requirements for compliance with the Building Code for the new use are additional to, or more onerous than, the requirements for the old use.

See Regulations 5 and 6 of the Building (Specified Systems, Change the Use, and Earthquake-Prone Buildings) Regulations 2005.

An owner of a building must give written notice to the territorial authority/regional authority if they propose to change the use of a building.

Where the owner proposes to change the use of a building to one or more household units, where household units did not exist before, they must obtain written notice from the territorial authority. This must state that the territorial authority is satisfied, on reasonable grounds, that the building, in its new use, will comply as nearly as is reasonably practicable, with the Building Code in all respects (usually through the issue of a building consent).

For any other change of use proposal, the owner must get written notice from the territorial authority/regional authority, stating that the authority is satisfied, on reasonable grounds, that the building, in its new use, will comply, as nearly as is reasonably practicable, with every provision of the Building Code that relates to either or both of the following matters:

- means of escape from fire, protection of other property, sanitary facilities, structural performance, and fire-rating performance
- access and facilities for people with disabilities (if this is a requirement under section 118 of the Building Act).

The territorial authority/regional authority must also be satisfied that the building will continue to comply with the other provisions of the Building Code to at least the same extent as before the change of use.

5.2.3 Extension of life (sections 114 and 116)

Where a building with a specified intended life is issued with a building consent that is subject to the condition that the building be altered before the end of its life, an 'extension of life' can be obtained.

An owner of a building must give written notice to the territorial authority/regional authority if it proposes to extend the life of a building.

The territorial authority/regional authority can only give its consent to the extension of life if it is satisfied that:

- the building has been altered in accordance with the original condition
- the alteration complies with section 112 of the Building Act (Alterations).

5.2.4 Subdivision (sections 114 and 116A)

An owner of a building must give written notice to the territorial authority if it proposes to subdivide land in a manner that affects a building.

The territorial authority can only issue a certificate under section 224(f) (relating to cross lease, company lease, and unit titles) of the Resource Management Act 1991 for the purpose of giving effect to a subdivision affecting a building or part of a building, if it is satisfied that the building will comply as nearly as reasonably practicable with every provision of the Building Code that relates to one or more of the following.

- Means of escape from fire
- Access and facilities for people with disabilities
- Protection of other property

The building must also continue to comply with other provisions of the Building Code to at least the same extent as it did before the application for subdivision was made.

5.2.5 Access for persons with disabilities (sections 117 to 120 and Schedule 2)

Any building (including parts of a building such as a driveway) that is open to the public, whether or not they are charged for entry, must have reasonable and adequate provision for access, parking and sanitary facilities for people with disabilities who may be expected to work or visit that building and carry out normal activities and processes in that building.

The most recent version of NZS 4121 Code of Practice for Design for Access and Use of Buildings by Persons with Disabilities is to be taken as an Acceptable Solution. Amend 13 Feb 2014

5.3 Code compliance certificate (sections 91 to 95)

A code compliance certificate (CCC) is a formal statement, issued under section 95 of the Building Act, which states that building work carried out under a building consent application complies with that building consent. A CCC provides assurance to the owner and subsequent property owners that the approved plans and specifications have been followed.

A CCC is not issued until all building work has been completed as per the plans and specifications submitted with the building consent application.

A CCC must be applied for after all building work carried out under a building consent granted to the owner is completed.

An application for a CCC where the building work was carried out under a consent granted under the former Act must be considered and determined as if the Building Act had not been passed. However, section 43(2) of the former Act must be read as if a CCC may only be issued if the territorial authority is satisfied that the building work complies with the Building Code that applied at the time the building consent was granted.

5.4 Certificates of acceptance (sections 96 to 99)

Certificates of acceptance were introduced by the Building Act. The certificate confirms that, to the extent an inspection was able to be carried out, the building work complies with the Building Code. A certificate of acceptance therefore has some similarities to a CCC in that it will provide some verification for a building owner, or future building owner, that all or part of the work is compliant.

A certificate of acceptance can be obtained in situations where:

- work has been done without a building consent when one should have been obtained
- a building consent authority or building certifier is unable or refuses to issue a CCC
- verification is required of urgent building work carried out under section 42 of the Building Act.

A certificate of acceptance can also be used in limited circumstances in relation to section 363B.

A certificate of acceptance is based on verification with the Building Code that was in place at the time of application. It is not based on what was in place at the time a building consent was granted, or should have been applied for, or when the work was actually carried out.

5.5 Notices to fix (sections 163 to 168)

A notice to fix is a statutory notice requiring a person to remedy a breach of the Building Act or Regulations under the Act. A notice to fix can be issued for all breaches of the Building Act, including non-complying building work, and for an incorrect building warrant of fitness or a compliance schedule that is not being properly complied with. A notice to fix can state that all or any building work must cease immediately.

A building consent authority, regional authority or a territorial authority must issue a notice to fix for any contravention of the Building Act and Building Regulations under section 164 of the Building Act. When a notice to fix has been issued by a building consent authority that is not a territorial authority or a regional authority, the matter is then handed to the territorial authority or regional authority to decide whether the notice has been complied with.

Some examples of where notices could be issued include:

- carrying out building work other than in accordance with a building consent
- displaying an incorrect building warrant of fitness
- changing the use of a building without notifying the territorial authority or regional authority.

5.6 Compliance schedules (sections 100 to 107)

A compliance schedule lists specified systems within a building. The compliance schedule for a building must identify which specified systems are present, the performance standards for those systems, and how those systems will be inspected and maintained to ensure they continue to function.

For more information on compliance schedules, see the Compliance Schedule Handbook.

5.7 Building warrants of fitness (sections 108 to 111)

A building warrant of fitness (BWoF) is a statement supplied by a building owner, to the territorial authority confirming that the systems specified in the compliance schedule for their building have been maintained and checked in accordance with the compliance schedule for the previous 12 months, and will continue to perform as required. For more information on building warrants of fitness, see the Compliance Schedule Handbook.

5.8 Certificates for public use (section 363A)

Amend 13 Feb 2014

A certificate for public use is a safety provision under the Building Act. It is a tool that can be used to certify that premises or parts of premises affected by building work are safe to be used by the public. Certificates for public use can only be used where a building consent has been granted for the building work but no CCC has yet been issued. Certificates for public use do not relieve the owner of a building from the obligation to apply for a CCC after all the building work has been carried out.

5.9 Building certificate

A building certificate was a formal confirmation by a building certifier that specific aspects of a building would or do comply with the Building Code. A territorial authority was obliged to accept such a certificate. Building certificates were allowed for under the former Act, but are only included under the Building Act 2004 as transitional allowances to phase them out.

Amend 13 Feb 2014

Contents

Amend 13 Feb 2014

Amend 13 Feb 2014

Amend 11 Sep 2010

Amend 11 Sep 2010

A General Provisions

CLAUSE A1—CLASSIFIED USES

1.0 EXPLANATION

1.0.1 For the purposes of this building code *buildings* are classified according to type, under seven categories.

1.0.2 A *building* with a given classified use may have one or more intended uses as defined in the Act.

2.0 HOUSING

2.0.1 Applies to *buildings* or use where there is self care and service (internal management). There are three types:

2.0.2 Detached Dwellings

Applies to a *building* or use where a group of people live as a single household or family. Examples: a holiday cottage, boarding house accommodating fewer than 6 people, dwelling or hut.

2.0.3 Multi-unit Dwelling

Applies to a *building* or use which contains more than one separate household or family. Examples: an attached dwelling, flat or multi-unit apartment.

2.0.4 Group Dwelling

Applies to a *building* or use where groups of people live as one large extended family. Examples: within a commune or marae.

3.0 COMMUNAL RESIDENTIAL

3.0.1 Applies to *buildings* or use where assistance or care is extended to the *principal users*. There are two types:

3.0.2 Community Service

Applies to a residential *building* or use where limited assistance or care is extended to the *principal users*. Examples: a boarding house, hall of residence, holiday cabin, [*backcountry hut*,] hostel, hotel, motel, nurses' home, retirement village, time-share accommodation, a work camp, or camping ground.

3.0.3 Community Care

Applies to a residential *building* or use where a large degree of assistance or care is extended to the *principal users*. There are two types:

(a) **Unrestrained**; where the *principal users* are free to come and go. Examples: a hospital, an old people's home or a health camp.

(b) **Restrained**; where the *principal users* are legally or physically constrained in their movements. Examples: a borstal or drug rehabilitation centre, an old people's home where substantial care is extended, a prison or hospital.

4.0 COMMUNAL NON-RESIDENTIAL

4.0.1 Applies to a *building* or use being a meeting place for people where care and service is provided by people other than the *principal users*. There are two types:

4.0.2 Assembly Service

Applies to a *building* or use where limited care and service is provided. Examples: a church, cinema, clubroom, hall, museum, public swimming pool, stadium, theatre, or whare runanga (the assembly house).

Schedule 1 clause A1 3.0.2: amended, on 31 October 2008, by regulation 4 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

CLAUSE A1—CLASSIFIED USES (continued)

4.0.3 Assembly Care

Applies to a *building* or use where a large degree of care and service is provided. Examples: an [early childhood education and care centre], college, day care institution, centre for handicapped persons, kindergarten, school or university.

5.0 COMMERCIAL

5.0.1 Applies to a *building* or use in which any natural resources, goods, services or money are either developed, sold, exchanged or stored. Examples: an amusement park, auction room, bank, car-park, catering facility, coffee bar, computer centre, fire station, funeral parlour, hairdresser, library, office (commercial or government), police station, post office, public laundry, radio station, restaurant, service station, shop, showroom, storage facility, television station or transport terminal.

6.0 INDUSTRIAL

6.0.1 Applies to a *building* or use where people use material and physical effort to:

(a) extract or convert natural resources,

(b) produce goods or energy from natural or converted resources,

(c) repair goods, or

(d) store goods (ensuing from the industrial process).

Examples: an agricultural building, agricultural processing facility, aircraft hanger, factory, power station, sewage treatment works, warehouse or utility.

7.0 OUTBUILDINGS

7.0.1 Applies to a *building* or use which may be included within each classified use but are not intended for human habitation, and are accessory to the principal use of associated *buildings*. Examples: a carport, farm *building*, garage, greenhouse, machinery room, private swimming pool, public toilet, or shed.

8.0 ANCILLARY

8.0.1 Applies to a *building* or use not for human habitation and which may be exempted from some amenity provisions, but which are required to comply with structural and safety-related aspects of the *building code*. Examples: a bridge, derrick, fence, free standing outdoor fireplace, jetty, mast, path, platform, pylon, retaining wall, tank, tunnel or dam.

Schedule 1 clause A1 4.0.3: amended, on 1 December 2008, by section 60(2) of the Education Amendment Act 2006 (2006 No 19).

CLAUSE A2—INTERPRETATION

This Clause of the New Zealand Building Code lists defined words used within the Code.

Those definitions, plus defined word or terms used in the Compliance Documents, are included in the section on definitions in this Handbook.

[CLAUSE A3—BUILDING IMPORTANCE LEVELS

For the purposes of clause C, a *building* has one of the importance levels set out below:

Importance level	Description of building type	Specific structure
Importance level 1	*Buildings* posing low risk to human life or the environment, or a low economic cost, should the building fail. These are typically small non-habitable *buildings*, such as sheds, barns, and the like, that are not normally occupied, though they may have occupants from time to time.	• Ancillary *buildings* not for human habitation • Minor storage facilities • Backcountry huts
Importance level 2	*Buildings* posing normal risk to human life or the environment, or a normal economic cost, should the *building* fail. These are typical residential, commercial, and industrial *buildings*.	• All *buildings* and facilities except those listed in importance levels 1, 3, 4, and 5
Importance level 3	*Buildings* of a higher level of societal benefit or importance, or with higher levels of risk-significant factors to building occupants. These *buildings* have increased performance requirements because they may house large numbers of people, vulnerable populations, or occupants with other risk factors, or fulfil a role of increased importance to the local community or to society in general.	• *Buildings* where more than 300 people congregate in 1 area • *Buildings* with primary school, secondary school, or daycare facilities with a capacity greater than 250 • *Buildings* with tertiary or adult education facilities with a capacity greater than 500 • Health care facilities with a capacity of 50 or more residents but not having surgery or emergency treatment facilities • Jails and detention facilities • Any other *building* with a capacity of 5 000 or more people • *Buildings* for power generating facilities, water treatment for potable water, wastewater treatment facilities, and other public utilities facilities not included in importance level 4

Schedule 1 clause A3: inserted, on 10 April 2012, by regulation 5 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

[CLAUSE A3—BUILDING IMPORTANCE LEVELS (continued)

Importance level	Description of building type	Specific structure
Importance level 3 (continued)		• *Buildings* not included in importance level 4 or 5 containing sufficient quantities of highly toxic gas or explosive materials capable of causing acutely hazardous conditions that do not extend beyond property boundaries
Importance level 4	*Buildings* that are essential to post-disaster recovery or associated with hazardous facilities.	• Hospitals and other health care facilities having surgery or emergency treatment facilities • *Fire*, rescue, and police stations and emergency vehicle garages • *Buildings* intended to be used as emergency shelters • *Buildings* intended by the owner to contribute to emergency preparedness, or to be used for communication, and operation centres in an emergency, and other facilities required for emergency response • Power generating stations and other utilities required as emergency backup facilities for importance level 3 structures • *Buildings* housing highly toxic gas or explosive materials capable of causing acutely hazardous conditions that extend beyond property boundaries • Aviation control towers, air traffic control centres, and emergency aircraft hangars • *Buildings* having critical national defence functions • Water treatment facilities required to maintain water pressure for fire suppression

Schedule 1 clause A3: inserted, on 10 April 2012, by regulation 5 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

[CLAUSE A3—BUILDING IMPORTANCE LEVELS (continued)

Importance level	Description of building type	Specific structure
Importance level 4 (continued)		• Ancillary *buildings* (including, but not limited to, communication towers, fuel storage tanks or other structures housing or supporting water or other *fire* suppression material or equipment) required for operation of importance level 4 structures during an emergency
Importance level 5	*Buildings* whose failure poses catastrophic risk to a large area (eg, 100 km^2) or a large number of people (eg, 100 000).	• Major dams • Extremely hazardous facilities

Schedule 1 clause A3: inserted, on 10 April 2012, by regulation 5 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

B Stability

CLAUSE B1—STRUCTURE

Provisions	Limits on application

OBJECTIVE

B1.1 The objective of this provision is to:

(a) Safeguard people from injury caused by structural failure,

(b) Safeguard people from loss of *amenity* caused by structural behaviour, and

(c) Protect other property from physical damage caused by structural failure.

FUNCTIONAL REQUIREMENT

B1.2 *Buildings*, *building elements* and *sitework* shall withstand the combination of loads that they are likely to experience during *construction* or *alteration* and throughout their lives.

PERFORMANCE

B1.3.1 *Buildings, building elements* and *sitework* shall have a low probability of rupturing, becoming unstable, losing equilibrium, or collapsing during *construction* or *alteration* and throughout their lives.

B1.3.2 *Buildings, building elements* and *sitework* shall have a low probability of causing loss of amenity through undue deformation, vibratory response, degradation, or other physical characteristics throughout their lives, or during *construction* or *alteration* when the *building* is in use.

B1.3.3 Account shall be taken of all physical conditions likely to affect the stability of *buildings, building elements* and *sitework*, including:

(a) Self-weight,

(b) Imposed gravity loads arising from use,

(c) Temperature,

(d) Earth pressure,

(e) Water and other liquids,

(f) Earthquake,

(g) Snow,

(h) Wind,

(i) *Fire*,

CLAUSE B1—STRUCTURE (continued)

Provisions	Limits on application
(j) Impact, (k) Explosion, (l) Reversing or fluctuating effects, (m) Differential movement, (n) Vegetation, (o) Adverse effects due to insufficient separation from other *buildings*, (p) Influence of equipment, services, non-structural elements and contents, (q) Time dependent effects including creep and shrinkage, and (r) Removal of support.	
B1.3.4 Due allowance shall be made for: (a) The consequences of failure, (b) The intended use of the *building*, (c) Effects of uncertainties resulting from *construction* activities, or the sequence in which *construction* activities occur, (d) Variation in the properties of materials and the characteristics of the site, and (e) Accuracy limitations inherent in the methods used to predict the stability of *buildings*.	
B1.3.5 The demolition of *buildings* shall be carried out in a way that avoids the likelihood of premature collapse.	
B1.3.6 *Sitework*, where necessary, shall be carried out to: (a) Provide stability for *construction* on the site, and (b) Avoid the likelihood of damage to *other property*.	
B1.3.7 Any *sitework* and associated supports shall take account of the effects of: (a) Changes in ground water level, (b) Water, weather and vegetation, and (c) Ground loss and slumping.	

CLAUSE B2—DURABILITY

Provisions	Limits on application
OBJECTIVE	
B2.1 The objective of this provision is to ensure that a *building* will throughout its life continue to satisfy the other objectives of this code.	
FUNCTIONAL REQUIREMENT	
B2.2 *Building* materials, components and *construction* methods shall be sufficiently durable to ensure that the *building*, without reconstruction or major renovation, satisfies the other functional requirements of this code throughout the life of the *building*.	
PERFORMANCE	
B2.3.1 *Building elements* must, with only normal maintenance, continue to satisfy the performance requirements of this code for the lesser of the *specified intended life* of the *building*, if stated, or:	Performance B2.3.1 applies from the time of issue of the applicable *code compliance certificate*. *Building elements* are not required to satisfy a durability performance which exceeds the *specified intended life* of the *building*
(a) The life of the *building*, being not less than 50 years, if:	
(i) Those *building elements* (including floors, walls, and fixings) provide structural stability to the *building*, or	
(ii) Those *building elements* are difficult to access or replace, or	
(iii) Failure of those *building elements* to comply with the *building code* would go undetected during both normal use and maintenance of the building	
(b) 15 years if:	
(i) Those *building elements* (including the *building* envelope, exposed plumbing in the subfloor space, and in-built chimneys and flues) are moderately difficult to access or replace, or	
(ii) Failure of those *building elements* to comply with the *building code* would go undetected during normal use of the *building*, but would be easily detected during normal maintenance.	

Clause B2.3 Schedule was substituted, as from 11 September 1997, by regulation 2 Building Amendment Regulations 1997 (SR 1997/156).

CLAUSE B2—DURABILITY (continued)

Provisions	Limits on application
(c) 5 years if: (i) The *building elements* (including services, linings, renewable protective coatings, and *fixtures*) are easy to access and replace, and (ii) Failure of those *building elements* to comply with the *building code* would be easily detected during normal use of the *building*. **B2.3.2** Individual *building elements* which are components of a *building* system and are difficult to access or replace must either: (a) All have the same durability, or (b) Be installed in a manner that permits the replacement of *building elements* of lesser durability without removing *building elements* that have greater durability and are not specifically designed for removal and replacement.	

C Protection from fire

[C1—OBJECTIVES OF CLAUSES C2 TO C6 (PROTECTION FROM FIRE)

Provisions	Limit on application
The objectives of clauses C2 to C6 are to: (a) safeguard people from an unacceptable risk of injury or illness caused by *fire*, (b) protect *other property* from damage caused by *fire*, and (c) facilitate firefighting and rescue operations.	

Schedule 1 clause C1: replaced, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

[C2—PREVENTION OF FIRE OCCURRING

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C2.1 Fixed appliances using controlled combustion and other fixed equipment must be designed, constructed, and installed in *buildings* in a way that reduces the likelihood of illness or injury due to *fire* occurring.	
PERFORMANCE	
C2.2 The maximum surface temperature of *combustible building materials* close to fixed appliances using controlled combustion and other fixed equipment when operating at their design level must not exceed 90°C.	
C2.3 Fixed appliances using controlled combustion and other fixed equipment must be designed, constructed and installed so that there is a low probability of explosive or hazardous conditions occurring within any spaces in or around the *building* that contains the appliances.	

Schedule 1 clause C2: replaced, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

[C3—FIRE AFFECTING AREAS BEYOND THE FIRE SOURCE

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C3.1 *Buildings* must be designed and constructed so that there is a low probability of injury or illness to persons not in close proximity to a *fire source*.	
C3.2 *Buildings* with a *building height* greater than 10 m where upper floors contain sleeping uses or *other property* must be designed and constructed so that there is a low probability of external vertical fire spread to upper floors in the *building*.	Clause C3.2 does not apply to importance level 1 *buildings*.
C3.3 *Buildings* must be designed and constructed so that there is a low probability of *fire* spread to *other property* vertically or horizontally across a *relevant boundary*.	

Schedule 1 clause C3: replaced, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

[C3—FIRE AFFECTING AREAS BEYOND THE FIRE SOURCE (continued)

Provisions	Limit on application
PERFORMANCE **C3.4** (a) materials used as internal surface linings in the following areas of *buildings* must meet the performance criteria specified below:	Clause C3.4 does not apply to *detached dwellings*, within *household units* in *multi-unit dwellings*, or *outbuildings* and *ancillary buildings*.

Area of *building*	**Performance determined under conditions described in ISO 9705: 1993**	
	***Buildings* not protected with an automatic *fire* sprinkler system**	***Buildings* protected with an automatic *fire* sprinkler system**
Wall/ceiling materials in sleeping areas where care or detention is provided	Material Group Number 1-S	Material Group Number 1 or 2
Wall/ceiling materials in exitways	Material Group Number 1-S	Material Group Number 1 or 2
Wall/ceiling materials in all *occupied spaces* in importance level 4 *buildings*	Material Group Number 1-S	Material Group Number 1 or 2
Internal surfaces of ducts for *HVAC systems*	Material Group Number 1-S	Material Group Number 1 or 2
Ceiling materials in crowd and sleeping uses except *household units* and where care or detention is provided	Material Group Number 1-S or 2-S	Material Group Number 1 or 2
Wall materials in crowd and sleeping uses except *household units* and where care or detention is provided	Material Group Number 1-S or 2-S	Material Group Number 1, 2, or 3
Wall/ceiling materials in occupied spaces in all other locations in *buildings*, including *household units*	Material Group Number 1, 2, or 3	Material Group Number 1, 2, or 3
External surfaces of ducts for *HVAC systems*	Material Group Number 1, 2, or 3	Material Group Number 1, 2, or 3
Acoustic treatment and pipe insulation within airhandling plenums in sleeping uses	Material Group Number 1, 2, or 3	Material Group Number 1, 2, or 3

Schedule 1 clause C3: replaced, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

[C3—FIRE AFFECTING AREAS BEYOND THE FIRE SOURCE (continued)

Provisions	Limit on application
(b) floor surface materials in the following areas of *buildings* must meet the performance criteria specified below:	

Area of *building*	Minimum critical radiant flux when tested to ISO 9239-1: 2010	
	Buildings **not protected with an automatic *fire* sprinkler system**	***Buildings*** **protected with an automatic *fire* sprinkler system**
Sleeping areas and exitways in *buildings* where care or detention is provided	4.5 kW/m^2	2.2 kW/m^2
Exitways in all other *buildings*	2.2 kW/m^2	2.2 kW/m^2
Firecells accommodating more than 50 persons	2.2 kW/m^2	1.2 kW/m^2
All other occupied spaces except *household units*	1.2 kW/m^2	1.2 kW/m^2

(c) suspended flexible fabrics and membrane structures used in the construction of *buildings* must have properties resulting in a low probability of injury or illness to persons not in close proximity to a *fire source*.

C3.5 *Buildings* must be designed and constructed so that fire does not spread more than 3.5 m vertically from the *fire source* over the external cladding of multi-level *buildings*.

C3.6 *Buildings* must be designed and constructed so that in the event of *fire* in the building the received radiation at the *relevant boundary* of the property does not exceed 30 kW/m^2 and at a distance of 1 m beyond the relevant boundary of the property does not exceed 16 kW/m^2.

Schedule 1 clause C3: replaced, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

[C3—FIRE AFFECTING AREAS BEYOND THE FIRE SOURCE (continued)

Provisions	Limit on application
C3.7 External walls of *buildings* that are located closer than 1 m to the *relevant boundary* of the property on which the *building* stands must either: (a) be constructed from materials which are not *combustible building materials*, or (b) for *buildings* in importance levels 3 and 4, be constructed from materials that, when subjected to a radiant flux of 30 kW/m^2, do not ignite for 30 minutes, or (c) for *buildings* in Importance Levels 1 and 2, be constructed from materials that, when subjected to a radiant flux of 30 kW/m^2, do not ignite for 15 minutes.	
C3.8 *Firecells* located within 15 m of a *relevant boundary* that are not protected by an automatic *fire* sprinkler system, and that contain a *fire load* greater than 20 TJ or that have a floor area greater than 5,000 m^2 must be designed and constructed so that at the time that firefighters first apply water to the *fire*, the maximum radiation flux at 1.5 m above the floor is no greater than 4.5 kW/m^2 and the smoke layer is not less than 2 m above the floor.	
C3.9 *Buildings* must be designed and constructed with regard to the likelihood and consequence of failure of any *fire safety* system intended to control *fire* spread.	

Schedule 1 clause C3: replaced, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

[C4—MOVEMENT TO PLACE OF SAFETY

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C4.1 *Buildings* must be provided with:	
(a) effective means of giving warning of *fire*, and	
(b) visibility in *escape routes* complying with clause F6.	
C4.2 *Buildings* must be provided with means of escape to ensure that there is a low probability of occupants of those buildings being unreasonably delayed or impeded from moving to a *place of safety* and that those occupants will not suffer injury or illness as a result.	
PERFORMANCE	
C4.3 The *evacuation time* must allow occupants of a building to move to a *place of safety* in the event of a fire so that occupants are not exposed to any of the following:	
(a) a *fractional effective dose* of carbon monoxide greater than 0.3:	
(b) a *fractional effective dose* of thermal effects greater than 0.3:	
(c) conditions where, due to smoke obscuration, visibility is less than 10 m except in rooms of less than 100 m^2 where visibility may fall to 5 m.	
C4.4 Clause C4.3(b) and (c) do not apply where it is not possible to expose more than 1 000 occupants in a *firecell* protected with an automatic *fire* sprinkler system.	
C4.5 Means of escape to a *place of safety* in *buildings* must be designed and constructed with regard to the likelihood and consequence of failure of any *fire safety systems.*	

Schedule 1 clause C4: replaced, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

[C5—ACCESS AND SAFETY FOR FIREFIGHTING OPERATIONS

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C5.1 *Buildings* must be designed and constructed so that there is a low probability of firefighters or other emergency services personnel being delayed in or impeded from assisting in rescue operations and performing firefighting operations.	
C5.2 *Buildings* must be designed and constructed so that there is a low probability of illness or injury to firefighters or other emergency services personnel during rescue and firefighting operations.	
PERFORMANCE	
C5.3 *Buildings* must be provided with access for fire service vehicles to a hard-standing from which there is an unobstructed path to the *building* within 20 m of: (a) the firefighter access into the *building*, and (b) the inlets to automatic fire sprinkler systems or fire hydrant systems, where these are installed.	Performance requirements in clauses C5.3 to C5.8 do not apply to *backcountry huts, detached dwellings*, within *household units* in *multi-unit dwellings*, or to *outbuildings*, and *ancillary buildings*.
C5.4 Access for fire service vehicles in accordance with clause C5.3 must be provided to more than 1 side of *firecells* greater than 5,000 m² in floor area that are not protected by an automatic fire sprinkler system.	
C5.5 *Buildings* must be provided with the means to deliver water for firefighting to all parts of the *building*.	
C5.6 *Buildings* must be designed and constructed in a manner that will allow firefighters, taking into account the firefighters' personal protective equipment and standard training, to: (a) reach the floor of fire origin, (b) search the general area of fire origin, and (c) protect their means of egress.	

Schedule 1 clause C5: inserted, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

[C5—ACCESS AND SAFETY FOR FIREFIGHTING OPERATIONS (continued)

Provisions	Limit on application
C5.7 *Buildings* must be provided with means of giving clear information to enable firefighters to: (a) establish the general location of the *fire*, (b) identify the *fire safety systems* available in the *building*, and (c) establish the presence of *hazardous substances* or process in the *building*.	
C5.8 Means to provide access for and safety of firefighters in *buildings* must be designed and constructed with regard to the likelihood and consequence of failure of any *fire safety systems*.	

Schedule 1 clause C5: inserted, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

[C6—STRUCTURAL STABILITY

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C6.1 Structural systems in *buildings* must be constructed to maintain structural stability during *fire* so that there is:	
(a) a low probability of injury or illness to occupants,	
(b) a low probability of injury or illness to *fire* service personnel during rescue and firefighting operations, and	
(c) a low probability of direct or consequential damage to adjacent *household units* or *other property*.	
PERFORMANCE	
C6.2 Structural systems in *buildings* that are necessary for structural stability in *fire* must be designed and constructed so that they remain stable during *fire* and after *fire* when required to protect *other property* taking into account:	
(a) the *fire* severity,	
(b) any automatic fire sprinkler systems within the *buildings*,	
(c) any other active *fire safety systems* that affect the *fire* severity and its impact on structural stability, and	
(d) the likelihood and consequence of failure of any *fire safety systems* that affect the *fire* severity and its impact on structural stability.	
C6.3 Structural systems in *buildings* that are necessary to provide firefighters with safe access to floors for the purpose of conducting firefighting and rescue operations must be designed and constructed so that they remain stable during and after *fire*.	
C6.4 Collapse of building elements that have lesser *fire* resistance must not cause the consequential collapse of elements that are required to have a higher *fire* resistance.	

Schedule 1 clause C6: inserted, on 10 April 2012, by regulation 6 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

D Access

CLAUSE D1—ACCESS ROUTES

Provisions	Limits on application
OBJECTIVE	
D1.1 The objective of this provision is:	
(a) Safeguard people from injury during movement into, within and out of *building*s,	
(b) Safeguard people from injury resulting from the movement of vehicles into, within and out of *building*s, and	
(c) Ensure that *people with disabilities* are able to enter and carry out normal activities and functions within *building*s.	Objective D1.1(c) shall apply only to those *building*s to which [section 47A of the Act] applies.
FUNCTIONAL REQUIREMENT	
D1.2.1 *Building*s shall be provided with reasonable and adequate access to enable safe and easy movement of people.	Requirement D1.2.1 shall not apply to *Ancillary buildings* or *Outbuildings*.
D1.2.2 Where a *building* is provided with loading or parking spaces, they shall be constructed to permit safe and easy unloading and movement of vehicles, and to avoid conflict between vehicles and pedestrians.	
PERFORMANCE	
D1.3.1 *Access routes* shall enable people to:	
(a) Safely and easily approach the main entrance of *building*s from the apron or *construction* edge of a *building*,	
(b) Enter *building*s,	
(c) Move into spaces within *building*s by such means as corridors, doors, stairs, ramps and lifts,	
(d) Manoeuvre and park cars, and	
(e) Manoeuvre and park delivery vehicles required to use the loading space.	
D1.3.2 At least one *access route* shall have features to enable *people with disabilities* to:	Performance D1.3.2 shall not apply to *Housing*, *Outbuildings*, [*backcountry huts*,] *Ancillary buildings*, and to *Industrial buildings* where no more than 10 people are employed.
(a) Approach the *building* from the street boundary or, where required to be provided, the *building* car park,	
(b) Have access to the internal space served by the principal access, and	
(c) Have access to and within those spaces where they may be expected to work or visit, or which contain facilities for personal hygiene as required by Clause G1 "Personal Hygiene".	

Note: Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

The limits on application to clause D1.1(c) were amended consequential on the Health Reforms (Transitional Provisions) Act 1993, as from 29 December 2000, by regulation 4(1) Building Amendment Regulations 2000 (SR 2000/119), by substituting the expression ""section 47A of the Act"" for the expression ""section 25 of the Disabled Persons Community Welfare Act 1975"".

Schedule 1 clause D1.3.2: amended, on 31 October 2008, by regulation 7 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

CLAUSE D1—ACCESS ROUTES (continued)

Provisions	Limits on application
D1.3.3 Access routes shall:	
(a) Have *adequate* activity space,	
(b) Be free from dangerous obstructions and from any projections likely to cause an obstruction,	
(c) Have a safe cross fall, and safe slope in the direction of travel,	
(d) Have *adequate* slip-resistant walking surfaces under all conditions of normal use,	
(e) Include stairs to allow access to upper floors irrespective of whether an escalator or lift has been provided,	
(f) Have stair treads, and ladder treads or rungs which:	
(i) provide *adequate* footing, and	
(ii) have uniform rise within each flight and for consecutive flights,	
(g) Have stair treads with a leading edge that can be easily seen,	
(h) Have stair treads which prevent children falling through or becoming held fast between treads, where open risers are used,	Performance D1.3.3(h) shall not apply within *Industrial buildings*, *Outbuildings* and *Ancillary buildings*.
(i) Not contain isolated steps,	Performance D1.3.3(i) shall not apply with *Detached Dwellings* or within *household units* of *Multi-unit Dwellings*, or to *Outbuildings* and *Ancillary buildings*.
(j) Have smooth, reachable and graspable *handrails* to provide support and to assist with movement along a stair or ladder,	Performance D1.3.3(j) shall not apply to isolated steps.
(k) Have *handrails* of *adequate* strength and rigidity as required by Clause B1 "Structure",	
(l) Have landings of appropriate dimensions and at appropriate intervals along a stair or ramp to prevent undue fatigue,	
(m) Have landings of appropriate dimensions where a door opens from or onto a stair, ramp or ladder so that the door does not create a hazard, and	
(n) Have any automatically controlled doors constructed to avoid the risk of people becoming caught or being struck by moving parts.	

CLAUSE D1—ACCESS ROUTES (continued)

Provisions	Limits on application
D1.3.4 An *accessible route*, in addition to the requirement of Clause D1.3.3, shall: (a) Be easy to find, as required by Clause F8 “Signs”, (b) Have *adequate* activity space to enable a person in a wheelchair to negotiate the route while permitting an ambulant person to pass, (c) Include a lift complying with Clause D2 “Mechanical Installations for Access” to upper floors where: (i) *building*s are four or more storeys high, (ii) *building*s are three storeys high and have a total design occupancy of 50 or more persons on the two upper floors, (iii) *building*s are two storeys high and have a total design occupancy of 40 or more persons on the upper floor, or (iv) an upper floor, irrespective of design occupancy, is to be used for the purposes of public reception areas of banks, central, regional and local government offices and facilities, hospitals, medical and dental surgeries and medical, paramedical and other primary health care centres, (d) Contain no thresholds or upstands forming a barrier to an unaided wheelchair user, (e) Have means to prevent the wheel of a wheelchair dropping over the side of the *accessible route*, (f) Have doors and related hardware which are easily used, (g) Not include spiral stairs, or stairs having open risers, (h) Have stair treads with leading edge which is rounded, and (i) Have *handrails* on both sides of the *accessible route* when the slope of the route exceeds 1 in 20. The *handrails* shall be continuous along both sides of the stair, ramp and landing except where the *handrail* is interrupted by a doorway.	

CLAUSE D1—ACCESS ROUTES (continued)

Provisions	Limits on application
D1.3.5 Vehicle spaces and circulation routes shall have: (a) Dimensions appropriate to the *intended use*, (b) Appropriate crossfall, and slope in the direction of travel, (c) *Adequate* queuing and circulation space, and (d) *Adequate* sight distances.	
D1.3.6 Vehicle spaces for use by *people with disabilities*, shall, in addition to the requirements of Clause D1.3.5, be: (a) Provided in sufficient numbers, (b) Located to avoid conflict between vehicles and people using or moving to or from the space, and (c) Easy to find as required by Clause F8 Signs.	

CLAUSE D2—MECHANICAL INSTALLATIONS FOR ACCESS

Provisions	Limits on application
OBJECTIVE	
D2.1 The objective of this provision is to:	
(a) Safeguard people from injury and loss of amenity while using mechanical installations for movement into, within and out of *building*s,	
(b) Safeguard maintenance personnel from injury while servicing mechanical installations for access, and	
(c) Ensure that *people with disabilities* are able to carry out normal activities and processes within *building*s.	Objective D2.1(c) shall apply only to those *building*s to which [section 47A of the Act] applies.
FUNCTIONAL REQUIREMENT	
D2.2 Mechanical installations for access into, within and out of *building*s shall provide for the safe and easy movement of people, and for the safety of maintenance personnel.	
PERFORMANCE	
D2.3.1 Mechanical installations for access shall:	
(a) Move people safely, and stop and hold as required for the normal use of the installation, for all loads up to and including 25% in excess of the rated load,	
(b) Not produce excessive acceleration or deceleration,	
(c) Be constructed to avoid the likelihood of people falling, tripping, becoming caught, being able to touch or be struck by moving parts, sharp edges or projections, under both normal and reasonably foreseeable abnormal conditions of use,	
(d) Be constructed to prevent collision between components, or between components and the *building*,	
(e) Have a control system that ensures safe abnormal operation in the event of overloading or failure of any single component, and	
(f) Be capable of being isolated for inspection, testing and maintenance.	

Note: Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

The limits on application to clause D2.1(c) were amended consequential on the Health Reforms (Transitional Provisions) Act 1993, as from 29 December 2000, by regulation 4(1) Building Amendment Regulations 2000 (SR 2000/119), by substituting the expression ""section 47A of the Act"" for the expression ""section 25 of the Disabled Persons Community Welfare Act 1975"".

CLAUSE D2—MECHANICAL INSTALLATIONS FOR ACCESS (continued)

Provisions	Limits on application
D2.3.2 Mechanical installations for access shall be provided with:	
(a) *Adequate* control over normal use, to ensure people's safety throughout any operation involving starting, stopping or changing the direction of travel,	
(b) Notification of position, where people are fully enclosed and the installation serves more than two levels,	
(c) *Adequate* lighting and ventilation for both normal and emergency use, and	
(d) Signs as required by Clause F8 "Signs",	
D2.3.3 Mechanical installations for access shall, for emergency purposes, be provided with a means of:	
(a) Calling outside help,	
(b) Releasing people safely,	
(c) Safeguarding people from exposure to *hazardous* situations, and	
(d) Allowing authorised personnel to override the normal running procedure and take exclusive control of the installation.	Performance D2.3.3(d) shall not apply to installations travelling less than 15m vertically.
D2.3.4 Potentially dangerous equipment shall be located in spaces which:	
(a) Are secure from unauthorised entry and contain only equipment associated with the installation,	
(b) Are appropriately sized and suitably guarded to provide *adequate* safe working areas for maintenance personnel,	
(c) Are provided with *adequate* power and lighting for maintenance, and	
(d) Have an environment that ensures the safe operation of the equipment under all likely conditions of use.	

CLAUSE D2—MECHANICAL INSTALLATIONS FOR ACCESS (continued)

Provisions	Limits on application
D2.3.5 Mechanical installations on *accessible routes* shall: (a) Where the passenger conveyor is manually controlled, provide: (i) controls which are easily identifiable and easy to use, (ii) *adequate* notification that the passenger conveyor has registered a summoning call, and (iii) *adequate* notification that the passenger conveyor has arrived, and of its future direction of travel, (b) Where the passenger conveyor is fully enclosed and serves more than two levels, provide an *adequate* means of informing occupants of their location, (c) Where appropriate, have doors which: (i) are power operated, (ii) are readily distinguishable from their surroundings, and (iii) where automatic, remain open sufficiently long to enable *people with disabilities* to pass through, and (d) Have *handrails* within the passenger conveyor.	

E Moisture

CLAUSE E1—SURFACE WATER

Provisions	Limits on application
OBJECTIVE	
E1.1 The objective of this provision is to:	
(a) Safeguard people from injury or illness, and *other property* from damage, caused by *surface water*, and	
(b) Protect the *outfalls* of drainage systems.	
FUNCTIONAL REQUIREMENT	
E1.2 *Building*s and *sitework* shall be constructed in a way that protects people and *other property* from the adverse effects of *surface water*.	
PERFORMANCE	
E1.3.1 [Except as otherwise required under the Resource Management Act 1991 for the protection of other property, *surface water*], resulting from [an event] having a 10% probability of occurring annually and which is collected or concentrated by *building*s or *sitework*, shall be disposed of in a way that avoids the likelihood of damage or nuisance to *other property*.	
E1.3.2 *Surface water*, resulting from [an event] having a 2% probability of occurring annually, shall not enter *building*s.	Performance E1.3.2 shall apply only to *Housing*, *Communal Residential* and *Communal Non-residential building*s.
E1.3.3 Drainage systems for the disposal of *surface water* shall be constructed to:	
(a) Convey *surface water* to an appropriate *outfall* using gravity flow where possible,	
(b) Avoid the likelihood of blockages,	
(c) Avoid the likelihood of leakage, penetration by roots, or the entry of ground water where pipes or lined channels are used,	
(d) Provide reasonable access for maintenance and clearing blockages,	
(e) Avoid the likelihood of damage to any *outfall*, in a manner acceptable to the *network utility operator*, and	
(f) Avoid the likelihood of damage from superimposed loads or normal ground movements.	

Clause E1.3.1 was amended, as from 22 December 1994, by regulation 3(2)(e) and (f) Building Regulations 1992, Amendment No 1 (SR 1994/263) by substituting the words ““Except as otherwise required under the Resource Management Act 1991 for the protection of other property, surface water”” for the words ““Surface water””.

Clause E1.3.1 was amended, as from 3 January 2002, by regulation 3(7) Building Amendment Regulations 2001 (SR 2001/374), by substituting the words ““an event”” for the words ““a storm””.

Clause E1.3.2 was amended, as from 3 January 2002, by regulation 3(8) Building Amendment Regulations 2001 (SR 2001/374), by substituting the words ““an event”” for the words ““a storm””.

[CLAUSE E2—EXTERNAL MOISTURE

Provisions	Limits on application
OBJECTIVE	
E2.1 The objective of this provision is to safeguard people from illness or injury that could result from external moisture entering the *building*.	
FUNCTIONAL REQUIREMENT	
E2.2 *Building*s must be constructed to provide adequate resistance to penetration by, and the accumulation of, moisture from the outside.	Requirement E2.2 does not apply to *building*s (for example, certain bus shelters, and certain *building*s used for horticulture or for equipment for washing motor vehicles automatically) if moisture from the outside penetrating them, or accumulating within them, or both, is unlikely to impair significantly all or any of their *amenity*, durability, and stability.
PERFORMANCE	
E2.3.1 Roofs must shed precipitated moisture. In locations subject to snowfalls, roofs must also shed melted snow.	
E2.3.2 Roofs and exterior walls must prevent the penetration of water that could cause undue dampness, damage to *building elements*, or both.	
E2.3.3 Walls, floors, and structural elements in contact with, or in close proximity to, the ground must not absorb or transmit moisture in quantities that could cause undue dampness, damage to *building elements*, or both.	
E2.3.4 *Building elements* susceptible to damage must be protected from the adverse effects of moisture entering the space below suspended floors.	
E2.3.5 *Concealed spaces* and cavities in *building*s must be constructed in a way that prevents external moisture being accumulated or transferred and causing condensation, fungal growth, or the degradation of *building elements*.	
E2.3.6 Excess moisture present at the completion of *construction* must be capable of being dissipated without permanent damage to *building elements*.	

Clause E2 was substituted, as from 21 June 2007, by regulation 4 Building Amendment Regulations 2007 (SR 2007/124).

[CLAUSE E2—EXTERNAL MOISTURE (continued)

Provisions	Limits on application
E2.3.7 *Building elements* must be constructed in a way that makes due allowance for the following: (a) the consequences of failure: (b) the effects of uncertainties resulting from *construction* or from the sequence in which different aspects of *construction* occur: (c) variation in the properties of materials and in the characteristics of the site.	

[CLAUSE E3—INTERNAL MOISTURE

Provisions	Limits on application
OBJECTIVE	
E3.1 The objective of this provision is to—	
(a) Safeguard people against illness, injury, or loss of *amenity* that could result from accumulation of internal moisture; and	
(b) Protect *household units* and other property from damage caused by free water from another *household unit* in the same *building*.	
FUNCTIONAL REQUIREMENT	
E3.2 *Buildings* must be constructed to avoid the likelihood of—	
(a) Fungal growth or the accumulation of contaminants on linings and other building elements; and	
(b) Free water overflow penetrat- ing to an adjoining *household unit*; and	
(c) Damage to *building elements* caused by the presence of moisture.	
PERFORMANCE	
E3.3.1 An *adequate* combination of *thermal resistance*, ventilation, and space temperature must be provided to all *habitable spaces*, bathrooms, laundries, and other spaces where moisture may be generated or may accumulate.	Performance E3.3.1 does not apply to *Communal Non-residential*, *Commercial*, *Industrial*, *Outbuildings*, or *Ancillary buildings*.
E3.3.2 *Freewater* from accidental overflow from *sanitary fixtures* or *sanitary appliances* must be disposed of in a way that avoids loss of *amenity* or damage to household units or *other property*.	
E3.3.3 Floor surfaces of any space containing *sanitary fixtures* or *sanitary appliances* must be *impervious* and easily cleaned.	
E3.3.4 Wall surfaces adjacent to *sanitary fixtures* or *sanitary appliances* must be *impervious* and easily cleaned.	
E3.3.5 Surfaces of *building elements* likely to be splashed or become contaminated in the course of the *intended use* of the *building*, must be *impervious* and easily cleaned.	
E3.3.6 Surfaces of *building elements* likely to be splashed must be constructed in a way that prevents water splash from penetrating behind linings or into *concealed spaces*.	

Clause E3 was substituted, as from 14 October 2004, by regulation 3 Building Amendment Regulations 2004 (SR 2004/317).

F Safety of Users

CLAUSE F1—HAZARDOUS AGENTS ON SITE

Provisions	Limits on application
OBJECTIVE	
F1.1 The objective of this provision is to safeguard people from injury or illness caused by *hazardous* agents or *contaminants* on a site.	
FUNCTIONAL REQUIREMENT	
F1.2 *Building*s shall be constructed to avoid the likelihood of people within the *building* being adversely affected by *hazardous* agents or *contaminants* on the site.	
PERFORMANCE	
F1.3.1 Sites shall be assessed to determine the presence and potential threat of any *hazardous* agents or *contaminants*.	
F1.3.2 The likely effect of any *hazardous* agent or *contaminant* on people shall be determined taking account of:	
(a) The *intended use* of the *building*,	
(b) The nature, potency or toxicity of the *hazardous* agent or *contaminant*, and,	
(c) The protection afforded by the *building* envelope and *building* systems.	

CLAUSE F2—HAZARDOUS BUILDING MATERIALS

Provisions	Limits on application
OBJECTIVE	
F2.1 The objective of this provision is to safeguard people from injury and illness caused by exposure to *hazardous building* materials.	
FUNCTIONAL REQUIREMENT	
F2.2 *Building* materials which are potentially *hazardous*, shall be used in ways that avoid undue risk to people.	
PERFORMANCE	
F2.3.1 The quantities of gas, liquid, radiation or solid particles emitted by materials used in the *construction* of *building*s, shall not give rise to harmful concentrations at the surface of the material where the material is exposed, or in the atmosphere of any space.	
F2.3.2 Transparent panels capable of being mistaken for an unimpeded path of travel shall be marked to make them visible.	Performance F2.3.2 does not apply to *Housing*
F2.3.3 Glass or other brittle materials with which people are likely to come into contact shall: (a) If broken on impact, break in a way which is unlikely to cause injury, or (b) Resist a reasonably foreseeable impact without breaking, or (c) Be protected from impact.	

CLAUSE F3—HAZARDOUS SUBSTANCES AND PROCESSES

Provisions	Limits on application

OBJECTIVE

F3.1 The objective of this provision is to safeguard people from injury or illness, and *other property* from damage, caused by *hazardous substances* or processes in *building*s.

FUNCTIONAL REQUIREMENT

F3.2 *Building*s where *hazardous substances* are stored and hazardous processes undertaken, shall be constructed to provide *adequate* protection to people and to *other property*.

PERFORMANCE

F3.3 Spaces in *building*s where *hazardous substances* are stored, handled or used, or where hazardous processes are undertaken, shall be located and constructed to protect people, and *other property*, under both normal and reasonably foreseeable abnormal conditions, and shall be provided with:

(a) Means of restricting unauthorised access,

(b) Means of preventing *hazardous substances*, or other materials unacceptable to the *network utility operator*, from entering *sewers* or public *drains*,

(c) Means of allowing the harmless release of pressure where there is a significant risk of explosion occurring,

(d) Protected ignition sources where flammable or explosive goods are stored,

(e) Means of rendering harmless by ventilation, containment, dilution, or chemical or biological action, any radioactive, toxic or flammable vapours, gases or materials which may escape from pipes, vessels or containers,

(f) Impervious, easily cleaned surface finishes on *building elements* likely to be splashed or become contaminated in the course of the *intended use* of the *building*, and

(g) Signs as required by Clause F8 “Signs”.

CLAUSE F4—SAFETY FROM FALLING

Provisions	Limits on application
OBJECTIVE	
F4.1 The objective of this provision is to safeguard people from injury caused by falling.	
FUNCTIONAL REQUIREMENT	
F4.2 *Building*s shall be constructed to reduce the likelihood of accidental fall.	
PERFORMANCE	
F4.3.1 Where people could fall 1 metre or more from an opening in the external envelope or floor of a *building*, or from a sudden change of level within or associated with a *building*, a barrier shall be provided.	Performance F4.3.1 shall not apply where such a barrier would be incompatible with the *intended use* of an area, or to temporary barriers on *construction* sites where the possible fall is less than 3 metres [, or to *building*s providing pedestrian access in remote locations where the route served presents similar natural hazards].
F4.3.2 Roofs with permanent access shall have barriers provided.	
F4.3.3 Swimming pools having a depth of water exceeding 400mm, shall [have barriers provided].	Performance F4.3.3 shall not apply to any pool exempted under section 5 of the Fencing of Swimming Pools Act 1987.
F4.3.4 Barriers shall:	
(a) Be continuous and extend for the full extent of the hazard,	
(b) Be of appropriate height,	
(c) Be constructed with *adequate* rigidity,	
(d) Be of *adequate* strength to withstand the foreseeable impact of people and, where appropriate, the static pressure of people pressing against them,	
(e) Be constructed to prevent people from falling through them, and	
[(f) In the case of a swimming pool, restrict the access of children under 6 years of age to the pool or the immediate pool area.]	[Performance F4.3.4(f) shall not apply to any pool exempted under section 5 of the Fencing of Swimming Pools Act 1987.]
[(g) Restrict the passage of children under 6 years of age when provided to guard a change of level in areas likely to be frequented by them.]	

Clause F4.3.1 was amended, as from 3 January 2002, by regulation 3(9) Building Amendment Regulations 2001 (SR 2001/374), by adding, to the entry adjacent to clause F4.3.1 in the column headed ""Limits on application"", the words "", or to buildings providing pedestrian access in remote locations where the route served presents similar natural hazards"".

Clause F4.3.3 was amended, as from 22 December 1994, by regulation 5(1) Buildings Regulations 1992, Amendment No 1 (SR 1994/263) by substituting the words ""have barriers provided"" for the words ""be constructed with a barrier to restrict access to the pool or the immediate pool area, by children under 6 years of age"".

Clause F4.3.4 was amended, as from 22 December 1994, by regulation 5(2) Buildings Regulations 1992, Amendment No 1 (SR 1994/263) by substituting para (f), inserting the text opposite para (f), and inserting para (g).

Clause F4.3.4(h) was inserted, as from 21 June 2007, by regulation 5 Building Amendment Regulations 2007 (SR 2007/124).

CLAUSE F4—SAFETY FROM FALLING (continued)

Provisions	Limits on application
[(h) Be constructed so that they are not readily able to be used as seats.]	[Performance F4.3.4(h) does not apply to *Housing*.]
F4.3.5 Barriers to swimming pools shall have in addition to performance F4.3.4:	
[(a) All gates and doors fitted with latching devices not readily operated by children, and constructed to automatically close and latch when released from any stationary position 150mm or more from the closed and secured position, but excluding sliding and sliding-folding doors that give access to the immediate pool surround from a *building* that forms part of the barrier, and]	
(b) No permanent objects on the outside of the barrier that could provide a climbing step.	

Clause F4.3.5 was amended, as from 22 December 1994, by regulation 5(3) Buildings Regulations 1992, Amendment No 1 (SR 1994/263) by substituting para (a).

CLAUSE F5—CONSTRUCTION AND DEMOLITION HAZARDS

Provisions	Limits on application

OBJECTIVE

F5.1 The objective of this provision is to safeguard people from injury, and *other property* from damage, caused by *construction* or demolition site hazards.

FUNCTIONAL REQUIREMENT

[F5.2] *Construction* and demolition work on buildings shall be performed in a manner that avoids the likelihood of:

(a) Objects falling onto people on or off the site,

(b) Objects falling on property off the site,

(c) Other hazards arising on the site affecting people off the site and *other property*, and

(d) Unauthorised entry of children to hazards on the site.

PERFORMANCE

F5.3.1 Suitable *construction* methods shall be used to avoid the likelihood of tools or materials falling onto places where people might be present.

F5.3.2 Where *construction* or demolition work presents a hazard in places to which the public has access, barriers shall be provided and shall:

(a) Be of appropriate height and *construction* to prevent site hazards from harming traffic or passersby,

(b) Be difficult to climb,

(c) Have no opening other than those approved by the *territorial authority* for access and viewing,

(d) Have no gates or doors which project beyond the site when opened,

(e) Contain no projection that would be a hazard to traffic or people, and

(f) Be clearly marked where the barrier itself may otherwise present a hazard to traffic or passersby.

Clause F5 was amended, as from 22 December 1994, by regulation 6 Buildings Regulations 1992, Amendment No 1 (SR 1994/263) by substituting the expression ““F5.2”” for the expression ““F5”” immediately under the heading ““FUNCTIONAL REQUIREMENT””.

CLAUSE F5—CONSTRUCTION AND DEMOLITION HAZARDS (continued)

Provisions	Limits on application
F5.3.3 Where a *construction* or demolition site contains any hazard which might be expected to attract the unauthorised entry of children, the hazard shall be enclosed to restrict access by children.	
F5.3.4 Suitable barriers shall be constructed to provide a safe route for people where lifting equipment creates a risk of accident from objects falling on a place of public access, or where a similar risk results from the height at which *construction* or demolition work is being carried out.	

[CLAUSE F6—VISIBILITY IN ESCAPE ROUTES

Provisions	Limits on application
OBJECTIVE	
F6.1 The objective of this provision is to help safeguard people from injury in *escape routes* during failure of the main lighting.	
FUNCTIONAL REQUIREMENT	
F6.2 *Specified features* in *escape routes* must be made *reasonably visible* by lighting systems, other systems, or both, during failure of the main lighting.	Requirement F6.2 does not apply to *Detached Dwellings*, *household units* within *Multi-unit Dwellings*, *Outbuildings*, [[*backcountry huts*,]] or *Ancillary buildings*.
PERFORMANCE	
F6.3.1 *Specified features* in *escape routes* must, when the systems for visibility are at their design level, be *reasonably visible*.	Performance F6.3.1 does not apply to *specified features* in the initial 20 metres of an *escape route* if the risk of injury, or impediment to movement of people, due to the *specified features* not being visible is low (for example, because people are familiar with the *escape route*, the *escape route* is level, and people do not require assistance to escape).
F6.3.2 The systems for visibility must operate to the following percentages of their design levels within the following times after failure of the main lighting: (a) 80% in 0.5 seconds in locations (examples of which are given by performance F6.3.3) where there is a high risk of injury due to delay in operation of the systems for visibility; and (b) 10% in 0.5 seconds, and 80% in 30 seconds, in stairs and in locations that are unfamiliar to users; and (c) 10% in 20 seconds, and 80% in 60 seconds, in all other locations.	

Schedule 1 clause F6.2: amended, on 31 October 2008, by regulation 8 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Clause F6.2 was amended, as from 22 December 1994, by regulation 7(1) Buildings Regulations 1992, Amendment No 1 (SR 1994/263) by substituting the word ““Ancillary”” for the word ““Ancilliary””.

Clause F6.3.1 was amended, as from 22 December 1994, by regulation 7(2) Buildings Regulations 1992, Amendment No 1 (SR 1994/263) by inserting the words ““or 30 minutes, whichever is the greater””.

Clause F6 was substituted, as from 21 June 2007, by regulation 6(1) Building Amendment Regulations 2007 (SR 2007/124).

[CLAUSE F6—VISIBILITY IN ESCAPE ROUTES (continued)

Provisions	Limits on application
F6.3.3 Examples of locations (referred to in performance F6.3.2(a)) where there is a high risk of injury due to delay in operation of the systems for visibility include: (a) areas where dangerous machinery is installed: (b) areas where hazardous processes take place: (c) clinical areas of hospitals: (d) prisons and other *building*s in which people are detained: (e) any part of an *escape route* designed for use at any time by more than 250 people.	
F6.3.4 The systems for visibility must operate continuously in *building*s or parts of *building*s in the following risk groups for the following periods after failure of the main lighting: (a) *risk group A*, until restoration of the main lighting system: (b) *risk group B*, 90 minutes: (c) *risk group C*, 30 minutes.	
F6.3.5 Despite performance F6.3.4, if a *building* or part of a *building* falls into both *risk group A* and *risk group B*, the systems for visibility must operate for whichever is the longer of the periods specified in performance F6.3.4(a) and (b).	
F6.3.6 Signs to indicate *escape routes* must be provided as required by Clause F8“Signs”.	

CLAUSE F7—WARNING SYSTEMS

Provisions	Limits on application
OBJECTIVE	
F7.1 The objective of this provision is to safeguard people from injury or illness due to lack of awareness of an emergency.	
FUNCTIONAL REQUIREMENT	
F7.2 *Building*s shall be provided with appropriate means of warning people to escape to a *safe place* [in an emergency].	
PERFORMANCE	
F7.3.1 A means of warning must alert people to the emergency in *adequate* time for them to reach a *safe place*.	Performance F7.3 does not apply to *Out-building*s[, *backcountry huts*,] or *Ancillary buildings*.
F7.3.2 Appropriate means of detection and warning for *fire* must be provided within each *household unit*.	
F7.3.3 Appropriate means of warning for *fire* and other emergencies must be provided in *building*s as necessary to satisfy the other performance requirements of this code.	

Clause F7.2 was amended, as from 24 April 2003, by regulation 3(1) Buildings Amendment Regulations (SR 2003/61) by adding the words ““in an emergency””.

Clause F7.3 was amended, as from 22 December 1994, by regulation 8 Buildings Regulations 1992, Amendment No 1 (SR 1994/263) by substituting the word ““Ancillary”” for the word ““Ancilliary””.

Clause F7.3 was substituted, as from 24 April 2003, by regulation 3(2) Buildings Amendment Regulations (SR 2003/61).

Schedule 1 clause F7.3.1: amended, on 31 October 2008, by regulation 9 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

[CLAUSE F8—SIGNS

Provisions	Limits on application
OBJECTIVE	
F8.1 The objective of this provision is to:	
(a) safeguard people from injury or illness resulting from inadequate identification of *escape routes*, or of hazards within or about the *building*,	
(b) safeguard people from loss of *amenity* due to inadequate direction, and	
(c) ensure that *people with disabilities* are able to carry out normal activities and processes within *building*s.	Objective F8.1(c) applies only to those *building*s to which section 118 of the Building Act 2004 applies.
FUNCTIONAL REQUIREMENT	
F8.2 Signs must be provided in and about *building*s to identify:	Requirement F8.2 does not apply to *detached dwellings*, or within *household units* in *multi-unit dwellings*.
(a) *escape routes*,	
(b) emergency related safety features,	
(c) potential hazards, and	
(d) *accessible routes* and facilities for *people with disabilities*.	
PERFORMANCE	
F8.3.1 Signs must be *clearly visible* and readily understandable under all conditions of foreseeable use, including emergency conditions.	
F8.3.2 Signs identifying potential hazards must be provided and located so that people encounter the signs before encountering the potential hazard	
F8.3.3 Signs to facilitate escape to a *place of safety* must be provided and	
(a) be located to to identify the *escape routes*, and	
(b) continue to meet the performance requirements in clause F8.3.1 during failure of the main lighting for the period required by performance F6.3.4 and performance F6.3.5.	
F8.3.4 Signs must be provided and located to identify *accessible routes* and facilities provided for *people with disabilities*.	
F8.3.4 *Accessible routes* must be identified with the International Symbol of Access.	

Schedule 1 clause F8: replaced, on 10 April 2012, by regulation 7 of the Building (Building Code: Fire Safety and Signs) Amendment Regulations 2012 (SR 2012/33).

G Services and Facilities

CLAUSE G1—PERSONAL HYGIENE

Provisions	Limits on application
OBJECTIVE	
G1.1 The objective of this provision is to:	
(a) Safeguard people from illness caused by infection or contamination,	
(b) Safeguard people from loss of *amenity* arising from the absence of appropriate personal hygiene facilities, and	
(c) Ensure *people with disabilities* are able to carry out normal activities and processes within *building*s.	Objective G1.1(c) shall apply only to those *building*s to which [section 47A of the Act] applies.
FUNCTIONAL REQUIREMENT	
G1.2 *Building*s shall be provided with appropriate spaces and facilities for personal hygiene.	
PERFORMANCE	
G1.3.1 *Sanitary fixtures* shall be provided in sufficient number and be appropriate for the people who are intended to use them.	
G1.3.2 *Sanitary fixtures* shall be located, constructed and installed to:	
(a) Facilitate *sanitation*,	
(b) Avoid risk of food contamination,	
(c) Avoid harbouring dirt or germs,	
(d) Provide appropriate privacy,	
(e) Avoid affecting occupants of adjacent spaces from the presence of unpleasant odours, accumulation of offensive matter, or other source of annoyance,	
(f) Allow effective cleaning,	
(g) Discharge to a plumbing and drainage system as required by clause G13 "Foul water" when water-borne disposal is used, and	
(h) Provide a healthy safe disposal system when non-water-borne disposal is used.	
G1.3.3 Facilities for personal hygiene shall be provided in convenient locations.	
G1.3.4 Personal hygiene facilities provided for *people with disabilities* shall be *accessible*.	Performance G1.3.4 shall not apply to *Housing*, *Outbuildings*, [*backcountry huts*,] *Ancillary buildings*, and to *Industrial buildings* where no more than 10 people are employed.

Note: Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

The limits on application to clause G1.1(c) were amended consequential on the Health Reforms (Transitional Provisions) Act 1993, as from 29 December 2000, by regulation 4(1) Building Amendment Regulations 2000 (SR 2000/119), by substituting the expression ""section 47A of the Act"" for the expression ""section 25 of the Disabled Persons Community Welfare Act 1975"".

Schedule 1 clause G1.3.4: amended, on 31 October 2008, by regulation 10 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

CLAUSE G2—LAUNDERING

Provisions	Limits on application
OBJECTIVE	
G2.1 The objective of this provision is to ensure:	
(a) *Adequate amenities* for people to do laundering, and	
(b) That *people with disabilities* are able to carry out normal activities and processes within *building*s.	Objective G2.1(b) shall apply to those *building*s to which [section 47A of the Act] applies.
FUNCTIONAL REQUIREMENT	
G2.2 *Building*s shall be provided with *adequate* space and facilities for laundering.	Requirement G2.2 shall apply only to *Housing*, old people's homes, early childhood centres, camping grounds and work camps.
PERFORMANCE	
G2.3.1 Facilities shall have capacity for the *intended use*, and consist of *fixtures*, or space and services for appliances.	
G2.3.2 Space shall be *adequate* in size to provide for the installation and use of *fixtures* or appliances.	
G2.3.3 Space and facilities shall be provided within each accommodation unit or may be grouped elsewhere in a convenient location.	
G2.3.4 *Accessible* facilities shall be provided for *people with disabilities*.	Performance G2.3.4 shall apply only to camping grounds.

Note: Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

The limits on application to clause G2.1(b) were amended consequential on the Health Reforms (Transitional Provisions) Act 1993, as from 29 December 2000, by regulation 4(1) Building Amendment Regulations 2000 (SR 2000/119), by substituting the expression ""section 47A of the Act"" for the expression ""section 25 of the Disabled Persons Community Welfare Act 1975"".

CLAUSE G3—FOOD PREPARATION AND PREVENTION OF CONTAMINATION

Provisions	Limits on application
OBJECTIVE	
G3.1 The objective of this provision is to:	
(a) Safeguard people from illness due to contamination,	
(b) Enable hygienic food preparation without loss of *amenity*, and	
(c) Ensure that *people with disabilities* are able to carry out normal activities and processes within *building*s.	Objective G3.1(c) shall apply only to those *building*s to which [section 47A of the Act] applies.
FUNCTIONAL REQUIREMENT	
G3.2.1 *Building*s shall be provided with space and facilities for the hygienic storage, preparation and cooking of food, that are *adequate* for the *intended use* of the *building*.	Requirement G3.2.1 shall apply to *Housing*, work camps, old people's homes and early childhood centres, and where appropriate shall also apply to *Commercial* and *Industrial buildings* whose intended uses include the manufacture, preparation, packaging or storage of food.
G3.2.2 *Building*s used for the storage, manufacture or processing of food, including animal products, shall be constructed to safeguard the contents from contamination.	
[G3.2.3] *Building*s used for the medical treatment of humans or animals, or the reception of dead bodies, shall be constructed to avoid the spread of contamination from the *building* contents.	
PERFORMANCE	
G3.3.1 Food preparation facilities shall be hygienic and include:	
(a) Space for a refrigerator, or a perishable food storage area capable of being cooled and protected from vermin and insects,	Performance G3.3.1(a) and (b) shall apply to *Housing*, work camps, old people's homes, early childhood centres and *Commercial* or *Industrial buildings* whose *intended use*s include the handling of perishable food.
(b) Means for food rinsing, utensil washing and waste water disposal,	
(c) Means for cooking food, and	Performance G3.3.1(c) shall apply to *Housing*, work camps, old people's homes and early childhood centres.
(d) Space and a surface for food preparation.	Performance G3.3.1(d) shall apply to *Housing*, work camps, old people's homes and early childhood centres.

Note: Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

Clause G3 was amended, as from 22 December 1994, by regulation 9 Buildings Regulations 1992, Amendment No 1 (SR 1994/263) by substituting the expression ""G3.2.3"" for the expression ""G3.2.2"" where it secondly occurred under the heading ""FUNCTIONAL REQUIREMENT"".

The limits on application to clause G3.1(c) were amended consequential on the Health Reforms (Transitional Provisions) Act 1993, as from 29 December 2000, by regulation 4(1) Building Amendment Regulations 2000 (SR 2000/119), by substituting the expression ""section 47A of the Act"" for the expression ""section 25 of the Disabled Persons Community Welfare Act 1975"".

CLAUSE G3—FOOD PREPARATION AND PREVENTION OF CONTAMINATION (continued)

Provisions	Limits on application
G3.3.2 Spaces for food preparation and utensil washing shall have:	
(a) Interior linings and work surfaces shall be *impervious* and easily cleaned,	
(b) All *building elements* constructed with materials which are free from *hazardous substances* which could cause contamination to the *building* contents, and	Performance G3.3.2(b) shall apply to *Housing*, work camps, old people's homes and early childhood centres, and where appropriate shall also apply to *Commercial* and *Industrial buildings* whose *intended use*s include the manufacture, preparation, packaging or storage of food.
(c) Exposed *building elements* located and shaped to avoid the accumulation of dirt.	Performance G3.3.2(c) shall not apply to *Housing*.
G3.3.3 An *adequate* energy supply shall be provided, appropriately located for use by cooking and refrigeration appliances.	
G3.3.4 Space and facilities shall be provided within each *household unit*, or grouped elsewhere in a convenient location.	
G3.3.5 Where facilities are provided for *people with disabilities* they shall be *accessible*.	Performance G3.3.5 shall apply only to camping grounds and *accessible* accommodation units in *Communal Residential building*s.
G3.3.6 Spaces in *building*s shall be protected from the likelihood of contamination or vermin entering areas used for the storage, processing or preparation of food, and shall have a means of preventing contamination spreading from these areas to other spaces.	Performance G3.3.6 shall apply to *Commercial* or *Industrial buildings* whose *intended use*s include the handling of perishable food, the medical treatment of humans or animals, the slaughter of animals or the reception of dead bodies.

CLAUSE G4—VENTILATION

Provisions	Limits on application
OBJECTIVE	
G4.1 The objective of this provision is to safeguard people from illness or loss of *amenity* due to lack of fresh air.	
FUNCTIONAL REQUIREMENT	
G4.2 Spaces within *building*s shall be provided with *adequate* ventilation consistent with their maximum occupancy [and their intended use].	
PERFORMANCE	
G4.3.1 Spaces within *building*s shall have means of ventilation with *outdoor air* that will provide an *adequate* number of air changes to maintain air purity.	
G4.3.2 Mechanical air-handling systems shall be constructed and maintained in a manner that prevents harmful bacteria, pathogens and allergens from multiplying within them.	
G4.3.3 *Building*s shall have a means of collecting or otherwise removing the following products from the spaces in which they are generated:	
(a) Cooking fumes and odours,	
(b) [Moisture] from laundering, utensil washing, bathing and showering,	
(c) Odours from sanitary and waste storage spaces,	
(d) Gaseous by-products and excessive moisture from commercial or industrial processes,	
(e) Poisonous fumes and gases,	
(f) Flammable fumes and gases,	
(g) Airborne particles,	
(h) Bacteria, viruses or other pathogens, or	
(i) Products of combustion.	
G4.3.4 Contaminated air shall be disposed of in a way which avoids creating a nuisance or hazard to people and *other property*.	
G4.3.5 The quantities of air supplied for ventilation shall meet the additional demands of any fixed *combustion appliances.*	

Clause G4.2 Schedule was amended, as from 11 September 1997, by regulation 3(1) Building Amendment Regulations 1997 (SR 1997/156) by inserting the words ““and their intended use””.

Clause G4.3.3(b) Schedule was amended, as from 11 September 1997, by regulation 3(1) Building Amendment Regulations 1997 (SR 1997/156) by substituting the word ““Moisture”” for the word ““Steam””.

CLAUSE G5—INTERIOR ENVIRONMENT

Provisions	Limits on application
OBJECTIVE	
G5.1 The objective of this provision is to:	
(a) Safeguard people from illness caused by low air temperature,	
(b) Safeguard people from injury or loss of *amenity* caused by inadequate activity space,	
(c) Safeguard people from injury caused by unsafe installations, and	
(d) Ensure that *people with disabilities* are able to carry out normal activities and processes within *building*s.	Objective G5.1(d) shall apply to those *building*s to which [section 47A of the Act] applies.
FUNCTIONAL REQUIREMENT	
G5.2.1 *Building*s shall be constructed to provide:	
(a) An *adequate*, controlled interior temperature,	Requirement G5.2.1(a) shall apply only to *habitable spaces*, bathrooms and recreation rooms in old people's homes and early childhood centres.
(b) *Adequate* activity space for the *intended use*, and	Requirement G5.2.1(b) shall apply only to [*old people's homes]*.
(c) Accessible spaces and facilities.	Requirement G5.2.1(c) shall apply only to *Communal Residential*, *Communal Non-residential*, and *Commercial building*s.
G5.2.2 Heating appliances in *building*s shall be installed in a way that reduces the likelihood of injury.	
PERFORMANCE	
G5.3.1 *Habitable spaces*, bathrooms and recreation rooms shall have provision for maintaining the internal temperature at no less than 16°C measured at 750mm above floor level, while the space is *adequately* ventilated.	Performance G5.3.1 shall apply only to old people's homes an early childhood centres.
G5.3.2 Heating appliances, and any attached cables, pipes or other fittings shall be securely fixed in place.	Performance G5.3.2 shall apply only to old people's homes and early childhood centres.
G5.3.3 *Habitable spaces* shall have sufficient space for activity, furniture, and sanitary and mobility aids.	Performance G5.3.3 shall apply only to old people's homes.
G5.3.4 Where reception counters or desks are provided for public use, at least one counter or desk shall be *accessible*.	Performance G5.3.4 applies only to *Communal Residential, Communal Non-Residential,* and *Commercial building*s.

Note: Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

Clause G5 was amended, as from 22 December 1994, by regulation 10 Buildings Regulations 1992, Amendment No 1 (SR 1994/263) by substituting the expression ““old people's homes”” for the expression ““old people's homes”” in italics in the second column, opposite clause G5.2.1(b)

The limits on application to clause G5.1(d) were amended consequential on the Health Reforms (Transitional Provisions) Act 1993, as from 29 December 2000, by regulation 4(1) Building Amendment Regulations 2000 (SR 2000/119), by substituting the expression ““section 47A of the Act”” for the expression ““section 25 of the Disabled Persons Community Welfare Act 1975””.

CLAUSE G5—INTERIOR ENVIRONMENT (continued)

Provisions	Limits on application
G5.3.5 *Building*s shall be provided with listening systems which enable enhanced hearing by people with hearing aids.	Performance G5.3.5 applies only to: (a) *Communal Non-Residential* assembly spaces occupied by more than 250 people, and (b) Any theatre, cinema, or public hall, and (c) Assembly spaces in old people's homes occupied by more than 20 people.
G5.3.6 Enhanced listening systems shall be identified by signs complying with Clause F8 "Signs".	

CLAUSE G6—AIRBORNE AND IMPACT SOUND

Provisions	Limits on application
OBJECTIVE	
G6.1 The objective of this provision is to safeguard people from illness or loss of *amenity* as a result of undue noise being transmitted between abutting occupancies.	
FUNCTIONAL REQUIREMENT	
G6.2 *Building elements* which are common between occupancies, shall be constructed to prevent undue noise transmission from other occupancies or common spaces, to the *habitable spaces* of *household units*.	
PERFORMANCE	
G6.3.1 The *Sound Transmission Class* of walls, floors and ceilings, shall be no less than 55.	
G6.3.2 The *Impact Insulation Class* of floors shall be no less than 55.	

CLAUSE G7—NATURAL LIGHT

Provisions	Limits on application
OBJECTIVE	
G7.1 The objective of this provision is to safeguard people from illness or loss of *amenity* due to isolation from natural light and the outside environment.	
FUNCTIONAL REQUIREMENT	
G7.2 *Habitable spaces* shall provide *adequate* openings for natural light and for a visual awareness of the outside environment.	Requirement G7.2 shall apply only to *Housing*, old people's homes and early childhood centres.
PERFORMANCE	
G7.3.1 Natural light shall provide an *illuminance* of no less than 30 lux at floor level for 75 percent of the *standard year*.	
G7.3.2 Openings to give awareness of the outside shall be transparent and provided in suitable locations.	

CLAUSE G8—ARTIFICIAL LIGHT

Provisions	Limits on application
OBJECTIVE	
G8.1 The objective of this provision is to safeguard people from injury due to lack of *adequate* lighting.	
FUNCTIONAL REQUIREMENT	
G8.2 Spaces within *building*s used by people, shall be provided with *adequate* artificial lighting which, when activated in the absence of sufficient natural light, will enable safe movement.	Requirement G8.2 shall apply to: (a) All *exitway*s in *Multi-unit Dwellings*, *Group Dwellings* and *Communal Residential* [(except *backcountry huts*)], *Communal Non-residential, Commercial* and *Industrial buildings*, (b) All *access routes* except those in *Outbuildings* [, *backcountry huts*,] and Ancillary buildings, and (c) All common spaces within *Multi-unit Dwellings, Group Dwellings,* and *Communal Residential* [(except *backcountry huts*)] and *Communal Non-residential building*s.
PERFORMANCE	
G8.3 *Illuminance* at floor level shall be no less than 20 lux.	[Performance G8.3 does not apply during a failure of the main lighting, when the requirements in Clause F6 “Visibility in escape routes” apply.]

Schedule 1 clause G8.2 paragraph (a): amended, on 31 October 2008, by regulation 11(1) of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Schedule 1 clause G8.2 paragraph (b): amended, on 31 October 2008, by regulation 11(2) of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Schedule 1 clause G8.2 paragraph (c): amended, on 31 October 2008, by regulation 11(3) of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

Clause G8.3 was amended, as from 21 June 2007, by regulation 6(5) Building Amendment Regulations 2007 (SR 2007/124) by substituting the limit on application.

CLAUSE G9—ELECTRICITY

Provisions	Limits on application
OBJECTIVE	
G9.1 The objective of this provision is to ensure that:	
(a) In *building*s supplied with electricity, the *electrical installation* has safeguards against outbreak of *fire* and personal injury, and	
(b) *People with disabilities* are able to carry out normal activities and processes within *building*s.	Objective G9.1(b) shall apply only to those *building*s to which [section 47A of the Act] applies.

Note: Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

FUNCTIONAL REQUIREMENT

G9.2 Where provided in a *building*, *electrical installation*s shall be safe for their *intended use*.

PERFORMANCE

G9.3.1 The *electrical installation* shall incorporate systems to:

(a) Protect people from contact with parts of the installation which are live during normal operation, and to prevent parts of the installation or other *building elements* becoming live during fault conditions,

(b) Permit the safe isolation of the installation and of electrical fittings and appliances,

(c) Safeguard people from excessive temperatures resulting from either normal operation of electrical equipment, or from currents which could exceed the installation rating,

(d) Safeguard people from injury which may result from electromechanical stress in electrical components caused by currents in excess of the installation rating,

(e) Protect *building elements* from risk of ignition, impairment of their physical or mechanical properties, or function, due to temperature increases resulting from heat transfer or electric arc,

(f) Operate safely in its intended environment, and

(g) Safeguard against ignition of the surrounding atmosphere where it is potentially flammable or explosive.

The limits on application to clause G9.1(b) were amended consequential on the Health Reforms (Transitional Provisions) Act 1993, as from 29 December 2000, by regulation 4(1) Building Amendment Regulations 2000 (SR 2000/119), by substituting the expression ""section 47A of the Act"" for the expression ""section 25 of the Disabled Persons Community Welfare Act 1975"".

CLAUSE G9—ELECTRICITY (continued)

Provisions	Limits on application
G9.3.2 An *electrical installation* supplying an essential service shall: (a) Maintain the supply for a time appropriate to that service, and (b) Be capable of being isolated from the supply system, independently of the remainder of the installation.	
G9.3.3 An *electrical installation* connected to an *electrical supply system*, shall contain safeguards which protect the safety features of the external supply.	
G9.3.4 In *building*s intended for use by *people with disabilities*, light switches and plug socket outlets shall be *accessible* and usable.	Performance G9.3.4 shall not apply to Housing, *Outbuildings*, *Ancillary buildings*, and to *Industrial buildings* where no more than 10 people are employed.

CLAUSE G10—PIPED SERVICES

Provisions	Limits on application
OBJECTIVE	
G10.1 The objective of this provision is to safeguard people from injury or illness caused by extreme temperatures or *hazardous substances* associated with *building* services.	
FUNCTIONAL REQUIREMENT	
G10.2 In *building*s provided with potentially *hazardous* services containing hot, cold, flammable, corrosive or toxic fluids, the installations shall be constructed to provide *adequate* safety for people.	
PERFORMANCE	
G10.3.1 Piping systems shall be constructed to avoid the likelihood of:	
(a) Significant leakage or damage during normal or reasonably foreseeable abnormal conditions,	
(b) Detrimental contamination of the contents by other substances,	
(c) Adverse interaction between services, or between piping and electrical systems, and	
(d) People having contact with pipes which could cause them harm.	
G10.3.2 Provision shall be made for the ready removal of moisture or condensate in gas pipes.	
G10.3.3 Pipes shall be protected against corrosion in the environment of their use.	
G10.3.4 Piping systems shall be identified with markings if the contents are not readily apparent from the location or associated equipment.	
G10.3.5 Enclosed spaces shall be constructed to avoid the likelihood of accumulating vented or leaking gas.	
G10.3.6 Piped systems shall have isolation devices which permit the installation or individual items of apparatus to be isolated from the supply system, for maintenance, testing, fault detection and repair.	

CLAUSE G11—GAS AS AN ENERGY SOURCE

Provisions	Limits on application
OBJECTIVE	
G11.1 The objective of this provision is to:	
(a) Safeguard people from injury arising from the use of gas as an energy source,	
(b) Safeguard people and *other property* from the risk of *fire* or explosion, and	
(c) Safeguard people from loss of *amenity* due to the gas supply being inadequate for the *intended use*.	
FUNCTIONAL REQUIREMENT	
G11.2 In *building*s where gas is used as an energy source, the supply system shall be safe and *adequate* for its *intended use*.	
PERFORMANCE	
G11.3.1 Supply systems shall be constructed to maintain a safe pressure range appropriate to the appliances and the type of gas used.	
G11.3.2 The gas supply to all appliances in a single ventilated space, shall be fitted with an automatic cut-off activated by failure of any continuous forced ventilation system used for combustion, ventilation or safe operation of a fixed gas appliance.	
G11.3.3 A flued fixed gas appliance shall have no adverse interaction with any other flued appliance.	
G11.3.4 Supply systems shall have isolation devices which permit the whole installation, or individual items of apparatus, to be isolated from the supply for maintenance, testing, fault detection or repair.	
G11.3.5 Where gas is supplied from an external source, the supply system within *building*s shall be constructed to avoid the likelihood of:	
(a) Contamination of the external supply from other gas sources within the *building*,	
(b) Adverse effects on the pressure of the external supply, and	
(c) The external supply pipe acting as an earthing conductor.	
G11.3.6 The location and installation of meters and service risers shall meet the requirements of the *network utility operator*.	

[CLAUSE G12—WATER SUPPLIES

Provisions	Limits on application
OBJECTIVE	
G12.1 The objective of this provision is to—	
(a) safeguard people from illness or injury caused by contaminated water:	
(b) safeguard people from injury caused by hot water system explosion, or from contact with excessively hot water:	
(c) safeguard people from loss of *amenity* arising from—	
(i) a lack of hot water for personal hygiene; or	
(ii) water for human consumption that is offensive in appearance, odour, or taste:	
(d) ensure that *people with disabilities* are able to carry out normal activities and functions within *building*s.	Objective G12.1(d) applies only to those *building*s to which section 47A of the Act applies.
FUNCTIONAL REQUIREMENT	
G12.2 *Building*s provided with water outlets, *sanitary fixtures*, or *sanitary appliances* must have safe and *adequate* water supplies.	
PERFORMANCE	
G12.3.1 Water intended for human consumption, food preparation, utensil washing, or oral hygiene must be potable	[[Performance G12.3.1 does not apply to *backcountry huts*.]]
G12.3.2 A potable *water supply system* must be—	
(a) protected from contamination; and	
(b) installed in a manner that avoids the likelihood of contamination within the system and the *water main*; and	
(c) installed using components that will not contaminate the water.	
G12.3.3 A non-potable *water supply system* used for personal hygiene must be installed in a manner that avoids the likelihood of illness or injury being caused by the system.	
G12.3.4 Water pipes and outlets provided with non-potable water must be clearly identified.	

Note: Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

Clause G12 was substituted, as from 3 January 2002, by regulation 3(10) Building Amendment Regulations 2001 (SR 2001/374).

Schedule 1 clause G12.3.1: amended, on 31 October 2008, by regulation 12 of the Building (Building Code: Backcountry Huts) Amendment Regulations 2008 (SR 2008/358).

The limits on application to clause G12.1(d) were amended consequential on the Health Reforms (Transitional Provisions) Act 1993, as from 29 December 2000, by regulation 4(1) Building Amendment Regulations 2000 (SR 2000/119), by substituting the expression ““section 47A of the Act”” for the expression ““section 25 of the Disabled Persons Community Welfare Act 1975””.

CLAUSE G12—WATER SUPPLIES (continued)

Provisions	Limits on application
G12.3.5 *Sanitary fixtures* and *sanitary appliances* must be provided with hot water when intended to be used for—	
(a) utensil washing; and	
(b) personal washing, showering, or bathing	Performance G12.3.5(b) applies to only *housing*, retirement homes, and early childhood centres.
G12.3.6 If hot water is provided to *sanitary fixtures* and *sanitary appliances* used for personal hygiene, it must be delivered at a temperature that avoids the likelihood of scalding.	
G12.3.7 *Water supply systems* must be installed in a manner that—	
(a) pipes water to *sanitary fixtures* and *sanitary appliances* at flow rates that are *adequate* for the correct functioning of those *fixtures* and *appliances* under normal conditions; and	
(b) avoids the likelihood of leakage; and	
(c) allows reasonable access to components likely to need maintenance; and	
(d) allows the system and any backflow prevention devices to be isolated for testing and maintenance.	
G12.3.8 Vessels used for producing or storing hot water must be provided with safety features that—	
(a) relieve excessive pressure during both normal and abnormal conditions; and	
(b) limit temperatures to avoid the likelihood of flash steam production in the event of rupture.	
G12.3.9 A *hot water system* must be capable of being controlled to prevent the growth of legionella bacteria.	
G12.3.10 Water supply taps must be *accessible* and usable for *people with disabilities*.	Performance G12.3.10 applies only to those *building*s to which section 47A of the Act applies.]

Note: Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

Clause G12.3.7 was amended, as from 22 December 1994, by regulation 11 Buildings Regulations 1992, Amendment No 1 (SR 1994/263) by substituting the word ""legionella"" for the word ""legionalla"".

CLAUSE G13—FOUL WATER

Provisions	Limits on application
OBJECTIVE **G13.1** The objective of this provision is to: (a) Safeguard people from illness due to infection or contamination resulting from personal hygiene activities, and (b) Safeguard people from loss of *amenity* due to the presence of unpleasant odours or the accumulation of offensive matter resulting from *foul water* disposal. **FUNCTIONAL REQUIREMENT** **[G13.2** *Building*s in which *sanitary fixtures* and *sanitary appliances* using water-borne waste disposal are installed must be provided with—] [(a) an *adequate* plumbing and drainage system to carry *foul water* to appropriate outfalls; and] [(b) if no *sewer* is available, an adequate system for the storage, treatment, and disposal of *foul water*.] **PERFORMANCE** **G13.3.1** The *plumbing system* shall be constructed to: (a) Convey *foul water* from *building*s to a drainage system, (b) Avoid the likelihood of blockage and leakage, (c) Avoid the likelihood of foul air and gases entering *building*s, and (d) provide reasonable access for maintenance and clearing blockages. **G13.3.2** The drainage system shall: (a) Convey *foul water* to an appropriate *outfall*, (b) Be constructed to avoid the likelihood of blockage, (c) Be supported, jointed and protected in a way that will avoid the likelihood of penetration of roots or the entry of ground water, (d) Be provided with reasonable access for maintenance and clearing blockages,	

Clause G13.2 was substituted, as from 21 June 2007, by regulation 7(1) Building Amendment Regulations 2007 (SR 2007/124).

CLAUSE G13—FOUL WATER (continued)

Provisions	Limits on application
(e) Be ventilated to avoid the likelihood of foul air and gases accumulating in the drainage system and *sewer*, and	
(f) Be constructed to avoid the likelihood of damage from superimposed loads or normal ground movement.	
G13.3.3 Where a *sewer* connection is available, the drainage system shall be connected to the *sewer*, and the connection shall be made in a manner that avoids damage to the *sewer* and is to the approval of the *network utility operator*.	
[G13.3.4 If no *sewer* is available, facilities for the storage, treatment, and disposal of *foul water* must be constructed—]	
[(a) with *adequate* capacity for the volume of *foul water* and the frequency of disposal; and]	
[(b) with *adequate* vehicle access for collection if required; and]	
[(c) to avoid the likelihood of contamination of any potable water supplies in compliance with Clause G12 “Water supplies”; and]	
[(d) to avoid the likelihood of contamination of soils, ground water, and waterways except as permitted under the Resource Management Act 1991; and]	
[(e) from materials that are impervious both to the *foul water* for which disposal is required, and to water; and]	
[(f) to avoid the likelihood of blockage and leakage; and]	
[(g) to avoid the likelihood of foul air and gases accumulating within or entering into *building*s; and]	
[(h) to avoid the likelihood of unauthorised access by people; and]	
[(i) to permit easy cleaning and maintenance; and]	
[(j) to avoid the likelihood of damage from superimposed loads or normal ground movement; and]	
[(k) if those facilities are buried underground, to resist hydrostatic uplift pressures.]	

Clause G13.3.4 was substituted, as from 21 June 2007, by regulation 7(2) Building Amendment Regulations 2007 (SR 2007/124).

CLAUSE G14—INDUSTRIAL LIQUID WASTE

Provisions	Limits on application
OBJECTIVE	
G14.1 The objective of this provision is to safeguard people from injury or illness caused by infection or contamination resulting from industrial liquid waste.	
FUNCTIONAL REQUIREMENT	
G14.2 *Building*s, in which industrial liquid waste is generated shall be provided with *adequate* spaces and facilities for the safe and hygienic collection, holding, treatment and disposal of the waste.	
PERFORMANCE	
G14.3.1 Industrial liquid waste shall be conveyed to storage containers and within disposal systems in a way which will:	
(a) Transfer wastes from *building*s safely and hygienically,	
(b) Avoid the likelihood of blockage and leakage,	
(c) Avoid the likelihood of foul air and gases entering *building*s, and	
(d) Provide reasonable access for clearing of blockages.	
[G14.3.2 Facilities for the storage, treatment, and disposal of industrial liquid waste must be constructed—]	
[(a) with adequate capacity for the volume of waste and the frequency of disposal; and]	
[(b) with *adequate* vehicle access for collection if required; and]	
[(c) to avoid the likelihood of contamination of any potable water supplies in compliance with Clause G12 "Water supplies"; and]	
[(d) to avoid the likelihood of contamination of soils, ground water, and waterways except as permitted under the Resource Management Act 1991; and]	
[(e) from materials that are impervious both to the waste for which disposal is required, and to water; and]	
[(f) to avoid the likelihood of blockage and leakage; and]	

Clause G14.3.2. (d) was amended, as from 22 December 1994, by regulation 12 Building Regulations 1992, Amendment No 1 (SR 1994/263) by omitting the words ""by a resource consent given"".

Clause G14.3.2 was substituted, as from 21 June 2007, by regulation 8 Building Amendment Regulations 2007 (SR 2007/124).

CLAUSE G14—INDUSTRIAL LIQUID WASTE (continued)

Provisions	Limits on application
[(g) to avoid the likelihood of foul air and gases accumulating within or entering into *building*s; and] [(h) to avoid the likelihood of unauthorised access by people; and] [(i) to permit easy cleaning and maintenance; and] [(j) to avoid the likelihood of damage from superimposed loads or normal ground movement; and] [(k) if those facilities are buried underground, to resist hydrostatic uplift pressures.]	

CLAUSE G15—SOLID WASTE

Provisions	Limits on application
OBJECTIVE	
G15.1 The objective of this provision is to safeguard people from injury or illness caused by infection or contamination from solid waste.	
FUNCTIONAL REQUIREMENT	
G15.2 *Building*s shall be provided with space and facilities for the collection, and safe hygienic holding prior to disposal, of solid waste arising from the *intended use* of the *building*s.	Requirement G15.2 shall not apply to *Detached Dwellings*, *household units* of *Multi-unit Dwellings*, *Outbuildings* or *Ancilliary building*s if there is independent access or private open space at ground level.
PERFORMANCE	
G15.3.1 Where provision is made within *building*s for the collection and temporary holding of solid waste, the spaces provided shall be: (a) Of sufficient size for the volume of waste and frequency of disposal, (b) Provided with reasonable access for the depositing and collection of the waste, (c) Capable of maintaining sanitary conditions having regard to the types of waste and storage containers, and (d) Capable of maintaining the appropriate temperature for the type of waste stored.	
G15.3.2 Where a rubbish chute is provided, it shall be located and constructed to: (a) Convey the solid waste to an appropriate storage container, (b) Avoid the likelihood of blockage or leakage, (c) Permit easy cleaning and maintenance, (d) Avoid the likelihood of foul air or gases accumulating or entering the *building*, (e) Avoid the likelihood of the spread of *fire* beyond the refuse chute, (f) Have openings that allow waste to be [safely] deposited in the chute, and (g) Restrict access by children, animals and vermin.	
G15.3.3 Where it is acceptable to the *network utility operator*, solid waste which has been suitably treated for disposal to a *sewer* may be discharged via a *foul water drain* complying with Clause G13 "Foul water".	

Clause G15.3.2(f) was amended, as from 22 December 1994, by regulation 13 Buildings Regulations 1992, Amendment No 1 (SR 1994/263) by substituting the word ""safely"" for the word ""safety"".

H Energy Efficiency

[CLAUSE H1—ENERGY EFFICIENCY PROVISIONS

Provisions	Limits on application
OBJECTIVE	
H1.1 The objective of this provision is to facilitate efficient use of energy.	Objective H 1.1 applies only when the energy is sourced from a *network utility operator* or a depletable energy resource.
FUNCTIONAL REQUIREMENT	
H1.2 *Building*s must be *constructed* to achieve an adequate degree of energy efficiency when that energy is used for—	
[[(a) modifying temperature, modifying humidity, providing ventilation, or doing all or any of those things; or]]	[[Requirement H1.2(a) does not apply to *assembly service building*s, *industrial buildings*, *outbuildings*, or *ancillary buildings*.]]
(b) providing hot water to [[and from]] *sanitary fixtures* or *sanitary appliances*, or both; or	
(c) providing artificial lighting	Requirement H1.2(c) applies only to *commercial building*s and *communal non-residential building*s whose floor area is greater than 300 m^2.
PERFORMANCE	
H1.3.1 The *building* envelope enclosing spaces where the temperature or humidity (or both) are modified must be constructed to—	
(a) provide *adequate thermal resistance*; and	
(b) limit uncontrollable airflow.	
H1.3.2 …	
[[H1.3.2A …	
[[H1.3.2B …	
[[[H1.3.2C] …	
[[[H1.3.2D] …	
[[[H1.3.2E *Building*s must be constructed to ensure that their *building performance index* does not exceed 1.55.]	[Performance H1.3.2E applies only to *Housing*.]]]
H1.3.3 Account must be taken of physical conditions likely to affect energy performance of *building*s, including—	
(a) the thermal mass of *building elements*; and	
(b) the building orientation and shape; and	
(c) the airtightness of the *building* envelope; and	

Clause H1 was substituted, as from 29 December 2000, by regulation 5 Building Amendment Regulations 2000 (SR 2000/119).

Schedule 1 clause H1.2(a): substituted, on 1 February 2009, by regulation 5 of the Building (Building Code: Energy Efficiency of Temperature, Humidity, and Ventilation Systems) Amendment Regulations 2008 (SR 2008/97).

Schedule 1 clause H1.2(b): amended, on 1 February 2009, by regulation 4 of the Building (Building Code: Energy Efficiency of Domestic Hot Water Systems) Amendment Regulations 2008 (SR 2009/256).

Schedule 1 clause H1.3.2: revoked, on 31 October 2007, by regulation 5 of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause H1.3.2A: revoked, on 30 June 2008, by regulation 6 of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

CLAUSE H1—ENERGY EFFICIENCY PROVISIONS (continued)

Provisions	Limits on application
(d) the heat gains from services, processes and occupants; and	
(e) the local climate; and	
(f) heat gains from solar radiation.	
[[H1.3.4 Systems for the heating, storage, or distribution of hot water to and from *sanitary fixtures* or *sanitary appliances* must, having regard to the energy source used,—]]	
[[(a) limit the energy lost in the heating process; and]]	
[[(b) be constructed to limit heat losses from storage vessels and from distribution systems; and]]	[[Performance H1.3.4(b) does not apply to individual storage vessels that are greater than 700 litres in capacity.]]
[[(c) be constructed to facilitate the efficient use of hot water.]]	[[Performance H1.3.4(c) applies only to *housing*.]]
H.1.3.5 Artificial lighting fixtures must—	Performance H1.3.5 does not apply to lighting provided solely to meet the requirements of clause F6.
(a) be located and sized to limit energy use, consistent with the *intended use* of space; and	
(b) be fitted with a means to enable light intensities to be reduced, consistent with reduced activity in the space.	
[[H1.3.6 HVAC systems must be located, constructed, and installed to—]]	[[Performance H1.3.6 applies only to *commercial building*s.]]
[[(a) limit energy use, consistent with the *intended use* of space; and]]	
[[(b) enable them to be maintained to ensure their use of energy remains limited, consistent with the *intended use* of space.]]	

Schedule 1 clause H1.3.2B: revoked, on 30 June 2008, by regulation 6 of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause H1.3.2C: revoked, on 30 September 2008, by regulation 7(1) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause H1.3.2C: inserted, on 30 June 2008, by regulation 6 of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause H1.3.2D: revoked, on 30 September 2008, by regulation 7(1) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause H1.3.2D: inserted, on 30 June 2008, by regulation 6 of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause H1.3.2E: inserted, on 30 September 2008, by regulation 7(1) of the Building Amendment Regulations (No 2) 2007 (SR 2007/226).

Schedule 1 clause H1.3.4: substituted, on 1 February 2009, by regulation 5 of the Building (Building Code: Energy Efficiency of Domestic Hot Water Systems) Amendment Regulations 2008 (SR 2009/256).

Schedule 1 clause H1.3.6: added, on 1 February 2009, by regulation 6 of the Building (Building Code: Energy Efficiency of Temperature, Humidity, and Ventilation Systems) Amendment Regulations 2008 (SR 2008/97).

Amend 13 Feb 2014

Publications Referenced in Handbook, Compliance Schedule Handbook, Acceptable Solutions and Verification Methods

For the purposes of New Zealand Building Code compliance, acceptable reference documents include only the quoted edition and specific amendments as listed below.

Dates in brackets indicate that the Standard was reviewed and reissued without change that year.

Acceptable Solutions and Verification Methods in which the particular references are quoted are identified by the relevant Building Code Clause and the number of the Verification Method or Acceptable Solution.

Amend 13 Feb 2014

For example: **B1**/VM1/AS3 indicates that the reference occurs in Verification Method 1, and Acceptable Solution 3 for Clause B1 Structure.

Where references are quoted in the Compliance Schedule Handbook, these are identified by the letters HB and the relevant section. For example: HB/SS 3 indicates that the reference occurs in the content guide for SS 3 in the Compliance Schedule Handbook.

Amend 13 Feb 2014

Places where the reference documents are quoted, are more specifically identified by paragraph or table, in the reference list contained in each Acceptable Solution and Verification Method.

Contents **Page**

Amend 11 Sep 2010

Standards New Zealand

		Where quoted
NZS/BS 21: 1985	Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions) *Amend: 1*	**G10**/AS1, **G14**/VM1

Amend 11 Sep 2010

		Where quoted
NZS/BS 476:-	Fire tests on building materials and structures	
Part 21: 1987	Methods for determination of the fire resistance of loadbearing elements of construction	**C/**AS1-**C/**AS6
Part 22: 1987	Methods for determination of the fire resistance of non-loadbearing elements of construction	**C/**AS1-**C/**AS6
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*	**E1**/AS1
NZS 1170:	Structural Design Actions	**B1**/VM1, **G12**/AS2
Part 5: 2004	Earthquake design actions – New Zealand standard	
AS/NZS 1170:	Structural Design Actions	
Part 0: 2002	General principles *Amends: 1, 2, 3, 4, 5*	**B1**/VM1/AS1/VM4, **C/AS1**, **G12**/AS2
Part 1: 2002	Permanent, imposed and other actions *Amends: 1, 2*	**B1**/VM1/AS1/VM4, **G12**/AS2
Part 2: 2002	Wind Actions *Amends: 1, 2, 3*	**B1**/VM1/AS1/VM4, **G12**/AS2
Part 3: 2003	Snow and ice actions *Amend: 1*	**B1**/VM1/AS1/VM4, **G12**/AS2
AS/NZS 1254: 2010	PVC pipes and fittings for stormwater and surface water applications *Amend: 1 (2011)*	**E1**/AS1
AS/NZS 1260: 2002	PVC pipes and fittings for drain, waste and vent applications	**SH**/AS1
AS/NZS 1260: 2009	PVC-U Pipes and fittings for drain, waste and vent applications *Amend: 1 (2011)*	**E1**/AS1, **G13**/AS1/AS2, **G14**/VM1
NZS/BS 1387: 1985 (1990)	Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or screwing to BS 21 pipe threads *Amend: 1*	**G10**/AS1, **G12**/AS1, **G14**/VM1
AS 1397: 2001	Steel sheet and strip – Hot-dipped zinc-coated or aluminium/zinc-coated	**E1**/AS1
AS/NZS 1477: 2006	PVC pipes and fittings for pressure applications *Amend: 1*	**G12**/AS1, **G14**/VM1

Amend 13 Feb 2014
Amend 13 Feb 2014
Amend 11 Sep 2010
Amend 13 Feb 2014
Amend 13 Feb 2014
Amend 13 Feb 2014
Amend 12 Oct 2011
Amend 13 Feb 2014
Amend 13 Feb 2014
Amend 12 Oct 2011
Amend 13 Feb 2014
Amend 11 Sep 2010

Amendment	Publication	Part	Title	Where quoted
Amend 13 Feb 2014				
Amend 12 Oct 2011	AS/NZS 1546: 2008		On-site domestic wastewater treatment units	**G14**/VM1
		Part 1:	Septic tanks	
Amend 13 Feb 2014	AS/NZS 1547: 2012		On-site domestic wastewater management	**G13**/VM1
	AS/NZS 1604:		Specification for preservative treatment	**SH**/AS1
		Part 3: 2002	Plywood	
	AS/NZS 1646: 2007		Elastomeric seals for waterworks purposes	**G13**/AS2
Amend 11 Sep 2010				
	NZS/AS 1657: 1992		Fixed platforms, walkways, stairways and ladders – Design, construction and installation (known as the SAA Code for fixed platforms, walkways, stairways, and ladders)	**D1**/AS1
	AS/NZS 1664:-		Aluminium structures	
		Part 1: 1997	Limit state design *Amend: 1*	**B1**/VM1
Amend 11 Sep 2010				
	AS/NZS 1668:-		The use of ventilation and air conditioning in buildings	**C/VM1**
		Part 1: 1998	Fire and smoke control in multi-compartment buildings *Amend: 1*	**C/**AS1-**C/**AS6
Amend 13 Feb 2014				
	AS/NZS 1680:		Interior and workplace lighting	**F6**/AS1
Amend 11 Sep 2010		Part 1: 2006	General principles and recommendations	
	AS/NZS 1730: 1996		Washbasins	**G1**/AS1
Amend 12 Oct 2011	AS/NZS 1734: 1997		Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate	**E1**/AS1, **E2**/AS1 **SH**/AS1
	AS/NZS 1748: 1997		Timber – Stress graded – Product requirements for mechanically stress-graded timber	**B1**/VM1
		Part 1: 2011	General requirements *Amend: 1*	**B1**/VM1
Amend 13 Feb 2014		Part 2: 2011	Qualification of grading method *Amend: 1*	**B1**/VM1
	AS/NZS 1859		Reconstituted wood-based panels	**SH**/AS1
Amend 11 Sep 2010		Part 1: 2002	Particleboard	
	AS/NZS 1905:-		Components for the protection of openings in fire-resistant walls	
Amend 12 Oct 2011		Part 1: 1997	Fire-resistant doorsets	**HB**/SS 15
	AS/NZS 2023: 1995		Baths for ablutionary purposes	**G1**/AS1

		Where quoted
Amend 11 Sep 2010 AS/NZS 2032: 2006	Installation of PVC pipe systems *Amend: 1*	**B1**/AS1, **E1**/AS1, **G12**/AS1, **G13**/AS1/AS2/AS3, **G14**/VM1
Amends 11 and 12 NZS/AS 2033: 2008	Installation of polyethylene pipe systems *Amend: 1, 2*	**B1**/AS1, **E1**/AS1, **G12**/AS1, **G13**/AS1/AS2, **G14**/AS1
Amend 11 Sep 2010 Amend 12 Oct 2011 AS/NZS 2243:1 2005	Safety in laboratories – Planning and operational aspects	**HB**/SS 11
AS/NZS 2243:8 2006	Safety in laboratories – Fume cupboards	**HB**/SS 11
AS/NZS 2269: 2004	Plywood – Structural	**SH**/AS1
Amend 12 Oct 2011 AS/NZS 2269: 2008	Plywood – Structural	**E2**/AS1 Modified 1 Aug 2011
Amends 11 and 12 Amend 13 Feb 2014 AS/NZS 2280: 2012	Ductile iron pipes and fittings	**E1**/AS1, **G13**/AS2
AS/NZS 2293:-	Emergency evacuation lighting for buildings	
Amend 11 Sep 2010 Amend 13 Feb 2014 Part 2: 1995	Inspection and maintenance *Amends: 1, 2, 3*	**F6**/AS1, **HB**/SS 4
Amends 11 and12 Amend 12 Oct 2011 NZS 2295: 2006	Pliable, permeable building underlays	**E2**/AS1, **SH**/AS1
AS/NZS 2566: 2002	Buried Flexible pipelines.	
Part 1: 1998	Structural Design	**B1**/AS1, **E1**/AS1
Amend 11 Sep 2010 Part 2: 2002	Installation	**B1**/AS1, **E1**/AS1, **G13**/AS2
AS/NZS 2588: 1998	Gypsum plasterboard	**SH**/AS1
AS/NZS 2642:-	Polybutylene pipe systems	
Amend 12 Oct 2011 Part 1: 2007	Polybutylene (PB) pipe extrusion compounds	**G12**/AS1
Amends 11 and 12 Part 2: 2008	Polybutylene (PB) pipe for hot and cold water applications	**G12**/AS1, **G14**/VM1
Amends 11 and 12 Part 3: 2008	Mechanical jointing fittings for use with polybutylene (PB) pipes for hot and cold water applications *Amend: 1*	**G12**/AS1, **G14**/VM1
Amend 11 Sep 2010 AS/NZS 2699:	Built-in components for masonry construction.	**SH**/AS1
Part 1: 2000	Wall ties	
Part 2: 2000	Connectors and accessories	
Part 3: 2002	Lintels and shelf angles (durability requirements)	
Amend 13 Feb 2014 AS/NZS 2712: 2007	Solar and heat pump water heaters – design and construction *Amend: 1, 2*	**G12**/AS2

			Where quoted
	AS/NZS 2712: 2007	Solar and heat pump water heaters – design and construction	**SH**/AS1
Amend 11 Sep 2010	AS/NZS 2728: 2007	Prefinished/prepainted sheet metal products for interior/exterior building applications – Performance requirements	**SH**/AS1
Amends 12 and 13	AS/NZS 2728: 2013	Prefinished/prepainted sheet metal products for interior/exterior building applications – Performance requirements	**E2**/AS11
	AS/NZS 2845:-	Water supply	
Amend 12 Oct 2011	Part 1: 2010	Materials, design and performance requirements	**G12**/AS1
Amend 13 Feb 2014	AS/NZS 2904: 1995	Damp-proof courses and flashings *Amend: 1*	**E2**/AS1
Amend 11 Sep 2010	AS/NZS 2908:	Cellulose-cement products	
	Part 2: 2000	Flat sheet	**E2**/AS1, **SH**/AS1
Amend 13 Feb 2014	AS/NZS 2918: 2001	Domestic solid fuel burning appliances – installation	**B1**/AS3 **C/**AS1-**C/**AS6 **SH**/AS1
Amend 13 Feb 2014	AS/NZS 3000: 2007	Electrical installations *Amends: 1, 2*	**G9**/VM1/AS1
	NZS 3101:-	Concrete structures standard	
	Part 1: 2006	The design of concrete structures *Amend: 1, 2*	**B2**/AS1 **B1**/VM1
	NZS 3106: 2009	Design of concrete structures for the storage of liquids	**B1**/VM1, **G14**/VM1
Amend 11 Sep 2010	NZS 3109: 1997	Specification for concrete construction *Amend: 1, 2*	**B1**/AS3, **SH**/AS1
	NZS 3112:-	Methods of test for concrete	
Amend 11 Sep 2010	Part 2: 1986	Tests relating to the determination of strength of concrete *Amend: 1, 2*	**B1**/AS3
	NZS 3114: 1987	Specification for concrete surface finishes *Amend: 1*	**D1**/AS1, **G15**/AS1
Amend 12 Oct 2011 Amends 11 and 12	NZS 3116: 2002	Concrete segmental and flagstone paving *Amend: 1*	**D1**/AS1
Amend 13 Feb 2014 Amend 11 Sep 2010	AS/NZS 3350.2.35: 1999	Safety of household and similar electrical appliances – Particular requirements – Instantaneous water heaters *Amends: 1, 2*	**SH**/AS1

		Where quoted
NZS 3404:-	Steel structures standard	
Part 1: 1997	Steel structures standard *Amend: 1, 2*	**B1**/VM1
AS/NZS 3500:-	National plumbing and drainage code	
Part 1: 2003	Water services *Amends: 1, 2*	**G12**/VM1/AS1
Part 2: 2003	Sanitary plumbing and drainage *Amends: 1, 2, 3, 4*	**G13**/AS1/VM2/AS2/ AS3
Part 4: 2003	Heated water services *Amends: 1, 2*	**G12**/VM1/AS1/AS2
Part 5: 2003	Domestic installation	**SH**/AS1
NZS 3501: 1976	Specification for copper tubes for water, gas, and sanitation *Amend: 1, 2 and 3*	**G10**/AS1, **G13**/AS1/AS2 **G12**/AS1
AS/NZS 3518: 2004	Acrylonitrile butadiene styrene (ABS) compounds pipes and fittings for pressure applications *Amend: 1*	**G13**/AS2, **G14**/VM1
NZS/BS 3601: 1987 (1993)	Specification for carbon steel pipes and tubes with specified room temperature properties for pressure purposes *Amend: 1, 2*	**G10**/AS1
NZS 3602:-		
Part 1: 2003	Timber and wood-based products for use in building	**B2**/AS1, **E2**/AS1 **SH**/AS1
NZS 3603: 1993	Timber structures standard *Amend: 1, 2* (Applies to building work consented prior to 1 April 2007)	**B1**/VM1/VM4
	Amend: 1, 2, 4 (Applies to building work consented on or after 1 April 2007)	**SH**/AS1
NZS 3604: 1990	Timber framed buildings	**G12**/AS1
NZS 3604: 1999	Timber framed buildings *Amend: 1, 2*	**G12**/AS2, **SH**/AS1
NZS 3604: 2011	Timber framed buildings	**B1**/AS1/AS3, **B2/**AS1 **E1**/AS1, **E2**/VM1/AS1/ AS2, **G12**/AS2. **G13**/AS2
NZS 3605: 2001	Timber piles and poles for use in building	**B1**/VM4, **SH**/AS1
NZS 3617: 1979	Specification for profiles of weatherboards, fascia boards, and flooring	**E2**/AS1, **SH**/AS1
NZS 3622: 2004	Verification of timber properties *Amend: 1*	**B1**/VM1, **SH**/AS1

Amend 11 Sep 2010
Amend 13 Feb 2014
Amend 13 Feb 2014
Amends 11 and 13
Amend 13 Feb 2014
Amend 11 Sep 2010
Amend 12 Oct 2011
Amend 12 Oct 2011
Amend 11 Sep 2010
Amend 13 Feb 2014
Amends 12 and 13
Amend 13 Feb 2014
Amend 12 Oct 2011
Amend 11 Sep 2010

			Where quoted
	NZS 3631: 1988	New Zealand timber grading rules	**SH**/AS1
Amend 12 Oct 2011	NZS 3640: 2003	Chemical preservation of round and sawn timber *Amend: 1, 2*	**B1**/VM4
Amend 11 Sep 2010	NZS 3640: 2003	Chemical preservation of round and sawn timber *Amend: 4*	**SH**/AS1
Amends 12 and 13	NZS 3640: 2003	Chemical preservation of round and sawn timber *Amend: 1, 2, 3, 4, 5*	**B2**/AS1
	AS/NZS 3661:-	Slip resistance of pedestrian surfaces	
	Part 1: 1993	Requirements	**D1**/VM1/AS1
	Part 2: 1994	Guide to the reduction of slip hazards	**D1**/AS1
Amend 11 Sep 2010			
	AS/NZS 3666:-	Air-handling and water systems of buildings – Microbial Control	
Amend 11 Sep 2010	Part 1: 2011	Design, installation and commissioning	**G4**/AS1
Amend 13 Feb 2014	Part 2: 2011	Operation and maintenance	**G4**/AS1, **HB**/SS 9
Amend 11 Sep 2010	Part 3: 2000	Performance-based maintenance of cooling water systems	**HB**/SS 9
Amend 11 Sep 2010	NZS/AS 3725: 2007	Design for installation of buried concrete pipes	**B1**/VM1
Amend 13 Feb 2014	AS/NZS 3837: 1998	Method of test for heat and smoke release rates for materials and products using an oxygen consumption calorimeter	**C/VM2**
Amend 11 Sep 2010	AS/NZS 3869: 1999	Domestic solid fuel burning appliances – Design and construction	**B1**/AS3
	AS/NZS 3896: 1998	Waters – Examination for legionellae including Legionella pneumophila *Amend: 1*	**HB**/SS 9
Amend 12 Oct 2011			
Amend 11 Sep 2010	AS/NZS 4020: 2005	Testing of products for use in contact with drinking water	**E2**/AS1, **G12**/AS1
	AS/NZS 4058: 2007	Pre cast concrete pipes(pressure and non-pressure)	**B1**/VM1, **E1**/AS1, **G13**/AS2, **G14**/VM1
Amend 11 Sep 2010	NZS 4121: 2001	Design for access and mobility – Buildings and associated facilities	**D1**/AS1, **G1**/AS1, **G5**/AS1, **SH**/AS1
Amends 11 and 12	AS/NZS 4129: 2008	Fillings for polyethylene (PE) pipes for pressure applications	**G12**/AS1, **G14**/VM1
Amends 12 and 13			
Amends 12 and 13	AS/NZS 4130: 2009	Polyethylene (PE) pipe for pressure applications *Amend: 1*	**E1**/AS1, **G12**/AS1, **G13**/AS2, **G14**/VM1
	AS/NZS 4200:	Pliable building membranes and underlays	**SH**/AS1
Amend 11 Sep 2010	Part 1: 1994	Materials *Amend: 1*	

Amend 12 Oct 2011

		Where quoted
NZS 4203: 1992	Code of practice for general structural design and design loadings for buildings *Corrigendum: 1*	**G12**/AS2
NZS 4206: 1992	Concrete interlocking roofing tiles	**E2**/AS1, **SH**/AS1
NZS 4210: 2001	Code of practice for masonry construction: materials and workmanship *Amend: 1*	**B1**/AS3, **SH**/AS1
NZS 4211: 1985	Specification for performance of windows *Amend: 1, 2, 3*	**SH**/AS1
NZS 4211: 2008	Specification for performance of windows	**B1**/VM1, **E2**/VM1/AS1
NZS 4214: 2006	Methods of determining the total thermal resistance of parts of buildings	**E3**/AS1, **G5**/AS1, **H1**/VM1/AS1
NZS 4217:-	Pressed metal tile roofs	
Part 1: 1980	Specification for roofing tiles and their accessories	**E2**/AS1, **SH**/AS1
Part 2: 1980	Code of practice for preparation of the structure and the laying and fixing of metal roofing tiles	**E2**/AS1, **SH**/AS1
NZS 4218: 2004	Energy efficiency – housing and small building envelope	**H1**/VM1/AS1
NZS 4219: 2009	Specification for seismic resistance of engineering systems in buildings	**B1**/VM1, **G10**/AS1 **G14**/VM1
NZS 4223:-	Code of practice for glazing in buildings	
Part 1: 2008	Glass selection and glazing	**B1**/AS1, **SH**/AS1
Part 2: 1985	The selection and installation of manufactured sealed insulating glass units *Amend: 1, 2*	**B1**/AS1, **SH**/AS1
Part 3: 1999	Human impact safety requirements	**B1**/AS1, **D2**/AS3 **F2**/AS1, **SH**/AS1
Part 4: 2008	Wind, dead, snow, and live actions	**B1**/AS1, **SH**/AS1
NZS 4229: 2013	Concrete masonry buildings not requiring specific engineering design	**B1**/AS1/AS3, **E1**/AS1, **G13**/AS2

Amend 11 Sep 2010 · Amend 11 Sep 2010 · Amend 11 Sep 2010 · Amend 12 Oct 2011 · Amend 11 Sep 2010 · Amend 11 Sep 2010 · Amend 11 Sep 2010 · Amends 11, 12, 13 · Amends 12 and 13 · Amend 11 Sep 2010 · Amend 13 Feb 2014 · Amend 11 Sep 2010 · Amend 13 Feb 2014

			Where quoted
Amend 11 Sep 2010	NZS 4230: 2004	Design of reinforced concrete masonry structures *Amend: 1*	**B1**/VM1
	NZS 4231: 1985	Specification for self-luminous exit signs *Amend: A*	**F8/**AS1
Amend 13 Feb 2014	NZS 4232:-	Performance criteria for fire resisting enclosures	**HB**/SS 15
	Part 2: 1988	Fire resisting glazing systems	**C/**AS2-**C**/AS6,
	NZS HB 4236: 2002	Masonary veneer wall cladding	**E2**/AS1
	NZS 4239: 1993	Automatic sliding door assemblies *Amend: A*	**HB**/SS 3
Amend 11 Sep 2010	NZS 4243:	Energy efficiency – large buildings	
	Part 1: 2007	Building thermal envelope	**H1**/VM1/AS1
	Part 2: 2007	Lighting	**H1**/VM1/AS1
	NZS 4246: 2006	Energy efficiency – Installing insulation in residential buildings	**SH**/AS1
	NZS 4251:-	Solid plastering	
Amend 12 Oct 2011	Part 1: 2007	Cement plaster for walls, ceilings and soffits	**B1**/AS1, **B2**/AS1, **E2**/AS1
Amend 11 Sep 2010	AS/NZS 4256:	Plastic roof and wall cladding materials	**E2**/AS1, **SH**/AS1
	Part 2: 1994	Unplasticized polyvinyl chloride (uPVC) building sheets	
Amend 12 Oct 2011	AS/NZS 4284: 2008	Testing of building facades	**E2**/VM1
	NZS 4297: 1998	Engineering design for earth buildings	**B1**/VM1, **B2**/AS1
Amend 11 Sep 2010	NZS 4298: 1998	Materials and workmanship for earth buildings *Amend: 1*	**E2**/AS2
Amend 11 Sep 2010	NZS 4299: 1998	Earth buildings not requiring specific design *Amend: 1*	**B1**/AS1, **B2**/AS1, **E2**/AS2
	NZS 4303: 1990	Ventilation for acceptable indoor air quality	**G4**/AS1
Amend 11 Sep 2010	NZS 4304: 2002	Health care waste management	**G15**/AS1
	NZS 4305: 1996	Energy efficiency – domestic type hot water systems	**H1**/AS1
	AS/NZS 4331: 1995	Metallic flanges	
	Part 1:	Steel flanges	**G10**/AS1, **G14**/VM1
	Part 2:	Cast iron flanges	**G10**/AS1, **G14**/VM1
Amend 11 Sep 2010	Part 3:	Copper alloy and composite flanges	**G14**/VM1
	NZS 4332: 1997	Non-domestic passenger and goods lifts	**C/**AS2-**C/**AS6, **D2**/AS1, **HB**/SS 8
Amend 13 Feb 2014	NZS 4334: 2012	Platform lifts and low-speed lifts	**D2**/AS2
Amend 11 Sep 2010	AS/NZS 4401: 2006	High density polyethylene (PE-HD) pipes and fittings for soil and waste discharge (low and high temperature) systems inside buildings	**G13**/AS1, **G14**/VM1

			Where quoted
	NZS 4402:-	Methods of testing soils for civil engineering purposes	**B1**/VM1
	Part 2:-	Soil classification tests	
Amend 11 Sep 2010	Test 2.2: 1986	Determination of the liquid limit	**B1**/Defs, **SH**/AS1
	Test 2.6: 1986	Determination of the linear shrinkage	**B1**/Defs
	Part 4:-	Soil compaction tests	
	Test 4.2.3: 1988	Related densities	**B1**/VM4
Amend 11 Sep 2010	NZS 4431: 1989	Code of practice for earth fill for residential development *Amend: 1*	**B1**/VM1, **E2**/AS2 **SH**/AS1
	NZS 4442: 1988	Welded steel pipes and fittings for water, sewage and medium pressure gas	**E1**/AS1, **G13**/AS2, **G14**/VM1
	AS/NZS 4455: 1997	Masonry units and segmental pavers	**SH**/AS1
Amend 13 Feb 2014; Amend 11 Sep 2010	AS/NZS 4456: 2003	Masonry unit and segmental pavers – Methods of test *Amend: 1, 2*	**SH**/AS1
Amends 11, 12, 13	NZS 4510: 2008	Fire hydrant systems for buildings	**C/**AS1-**C/**AS7, **C/**VM2, **HB**/SS 6
	NZS 4512: 2010	Fire detection and alarm systems in buildings	**C/**AS1-**C/**AS7, **C/**VM2, **HB**/SS 2, **HB**/SS 15, **F7/**AS1
	NZS 4514: 2009	Interconnected smoke alarms for houses	**C/**AS2, **F7/**AS1
	NZS 4515: 2009	Fire sprinkler systems for life safety in sleeping occupancies (up to 2000 m^2)	**C/**AS1-**C/**AS6, **C/**VM2, **HB**/SS 1, **F7**/AS1
Amends 12 and 13	NZS 4520: 2010	Fire resistant doorsets	**C**/AS1-**C**/AS6
Amend 12 Oct 2011	AS/NZS 4534: 2006	Zinc and zinc/aluminium-alloy coatings on steel wire	**E2**/AS1
Amend 13 Feb 2014	NZS 4541: 2013	Automatic fire sprinkler systems *Amend: 1*	**C/**AS1-**C/**AS6, **C/**VM2, **F7/**AS1, **HB**/SS 1
	AS/NZS 4586: 2004	Slip resistance classification of new pedestrian surface materials	**SH**/AS1
Amend 11 Sep 2010	AS/NZS 4600: 2005	Cold-formed steel structures	**B1**/VM1
	NZS 4602: 1988	Low pressure copper thermal storage electric water heaters *Amend: 1*	**G12**/AS1
Amend 11 Sep 2010	NZS 4603: 1985	Installation of low pressure thermal storage electric water heaters with copper cylinders (open vented systems) *Amend: 1*	**G12**/AS1, **SH**/AS1

Amendment	Standard	Title	Where quoted
	NZS 4606:-	Storage water heaters	
Amend 11 Sep 2010	Part 1: 1989	General requirements *Amend: 1, 2, 3*	**G12**/AS1, **SH**/AS1
Amend 11 Sep 2010	Part 2: 1989	Specific requirements for water heaters with single shells *Amend: A*	**SH**/AS1 **G12**/AS1, **SH**/AS1
Amend 11 Sep 2010	Part 3: 1992	Specific requirements for water heaters with composite shells *Amend: A*	**G12**/AS1
	NZS 4607: 1989	Installation of thermal storage electric water heaters: valve vented systems	**G12**/AS1
	NZS 4608: 1992	Control valves for hot water systems	**G12**/AS1
Amend 11 Sep 2010	NZS 4613: 1986	Domestic solar water heaters	**G12**/AS1/AS2
Amend 13 Feb 2014	NZS 4614: 1986	Installation of domestic solar water heating systems *Amend: 1 (1986) Erratum*	**G12**/AS2
	NZS 4617: 1989	Tempering (3-port mixing) valves	**G12**/AS1
Amend 11 Sep 2010	AS/NZS 4671: 2001	Steel reinforcing materials	**SH**/AS1
Amend 12 Oct 2011	AS/NZS 4671: 2001	Steel Reinforcing Materials *Amend: 1*	**B1**/AS1/AS3
Amend 12 Oct 2011	AS/NZS 4680: 2006	Hot-dip galvanised (zinc) coating on fabricated ferrous articles	**B1**/AS3, **E2**/AS1, **SH**/AS1
	AS/NZS 4692: Part 2: 2005	Electric water heaters Minimum Energy Performance Standards (MEPS) requirements and energy labelling	**G12**/AS2
Amend 11 Sep 2010	AS/NZS 4740: 2000	Natural ventilaters – classification and performance	**G4**/AS1
	AS/NZS 4765: 2007	Modified polyvinyl chloride (PVC-M) pipes for pressure applications	**G14**/VM1
	AS/NZS 4858: 2004	Wet area membranes	**E2**/AS1
	AS/NZS 4859:- Part 1: 2002	Materials for the thermal insulation of buildings General criteria and technical provisions	**H1**/AS1
	AS/NZS 4936: 2002	Air admittance valves for use in sanitary plumbing and drainage systems.	**G13**/AS1, **SH**/AS1
Amend 11 Sep 2010	AS/NZS 5000.1 2005	Electric cables – Polymeric insulated – For working voltages up to and including 0.6/1 (1.2) kV *Amend: 1*	**G12**/AS1
	AS/NZS 5000.2 2006	Electric cables – Polymeric insulated Part 2: For working voltages up to and including 450/750 v.	**G12**/AS1
Amend 12 Oct 2011	AS/NZS 5065: 2005	Polyethylene and polypropylene pipe and fittings for drainage and sewerage applications *Amend: 1*	**E1**/AS1, **G13**/AS2

		Where quoted
NZS/BS 5252: 1976	Framework for colour co-ordination for building purposes *Amend: 1*	**F8/AS1**
NZS 5261: 2003 *Amend: 1, 2*	Gas installation	**SH**/AS1
NZS 5262: 2003	Gas appliance safety *Amend: 1*	**SH**/AS1
AS/NZS 5601:-	Gas installations	
Part 1: 2010	General installations *Amend: 1*	**C/**AS1–**C/**AS6, **G4**/AS1, **G10**/VM1/AS1, **G11**/AS1
NZS 5807:-	Code of practice for industrial identification by colour, wording or other coding	
Part 2: 1980	Identification of contents of piping, conduit and ducts *Amend: 1, 2*	**G10**/AS1 **G12**/AS1
NZS 6214: 1988	Thermostats and thermal cutouts for domestic thermal storage electric water heaters (alternating current only)	**G12**/AS1
NZS 6703: 1984	Code of practice for interior lighting design *Amend C1: 1985*	**G7**/AS1/VM1 **G8**/VM1
NZS 6742: 1971	Code of practice for emergency lighting in buildings	**F8/**AS1, **HB**/SS 4
NZS 7601: 1978	Specification for polyethylene pipe (Type 3) for cold water services	**G12**/AS1, **G14**/VM1
NZS 7602: 1977	Specification for polyethylene pipe (Type 5) for cold water services *Amend: 1*	**G12**/AS1
NZS 7610: 1991	Blue polyethylene pipes up to nominal size 63 for below ground use for potable water *Amend: 1, 2, A*	**G12**/AS1
NZS 7646: 1978	Specification for polyethylene pipes and fittings for gas reticulation	**G10**/AS1
SNZ HB 8630: 2009	Tracks and outdoor visitor structures	**B1**/VM1
AS/NZS 60335	Household and similar electrical appliances	
Part 2.30: 2009	Safety appliance – Particular requirements for room heaters	**SH**/AS1
Part 2.35: 2004	Particular requirements – Instantaneous water heaters	**G12**/AS1
AS/NZS 60598: 2001	Luminaires	
Part 2.2	Particular requirements – Recessed Luminaires	**C/**AS1, **C/**AS2

Amend 13 Feb 2014
Amends 11 and 13
Amend 13 Feb 2014
Amend 12 Oct 2011
Amends 11 and 12
Amend 13 Feb 2014
Amend 11 Sep 2010
Amend 11 Sep 2010
Amend 11 Sep 2010
Amend 11 Sep 2010
Amend 11 Sep 2010
Amend 13 Feb 2014
Amend 13 Feb 2014

Standards Australia

			Where quoted
	AS D26: 1972	Tube fittings with Dryseal American standard taper pipe and unified threads for automotive and industrial use	**G10**/AS1
Amend 12 Oct 2011			
	AS 1111:	ISO metric hexagon bolts and screws – Product grades A and B	**SH**/AS1
	Part 1: 2000	Bolts	
Amend 11 Sep 2010	Part 2: 2000	Screws	
	AS 1167:-	Welding and brazing – Filler metals	
Amend 11 Sep 2010	Part 1: 2005	Filler metal for brazing and braze welding	**G10**/AS1
Amend 12 Oct 2011	AS 1214: 1983	Hot-dip galvanised coatings on threaded fasteners (ISO metric coarse thread series)	**SH**/AS1
Amend 12 Oct 2011	AS 1229: 2002	Laundry troughs	**G2**/AS1
Amend 11 Sep 2010			
	AS 1273: 1991	Unplasticized PVC (uPVC) downpipe and fittings for rainwater	**E1**/AS1
	AS 1308: 1987	Electric water heaters – Thermostats and thermal cut-outs *Amend: 1*	**G12**/AS1
	AS 1357:-	Water valves for use with unvented water heaters	
	Part 1: 2009	Protection valves *Amend: 1, 2*	**G12**/AS1
Amend 11 Sep 2010	Part 2: 2005	Control valves *Amend: 1, 2*	**G12**/AS1
	AS 1366:-	Rigid cellular plastics sheets for thermal insulation	
	Part 1: 1992	Rigid cellular polyurethane (RC/PUR) *Amend: 1*	**C**/AS1-**C**/AS**6**, **C**/VM2
	Part 2: 1992	Rigid cellular polyisocyanurate (RC/PIR)	**C**/AS1-**C**/AS**6**, **C**/VM2
	Part 3: 1992	Rigid cellular polystyrene – moulded (RC/PS-M) *Amend: 1*	**C**/AS1-**C**/AS**6**, **C**/VM2 **E2**/AS1
Amend 13 Feb 2014	Part 4: 1989	Rigid cellular polystyrene – extruded (RC/PS-E)	**C**/AS1-**C**/AS**6**, **C**/VM2 **E2**/AS1
Amends 11 and 12	AS 1397: 2011	Continuous hot-dip metallic sheet coated steel sheet and strip – Coatings of zinc and zinc allowed with aluminium and magnesium *Amend: 1*	**B1**/AS3, **E2**/AS1, **SH**/AS1
Amend 13 Feb 2014			
	AS 1432: 2004	Copper tubes for plumbing, gasfitting and drainage applications	**G10**/AS1
Amends 11 and 12			

			Where quoted
	AS 1530:-	Methods for fire tests on building materials, components and structures	
Amend 11 Sep 2010	Part 1: 1994	Combustibility test for materials	**C**/AS1-**C**/AS6, **C**/VM2
	Part 2: 1993	Test for flammability of materials	**C**/AS1-**C**/AS6, **C**/VM2
Amend 12 Oct 2011 Amend 13 Feb 2014	Part 4: 2005	Fire-resistance tests of elements of building construction	**C**/AS1-**C**/AS6, **C**/VM2
	AS 1566: 1997	Cooper and copper alloys – Rolled flat products	**E2**/AS1
Amend 11 Sep 2010	AS 1579: 2001	Arc welded steel pipes and fittings for water and waste water	**E1**/AS1, **G13**/AS2
Amend 11 Sep 2010	AS 1589: 2001	Copper and copper alloy waste fittings	**G13**/AS1
	AS 1646: 2007	Elastomeric seals for waterworks purposes	**E1**/AS1
	AS 1668:-	The use of mechanical ventilation and air-conditioning in buildings	**G4**/AS1
Amend 12 Oct 2011	Part 2: 2002	Ventilation design for indoor-air containment control *Amend: 1, 2*	**G4**/AS1
	AS 1670:-	Fire detection, warning, control and intercom systems – System design, installation and commissioning	
	Part 6: 1997	Smoke alarms	**F7**/AS1
Amends 11 and 13	AS 1691: 1985	Domestic oil-fired appliances – installation	**C**/AS1-**C**/AS6
	AS 1741: 1991	Vitrified clay pipes and fittings with flexible joints – Sewerage quality	**E1**/AS1, **G14**/VM1
Amend 11 Sep 2010	AS 1804: 1976	Soft lead sheet and strip	**E2**/AS1, **SH**/AS1
	AS 1851: 2005	Maintenance of fire protection equipment	**HB**/SS 1, SS 2, SS 5, SS 9, SS 13, SS 15
Amend 12 Oct 2011	AS 1976: 1992	Vitreous china used in sanitary appliances	**G1**/AS1
	AS 2033: 2008	Installation of polyethylene pipe systems	**G14**/VM1, **E1**/AS1
Amend 11 Sep 2010	AS 2049: 2002	Roof tiles	**E2**/AS1, **SH**/AS1
	AS 2050: 2002	Installation of roof tiles	**E2**/VM1
Amend 12 Oct 2011	AS 2159: 1995	Rules for the design and installation of piling (known as the SAA Piling Code) *Amend: 1*	**B1**/VM4

Amend 13 Feb 2014

Amend 11 Sep 2010

Amendment	Reference	Title	Where quoted
Amend 11 Sep 2010	AS 2293:	Emergency escape lighting and exit signs for buildings	
Amend 12 Oct 2011	Part 1: 2005	System design, installation and operation *Amend: 1*	**F6**/AS1, **F8**/AS1
Amends 12 and 13; Amend 12 Oct 2011	Part 3: 2005	Emergency escape luminaires and exit signs *Amend: 1*	**F6**/AS1, **F8**/AS1
	AS 2845:-	Water supply – Mechanical backflow prevention devices	
Amend 12 Oct 2011	Part 3: 1993	Field testing and maintenance *Amend: 1*	**G12**/AS1, **HB**/SS 7
Amend 11 Sep 2010	AS 2870: 1996	Residential slabs and footings – Construction	**SH**/AS1
	AS 2887: 1993	Plastic waste fittings	**G13**/AS1
	AS 2890:-	Parking facilities	
	Part 1: 2004	Off-street parking *Amend: 1*	**D1**/AS1
Amend 12 Oct 2011	Part 2: 2002	Off-street commercial facilities *Amend: 1*	**D1**/AS1
Amend 11 Sep 2010	AS 3566	Self-drilling screws for the building and construction industries	**E2**/AS1, **SH/**AS1
	Part 2: 2002	Corrosion resistance	
	AS 3571: 2009	Plastic piping systems – Glass reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin – pressure and non-pressure drainage and sewerage (ISO 10467: 2004 MOD)	**G13**/AS2
Amend 12 Oct 2011	AS 3588: 1996	Shower bases and shower modules	**G1**/AS1
Amend 12 Oct 2011	AS 3688: 2005	Water supply – Copper and copper alloy compression and capillary fittings and threaded end connectors *Amend: 1,2*	**G10**/AS1
Amends 11 and 12	AS 3690: 2009	Installation of ABS pipe systems	**G14**/VM1
	AS 3706:-	Geotextiles – Methods of test	
Amend 11 Sep 2010	Part 1: 2003	General requirements, sampling, conditioning, basic physical properties and statistical analysis	**E1**/VM1
	AS 3730	Guide to the properties of paints for buildings	**SH/**AS1
	Part 6: 1991	Solvent-borne – Exterior – Full gloss enamel	
	Part 7: 1992	Latex – Exterior – Flat	
	Part 8: 1992	Latex – Exterior – Low gloss	
	Part 9: 1992	Latex – Exterior – Semi-gloss	
Amend 11 Sep 2010	Part 10: 1992	Latex – Exterior – Gloss	

		Where quoted
AS 3730	Guide to the properties of paints for buildings	**E2**/AS1
Part 6: 2006	Solvent-borne – Exterior – Full gloss enamel	**E2**/AS1
Part 7: 2006	Latex – Exterior – Flat	**E2**/AS1
Part 8: 2006	Latex – Exterior – Low gloss	**E2**/AS1
Part 9: 2006	Latex – Exterior – Semi-gloss	**E2**/AS1
Part 10: 2006	Latex – Exterior – Gloss	**E2**/AS1
AS 3786: 1993	Smoke alarms *Amend: 1, 2, 3, 4*	**F7**/AS1
AS 4046	Methods of testing roof tiles	
Part 9: 2002	Determination of dynamic weather resistance	**E2**/AS1
AS 4072:-	Components for the protection of openings in fire-resistant separating elements	**C**/VM2
Part 1: 2005	Service penetrations and control joints *Amend: 1*	**C**/AS1-**C**/AS6,
AS 4139: 2003	Fibre reinforced concrete pipes and fittings	**G13**/AS2
AS 4178: 1994	Electromagnetic door holders	**HB**/SS 3
AS 4254:-	Ductwork for air-handling systems in buildings	
Part 1: 2012	Flexible duct	**C**/VM2
Part 2: 2012	Rigid duct	**C**/VM2
AS 4276:-		
Part 3.1: 2007	Water plate microbiology – Pour plate method using plate count agar	**HB**/SS 9
AS 4290: 2000	Design and installation of revolving doors *Amend: 1, 2*	**HB**/SS 3
AS 5007: 2007	Powered doors for pedestrian access and egress	**HB**/SS 3
AS 60188.4: 2007	Hearing aids – magnetic field strength in audio-frequency induction loops for hearing aid purposes	**HB**/SS 12

Amend 12 Oct 2011
Amend 12 Oct 2011
Amend 11 Sep 2010
Amend 12 Oct 2011
Amend 13 Feb 2014
Amend 12 Oct 2011
Amend 11 Sep 2010
Amend 13 Oct 2014
Amend 12 Oct 2011
Amend 12 Oct 2011

British Standards Institution

		Where quoted
Amend 12 Oct 2011		
BS 10: 2009	Specification for flanges and bolting for pipes, valves and fittings	**G10**/AS1
BS 143, and BS 1256: 2000	Threaded pipe fittings in malleable cast iron and cast copper alloy *Amend: 1, 2, 3, 4*	**G10**/AS1, **G14**/VM1
Amend 12 Oct 2011		
BSDD 175: 1988	Code of practice for the identification of potentially contaminated land and its investigation	**F1**/VM1
Amend 11 Sep 2010		
BS 437: 2008	Specification for cast iron spigot and socket drain pipes and fittings *Amend: 5877*	**G13**/AS2
BS 585:-	Wood stairs	
Part 1: 1989	Specification for stairs with closed risers for domestic use, including straight and winder flights and quarter or half landings	**D1**/AS1
BS EN 988: 1997	Zinc and zinc alloys. Specification for rolled flat products for building	**E2**/AS1
BS EN 1044:1999	Brazing. Filler metals	**G10**/AS1
Amend 12 Oct 2011		
BS EN 1172: 1997	Copper and copper alloys – sheet and strip for building	**E1**/AS1
BS EN 1490: 2000	Building valves. Combined temperature and pressure relief valves. Tests and requirements	**G12**/AS1
BS EN 1491: 2000	Building valves. Expansion valves. Tests and requirements	**G12**/AS1
BS EN 1567: 1999	Building valves. Water pressure reducing valves and combination water reducing valves. Requirements and tests.	**G12**/AS1
BS EN 1595: 1997	Pressure equipment made from borosilicate glass 3.3 – general rules for design, manufacture and testing	**G14**/VM1
Amend 11 Sep 2010		
Amend 12 Oct 2011		

		Where quoted
BS EN 1759	Flanges and their joints.	
Part 1: 2004	Circular flanges for pipes, valves, fittings and accessories, class-designated. Steel flanges, NPS 1/2 to 24.	**E1**/AS1
BS 2971: 1991	Specification for Class II arc welding of carbon steel pipework for carrying fluids	**G14**/VM1
BS 3402: 1969	Specification for quality of vitreous china sanitary appliances	**G1**/AS1
BS 3799: 1974 (1994)	Specification for steel pipe fittings, screwed and socket-welding for the petroleum industry	**G10**/AS1
BS 4991: 1974 (1982)	Specification for propylene copolymer pressure pipe	**G14**/VM1
BS 5252: 1976	Framework for colour co-ordination for building purposes *Amend: 1*	**F8/**AS1
BS 5378:-	Safety signs and colours	
Part 1: 1980	Specification for colour and design	**F8/**AS1
BS 5395:-	Stairs, ladders and walkways	
Part 2: 1984	Code of practice for the design of helical and spiral stairs	**D1**/AS1
BS 5446:-	Components of automatic fire alarm systems for residential premises	
Part 1: 1990	Specification for self-contained smoke alarms and point-type smoke detectors *Amends: 6863, 7648, 9628*	**F7/AS1**
BS 6037:-	Code of practice for the Planning, design, installation and use of permanently installed access equipment	
Part 1: 2003	Suspended access equipment	**HB**/SS 10
Part 2: 2004	Travelling ladders and gantries	**HB**/SS 10

Amend 11 Sep 2010
Amends 11 and 12
Amend 11 Sep 2010
Amend 12 Oct 2011
Amend 11 Sep 2010
Amend 13 Feb 2014
Amend 11 Sep 2010
Amend 13 Feb 2014
Amend 13 Feb 2014
Amend 11 Sep 2010
Amend 11 Sep 2010

		Where quoted
BS 6374:-	Lining of equipment with polymeric materials for the process industries	
Part 1: 1985	Specification for lining with sheet thermoplastics	**G14**/VM1
Part 2: 1984	Specification for lining with non-sheet applied thermoplastics	**G14**/VM1
Part 3: 1984	Specification for lining with stoved thermosetting resins	**G14**/VM1
Part 4: 1984	Specification for lining with cold curing thermosetting resins	**G14**/VM1
Part 5: 1985	Specification for lining with rubbers	**G14**/VM1
BS 6464: 1984	Specification for reinforced plastics pipes, fittings and joints for process plants	**G14**/VM1
BS 6538: 1987	Air permeanence of paper and board	**E2**/AS1
Part 3: 1987	Method for determination of air permeanence using the Garley apparatus	
BS 6920:-	Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water	
Part 1: 2000	Specification	**G12**/AS1
Part 2: 2000	Methods of tests	**G12**/AS1
Amend 11 Sep 2010 Part 3: 2000	High temperature tests	**G12**/AS1
Amend 12 Oct 2011 BS 7159: 1989	Code of practice for design and construction of glass-reinforced plastics (GRP) piping systems for individual plants or sites	**G14**/VM1
BS 7273:-	Code of practice for the operation of fire protection measures	**C**/VM2
Amend 13 Feb 2014 Part 4: 2007	Actuation of release mechanisms for doors	
BS 7777: 1993	Flat bottomed, vertical, cylindrical storage tanks for low temperature service Part 1: Guide to the general provisions applying for design, construction and installation Part 2: Specification for design and construction ofsingle, double and full containment metal tanks for the storage of liquified gas at temperatures down to –165°C Part 3: Recommendations for the design and construction of prestressed and reinforced concrete tanks and tank foundations and for the design and installation of tank insulation, tank lines and tank coating	**G14**/VM1
Amend 11 Sep 2010		
BS 8004: 1986	Code of practice for foundations	**B1**/VM4
Amend 11 Sep 2010 BS EN 10241: 2000	Steel threaded pipe fittings	**G10**/AS1
Amend 12 Oct 2011 BS EN 10253-2: 2007	Butt-welding pipe fittings – non-alloy and ferric alloy steels with specific inspection requirements	**G10**/AS1

		Where quoted
Amend 12 Oct 2011	BS EN 10253-3: 2008 Butt-welding pipe fittings – wrought austenitic and austenitic-ferritic (duplex) stainless steels without specific inspection requirements	**G10**/AS1
Amend 11 Sep 2010	BS EN 12056-2: 2000 Gravity drainage systems inside buildings. Sanitary pipework, layout and calculation	**G13**/VM1
Amend 13 Feb 2014	BS EN 12101 Smoke and heat control systems	
	Part 1: 2005 Specification for smoke barriers	**C**/AS2-**C**/AS6
Amend 12 Oct 2011	BS EN 12285: Workshop fabricated steel tanks	
	Part 1: 2003 Horizontal cylindrical single skin and double skin tanks for the underground storage of flammable and non-flammable water polluting liquids	**G14**/VM1
	Part 2: 2005 Horizontal cylindrical single skin and double skin tanks for the aboveground storage of flammable and non-flammable water polluting liquids	**G14**/VM1
	BS EN 12585: 1999 Glass plant, pipeline and fittings – Pipeline and fittings DN 15 to 1000 – compatibility and interchangeability	**G14**/VM1
Amend 12 Oct 2011	BS EN 13121-3: 2008 GRP tanks and vessels for use above ground. Design and workmanship *Amend: 1 (2010)*	**G14**/VM1
Amend 11 Sep 2010	BS EN 14324: 2004 Brazing. Guidance on the application of brazed joints	**G10**/AS1
Amend 13 Feb 2014	BS EN 14604: 2005 Smoke alarm devices	**F7**/AS1

New Zealand Publications

Building Research Association of New Zealand

Amend 11 Sep 2010	BRANZ Bulletin 330: 1995 Thin flooring materials – 2. Preparation and laying. Appendix 1	**E2**/AS1, **SH**/AS1
Amend 11 Sep 2010	BRANZ Bulletin 411: 2001 Recommended timber cladding profiles	**E2**/AS1, **SH**/AS1
	BRANZ EM 4: 2005 Evaluation method for jointing systems for flush finished fibre cement sheet	**E2**/AS1
	BRANZ EM 5: 2005 Evaluation method for adhesives and seam tapes for butyl and EPDM rubber membranes	**E2**/AS1
Amend 12 Oct 2011	BRANZ EM 6: 2011 Evaluation method for window and door support mechanisms or bars	**E2**/AS1
	BRANZ House Insulation Guide: 1995	**E3**/AS1, **SH**/AS1
Amend 11 Sep 2010	BRANZ Paper C1: 1978 A construction guide to home insulation (second edition)	**E3**/AS1
Amend 11 Sep 2010	BRANZ Technical paper P21: 1991 A wall bracing test and evaluation procedure	**SH**/AS1
	BRANZ Supplement to P21 An evaluation method of P21 test results for use with NZS 3604: 1990	**SH**/AS1

Amendment	Publication	Where quoted
Amend 13 Feb 2014	BRANZ Study Report No. 137: 2005 Development of the Vertical Channel Test Method for Regulatory Control of Combustible Exterior Cladding Systems, Whiting, P.N.	**C**/VM2
	BRANZ Technical paper P36: 1983 Food processing floors, a guide to design, materials and construction. W.R. Sharman	**G3/**AS1
Amend 11 Sep 2010	BRANZ Evaluation Method EM1 Structural joints – strength and stiffness evaluation	**SH**/AS1
	ALF 3: The 'Annual Loss Factor' Method. A design tool for energy efficient houses, 3rd edition (April 2000) Albrecht Stoecklein and Mark Bassett	**H1**/Defs
	Cement & Concrete Association of New Zealand	
Amends 12 and 13	CCANZ CP01: 2014 Code of Practice for weathertight concrete and concrete masonry construction	**E2**/AS3
	Centre for Advanced Engineering	
	Fire Engineering Design Guide, 2008	**C/**VM2
	Chemical Industry Council Incorporated	
Amend 13 Feb 2014	HSNO Code of Practice 2-1 09-04 Signage for premises storing hazardous substances and dangerous goods	**F8**/AS1
	Master Plumbers, Gasfitters and Drainlayers NZ Inc and Water New Zealand	**G12**/AS1, **HB**/SS 7
	NZ Backflow testing standard 2011AS1 3.6.1 b), 3.7.2 Field testing of backflow prevention devices and verification of air gaps	
	New Zealand Metal Roofing Manufacturers Inc	
	New Zealand Metal Roof and Wall Cladding Code of Practice: 2008	**E2**/AS1
	The National Association of Steel Framed Housing Inc (NASH)	
Amend 12 Oct 2011	NASH Standard: Residential and Low Rise Steel Framing Part 1 2010 Design Criteria	**B1**/AS1
	Royal New Zealand Foundation of the Blind	
Amend 13 Feb 2014	Accessible Signage Guidelines: 2010	**F8**/AS1
	Government Departments and Agencies	
	Department of Labour	
	Workplace exposure standards and biological indices for New Zealand: 1992	**F1**/VM1, **G4**/VM1
	Ministry of Agriculture and Fisheries	
	MQ 1: 1988 Qual approvals manual	**G3/**AS1

		Where quoted
Ministry of Economic Development		
NZECP 34: 2001	Electrical safety distances	**G9**/VM1
NZECP 36: 1993	Harmonic levels	**G9**/VM1
NZECP 51: 2004	Homeowner/occupier's electrical wiring work in domestic installations	**G9**/AS1
Amend 13 Feb 2014 NZECP 54: 2001	Installation of recessed luminaires and auxiliary equipment	**G9**/AS1
Ministry of Health		
Ministry of Health: 2005 Drinking Water Standards for New Zealand		**SH**/AS1
Ministry of Health: 2006	Household water supplies: the selection, operation and maintenance of individual household water supplies	**SH**/AS1
Amend 11 Sep 2010		
Ministry of Transport		
Power Lift Rules: 1989		**HB**/SS 8
Rules for power lifts not exceeding 750 watts (one horsepower): 1985		**HB**/SS 8
SCION		
Amend 12 Oct 2011 Measurement of moisture content of wood		**E2**/AS1
National Institute of Water and Atmospheric Research Ltd (NIWA)		
Amend 11 Sep 2010 Temperature Normals for New Zealand 1961-1990 by A I Tomlinson and J Sansom (ISBN 0478083343)		**H1**/Defs
Amend 12 Oct 2011 **New Zealand Legislation**		
Amend 11 Sep 2010 Chartered Professional Engineers of New Zealand Act 2002		**B1**/VM1
Amend 13 Feb 2014 Education (Early Childhood Services) Regulations 2008		**C/**AS4
Fencing of Swimming Pools Act 1987		**F4**/AS1
Amends 12 and 13 Fire Safety and Evacuation of Buildings Regulations 2006		**C/**AS2-**C/**AS6
Gas Regulations 1993		**G12**/AS1
Amend 13 Feb 2014 Hazardous Substances and New Organisms Act 1996		**C**/AS1-**C**/AS6, **F3**/VM1
Hazardous Substances (Classification) Regulations 2001		**F3**/VM1
Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001		**F3**/VM1
Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004		**F3**/VM1
Amend 11 Sep 2010 Hazardous Substances (Disposal) Regulations 2001		**G14**/VM1
Hazardous Substances (Emergency Management) Regulations 2001		**F3**/VM1
Health & Safety in Employment Act 1992		**HB**/SS 9
Amend 11 Sep 2010 Plumbers, Gasfitters, and Drainlayers Act 2006		**SH**/AS1
Resource Management Act 1991		**E1**/VM1, **G14**/VM1
Amend 11 Sep 2010 Resource Management (National Environment Standards relating to certain Pollutants, Dioxins and other Toxins) Regulations: 2004 (NESAQ)		**SH**/AS1

	Where quoted
New Zealand Geomechanics Society	
Guidelines for the field descriptions of soils and rocks in engineering use. Nov 1988	**B1**/VM1

Amend 12 Oct 11

Australian Publications

Amend 13 Feb 2014

Australian Building Codes Board	
International Fire Engineering Guidelines (IFEG): 2005	**C**/VM2

Australia/NZ Publications

Australian and New Zealand Environment and Conservation Council	
Guidelines for assessment and management of contaminated sites: 1992	**F1**/VM1

British Publications

Building Research Establishment (UK)	
BRE Defect action sheet DAS 131: May 1989 External walls: Combustible external plastics insulation: Horizontal fire barriers	**C**/AS2-**C**/AS6
BRE Report 135: 1988 Fire performance of external thermal insulation for walls in multi-storey buildings. Rogowski B.F., Ramaprasad R., Southern J.R.	**C**/AS2-**C**/AS6

Amend 13 Feb 2014

Chartered Institution of Building Services Engineers, London	
CIBSE Code Series A: 1996 Air distribution systems	**G4**/VM1/AS1

Amend 11 Sep 2010

International Publications

EIFS Industry Members Association		
EIMA 101.91: 1992	Standard Guide for resin of resin coated glass fibre mesh in exterior insulation and finish systems (EIFS), Class PB.	**E2**/AS1
The European Committee for Standardisation		
EN 81:-	Safety rules for the construction and installation of lifts	
Part 1: 1998	Electric lifts	**D2**/AS1, **HB**/SS 8
Part 2: 1998	Hydraulic lifts	**D2**/AS1, **HB**/SS 8
EN 115:-	Safety of escalators and moving walks	**D2**/AS3, **HB**/SS 8
Part 1: 2008	Construction and installation *Amend: A1*	

Amend 13 Feb 2014

		Where quoted
Amend 13 Feb 2014 BS EN 12101:-	Smoke and heat control systems	
Part 1: 2008	Construction and installation	**C**/AS1-**C**/AS6
EN 12380: 1999	Air admittance valves for drainage systems – Requirements and test methods	**G13**/AS1
Eurocode DD ENV 1991:		
Eurocode 1:	Basis of design actions on structures	
Part 2.2: 1996	Actions on structures exposed to fire	**C**/VM2

International Standards Organisation, Geneva

ICBO Evaluation Services Inc AC148:	Acceptance criteria for flashing materials	**E2**/AS1
ISO 140/VII: 1978	Field measurements of impact sound insulation of floors	**G6**/VM1
Amend 11 Sep 2010 ISO 1182: 2010	Reaction to fire tests for products – Non-combustibility test	**C**/VM2
ISO 3864: 2002	Safety colours and safety signs	**F8**/AS1
Part 1: Design principles for safety signs in workplaces and public areas		
ISO 5660:-	Reaction-to-fire tests – Heat release, smoke production and mass loss rate	
Part 1: 2002	Heat release rate (cone calorimeter method)	**C**/AS1-**C**/AS6, **C**/VM2
Part 2: 2002	Smoke production rate (dynamic measurement)	**C**/AS1-**C**/AS6, **C**/VM2
ISO 7000: 2004	Graphic symbols for use on equipment	**F8**/AS1
ISO 7010: 2003	Graphical symbols – safety colours and safety signs – Safety signs used in workplaces and public areas	**F8**/AS1
Amend 13 Feb 2014 ISO 9223: 1992	Corrosion of metals and alloys; corrosivity of atmospheres; classification	**E2**/AS1
ISO 9239:-	Reaction to fire tests for flooring	
Part 1: 2010	Determination of the burning behaviour using a radiant heat source	**C**/AS1-**C**/AS6, **C**/VM2
Amend 13 Feb 2014 ISO 9705: 1993	Fire tests – Full scale room test for surface products	**C**/AS1-**C**/AS6, **C**/VM2
Amend 11 Sep 2010 ISO 11600: 2002	Building Construction – Jointing products Classification and requirements for sealants	**E2/**AS1**, SH/**AS1
Amend 13 Feb 2014 ISO 12239 2003	Fire detection and fire alarm systems – smoke alarms	**F7**/AS1
Amend 11 Sep 2010 ISO/TS 15510: 2003	Stainless steels – chemical composition	**E2**/AS1, **SH**/AS1
ISO 13571: 2007	Life-threatening components of fire Guidelines for the estimation of time available for escape using fire data	**C**/VM2
ISO 13784:-	Reaction-to-fire tests for sandwich panel building systems	
Amend 13 Feb 2014 Part 1: 2002	Test method for small rooms	**C**/VM2

		Where quoted
Amend 13 Feb 2014 ISO 13785:-	Reaction-to-fire tests for façades	
Part 1: 2002	Immediate-scale test	**C**/VM2

Amend 11 Sep 2010

World Health Organisation/Food and Agriculture Organisation

Environmental Health Criteria 70	"Environment health criteria" for various chemicals	**F1**/VM1
	Evaluation of certain food additives and contaminants, Technical report series 776 Geneva: 1989	**F1**/VM1
	IARC Monographs on the evaluation of carcinogenic risks to humans for individual chemicals, groups of chemicals, or processes. Published by the International Agency for Research on Cancer	**F1**/VM1
	Principles for the safety assessment of food additives and contaminants in food, Geneva: 1987	**F1**/VM1

German Institute for Standardisation

DIN 5381: 1985	Identification colours	**F8**/AS1
DIN 6164: 1980	DIN Colour chart	**F8**/AS1
Amend 13 Feb 2014 Part 2: Specification of colour samples		

United States of America Publications

Amend 11 Sep 2010

American National Standards Institute and

American Society of Mechanical Engineers

ANSI/ASME B16.1: 1989	Cast iron pipe flanges and flanged fittings, Class 25, 125, 250 and 800	**G10**/AS1
Amend 11 Sep 2010 ANSI/ASME B16.3: 1985	Malleable-iron threaded fittings, Classes 150 and 300	**G10**/AS1
Amend 11 Sep 2010 ANSI/ASME B16.5: 1988	Pipe flanges and flanged fittings, steel-nickel alloy and other special alloys	**G10**/AS1
ANSI/ASME B16.9: 1990	Factory-made wrought steel butt-welding fittings	**G10**/AS1
ANSI B16.11: 1980	Forged steel fittings, socket-welding and threaded	**G10**/AS1

Amend 11 Sep 2010

American Petroleum Institute

API SPEC 5L: 1991	Specification for line pipe	**G10**/AS1
Amend 11 Sep 2010 API STD 1104: 1988	Welding of pipelines and related facilities	**G10**/AS1

		Where quoted
American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)		
Design of smoke management systems. Klote and Milke 1992		**C**/AS1
American Society of Sanitary Engineers		
ASSE 1050: 1991	Performance requirements for air admittance valves for plumbing DWV systems stack type devices	**G13**/AS1
ASSE 1051: 1992	Performance requirements for air admittance valves for plumbing drainage systems	**G13**/AS1
American Society for Testing and Materials		
Amend 11 Sep 2010 ASTM A 53 – 90a	Specification for pipe, steel, black and hot-dipped, zinc-coated welded and seamless	**G10**/AS1
ASTM A 106 – 91a	Specification for seamless carbon steel pipe for high temperature service	**G10**/AS1
Amend 12 Oct 2011		
ASTM D 1143: 1981	Test method for piles under static axial compressive load	**B1**/VM4
Amend 12 Oct 2011 Amends 11 and 12 ASTM C 1549: 2009	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer	**SH**/AS1
ASTM C 1549: 2009	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer	**E2**/AS1
Amend 12 Oct 2011 ASTM D 1667: 2005	Standard Test Specification for Flexible Cellular Materials – Vinyl Chloride Polymers and Capolymers (Closed-cell foam)	**E2**/AS1
Amend 12 Oct 2011 ASTM D 2240: 2005	Standard Test method for Rubber Property	**E2**/AS1
Amend 13 Feb 2014 ASTM D 2898: 2010	Standard Practice for Accelerated Weathering of Fire-retardant Treated Wood for Fire Testing	**C**/AS2-**C**/AS6
Amend 12 Oct 2011 ASTM D 6134: 1997	Standard Specification for Vulcanised Rubber Sheets Used in Waterproofing Systems	**SH**/AS1
Amend 11 Sep 2010 ASTM D 6134: 2007	Standard Specification for Vulcanised Rubber Sheets Used in Waterproofing Systems	**E2**/AS1
Amend 12 Oct 2011 ASTM E 96: 1992	Standard test methods for water vapour transmission of materials	**SH**/AS1
Amend 12 Oct 2011 ASTM E 96: 2005	Standard test methods for water vapour transmission of materials	**E2**/AS1
ASTM E104: 2002	Standard Practice for Maintaining Constant Relative Humidity by Means of Aqueous Solutions	**E2**/AS1

		Where quoted
	ASTM E 336: 1990 Method for measurement of airborne sound insulation in buildings	**G6**/VM1
	ASTM E 413: 1987 Classification for rating sound insulation	**G6**/VM1
	ASTM E 492: 1990 Test method for laboratory measurement of impact sound transmission through floor-ceiling assemblies using a tapping machine	**G6**/VM1
Amends 10 and 11	ASTM E 903: 1996 Standard Test Method for Solar Absorbance, Reflectance, and Transmittance of Materials Using Integrating Spheres	**SH**/AS1
	ASTM E 989: 1989 Classification for determination of impact insulation class (IIC)	**G6**/VM1
	ASTM E 2098: 2000 Standard Test Method for Determining Tensile Breaking Strength of Glass Fibre Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to a Sodium Hydroxide Solution	**E2**/AS1
	ASTM E 2134: 2001 Standard Test Method for Evaluation the Tensile-Adhesion Performance of an Exterior Insulation amd Finish System (EIFS)	**E2**/AS1
Amend 12 Oct 2011	ASTM G 154: 2006 Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials	**E2**/AS1
Amend 12 Oct 2011	ASTM G 155: 2005 Standard Practice for Operating Xenon Arc Light Apparatus for UV Exposure of Nonmetallic Materials	**E2**/AS1

National Fire Protection Association of America

Amend 11 Sep 2010

Amend 13 Feb 2014	NFPA 285: 1998 Standard method of test for the evaluation of flammability characteristics of exterior non load bearing wall assemblies containing components using the intermediate scale, multi-storey test apparatus	**C**/AS1-**C**/AS6, **C**/VM2

Society of Fire Protection Engineers

	The Handbook of Fire Protection Engineering, 4th Edition, National Fire Protection Association, Quincy, M.A., USA, 2008	
	Gwynne, S.M.V., and Rosenbaum, E.R., "Employing the Hydraulic Model in Assessing Emergency Movement", Section 3 Chapter 13	**C**/VM2
Amend 13 Feb 2014	SFPE Engineering Guide to Predicting 1st and 2nd Degree Skin Burns from Thermal Radiation, 2000	**C**/VM2

	Where quoted
United States Environmental Protection Agency (EPA)	
USEPA SW 846: 1986 Test methods for evaluating solid waste	**F1**/VM1
EPA/540/1 – 89/002: 1989 Risk assessment guidance for Superfund, Vol 1. Human health evaluation manual (Part A) Interim final. Prepared by USEPA Office of Emergency and Remedial Response	**F1**/VM1
Amend 12 Oct 2011 Federal Specification Standard TT-S-00230C: Elastomeric type, cold applied single component for caulking, sealing, and glazing in buildings, building areas (plazas, decks, pavements, and other structures)	**E2**/AS1, **SH**/AS1
Cross-connection Control Manual: 1989	**HB**/SS 7
United States Public Health Service	
Toxicological profiles on individual chemicals. Prepared by the Agency for Toxicological Substances and Disease Registry, in collaboration with the US Environmental Protection Agency	**F1**/VM1
Miscellaneous Publication	
Casarett and Doull's Toxicology. The basic science of poisons. 4th ed. Macmillan. New York 1991. Klassen CD, Amdur MO, Doull J (Eds)	**F1**/VM1

Definitions

Many of the definitions in this section come from the Building Act 2004, regulations, including the Building Code, and Acceptable Solutions and Verification Methods. Although every effort has been made to ensure definitions are accurate at the time of publication, it is possible that definitions may become out of date as changes occur to the legislation and Acceptable Solutions and Verification Methods. In the event there is any discrepancy between the definitions in this section and the definitions in the legislation or Acceptable Solutions and Verification Methods, the definitions in the legislation and Acceptable Solutions and Verification Methods will prevail.

Amend 13 Feb 2014 Note that some legislation and Acceptable Solutions and Verification Methods may contain different definitions for the terms listed below. When using particular legislation or an Acceptable Solution or Verification Method, reference should be made to the definitions provided in that document.

Source Key:

BA04	Building Act 2004
BR1	Building Regulations 1992
BR2	Building (Specified Systems, Change the Use, and Earthquake-prone Buildings) Regulations 2005
Code	New Zealand Building Code
EA	Electricity Act 1992
FSA	Fire Service Act 1975
HB	Handbook
HSNOA	Hazardous Substances and New Organisms Act 1996
LGA	Local Government Act 1974 or 2002
PGDA	Plumbers, Gasfitters, and Drainlayers Act 1976
RA	Railway Act 2005
RMA	Resource Management Act 1991
Amend 13 Feb 2014 **AS/VM (Code clause)**	Acceptable Solution or Verification Method for given Code clause (eg, AS/VM G13)
Amend 11 Sep 2010 **DG**	Builidng Consent Authority Development Guide
Simple House	Simple House Acceptable Solution

Definition	**Source**

A

Abutment The part of the valley side against which the *dam* is constructed.	**DG**
Acceptable risk The level of risk the public is prepared to accept without further management. The risk is the combination of the probability and the consequence of a specified hazardous event.	**DG**
Acceptable Solution means a solution that must be accepted as complying with the *Building Code*.	**BA04**
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*.	**AS/VM E1, G13**
Access point A place where access may be made to a *drain* or *discharge pipe* for inspection, cleaning or maintenance; and may include a *cleaning eye*, *inspection point*, *rodding point*, *inspection chamber* or *access chamber*.	**AS/VM G13**
Access route A continuous route that permits people and goods to move between the apron or *construction* edge of the *building* to spaces within a *building*, and between spaces within a *building*.	**Code**

Definition	Source
Accessible Having features to permit use by *people with disabilities*.	**Code**
Accessible route An *access route* usable by *people with disabilities*. It shall be a continuous route that can be negotiated unaided by a wheelchair user. The route shall extend from street *boundary* or car parking area to those spaces within the *building* required to be *accessible* to enable *people with disabilities* to carry out normal activities and processes within the *building*.	**Code**
Accessible stairway A *stairway* having features for use by a *person with a disability. Buildings* required to be *accessible* shall have at least one *accessible stairway* leading off an *accessible route* whether or not a lift is provided.	**AS/VM C**
Accreditation certificate means a certificate that was issued by the Building Industry Authority under the Building Act 1991.	**HB**

COMMENT:
Accreditation certificates have become product certificates under the *Building Act 2004* and are subject to the product certification scheme under the *Building Act 2004*.

Definition	Source
Active conductor Any conductor in which the electrical potential differs from that of a neutral conductor or earth.	**AS/VM F8**
Adequate means *Adequate* to achieve the objectives of the *Building Code*.	**Code**
Adjacent building A nearby *building*, including an adjoining *building*, whether or not erected on *other property*.	**Code**
Air gap The vertical distance through air between the lowest point of the water supply outlet and the *flood level rim* of the equipment or the *fixture* into which the outlet discharges.	**AS/VM G12**
Air admittance valve A valve that allows air to enter but not to escape in order to limit pressure fluctuations within the sanitary plumbing or drainage system.	**AS/VM G13**
Air seal A continuous seal fitted between a window or door reveal and the surrounding wall *framing* to prevent the flow of air into the interior of the *building*.	**AS/VM E2**
Allotment has the meaning given to it by section 10 of the *Building Act 2004*.	**BA04**

Section 10 states:

"(1) In this Act, unless the context otherwise requires, **allotment** means a parcel of land—
(a) that is a continuous area of land; and
(b) whose boundaries are shown on a survey plan, whether or not as a subdivision—
(i) approved by way of a subdivision consent granted under the Resource Management Act 1991; or
(ii) allowed or granted under any other Act; and
(c) that is—
(i) subject to the Land Transfer Act 1952 and comprised in 1 certificate of title or for which 1 certificate of title could be issued under that Act; or
(ii) not subject to that Act and was acquired by its owner under 1 instrument of conveyance

Definition	Source
(2) For the purposes of subsection (1), an allotment is taken— (a) to be a continuous area of land even if part of it is physically separated from any other part by a road or in any other manner, unless the division of the allotment into those parts has been allowed by a subdivision consent granted under the Resource Management Act 1991 or a subdivision approval under any former enactment relating to the subdivision of land: (b) to include the balance of any land from which any allotment is being or has been subdivided."	
Alter in relation to a *building*, includes to rebuild, re-erect, repair, enlarge and extend the *building*.	**BA04**
Alternative solution means a solution that is compliant with the *Building Code* but is not part of the *Compliance Document*.	**HB**
Aluminium flashings Aluminium *flashings* shall be a minimum thickness of 0.7 mm, and formed from 5000 series in accordance with AS/NZS 1734 and, where pre-painted, have a factory-applied finish complying with AS/NZS 2728.	**Simple House**
Aluminium-zinc coated steel flashings Aluminium-zinc coated steel flashings shall be: (a) *BMT* 0.55 mm minimum of steel for *flashings* generally (b) *BMT* 0.4 mm of steel for roll-formed roll-top ridge *flashings* (c) in aluminium-zinc coating of AZ150 to AS 1397, with a factory-applied finish in accordance with AS/NZS 2728 Type 4, and in sea spray zone and corrosion zone 1 the factory-applied finish shall be Type 5 minimum. Amend 11 Sep 2010	**Simple House**
Amenity means an attribute of a *building* which contributes to the health, physical independence, and well being of the *building's* users but which is not associated with disease or a specific illness.	**Code**
Anti-ponding board A board laid under the lowest row of concrete and clay roof tiles and supports the *roof underlay*. The board is sloped to ensure moisture under the tiles is directed to the exterior of the roof.	**AS/VM E2**
Appliance hearth A layer of *non-combustible* material under or near an appliance. It may be either part of the *building* structure or an overlay on a *combustible* floor.	**AS/VM C**
Approved temperature data means the temperature data contained in A I Tomlinson and J Sansom, *Temperature Normals for New Zealand for period 1961 to 1990* (NIWA, ISBN 0478083343). Amend 11 Sep 2010	**Code** **AS/VM H1**
Appurtenant structure, in relation to a *dam*, means a structure that is integral to the proper functioning of the *dam*.	**BA04**
Apron flashing A near flat or sloping *flashing* with a vertical upstand, used at junctions between roofs and walls.	**AS/VM E2**

Definition	Source
Asbestos as defined by the Health and Safety in Employment (Asbestos) Regulations 1983 means:	AS/VM F2

(a) Actinolite, amosite, chrysotile,crocidolite, fibrous anthophyllite, or tremolite; or

(b) A mixture containing a mineral specified in paragraph a) of this definition; or

(c) A material that is composed wholly or partly of any such mineral; or

(d) A material or article that is contaminated by any such material.

COMMENT:
Asbestos now has the meaning given to it by Regulation 2 of the Health and Safety in Employment (Asbestos) Regulations 1998. This meaning is:

(a) Amosite, chrysotile, crocidolite, fibrous actinolite, fibrous anthophyllite, or fibrous tremolite; or

(b) A mixture containing a mineral specified in paragraph (a); or

(c) A material that is composed wholly or partly of a mineral specified in paragraph (a); or

(d) A material or article that is contaminated by a mineral specified in paragraph (a):

Atmospheric burner A burner system where all the air for combustion is induced by the inspirating effect of a gas injector and/or by natural draught in the combustion chamber without mechanical assistance. **AS/VM G4**

Amend 12 Oct 2011

Attached garage A garage that shares a common *wall* or *walls* with a habitable *building*, and is enclosed by *roof* and *wall claddings* that are continuous with the habitable part of the *building*. **AS/VM E2**

Authority means the Building Industry Authority that was established under the Building Act 1991. **HB**

COMMENT:
The Authority was dissolved under the *Building Act 2004* and its functions and powers transferred to the Department of Building and Housing.

Amend 13 Feb 2014

Available safe egress time (ASET) Time available for escape for an individual occupant. This is the calculated time interval between the time of ignition of a fire and the time at which conditions become such that the occupant is estimated to be incapacitated (ie, unable to take effective action to escape to a *place of safety*). **AS/VM C**

B

Amend 11 Sep 2010

Backcountry hut means a building that— **Code**

(a) is located on land that is administered by the Department of Conservation for conservation, recreational, scientific, or other related purposes, including any land administered under any of the following:

(i) the Conservation Act 1987:

(ii) the National Parks Act 1980:

(iii) the Reserves Act 1977; and

(b) is intended to provide overnight shelter to any person who may visit and who carries his or her own food, bedding, clothing, and outdoor equipment; and

(c) contains only basic facilities, which may include (but are not limited to) any or all of the following:

Definition	Source
(i) sleeping platforms or bunks:	
(ii) mattresses:	
(iii) food preparation surfaces:	
(iv) appliances for heating:	
(v) appliances for cooking:	
(vi) toilets; and	
(d) has been certified by the Director-General as being in a location that wheelchair users are unlikely to be able to visit; and	
(e) is intended to be able to sleep—	
(i) no more than 20 people in its *backcountry hut sleeping area*; and	
(ii) no more than 40 people in total; and	
(f) does not contain any connection, except by *radiocommunications*, to a *network utility operator*]	
Backcountry hut sleeping area means the area of a backcountry hut that contains sleeping platforms, bunks, or beds that are—	**Code**
(a) within the same room as a food preparation or eating area; or	
(b) in a fully enclosed room that is separate from any food preparation or eating area and has—	
(i) internal walls that limit the spread of fire; and	
Amend 11 Sep 2010 (ii) the means of direct egress to outside the hut.	
Backflow A flowing back or reversal of the normal direction of the flow caused by *back-pressure* and includes *back-siphonage*.	**AS/VM -C**
Backflow prevention device A device that prevents *backflow*.	**AS/VM C, G12**
Amend 11 Sep 2010 **Backing rod** Closed cell polyethylene foam (PEF) rod inserted into gap to provide backing support for foam *air seal* or *sealant*.	**Simple House**
Back-pressure A *backflow* condition caused by the downstream pressure becoming greater than the supply pressure.	**AS/VM G12**
Back-siphonage *Backflow* condition caused by the supply pressure becoming less than the downstream pressure.	**AS/VM G12**
Baluster A post providing the support for the top and bottom rails of a barrier.	**CD-B1, CD-B2**
Amend 11 Sep 2010 **Baluster** An infil member that provides support for the top and bottom rails of a barrier.	**Simple House**
Balustrade The infill parts of a barrier (typically between floor and top rail).	**AS/VM B2, F4**
Basement Any *firecell* or part of a *firecell* below the level of the lowest *final exit*.	**AS/VM C**

COMMENT:

Amend 13 Feb 2014

Because *fire safety systems* are increased with increases in *escape height*, the precautions for *basements* increase with *basement* depth. Thus a single floor *building* with one *basement* level is treated as a two floor *building*, a single floor *building* with three *basement* levels as a four floor *building*.

Definition	Source
Base metal thickness (BMT) The thickness of the bare or base metal before any subsequent coating, such as galvanizing.	**AS/VM E2**
Amend 11 Sep 2010 **Batten** See **ceiling batten**, **tile batten**.	**Simple House**
Bird's beak A double fold applied to the edge of a horizontal metal *flashing* to stiffen the edge and to assist in deflecting moisture away from the *cladding system* below. Refer also *Kick-out* and *Drip edge*.	**AS/VM E2**
COMMENT: A *bird's beak* is used at the bottom of a *capping* to deflect water away from the *enclosed balustrade cladding*.	
Blocking Solid timber having the same depth as the joists and set at right angles between the joists to stiffen and prevent them from buckling.	**Simple House**
Bond, **running** or **stretcher** The *bond* when the units of each course overlap the units in the preceding course by between 25% and 75% of the length of the units.	**Simple House**
Amend 11 Sep 2010 **Bottom plate** A plate placed under the bottom end of *studs*.	**Simple House**
Boundary means any *boundary* that is shown on a survey plan that is approved by the Surveyor-General and deposited with the Registrar-General of Land, whether or not a new title has been issued. Amend 13 Feb 2014	**AS/VM C**
Boundary joist A joist running along the outer ends of the floor joists.	**AS/VM B1**
Bracing Any method employed to provide lateral support to a *building*.	**Simple House**
Bracing capacity Strength of *bracing* of a whole *building* or of elements within a *building*. *Bracing capacity* is measured in *bracing units* (BUs).	**Simple House**
Bracing demand The horizontal forces to be resisted by a whole *building* or by an element within a *building*. These horizontal forces are a result of wind or earthquake action. *Bracing demand* forces are measured in *bracing units* (BUs).	**Simple House**
Bracing line A line along or across a *building* containing *wall bracing elements*.	**Simple House**
Bracing rating The lateral load resistance assigned, for example, to a *wall bracing* system.	**Simple House**
Bracing unit (BU) A *bracing* unit is a measure of: (a) the horizontal force (*bracing demand*) on the *building* (1 kiloNewton is equal to 20 bracing units) Amend 11 Sep 2010 (b) the resistance to horizontal force (*bracing capacity*) of *building elements*.	**Simple House**
Branch discharge pipe A *discharge pipe* that serves one or more *fixture discharge pipes* for any one floor.	**AS/VM G13**
Branch vent pipe A *vent pipe* that serves two or more *fixture vent pipes*.	**AS/VM G13**
Building has the meaning given to it by sections 8 and 9 of the *Building Act 2004*.	**BA04**

Section 8 states:

"8 Building: what it means and includes:

(1) In this Act, unless the context otherwise requires, building—

(a) means a temporary or permanent movable or immovable structure (including a structure intended for occupation by people, animals, machinery, or chattels); and

Definition	Source

(b) includes—
(i) a mechanical, electrical, or other system; and
(ii) a fence as defined in section 2 of the Fencing of Swimming Pools Act 1987; and
2(1) of the Land Transport Act 1998) that is immovable and is occupied by people on a permanent or long term basis; and
(iii) a vehicle or motor vehicle (including a vehicle or motor vehicle as defined in section
(iv) a mast pole or a telecommunication aerial that is on, or forms part of, a building and that is more than 7 m in height above the point of its attachment or base support (except a dish aerial that is less than 2 m wide); and
(c) includes any 2 or more buildings that, on completion of building work, are intended to be managed as one building with a common use and a common set of ownership arrangements; and
(d) includes the non-moving parts of a cable car attached to or servicing a building; and
(e) after 30 March 2008, includes the moving parts of a cable car attached to or servicing a building
(2) Subsection (1)(b)(i) only applies if—
(a) the mechanical, electrical, or other system is attached to the structure referred to in subsection (1)(a); and
(b) the system—
(i) is required by the Building Code; or
(ii) if installed, is required to comply with the Building Code.
(3) Subsection (1)(c) only applies in relation to—
(a) subpart 2 of Part 2; and
(b) a building consent; and
(c) a code compliance certificate; and
(d) a compliance schedule.
(4) This section is subject to section 9."

Section 9 states:
"9 Building: what it does not include
In this Act, **building** does not include—
(a) a NUO system, or part of a NUO system, that—
(i) is external to the building; and
(ii) is connected to, or is intended to be connected to, the building to provide for the successful functioning of the NUO system in accordance with the system's intended design and purpose; and
(iii) is not a mast pole or a telecommunication aerial that is on, or forms part of, a building; or
(b) cranes (including any cranes as defined in regulations made under the Health and Safety in Employment Act 1992); or
(c) any of the following, whether or not incorporated within another structure:
(i) ski tows:
(ii) other similar stand-alone machinery systems; or

Definition	Source
(d) any description of vessel, boat, ferry, or craft used in navigation— (i) whether or not it has a means of propulsion; and (ii) regardless of what that means of propulsion is; or (e) aircraft (including any machine that can derive support in the atmosphere from the reactions of the air otherwise than by the reactions of the air against the surface of the earth); or (f) any offshore installation (as defined in section 222 of the Maritime Transport Act 1994) to be used for petroleum mining; or (g) containers as defined in section 2(1) of the Hazardous Substances and New Organisms Act 1996; or (h) magazines as defined in section 222 of the Hazardous Substances and New Organisms Act 1996; or (i) scaffolding used in the course of the construction process; or (j) falsework."	
Building Act 2004 (the Building Act) means the principal legislation dealing with building controls in New Zealand.	**HB**
COMMENT: The *Building Act* applies to the construction, alteration, and demolition of new and existing buildings throughout New Zealand.	
Building certifier means a *person* approved as a *building certifier* by the *Authority* under the *former Act*.	**HB**
COMMENT: *Building certifiers* are not provided for under the *Building Act 2004*. There are no longer any *building certifiers*.	
Building Code means the regulations made under section 400 of the *Building Act 2004*.	**BA04**
COMMENT: No regulations have yet been made under section 400 of the Building Act 2004. However, the *Building Code* is currently the First Schedule of the Building Regulations 1992, which continue in force under regulation 8(2) of the Building Forms (Regulations) 2004.	
Building consent means a consent to carry out *building work* granted by a *building consent authority* under section 49 of the *Building Act 2004*.	**BA04**
Amend 11 Sep 2010 **Building consent** A consent issued by a building consent authority for building work to begin in accordance with the approved plans and specifications.	**Simple House**
Building consent accreditation body means the person referred to in section 248(2) of the *Building Act 2004*.	**BA04**
Building consent authority (BCA) means a *person* whose name is entered in the register referred to in section 273(1)(a) of the *Building Act 2004*.	**BA04**
Building element Any structural and non-structural component and assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.	**Code**

Definition	Source
Building height Building height means the vertical distance between the floor level of the lowest *occupied space* above the ground and the top of the highest occupied floor, but not including spaces located within or on the roof that enclose stairways, lift shafts, or machinery rooms.	**Code**
Building levy means a levy payable under section 53 of the *Building Act 2004*.	**BA04**
Building method or product has the meaning given to it by section 20 of the *Building Act 2004*. Section 20(2)(c) states: "(c) building methods, methods of construction, building design, or building materials (building methods or products) that have a current product certificate issued under section 269."	**BA04**
Building performance index (BPI) in relation to a *building*, means the *heating energy* of the *building* divided by the product of the *heating degrees total* and the sum of the *floor area* and the *total wall area*, and so is calculated in accordance with the following formula: $\text{BPI} = \dfrac{\textit{heating energy}}{\textit{heating degrees total} \times (\textit{floor area} + \textit{total wall area})}$	**Code**
Building work— (a) means work— (i) for, or in connection with, the *construction*, *alteration*, demolition, or removal of a *building*; and (ii) on an *allotment* that is likely to affect the extent to which an existing *building* on that *allotment* complies with the *Building Code*; and (b) includes *sitework*; and (c) includes design work (relating to *building work*) that is design work of a kind declared by the Governor-General by Order in Council to be restricted *building work* for the purposes of this Act; and (d) in Part **4**, and the definition in this section of ``supervise'', also includes design work (relating to building work) of a kind declared by the Governor-General by Order in Council to be *building work* for the purposes of Part **4**]	**BA04**
Building warrant of fitness (BWoF) means the warrant of fitness an *owner* of a *building* must supply to a *territorial authority* under section 108 of the *Building Act 2004.*	**HB**
Building wrap or **building underlay** See **wall underlay**.	**Simple House**
Burnout Means exposure to fire for a time that includes fire growth, full development, and decay in the absence of intervention or automatic suppression, beyond which the fire is no longer a threat to building elements intended to perform loadbearing or fire separation functions, or both.	**Code**

Amend 13 Feb 2014

Amend 11 Sep 2010

Amend 12 Oct 2011

Amend 11 Sep 2010

Amend 13 Feb 2014

Definition	Source
Butt flashing A preformed wall *flashing*, used to flash windows and corners on horizontal profiled metal wall *cladding*. A *butt flashing* is shaped to underflash the *cladding*, with the *cladding* butting against the exposed box portion of the *flashing*.	**AS/VM E2**
Butyl rubber and **EPDM flashings** *Butyl rubber* and *EPDM flashings* shall be a minimum thickness of 1.0 mm, and shall comply with the following parts of Table 1 in ASTM D6134:	**Simple House**

(b) tensile strength

(c) elongation

(d) water absorption

(e) water vapour transmission

(f) heat aging followed by:
  i) tensile strength
  ii) elongation.

Amend 11 Sep 2010

C

Cable car— **BA04**

(a) means a vehicle—

(i) that carries people or goods on or along an inclined plane or a suspended cable; and

(ii) that operates wholly or partly outside of a *building*;

And

(iii) the traction for which is supplied by a cable or any other means; but

(b) does not include a lift that carries people or goods between the floors of a *building*.

Definition	Source
Cantilevered deck A *deck* where no support is provided at the outer extremities of the *deck*.	**AS/VM E2**

COMMENT:
Cantilevered decks are often *constructed* by extending *framing* members through the *cladding* beyond the *building* face. *Cantilevered decks* are sometimes known as balconies.

Definition	Source
Canterbury earthquake region is the area contained within the boundaries of the Christchurch City Council, the Selwyn District Council and the Waimakariri District Council. (Amend 12 Oct 2011)	**AS/VM B1**
Capacity The load resistance of a connector or fixing. (Amend 11 Sep 2010)	**Simple House**
Capping A *flashing* formed to cover the top of an *enclosed balustrade* or *parapet*. Also known as a coping.	**AS/VM E2**
Cavity barrier A *construction* provided to close openings within a *concealed space* against the passage of *fire*, or to restrict the spread of *fire* within such spaces.	**AS/VM C**
Cavity batten A vertical packing member used to create a *drained cavity* as part of a *cladding system*.	**AS/VM E2**

Definition	Source
Cavity spacer A short block used to provide intermittent support for fixings or pipe penetrations through a *drained cavity*, while not interrupting drainage within the cavity. A *cavity spacer* is required to be set to a slight fall (5° minimum from horizontal) to allow drainage of any moisture from the top.	**AS/VM E2**
Cavity wall A term used to describe a wall that incorporates a *drained cavity*.	**AS/VM E2**
Amend 11 Sep 2010 **Ceiling batten** A horizontal member fixed below *rafters*, or truss bottom chords to which the ceiling *lining* is attached.	**Simple House**
Certificate of acceptance means a certificate issued under section 96 of the *Building Act 2004*.	**BA04**
Certificate for public use means a certificate issued under section 363A of the *Building Act 2004*.	**HB**
Change the use for the purposes of sections **114** and **115** of the *Building Act 2004*, change the use, in relation to a *building*, means to change the use (determined in accordance with regulation **6**) of all or a part of the *building* from one use (the old use) to another (the new use) and with the result that the requirements for compliance with the *Building Code* in relation to the new use are additional to, or more onerous than, the requirements for compliance with the *Building Code* in relation to the old use.	**BR2**
Check valve (or non-return valve) A valve that permits flow in one direction but prevents a return flow and is part of a *backflow prevention device.*	**AS/VM G12**
Chimney A *non-combustible* structure which encloses one or more *flues*, *fireplaces* or other heating appliances.	**AS/VM B1, C, G4**
Chimney back The *non-combustible* wall forming the back of a *fireplace*.	**AS/VM B1, C**
Chimney base That part of a *chimney* which houses the *fireplace*.	**AS/VM B1**
Chimney breast The front *fireplace* wall *construction* above the *fireplace* opening.	**AS/VM B1**
Chimney jambs The side walls of a *fireplace*.	**AS/VM B1, C**
Cladding The exterior weather-resistant surface of a *building*. **COMMENT:** Includes any supporting substrate and, if applicable, surface treatment.	**AS/VM E2**
Amend 12 Oct 2011 **Cladding system** The outside or exterior weather-resistant surface of a *building*; including *roof cladding* and *roof underlays*, wall *cladding* and *wall underlays*, and cavity components, rooflights, windows, doors and all penetrations, *flashings*, seals, joints and junctions. Where required by this Acceptable Solution, the *cladding system* shall include a *drained cavity*.	**AS/VM E2**
Amend 11 Sep 2010 **Cladding system** The weatherproof wall or *roof* enclosure of a *building*, including underlays, *claddings* and their fixings, windows, doors and all penetrations, *flashings*, seals, joints and junctions.	**Simple House**
Classified use means a *classified use* listed in clause A1 of the *Building Code*.	**BR1**
Cleaning eye A small *diameter access point* usually formed as part of a fitting or trap.	**AS/VM G13**

Definition	Source
Amend 11 Sep 2010 **Cleared ground level (CGL)** The *ground level* after completion of site excavation and removal of all harmful material, but before excavation for *foundations*.	**Simple House**
Amend 13 Feb 2014 **Clearly visible** for the purposes of Clause F8 and in relation to a sign means the nearest such sign is visible and readable at the maximum distance from which it needs to be viewed, to a person who either does not have a visual impairment, or uses corrective lenses.	**Code**
Code compliance certificate means a certificate issued by a *building consent authority* under section 95 of the *Building Act 2004*.	**BA04**
Combined waste pipe A *discharge pipe* which serves two or more *waste pipes*.	**AS/VM G13**
Combustible See *non-combustible*.	**AS/VM B1, C**
Combustion appliance A slow combustion stove, a free standing metal cone fireplace, a cast iron pot belly stove, an oil burning space heater, or a vented gas burning heater.	**Code**
Amend 11 Sep 2010 **Common extract duct** A mechanical ventilation duct that extracts from different household units, and may contain air, moisture and contaminant.	**AS/VM G4**
Common ramp A ramp which is used, or intended to be used by the public whether as of right or not, and is not a *service ramp* or *accessible* ramp.	**AS/VM D1**
Common stairway A *stairway* which is used, or intended to be used, by the public whether as of right or not, and is not a *private stairway, service stairway* or *accessible stairway*.	**AS/VM D1**
Compliance document has the meaning given to it by section 22 of the *Building Act 2004*.	**BA04**

Section 22 states:

"22. Compliance document for use in establishing compliance with Building Code —
(1) The chief executive may, by notice in the Gazette, issue a document for use in establishing compliance with the Building Code (a Compliance Document).
(2) A person who complies with a Compliance Document must, for the purposes of this Act, be treated as having complied with the provisions of the Building Code to which the document relates.
(3) Subsection (2) is subject to any regulations referred to in section 20".

Definition	Source
Compliance schedule means a *compliance schedule* required under section 100 of the *Building Act 2004*.	**BA04**
Compliance schedule statement means a statement issued by a *territorial* or *regional authority* referred to in section 105(e) of the Building Act 2004.	**HB**
Amend 13 Feb 2014 **Computational fluid dynamics (CFD)** Calculation method that solves equations to represent the movement of fluids in an environment.	**AS/VM C**
Concealed space Any part of the space within a *building* that cannot be seen from an *occupied space*.	**Code**

COMMENT:
This term includes any ceiling space, roof space, space under a raised floor (such as computer rooms, floors, or stages), plenums, spaces under a tiered floor, "left-over spaces" created when some structural element or the like has been covered in; small service or duct spaces within the volume of a *firecell* and the like, but not a *protected shaft*.

Definition	**Source**
Amend 11 Sep 2010 **Concrete slab shrinkage control joint** A line along which the horizontal strength of the slab is deliberately reduced so that any shrinkage in the slab will result in a crack forming along that line.	**Simple House**
Constant pressure means subjected to the sustained force of fluid forming the reservoir. When there is no water in a reservoir, there is no pressure. When a reservoir is partially filled, there is a constant pressure – in terms of it being a pressure sustained in time.	**DG**
Construct in relation to a *building*, includes to design, build, erect, prefabricate, and relocate the *building*.	**BA04**
Contaminant includes any substance (including gases, odorous compounds, liquids, solids, and microorganisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or heat. (a) When discharged into water, changes or is likely to change the physical, chemical, or biological condition of water, or (b) When discharged onto or into land or into air, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged.	**RMA**
Controlled area That area where the use of radioactive material or an irradiating apparatus may, in the opinion of the *licensee*, present a hazard to *persons* within that area.	**AS/VM F8**
Control joint A joint designed to prevent damage by accommodating movement. See also *Expansion joint.*	**AS/VM E2**
Amend 11 Sep 2010	
Cross connection Any actual or potential connection between a *potable water* supply and a source of contamination.	**AS/VM G12**

D

Amend 11 Sep 2010 **D** A deformed reinforcing bar of the stated *diameter* in millimetres.	**Simple House**
Dam	**BA04**

(a) means an artificial barrier, and its appurtenant structures, that—
- (i) is constructed to hold back water or other fluid under constant pressure so as to form a reservoir; and
- (ii) is used for the storage, control, or diversion of water or other fluid; and
- (iii) retains 3 or more metres depth, and holds 20,000 or more cubic metres volume, of water or other fluid; and

(b) includes—
- (i) a flood control *dam*; and
- (ii) a natural feature that has been significantly modified to function as a *dam*; and
- (iii) a canal; but

(c) does not include a stopbank designed to control floodwaters.

Definition	Source
COMMENT: 20,000 cubic metres is equivalent to six Olympic size swimming pools. Note: An Olympic swimming pool size is 50 m long x 25 m wide x 2 m deep.	
Dam safety assurance programme means a *dam safety assurance programme* prepared by an owner of a *dam* under section 140 of the *Building Act 2004*.	**BA04**
COMMENT: In order for *dams* to maintain their integrity ongoing monitoring, maintenance and repair is essential. For those *dams* classified as medium or high potential impact, *dam* owners have to prepare and submit a safety assurance programme to the *regional authority* on an annual basis.	
Dam compliance certificate A certificate issued by the owner of a *dam* annually stating that all procedures in the *dam safety assurance programme* have been fully complied with during the previous 12 months.	**DG**
Damp-proof course (DPC) A narrow strip (generally up to 300 mm wide) of *durable vapour barrier* placed between *building elements* to prevent the passage of moisture from one element to another.	**AS/VM E2**
Damp-proof course (DPC) A narrow strip (generally up to 300 mm wide) of *durable vapour barrier* greater than 90MN s/g to ASTM E96 and placed between *building elements* to prevent the passage of moisture from one element to another. (Amend 11 Sep 2010)	**Simple House**
Damp-proof membrane (DPM) A sheet material, coating or *vapour barrier*, having a low water vapour transmission, and used to prevent water and water vapour movement through concrete in contact with the ground. (Also known as a concrete underlay.)	**AS/VM B2, E2**
Dangerous goods Any materials included in the UN classification, classes 2-5.	**AS/VM F8**
COMMENT: See *Hazardous substance.*	
Dangerous goods workroom A room reserved primarily for the use of *dangerous goods* of Class 3(a) or Class 3(b) (i.e. flammable liquids).	**AS/VM F8**
Dead end That part of an *open path* where escape is possible in only one direction.	**AS/VM C**
COMMENT: A *dead end* ceases to exist where the *escape route* reaches a point in the *open path* which offers alternative directions of travel, or at a *final exit* or an *exitway.*	
Deck An open platform projecting from an exterior wall of a *building* and supported by *framing*. A *deck* may be over enclosed internal spaces, or may be open underneath. Refer also *Enclosed deck*. Also known as a balcony.	**AS/VM E2**

Amend 11 Sep 2010

Definition	Source
Department means the Department of Building and Housing.	**HB**
Amend 11 Sep 2010 **Department of Conservation** means the department of State established by section 5 of the Conservation Act 1987.	**Code**
Design fire Quantitative description of assumed *fire* characteristics within the *design scenario*.	**AS/VM C**
Design scenario Specific scenario on which a deterministic *fire safety engineering* analysis is conducted.	**AS/VM C**
Amend 13 Feb 2014 **Detection time** Time interval between ignition of a *fire* and its detection by an automatic or manual system.	**AS/VM -C**
Determination means a determination made by the Chief Executive under subpart 1 of Part 3 of the *Building Act 2004*.	**BA04**
Developed length The total length along the centre line of a pipe including fittings and bends.	**AS/VM G13**
Amend 11 Sep 2010 **Diagonal brace** A member of a framed *building* fixed diagonally and used to resist tension or compression or both.	**Simple House**
Diameter (or bore) The nominal internal *diameter*.	**AS/VM G12, G13**
Direct fixed A term used to describe a wall *cladding* attached directly to the wall *framing*, without the use of a *drained cavity*.	**AS/VM E2**
Amend 11 Sep 2010 **Director-General** has the same meaning as in section 2(1) of the Conservation Act 1987.	**Code**
Discharge pipe Any pipe that is intended to convey discharge from *sanitary fixtures* or *sanitary appliances*.	**AS/VM G13**
Discharge stack A *discharge pipe* that has one or more *discharge pipe* connections, and which is vented at one end via a *discharge stack vent*.	**AS/VM G13**
Discharge stack vent A *vent pipe* connected to the top of the *discharge stack*.	**AS/VM G13**
Discharge unit The unit of measure for the discharge (hydraulic load) in the *plumbing system*, and is based on the rate, duration and frequency of discharge from a *sanitary fixture* or *sanitary appliance*.	**AS/VM G13**
Doorset A complete assembly comprising a door leaf or leaves including any glazed or solid panels adjacent to or over the leaves within the door frame including hardware or other inbuilt features; and a door frame, if any, with its fixings to the wall and, for a sliding or tilting door, all guides and their respective fixings to the lintel, wall or sill.	**AS/VM C, F8**
Dormer or dormer window A framed structure that projects from a sloping roof, and has a window at its outer end.	**AS/VM E2**
Drain A pipe normally laid below ground level including fittings and equipment and intended to convey *foul water* or *surface water* to an *outfall*.	**Code**
Drained cavity A cavity space, immediately behind a wall *cladding*, that has vents at the base of the wall. Also known as a drained and vented cavity and Amend 12 Oct 2011 referred to in E2/AS1 as a cavity or *drained cavity*.	**AS/VM E2**

A *drained cavity* assists drying by allowing water which occasionally penetrates the wall *cladding system* to drain to the exterior of the *building*, and any remaining

Definition	Source
moisture to dry by evaporation. Where E2/AS1 requires a nominal 20 mm *drained cavity*, the depth shall be between limits of 18 mm and 25 mm. For definition of masonry veneer cavity refer to SNZ HB 4236.	
Drain vent pipe Any pipe which is intended to permit the movement of air into and out of the *drain* and *sewer*.	**AS/VM G13**
Draught diverter A device, without moving parts, fitted in the *flue* of an appliance for isolating the combustion system from the effects of pressure changes in the secondary *flue*.	**AS/VM G4, C**
Drip edge Fold(s) applied to the edge of a horizontal metal *flashing* to deflect moisture away from the *cladding system* below. Refer also *Bird's beak* and *Kick-out*.	**AS/VM E2**
Durable Resistant to wear and decay.	**AS/VM B2**
Amend 12 Oct 2011 **Dwang** A short (usually horizontal) member fixed between vertical *framing* timbers. Also known as nogging.	**AS/VM E2**

E

Definition	Source
Early childhood centre means premises used regularly for the education or care of 3 or more children (not being children of the persons providing the education or care, or children enrolled at a school being provided with education or care before or after school) under the age of six— a) by the day or part of a day; but b) not for any continuous period of more than seven days. Amend 13 Feb 2014 ECC does not include home based early childhood services.	**AS/VM C**
Amend 12 Oct 2011 **Eaves** That part of the roof *construction*, including *cladding*, fascia and eaves gutter (spouting), that extends beyond the exterior face of the wall.	**AS/VM E2**
Eaves bearer or **soffit bearer** or **sprocket** A horizontal member attached to the end of a truss or a *rafter* and to a *stud*, or a ribbon board, or a soffit plate, and to which the *eaves lining* is attached.	**Simple House**
Amend 11 Sep 2010 **EPDM** Ethylene Propylene Diene Monomer – a thermosetting synthetic rubber. See **butyl rubber**.	**Simple House**
EIFS (Exterior Insulation and Finish System) A polystyrene sheet-based *cladding system* that uses mesh reinforced polymer-modified cement-based or polymer-based plaster base coats and a protective top coating.	**AS/VM E2**
Electrical fixed appliance An electrical appliance which is fixed-wired to the *electrical installation*, or intended to remain permanently attached and form part of the *building*.	**Code**
Electrical installation Any *electrical fixed appliances* and components used in the reticulation of electricity, which are intended to remain permanently attached to and form part of the *building*.	**Code**
Electrical supply system The source of electricity external to the *electrical installation*.	**Code**
Electrolytic corrosion Galvanic corrosion commonly resulting from the contact of two dissimilar metals when an electrolyte such as water is present.	**AS/VM E2**

Definition	Source
Enclosed balustrade A timber-framed barrier with *cladding* across all exposed faces. Refer also Parapet. (Amend 12 Oct 2011)	**AS/VM E2**
Enclosed deck A *deck*, whether over an interior or exterior space, that has an impermeable upper surface and is closed on the underside. May also be known as a balcony.	**AS/VM E2**
Energy work means— (a) gasfitting; or (b) prescribed electrical work	**BA04**
Energy work certificate means a certificate of the kind referred to in section 19(1)(e) of the *Building Act 2004*.	**BA04**
Envelope complexity The categorisation of the complexity of the total *building* envelope into one of four classes, depending on the particular features of the *building* as specified in E2/AS1.	**AS/VM E2**
EPDM (Ethylene Propylene Diene Monomer) A thermosetting synthetic rubber used as a resilient part of a sealing washer, or as a roof *membrane*.	**AS/VM E2**
Equivalent aerodynamic area The area of an equivalent aerodynamically perfect orifice, and equals the penetration area required by the natural ventilation device multiplied by the discharge coefficient determined under test. (Amend 11 Sep 2010)	**AS/VM G4**
Escape height The height between the floor level in the *firecell* being considered and the floor level of the required *final exit* which is the greatest vertical distance above or below that *firecell*.	**AS/VM C, F3, F6**

COMMENT:

1. It is necessary only to use the greatest height to the exits required for the *firecell* being considered, even though the *building* may have other *final exits* at lower or higher levels.
2. Where the *firecell* contains *intermediate floors*, or upper floors within *household units* the *escape height* shall be measured from the floor having the greatest vertical separation from the *final exit*.

Escape route A continuous unobstructed route from any *occupied space* in a *building* to a *final exit* to enable occupants to reach a *safe place*, and shall comprise one or more of the following: *open paths*, *protected paths* and *safe paths*.	**Code**

COMMENT:

Doors are not obstructions in an *escape route* provided they comply with **C/AS1** Part 3 and D1/AS1.

Essential service In the context of an *electrical installation* means emergency lighting, firemen's lifts, alarms, water pumps, sprinklers, detectors, ventilation systems and public address systems necessary for the safety of people in *buildings*.	**Code**
Estimated value in relation to *building work*, means the estimated aggregate of the values, determined in accordance with section 10 of the Goods and Services Tax Act 1985, of all goods and services to be supplied for the *building work*.	**BA04**
Evacuation time Time interval between the time of warning of a *fire* being transmitted to the occupants and the time at which the occupants of a specified part of a *building* or all of the *building* are able to enter a *place of safety*. (Amend 13 Feb 2014)	**Code**

Definition	Source
Exitway All parts of an *escape route* protected by *fire* or *smoke separations*, or by distance when exposed to open air, and terminating at a *final exit*.	**Code**
Expansion joint A joint designed to prevent damage by accommodating movement. See also *Control joint*.	**AS/VM E2**
External wall Any exterior face of a *building* within 30° of vertical, consisting of *primary* and/or *secondary elements* intended to provide protection against the outdoor environment, but which may also contain *unprotected areas*.	**Code**

COMMENT:
A roof is an *external wall* if within 30° of the vertical.

Amend 11 Sep 2010

External wall An outer wall of a *building*.	**Simple House**

Amend 12 Oct 2011

External wall Any vertical exterior face of a *building* consisting of *primary* and/or *secondary elements* intended to provide protection against the outdoor environment.	**AS/VM E2**

F

Factor of safety in relation to any *building* means the ratio of resisting forces to applied forces for a given loading condition. It is generally expressed to two significant figures.	**AS/VM B1**
Falsework, in relation to *building work* or the maintenance of a *building*,—`	**BA04**

(a) means any temporary structure or framework used to support materials, equipment, or an assembly; and

(b) includes steel tubes, adjustable steel props, proprietary frames, or other means used to support a permanent structure until it becomes self-supporting; but

(c) does not include scaffolding or cranes used for support.

Final exit The point at which an *escape route* terminates by giving direct access to a *safe place*.	**Code**

COMMENT:
Final exits are commonly the external doors from a ground floor, but this applies only if such doors open directly onto a *safe place*. If a *safe place* can be reached only by passing down an alley, or across a bridge, then the *final exit* is not reached until the end of such an alley or bridge. *Final exits*, therefore, should be seen strictly as a point of arrival, rather than as any particular element of a *building*. They are determined entirely by the definition of *safe place*.

Amend 12 Oct 2011

Finished ground level (FGL) The level of the ground against any part of a *building* after all backfilling and/or landscaping and/or surface paving has been completed.	**AS/VM E2**
Fire The state of combustion during which flammable materials burn producing heat, toxic gases, or smoke or flame or any combination of these.	**Code**
Firecell Any space including a group of contiguous spaces on the same or different levels within a *building*, which is enclosed by any combination of *fire separations*, *external walls*, roofs, and floors.	**Code**

COMMENT:
Floors, in this context, includes ground floors and those in which the underside is exposed to the external environment (eg, when cantilevered). Note also that internal floors between *firecells* are *fire separations*.

Definition	Source

Amend 13 Feb 2014

Fire damper A device with a specified *FRR* complete with fixings and operating mechanism for automatically closing off an airway where it passes through a *fire separation*. — **AS/VM C**

COMMENT:
An airway may be a duct, plenum, ceiling space, roof space or similar *construction* used for the passage of ventilating air.

Amend 13 Feb 2014

Fire decay Stage of *fire* development after a *fire* has reached its maximum intensity and during which the *heat release rate* and the temperature of the *fire* are decreasing. — **AS/VM C**

Fire door A *doorset*, single or multi-leaf, having a specific *fire resistance rating*, and in certain situations a smoke control capability, and forming part of a *fire separation*. The door, in the event of *fire*, if not already closed, will close automatically and be self latching. — **AS/VM C**

COMMENT:
Requirements for fire doors are given in **C/AS1** Paragraphs 6.19.1 and 6.19.8 and Appendix C, Paragraph C 8.1.

Amend 13 Feb 2014

Fire growth Stage of *fire* development during which the *heat release rate* and the temperature of the *fire* are increasing. — **AS/VM C**

Fire hazard means the danger of potential harm and degree of exposure arising from— — **BA04**

(a) the start and spread of *fire*; and

(b) the smoke and gases that are generated by the start and spread of *fire*.

Fire hazard category (FHC) The number (graded 1 to 4 in order of increasing severity), used to classify *purpose groups* or activities having a similar *fire hazard*, and where fully developed *fires* are likely to have similar impact on the structural stability of the *building*. — **AS/VM C**

COMMENT:
Fire hazard categories are identified in **C/AS1** Table 2.1.

Fire intensity The rate release of calorific energy in watts, determined either theoretically or empirically, as applicable. — **Code**

Amend 13 Feb 2014

Fire load Quantity of heat which can be released by the complete combustion of all the *combustible* materials in a volume, including the facings of all bounding surfaces (Joules). — **AS/VM C/VM2**

Fire load The sum of the net calorific values of the *combustible* contents which can reasonably be expected to burn within a *firecell*, including furnishings, built-in and removable materials, and *building elements*. The calorific values shall be determined at the ambient moisture content or humidity. (The unit of measurement is MJ.) — **Code**

Definition	Source
Amend 13 Feb 2014 **Fire load energy density (FLED)** *Fire load* per unit area (MJ/M^2).	**AS/VM C**
Fireplace A space formed by the *chimney back*, the *chimney jambs*, and the *chimney breast* in which fuel is burned for the purpose of heating the room into which it opens.	**AS/VM B1, C**
Fire resistance rating (FRR) The term used to describe the minimum *fire* resistance required of *primary* and *secondary elements* as determined in the *standard test* for *fire* resistance, or in accordance with a specific calculation method verified by experimental data from standard *fire* resistance tests. It comprises three numbers giving the time in minutes for which each of the criteria *structural adequacy, integrity* and *insulation* are satisfied, and is presented always in that order. (Amend 13 Feb 2014)	**AS/VM C**

COMMENT:

1. Examples of *FRRs* are:

(a) 60/60/30 indicating *structural adequacy* 60 minutes, *integrity* 60 minutes, *insulation* 30 minutes.

b) 30/-/- indicating *structural adequacy* 30 minutes, but no time requirement for *integrity* or *insulation*.

c) 60/30/x indicating *structural adequacy* of 60 minutes, *integrity* of 30 minutes, and a requirement for *insulation*.

Amend 13 Feb 2014

2. **C/AS1**–7 Part 2 gives more information on *FRRs*.

Definition	Source
Fire resisting closure A *fire* rated device or assembly for closing an opening through a *fire separation*. (Amend 13 Feb 2014)	**Code**

COMMENT:
A *fire resisting closure* is intended to include *fire doors*, *fire* windows or access panels. In this context the opening may be used to permit passage of people or goods, or to transmit light, but does not include an opening to permit the passage of *building* services.

Definition	Source
Fire resisting glazing Fixed or openable glazing, complete with frame and fixings, mullions, transoms and glazing beads, with a specified *FRR* and complying with NZS 4232: Part 2.	**AS/VM C**

COMMENT:

1. The requirement for *fire resisting glazing* will not be met by ordinary window glass, or safety glasses, but rather by wired glass, or by special *fire* resisting glass shown by test to perform adequately. The nature and design of the frames also have an effect on the performance of *fire resisting glazing*.
2. Openable glazing is required by NZS 4232 Part 2 to be fitted with an automatic device which, in the event of *fire*, will close and latch the window sash.

Definition	Source
Amend 13 Feb 2014 **Fire retardant** A substance or a treatment, incorporated in or applied to a material, which suppresses or delays the combustion of that material under specified conditions.	**AS/VM C**
Fire safety engineering Application of engineering methods based on scientific principles to the development or assessment of designs in the built environment through the analysis of specific *design scenarios* or through the quantification of risk for a group of *design scenarios.*	**AS/VM C**

Definition	Source
Fire safety systems means the combination of all active and passive protection methods used in a *building* to— (a) warn people of an emergency; and (b) provide for safe evacuation; and (c) provide for access by, and the safety of, firefighters; and (d) restrict the spread of *fire*; and (e) limit the impact of *fire* on structural stability	**Code**
Fire separation Any *building element* which separates *firecells* or *firecells* and *safe paths*, and provides a specific *fire resistance rating*.	**Code**
Fire shutter A *fire* rated device, complete with fixings and operating mechanism, for automatically closing off an opening in a *fire separation* or *protected shaft*.	**AS/VM C**
Fire stop A material or method of *construction* used to restrict the spread of *fire* within or through *fire separations*, and having a *FRR* no less than that of the *fire separation*.	**AS/VM C**

Amend 13 Feb 2014

COMMENT:
Fire stops are mainly used to seal around *penetrations*, but can also be used to seal narrow gaps between *building elements*.

Definition	Source
Fixture An article intended to remain permanently attached to and form part of a *building*.	**Code**
Fixture discharge pipe A *discharge pipe* that is used to convey waste from a single *sanitary fixture* or *sanitary appliance* to a *branch discharge pipe*, a *discharge stack*, or directly to a *drain*. It does not include any pipes forming part of a *sanitary appliance*.	**AS/VM G13**
Fixture vent pipe (trap vent) A *vent pipe* that is connected to a *fixture discharge pipe* or the *sanitary fixture* itself.	**AS/VM G13**

Amend 13 Feb 2014

Definition	Source
Flame safeguard system A system consisting of a flame detector(s) plus associated circuitry, integral components, valves and interlocks the function of which is to shut off the fuel supply to the burner(s) in the event of ignition failure or flame failure.	**AS/VM G11**
Flammability index (FI) That index number for flammability, which is determined according to the *standard test* method for flammability of thin flexible materials.	**AS/VM C**
Flashing A component, formed from a rigid or flexible *waterproof* material, that drains or deflects water back outside the *cladding system*.	**AS/VM E2**
Amend 13 Feb 2014 **Flashover** Stage of *fire* transition to a state of total surface involvement in a *fire* of *combustible* materials within an enclosure.	**AS/VM C**
Amend 11 Sep 2010 **Flexible flashing tape** A flexible self-adhesive *waterproof* tape. Usually used as an accessory for *wall underlays*, to seal corners and intersections.	**AS/VM E2**

Definition	Source
Flexible flashing tape A flexible self-adhesive *waterproof* tape. Usually used as an accessory for *wall underlays* to seal corners and intersections	**Simple House**
Flood level rim The top edge at which water can overflow from equipment or a *fixture*.	**AS/VM G12**
Amend 11 Sep 2010 **Floor area**, in relation to a *building*, means the *floor area* (expressed in square metres) of all interior spaces used for activities normally associated with domestic living.	**Code**
Floor waste An outlet located at the low point of a graded floor or in a level floor designed to receive accidental or intentional discharges.	**AS/VM E3, G13**
Amend 11 Sep 2010 **Floor waste gully** A disconnector gully for installation inside a *building*, for use with a floor grating or waste outlet fitting on a riser pipe and with provision, where required, for connection of waste pipes for *sanitary fixtures*.	**Simple House**
Floor waste pipe A pipe that receives the discharge from a *floor waste* and that discharges outside the *building* or to the *foul water* drainage or sanitary *plumbing system*.	**AS/VM G13**
Flue The passage through which the products of combustion are conveyed to the outside.	**AS/VM B1, B2, C, G4, G11**
Flue liner Pipes or linings of *fire* clay, metal or *fire* brick, surrounding *flues*.	**AS/VM C**
Flue system A series of interconnecting *flue* pipe casings which form a safe passage ***(flue)*** for conveying products of combustion from within an appliance to the outside of a *building* or structure.	**AS/VM C**
Flush-finished The description of a *cladding* and joints system which relies on a protective coating applied to the face of the *cladding* to prevent the penetration of water.	**AS/VM E2**
Foamed plastics *Combustible* foamed plastic polymeric materials of low density (typically less than 100 kg/m^3) and are classified as cellular polymers which are manufactured by creating a multitude of fine voids (typically 90 to 98%) distributed more or less uniformly throughout the product. Examples of *foamed plastics* are latex foams, polyethylene foams, polyvinyl chloride foams, expanded or extruded polystyrene foams, phenolic foams, ureaformaldehyde foams, polyurethane foams and polychloropene foams.	**AS/VM C**

COMMENT:

1. *Foamed plastics* may be rigid or flexible, but rigid foams are the most common in *building* products. When burnt they tend to generate high levels of heat energy (kJ/kg) and varying quantities of smoke and other toxic gases depending on the nature and volume of the particular product.
2. Where doubt exists as to whether a *building* material is *foamed plastics*, an opinion should be sought from a *person* or organisation with appropriate skill and experience in *fire* engineering. That opinion should be included with the *building consent* application to the *building consent authority*.

Definition	Source
Amend 11 Sep 2010 **Footing** That portion of a *foundation* bearing on the ground and any adjoining portion that is reinforced so as to resist the bearing forces.	**Simple House**

Definition	Source
Forced or induced draught appliance An appliance where all or part of the air for combustion is provided by a fan or other mechanical device which is an integral part of the combustion system.	**AS/VM G4**
Former Act means the Building Act 1991.	**BA04**
Foul water The discharge from any *sanitary fixture* or *sanitary appliance*.	**Code**
Foul water drainage system *Drains,* joints and fittings normally laid underground and used specifically for the conveyance of water from the *plumbing system* to an *outfall*.	**Code**
Amend 11 Sep 2010 **Foundation** Those parts of a *building* transmitting and distributing loads to the ground through a *footing*.	**Simple House**
Fractional effective dose (FED) The fraction of the dose (of carbon monoxide (CO) or thermal effects) that would render a person of average susceptibility incapable of escape.	

COMMENT:

The definition for FED has been modified from the ISO definition to be made specific for Verification Method C/VM2. The ISO definition is "Ratio of the exposure dose for an insult to that exposure dose of the insult expected to produce a specified effect on an exposed subject of average susceptibility."

Amend 13 Feb 2014

Definition	Source
Framing Timber members to which *lining*, *cladding*, flooring, or decking is attached; or which are depended upon for supporting the structure, or for resisting forces applied to it.	**AS/VM E2**
Free outlet (push through) In the context of *storage water heaters* means a *water heater* with a tap on the cold water inlet so designed that the hot water is discharged through an open outlet.	**AS/VM G12**
Amend 13 Feb 2014 **Fully developed fire** State of total involvement of *combustible* materials in a *fire*.	**AS/VM C**
Functional requirements in relation to a *building*, means those functions which a *building* is to perform for the purposes of the *Building Act 2004*.	**BA04**

G

Definition	Source
Gable Triangular part of an *external wall* between the planes of the *roof* and the line of the *eaves*.	**Simple House**
Galvanised steel flashings Galvanised steel *flashings* shall be: (a) *BMT* of 0.55 mm minimum for *flashings* generally (b) *BMT* of 0.4 mm minimum for roll-formed roll-top ridge *flashings* (c) Hot-dipped zinc coated Z275 with a factory-applied finish that complies with AS/NZS 2728 Type 4, and in Sea Spray and corrosion Zone 1 the factory-applied finish shall be Type 5 minimum. Amend 11 Sep 2010	**Simple House**
Gantry A structure covering a public way providing protection from both the side and overhead.	**AS/VM F5**

Definition	Source
Gasfitting has the meaning given to it by section 2 of the Plumbers, Gasfitters, and Drainlayers Act 1976.	**BA04/PGDA**

Section 2 states:

"(a) The work of fixing or unfixing pipes (including flue and ventilation pipes) beyond the outlet of any gas measurement system supplying a consumer or gas refueller with gas (or, where there is no such gas measurement system, beyond the custody transfer point of the place at which gas is supplied to a consumer or gas refueller):

(b) The work of fixing or unfixing pipes (including flue and ventilation pipes) that convey gas from any gas storage container in the possession or control of a consumer or gas refueller, and—

(i) In the case of liquefied petroleum gas, that are downstream of the first regulator beyond that container; or

(ii) In the case of any other gas or where there is no such regulator (in the case of liquefied petroleum gas), that are downstream of the outlet valve of the container:

(c) The work of fixing or unfixing the whole or part of the control system of any gas appliance—
but does not include—

(d) Work on any gas storage container, including its fixing or unfixing; or

(e) Work on any gas transmission system or distribution system; or

(f) Work on any pipes or fittings supplied with liquefied petroleum gas from any gas storage container or containers that contains, or together contain, less than 15 kilograms net weight of liquefied petroleum gas; or

(g) Work in any circumstances where the exclusions in section 3(2) of the Gas Act 1992 apply:]"

Gather That part of a *chimney* where the transition from *fireplace* to stack occurs.	**AS/VM B1**
Good ground means any soil or rock capable of permanently withstanding an ultimate bearing pressure of 300 kPa (i.e. an allowable bearing pressure of 100 kPa using a *factor of safety* of 3.0), but excludes:	**AS/VM B1**

(a) Potentially compressible ground such as topsoil, soft soils such as clay which can be moulded easily in the fingers, and uncompacted loose gravel which contains obvious voids,

(b) Expansive soils being those that have a liquid limit of more than 50% when tested in accordance with NZS 4402 Test 2.2, and a linear shrinkage of more than 15% when tested, from the liquid limit, in accordance with NZS 4402 Test 2.6, and

(c) Any ground which could forseeably experience movement of 25 mm or greater for any reason including one or a combination of: land instability, ground creep, subsidence, (liquefaction, lateral spread – for the *Canterbury earthquake region* only), seasonal swelling and shrinking, frost heave, changing ground water level, erosion, dissolution of soil in water, and effects of tree roots.

Amend 12 Oct 2011

Definition	Source

COMMENT:
Soils (excepting those described in (a), (b) and (c) above) tested with a dynamic cone penetrometer in accordance with NZS 4402 Test 6.5.2, shall be acceptable as *good ground* for *building* foundations if penetration resistance is no less than:

(a) 5 blows per 100 mm at depths down to twice the footing width.

Amend 13 Feb 2014

(b) 3 blows per 100 mm at depths greater than twice the footing width.

Depths shall be measured from the underside of the proposed footing.

Good ground Any soil or rock capable of permanently withstanding an ultimate bearing pressure of 300 kPa (ie, an allowable bearing pressure of 100 kPa using a *factor of safety* of 3.0) but excluding: — **Simple House**

(a) potentially compressible ground such as top soil, soft soils such as clay which can be moulded easily in the fingers, and uncompacted loose gravel which contains obvious voids;

(b) expansive soils being those that have a liquid limit of more than 50% when tested in accordance with NZS 4402 Test 2.2, and a linear shrinkage of more than 15% when tested from the liquid limit in accordance with NZS 4402 Test 2.6, and

(c) any ground which could foreseeably experience movement of 25 mm or greater for any reason including one or a combination of: land instability, ground creep, subsidence, seasonal swelling and shrinkage, frost heave, changing ground water level, erosion, dissolution of soil in water, and effects of tree roots.

(Note that soils, excepting those described in (a), (b) and (c) above, tested with a dynamic cone penetrometer in accordance with NZS 4402 Test 6.5.2, shall be acceptable as *good ground* for *building foundations* if penetration resistance is no less than:

(i) 3 blows per 75 mm at depths no greater than the footing width

(ii) 2 blows per 75 mm at depths greater than the footing width.

Amend 11 Sep 2010

Depths shall be measured from the underside of the proposed *footing*.)

Grease trap A device designed to intercept grease in a *foul water* discharge. — **AS/VM G13, AS/VM G14**

Gross floor area The area contained within the outside face of the exterior timber wall *framing* of a *simple house*. — **Simple House**

Amend 11 Sep 2010

Ground level See **cleared ground level, finished ground level**. — **Simple House**

Group Number The classification number for a material used as a finish, surface, lining, or attachment to a wall or ceiling within an *occupied space* and determined according to the *standard test* methods for measuring the properties of lining materials. — **Code**

Amend 13 Feb 2014

COMMENT:
The method for determining a Group Number is described in **C/VM2** Appendix A.

Definition	Source
Group sleeping area A *firecell* containing communal sleeping accommodation for a specified number of people who may or may not be known to one another. Partial subdivision within the *firecell* is permitted with specific limitation including that no *occupied space* is fully enclosed and all *occupied spaces* are open and available to all occupants at any time. A *group sleeping area firecell* may include spaces for associated direct support functions, such as hygiene facilities and tea making (not cooking) activities, for use by the occupants. It does not include spaces, such as waiting rooms, lounges, dining rooms or kitchens, providing a communal service function for all occupants.	**AS/VM C**

COMMENT:

1. Examples of *group sleeping area firecells* are dormitories, hospital wards, *wharenui*, backpacker hostels and ski lodges.
2. The maximum number of people permitted in a *group sleeping area firecell*, and the permitted form of subdivision, will depend on the ability of the occupants to react to the presence of *fire* and escape to a *safe place*.

Gully trap A fitting designed to prevent foul air escaping from the drainage system and used to receive the discharge from *waste pipes*.	**AS/VM G13**

H

Habitable space A space used for activities normally associated with domestic living, but excludes any bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods.	**Code**
Handrail A rail to provide support to, or assist with the movement of a *person*.	**Code**
Hazardous Creating an unreasonable risk to people of bodily injury or deterioration of health.	**Code**
Hazardous substance Has the meaning given to it by section 2 of the Fire Service Act 1975 and section 2 of the Hazardous Substances and New Organisms Act 1996	**Code/FSA/ HSNOA**

Section 2 of the Fire Service Act 1975 states:

"Hazardous substance" means

(a) Any hazardous substance as defined in section 2 of the Hazardous Substances and New Organisms Act 1996; and

(b) Any infectious or radioactive substance that may impair human, animal, or plant" health:

Section 2 of the Hazardous Substances and New Organisms Act 1996 states:

``Hazardous substance" means, unless expressly provided otherwise by regulations, any substance—

(a) With one or more of the following intrinsic properties:

(i) Explosiveness:

(ii) Flammability:

(iii) A capacity to oxidise

Definition	Source
(iv) Corrosiveness: (v) Toxicity (including chronic toxicity (vi) Ecotoxicity, with or without bioaccumulation; or (b) Which on contact with air or water (other than air or water where the temperature or pressure has been artificially increased or decreased) generates a substance with any one or more of the properties specified in paragraph (a) of this definition."	
Hearth The insulating floor under the *fire* and in front and at the sides of the *fireplace*.	**AS/VM B1**,**CC**
Heating degrees, in relation to a location and a *heating month*, means the degrees obtained by subtracting from a base temperature of 14°C the mean (calculated using the *approved temperature data*) of the outdoor temperatures at that location during that month.	**Code**
Heating degrees total, in relation to a location and a year, means whichever is the greater of the following: (a) the value of 12 and (b) the sum of all the *heating degrees* (calculated using the *approved temperature data*) for all of the *heating months* of the year.	**Code**
Heating energy, in relation to a *building*, means the energy from a *network utility operator* or a depletable resource (expressed in kilowatt-hours, and calculated using the Building Research Association of New Zealand's *ALF 3, The 'Annual Loss Factor' Method, A design tool for energy efficient houses* (3rd edition, April 2000) or some other method that can be correlated with that manual) needed to maintain the *building* at all times within a year at a constant internal temperature under the following standard conditions: (a) a continuous temperature of 20°C throughout the *building* (b) an air change rate of 1 change per hour or the actual air leakage rate, whichever is the greater (c) a heat emission contribution arising from internal heat sources for any period in the year of 1000 kilowatt-hours for the first 50 m^2 of *floor area*, and 10 kilowatt-hours for every additional square metre of *floor area* (d) no allowance for— (i) carpets or (ii) blinds, curtains, or drapes, on windows (e) windows to have a shading coefficient of 0.6 (made up of 0.8 for windows and recesses and 0.75 for site shading).	**Code**
Heating month, in relation to a location, means a month in which a base temperature of 14°C is greater than the mean (calculated using the *approved temperature data*) of the outdoor temperatures at that location during that month.	**Code**
Heat of combustion Thermal energy produced by combustion of unit mass of a given substance (kJ/g).	**AS/VM C**
Heat release Thermal energy produced by combustion (Joules).	**AS/VM C**

Amend 11 Sep 2010

Amend 13 Feb 2014

Definition	Source
Amend 13 Feb 2014 **Heat release rate (HRR)** Rate of thermal energy production generated by combustion (kW or MW).	**AS/VM C**
Hem A flat fold, not completely closed, applied to the edge of a metal *flashing*.	**AS/VM E2**
Hidden gutter A gutter located within the boundaries of the roof *framing*. *Hidden gutters* may also be known as secret gutters or internal gutters. See also *Valley gutters*.	**AS/VM E2**

COMMENT:
Hidden gutters are distinct from gutters or spouting that are externally located beyond the bounds of the roof and wall *framing*.

Hoarding A structure alongside a public way providing side protection but no overhead protection.	**AS/VM F5**
Hold-open device A device which holds a *smoke control door* or *fire door* open during normal use, but is released by deactivating the device by an automatic *fire* detection system, allowing the door to close automatically under the action of a self-closing device.	**AS/VM C, F7, F8**
Hook An open fold applied to the edge of a metal *flashing*.	**AS/VM E2**

COMMENT:
A *hook* is distinct from a *hem*, as it is open at an acute angle rather than flattened.

Household unit — **BA04**

(a) means a *building* or group of *buildings*, or part of a *building* or group of *buildings*, that is—

(i) used, or intended to be used, only or mainly for residential purposes; and

(ii) occupied, or intended to be occupied, exclusively as the home or residence of not more than 1 household; but

(b) does not include a hostel, boarding house, or other specialised accommodation.

Amend 11 Sep 2010 **Household unit** For a *simple house*, means a *building* or part of a *building* that is used or intended to be used for residential purposes.	**Simple House**
HVAC An abbreviation for heating, ventilating and airconditioning.	**AS/VM C, F7**
Amend 11 Sep 2010 **HVAC system** for the purposes of performance H1.3.6 and in relation to a building, means a mechanical, electrical, or other system for modifying air temperature, modifying air humidity, providing ventilation, or doing all or any of those things, in a space within the building.	**Code**

I

Illuminance The luminous flux falling onto a unit area of surface.	**Code**
Impact insulation class (IIC) A single number rating derived from measured values of normalized impact sound pressure levels in accordance with Method ASTM E 492, Annex A1, Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine. It provides an estimate of the impact sound insulating performance of a floor-ceiling assembly.	**Code**

Definition	Source
Impervious That which does not allow the passage of moisture.	**Code**
Amend 13 Feb 2014 **Importance level** As specified in Clause A3 of the *Building Code*.	**AS/VM C**
Incapacitated State of physical inability to accomplish a specific task.	**AS/VM C**
Independent qualified person (IQP) means a *person* accepted by a *territorial authority* in accordance with section 438 of the *Building Act 2004* as being qualified to carry out the inspection, maintenance, and reporting procedures required for a *specified system* stated in a *compliance schedule*.	**HB**
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*.	**AS/VM E1, G13**
Inspection point A removable cap at *drain* level through which access may be made for cleaning and inspecting the drainage system.	**AS/VM E1, G13**
Insulating material A material that has a thermal conductivity of less than 0.07 W/mK.	**AS/VM C, E3**
Insulation In the context of *fire* protection, the time in minutes for which a prototype specimen of a *fire separation*, when subjected to the *standard test* for *fire* resistance, has limited the transmission of heat through the specimen.	**Code**
Integrity In the context of *fire* protection, the time in minutes for which a prototype specimen of a *fire separation*, when subjected to the *standard test* for *fire* resistance, has prevented the passage of flame or hot gases.	**Code**

COMMENT:
The precise meaning of *integrity* depends on the type of *building elements* being treated and how it is defined in the *standard test* being used.

Intended use in relation to a *building*,— **BA04**

(a) includes any or all of the following:

(i) any reasonably foreseeable occasional use that is not incompatible with the *intended use*:

(ii) normal maintenance:

(iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but

(b) does not include any other maintenance and repairs or rebuilding.

Interceptor trap A device which will separate and retain desired liquids and solids from a liquid stream and which will provide a water barrier to prevent foul air or gas from entering any downstream system. **AS/VM G14**

Intermediate floor Any upper floor within a *firecell* which because of its configuration provides an opening allowing smoke or *fire* to spread from a lower to an upper level within the *firecell.* **AS/VM C**

COMMENT:
1. Upper floors within *household units* need not meet the specific *fire* safety requirements which apply to *intermediate floors* in all other situations.
2. An *intermediate floor* may be open to the *firecell* or enclosed with non-*fire* rated *construction.* If enclosed with *fire* rated walls another *firecell* is created.

Amend 13 Feb 2014

Definition	Source
3. *Household units* occur only in *risk groups* SM and SH. Life safety provisions are governed by the limitations in permitted *open path* lengths.	
4. *Risk groups* SM, SI, CA, WB, WS and VP allow limited area intermediate floors of 20% or 40% of the floor area depending on other fire safety requirements. In other situations C/VM2 is to be used.	

Amend 13 Feb 2014

Amend 11 Sep 2010

Internal wall A wall other than an *external wall*. — **Simple House**

K

Kerb ramp means a short ramp either cutting through a kerb or built up to the kerb. — **AS/VM D1**

Kick-out A single fold applied to the edge of a horizontal metal *flashing* to deflect moisture away from the *cladding system* below. Refer also *Bird's beak*. — **AS/VM E2**

COMMENT:
A *kick-out* is used at the bottom of a *capping* or other *flashing* to deflect water away from the *cladding* below.

L

Lead flashings Lead sheet *flashings* that: — **Simple House**

(a) comply with AS 1804, and
(b) have a minimum unit mass of 17 kg/m².

Amend 11 Sep 2010

Life rating The *fire resistance rating* to be applied to elements of *construction* that allows movement of people from their location in a *building* to a *safe place*. — **AS/VM C**

Amend 13 Feb 2014

Licensee A *person* holding a licence issued under the Radiation Protection Act 1965 and for the time being in force. — **AS/VM F8**

Licensed building practitioner means a building practitioner whose name is, for the time being, entered in the register established and maintained under section 298(1) of the *Building Act 2004*. — **BA04**

Lightweight wall cladding Timber weatherboard (bevel-back or rusticated) or flat sheet (plywood or fibre-cement) *wall claddings* for use in this [Simple House] *Acceptable Solution*. — **Simple House**

Amend 11 Sep 2010

Limited area atrium A single *firecell* in which individual *occupied spaces* at different levels open onto a common enclosed space. Limitations are placed on the number of *intermediate floors* (no more than two levels), individual floor areas and permitted *occupant load*, depending on the provisions for smoke detection, smoke control and the *means of escape from fire*. — **AS/VM C**

COMMENT:
Typical *limited area atrium buildings* are small shopping malls, and motel complexes with a central atrium feature open to a number of floors.

Amend 11 Sep 2010

Lining The rigid sheet covering for a wall, ceiling or other interior surface. — **AS/VM E2**

Lintel A horizontal *framing* member spanning an opening in a wall. — **Simple House**

Loadbearing stud A *stud* in a *loadbearing wall*. — **Simple House**

Loadbearing wall A wall supporting vertical loading from a *roof*. — **Simple House**

Definition	Source
Amend 11 Sep 2010 **Loaded dimension** The loaded dimension of structural elements which support other members at right angles. Refer to [SH/AS1] Figure 5.2.2.	**Simple House**
Lock-out The safety shut down condition of the control system such that re-start cannot be accomplished without manual resetting.	**AS/VM-C, G11**
Amend 13 Feb 2014 **Luminance** The luminous intensity of a surface in a given direction per unit projected area (candela m^2)	**AS/VMF8**

M

Definition	Source
Amend 11 Sep 2010 **M** A steel bolt of the stated *diameter* in millimetres.	**Simple House**
Main private stairway A *private stairway* intended to provide access to and between frequently used spaces such as living areas, kitchens and garages, and includes all exterior *private stairways*.	**AS/VMD1**
Masonry tiles Clay or concrete tile roof *cladding*.	**AS/VME2**
Masonry veneer Clay or concrete block veneer *cladding*.	**AS/VME2**
Means of escape from fire, in relation to a *building* that has a floor area,— (a) means continuous unobstructed routes of travel from any part of the floor area of that *building* to a place of safety, and (b) includes all active and passive protection features required to warn people of *fire* and to assist in protecting people from the effects of *fire* in the course of their escape from the *fire*.	**BA04**
Amend 13 Feb 2014 **COMMENT:** Means of escape include features providing visibility in escape routes complying with F6 and signs complying with F8	
Amend 11 Sep 2010 **Member span** The clear distance between supports, measured along the member.	**Simple House**
Membrane A non-metallic material, usually synthetic, used as a fully supported roof *cladding*, *deck* surface or, in conjunction with other *claddings*, as gutters or *flashings*.	**AS/VME2**
Minister means the Minister of the Crown who, under the authority of a warrant or with the authority of the Prime Minister, is responsible for the administration of the *Building Act 2004*.	**BA04**
Minor private stairway A *private stairway* not on a main thoroughfare, and intended to provide infrequent access to a single room which is not a living area or kitchen.	**AS/VM D1**
Amend 11 Sep 2010 **MSG** Machine stress graded refers to timber that is initially sorted by machine, calibrated to NZS 3603. See also **VSG**.	**Simple House**
Multi-unit dwelling Applies to a *building* or use which contains more than one separate household or family.	**AS/VM C**
COMMENT: For *fire* safety purposes each *household unit* is a separate *firecell*.	

Definition	Source
N	
Natural draught The flow produced by the tendency of warmed gases to rise.	**AS/VM G4**
Natural hazard has the meaning given to it by section 71 of the Building Act 2004. Section 71(3) states: "(3) In this section and sections 72 to 74, natural hazard means any of the following: (a) erosion (including coastal erosion, bank erosion, and sheet erosion): (b) falling debris (including soil, rock, snow, and ice): (c) subsidence: (d) inundation (including flooding, overland flow, storm surge, tidal effects, and ponding): (e) slippage."	**BA04**
Amend 11 Sep 2010 **Net openable area** is the area of windows or doors or other opening measured on the face dimensions of the openable building element concerned.	**AS/VM G4**
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 (Amend 12 Oct 2011) (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 (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	**BA04**
Amend 11 Sep 2010 **Nogging** See **dwang**	**Simple House**
Nominal pile width The least width of a pile in side view and is equal to the diameter in round piles.	**AS/VM B1**
Non-combustible Materials shall be classified as *non-combustible* or *combustible* when tested to: AS 1530 – Part 1.	**AS/VM B1, C**
Amend 11 Sep 2010 **Non-loadbearing stud** A stud in a *non-loadbearing wall.*	**Simple House**
Non-loadbearing wall A wall other than a *loadbearing wall*.	**Simple House**
Non-return valve A valve that permits flow in one direction but prevents a return flow and is part of a hot or cold water system.	**AS/VM G12**
Nosing The rounded projecting edge of a stair tread.	**AS/VM D1, F4**

Definition	Source
Notice to fix has the meaning given to it by section 164(2) of the *Building Act 2004*. Section 164(2) states: "(2) A responsible authority must issue to the specified person concerned a notice (a notice to fix) requiring the person— (a) to remedy the contravention of, or to comply with, this Act or the regulations; or (b) to correct the warrant of fitness; or (c) to properly comply with the inspection, maintenance, or reporting procedures stated in the compliance schedule."	**BA04**
Notional boundary The *boundary* which for *fire* safety purposes, is assumed to exist between two *buildings* on the same property under a single land title.	**AS/VM C**

COMMENT:
A *notional boundary* may be located anywhere between the two *buildings* on the same property using the following rules:

1. The *notional boundary* is assumed to exist in the space between the *buildings* and is positioned so that one of the *buildings* would comply with the provisions for space separation having regard to the amount of its *unprotected area*. In practice, if one of the *buildings* is existing, the position of the *boundary* will be set by the space separation factors for that *building*.
2. The siting of the new *building*, or the second *building* if both are new, can then be checked to see that it also complies, using the *notional boundary* as the *relevant boundary* for the second *building*. (Once the *notional boundary* is set for the first *building* it becomes the *relevant boundary* for the second (new) *building* and does not move).

Amends 11 and 13

NUO system means a system owned or controlled by a *network utility operator*.	**BA04**
Amend 12 Oct 2011 **NZBC** New Zealand Building Code.	**AS/VM E2**

O

Occupant load The greatest number of people likely to occupy a particular space within a *building*. It is determined by: a) dividing the total floor area by the m² per person (occupant density) for the activity being undertaken, or b) for sleeping areas, counting the number of sleeping (or care) spaces, or (c) for fixed seating areas, counting the number of seats.	**AS/VM C, F6, F7**

Amend 13 Feb 2014

COMMENT:
See Paragraphs 1.4.5 (for fixed seating) and 1.4.6 (for sleeping areas) of **C/AS1–C/AS7** where appropriate

Occupied space Any space within a *building* in which a *person* will be present from time to time during the *intended use* of the *building*.	**Code**
Opacity of smoke Ratio of incident light intensity to transmitted light intensity through smoke under specified conditions.	**AS/VM C**
Open path That part of an *escape route* (including *dead ends*) within a *firecell* where occupants may be exposed to *fire* or smoke while making their escape.	**Code**

Amend 13 Feb 2014

Definition	Source
Amend 13 Feb 2014 **Open space** includes land on which there are, and will be, no *buildings* and which has no roof over any part of it other than overhanging eaves.	**AS/VM C**
Open vented storage water heater A *water heater* incorporating a *vent pipe* which is permanently open to the atmosphere.	**AS/VM G12**
Optical density of smoke Measure of the attenuation of a light beam passing through smoke expressed as the logarithm to the base 10 of the opacity of smoke.	**AS/VM C**
Other property—	**BA04**
(a) means any land or *buildings*, or part of any land or *buildings*, that are—	
(i) not held under the same *allotment*; or	
(ii) not held under the same ownership; and	
(b) includes a road	
Outdoor air Air as typically comprising by volume:	**Code**
(i) oxygen 20.94%	
(ii) carbon dioxide 0.03%	
(iii) nitrogen and other inert gases 79.03%.	
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 *sewer* or a septic tank. For *surface water*, the *outfall* may include a natural water course, kerb and channel, or soakage system.	**Code**
Over-pressure protection Devices preventing the pressure in piping or appliances from exceeding a predetermined value.	**AS/VM G11**
Owner, in relation to land and any *buildings* on the land,—	**BA04**
(a) means the *person* who—	
(i) is entitled to the rack rent from the land; or	
(ii) would be so entitled if the land were let to a tenant at a rack rent; and	
(b) includes—	
(i) the *owner* of the fee simple of the land; and	
(ii) any *person* who has agreed in writing, whether conditionally or unconditionally, to purchase the land or any leasehold estate or interest in the land or to take a lease of the land and who is bound by the agreement because the agreement is still in force.	
P	
Parallel flashing A roof *flashing* that runs along the roof slope, parallel to the roof *cladding* profile. Also known as a longitudinal *flashing*.	**AS/VM E2**
Amend 12 Oct 2011 **Parapet** A timber-framed wall that extends above the level of the roof *cladding*. Refer also Enclosed balustrade.	**AS/VM E2**
Amend 11 Sep 2010 **Passive stack ventilator** A system including a ventilation shaft which uses natural draught to ventilate spaces.	**AS/VM G4**
Penetration A pipe, cable or duct passing through an opening in a *fire separation*.	**AS/VM C**

Definition	Source
Penstocks are conduits to control the flow of water in water supply, hydroelectric power and sewerage systems. Penstocks are normally equipped with a gate system and surge tank.	**DG**
People with disabilities People whose ability to use *buildings* is affected by mental, physical, hearing or sight impairment.	**Code**
Performance criteria in relation to a *building*, means those qualitative or quantitative criteria that the *building* is required to satisfy in performing its *functional requirement*.	**BA04**
Amend 11 Sep 2010 **Permanent opening** An opening which cannot be closed, this implies that doors, windows etc are NOT permanent openings, although door undercuts are.	**AS/VM G4**
Person includes— (a) the Crown; and (b) a corporation sole; and (c) a body of persons (whether corporate or unincorporate) Amend 12 Oct 2011	**BA04**
Person with a disability means a *person* who has an impairment or a combination of impairments that limits the extent to which the *person* can engage in the activities, pursuits, and processes of everyday life, including, without limitation, any of the following: (a) a physical, sensory, neurological, or intellectual impairment: (b) a mental illness.	**BA04**
Piping system An assembly of pipes, pipe fittings, gaskets, bolting and pipe supports.	**AS/VM G14**
Pitch line The line joining the leading edge or *nosings* (if any) of successive stair treads within a single flight of *stairs*.	**AS/VM F4** (Sep 07)
Place of safety means either— a) a *safe place*; or b) a place that is inside a *building* and meets the following requirements: i) the place is constructed with *fire separations* that have *fire* resistance sufficient to withstand *burnout* at the point of the *fire source*; and ii) the place is in a *building* that is protected by an automatic fire sprinkler system that complies with NZS 4541 or NZS 4515 as appropriate to the *building's* use; and iii) the place is designed to accommodate the intended number of persons at a design occupant density of not less than 1.0 m^2 per person; and iv) the place is provided with sufficient means of escape to enable the intended number of persons to escape to a *safe place* that is outside a *building*. Amend 13 Feb 2014	**Code**

Definition	Source
Plans and specifications— (a) means the drawings, specifications, and other documents according to which a *building* is proposed to be *constructed, altered,* demolished, or removed; and (b) includes the proposed procedures for inspection during the *construction*, *alteration*, demolition, or removal of a *building*; and (c) in the case of the *construction* or *alteration* of a *building*, also includes— (i) the *intended use* of the *building*; and (ii) the *specified systems* that the applicant for *building consent* considers will be required to be included in a *compliance schedule* required under section 100; and (iii) the proposed procedures for inspection and routine maintenance for the purposes of the *compliance schedule* for those *specified systems*.	**BA04**
Amend 11 Sep 2010 **Plate** A timber member supported by a *foundation* or *studs* to support and distribute the load from floors, walls, *roofs* or ceilings. See **bottom plate**, **top plate**.	**Simple House**
Plumbing system Pipes, joints and fittings laid above ground and used for the conveyance of *foul water* to the *foul water drain*, and includes *vent pipes*.	**Code**
Amend 11 Sep 2010 **Post** An isolated vertical member acting as a support.	**Simple House**
Potable (and potable water) Water that is suitable for human consumption.	**AS/VM G12**
Potential impact classification is related to the consequence (effects) of the *dam* failing, if it should release its stored contents. Consequences include loss of life, socio-economic, financial and environmental.	**DG**
Prescribed electrical work has the meaning given to it by section 2(1) of the Electricity Act 1992.	**BA04, EA**
Amend 13 Feb 2014 **Pre-travel activity time** Time period after an alarm or *fire* cue is transmitted and before occupants first travel towards an exit.	**AS/VM C**
Primary element A *building element* providing the basic load bearing capacity to the structure, and which if affected by *fire* may initiate instability or premature structural collapse. **COMMENT:** Suspended floors in multi-storey *buildings* are *primary elements*.	**AS/VM B2, C**
Principal user A member of the primary group for which a *building* was constructed, and therefore explicitly excludes *persons* or groups of *persons* providing care or control of that *principal user* group.	**Code**
Privacy The situation of being withdrawn from view.	**AS/VM G1**
Private stairway A *stairway* used, or intended to be used, by the occupants of a single *household unit*.	**AS/VM D1**
Privy A private room containing a receptacle (other than a WC) or an excavation for excreted liquid or solid human waste, and with a means of disposal or containment of the waste.	**AS/VM G1**

Definition	Source
Producer statements are formal statements supplied by or on behalf of (i) an applicant for a *building consent*, or (ii) by or on behalf of a *person* who has carried out *building work*. that can be accepted by a *building consent authority* as verification that certain work will be or has been carried out in accordance with nominated performance requirements of the *Building Code*. **COMMENT:** Although no longer expressly referred to in the *Building Act 2004*, these could be accepted and considered as part of the plans or specifications.	**HB**
Product certificate means a certificate issued under section 269 of the *Building Act 2004* that a *building consent authority* must accept as establishing compliance with the *Building Code*.	**HB**
Product certification accreditation body means the *person* referred to in section 261(2) of the *Building Act 2004*.	**BA04**
Property includes land, *buildings*, and goods; but does not include incorporeal forms of *property*.	**BA04**
Amend 13 Feb 2014 **Property rating** The *fire resistance rating* to be applied to elements of *construction* that allows for protection of *other property.*	**AS/VM C**
Proprietary fasteners *Proprietary fasteners* may be used where the fixing *capacity* of fixings are specifically identified in this [SH/AS1] *Acceptable Solution*. Manufacturers of a timber connector or fixing shall provide the following information on each package of fixings, or on a securely attached label: (a) the name, or registered trade name, or make and address of manufacturer (b) the materials used in manufacture including fasteners and corrosion protection (c) the load capacity of the timber connector or fixing in kN determined in accordance with the following equation: $R = \varphi \times Q_k \times n \times k$ Where: R = connector capacity in kN φ = capacity reduction factor from NZS 3603 Q_k = characteristic value obtained by test in accordance with BRANZ Evaluation Method EM1 or AS/NZS 2699: Part 2 as appropriate n = number of tested elements making up the complete joint k = modification factors from NZS 3603 (Section 4) as appropriate to specific application. (d) fastener's requirements (e) details of *intended use* Amend 11 Sep 2010 (f) durability in accordance with Paragraph 2.5.4. Amend 13 Feb 2014	**Simple House**
Protected shaft A space, other than a *safe path*, enclosed by *fire separations* or *external walls* used to house *building* services, lifts, or conveyors which pass from one *firecell* to another.	**AS/VM C**

Definition	Source
Purlin A horizontal member laid to span across *rafters* or trusses, and to which the roof *cladding* is attached.	**AS/VM E2**
Amend 11 Sep 2010 **Purlin** Includes **tile batten.** A horizontal member laid to span across *rafters* or trusses and to which the *roof cladding* is attached.	**Simple House**
Purpose group The classification of spaces within a *building* according to the activity for which the spaces are used.	**Code**

R

Definition	Source
Amend 11 Sep 2010 **R** A plain round reinforcing bar of the stated *diameter* in millimetres.	**Simple House**
R-value The common abbreviation for describing the values of both *thermal resistance* and *total thermal resistance*.	**AS/VM E3, G5, H1**
Radiocommunications has the same meaning as in section 2(1) of the Radiocommunications Act 1989.	
Rafter A *framing* timber, normally parallel to the slope of the roof, providing support for sarking, *purlins* or roof *cladding*.	**AS/VM E2**
Amend 11 Sep 2010 **Rafter** A *framing* timber normally parallel to the slope of the *roof* and providing support for the *purlins* or *roof* covering, or ceiling *lining*.	**Simple House**
Railway line has the meaning ascribed to it by section 2 of the Transport Services Licensing Act 1989.	**AS/VM C, RA**

The definition of 'Railway line' in the Transport Services Licensing Act 1989 has been repealed by the Railways Act 2005. Section 4 of the Railways Act 2005 now contains the definition for "railway line".

Section 4 states

``railway line" —

(a) means a single rail or set of rails, having a gauge of 550 mm or greater between them, laid for the purposes of transporting people or goods by rail; and

(b) includes—

- (i) sleepers, associated formation and ballast, tunnels, and bridges; and
- (ii) in relation to a single rail or set of rails that are laid on a road for the purposes of 1 or more light rail vehicles,—
  - (A) any area between the rails; and
  - (B) the area that extends 500 mm outside the extremity of any light rail vehicle being used on that single rail or set of rails; and
- (iii) a set of rails, having a gauge of less than 550 mm between them, that is designated as a railway line in regulations made under section 59(l); and
- (iv) except as provided in subparagraph (ii), any area within 5 m of a single rail or within 5 m of a line drawn midway between a set of rails; but

(c) excludes—

- (i) a railway line that is part of a railway used as an amusement device as defined in section 21A(1) of the Machinery Act 1950:
- (ii) a railway line excluded by regulations made under section 59(m):
- (iii) a railway line that exclusively serves private cable cars".

Definition	Source
Reasonably visible, in relation to a *specified feature*, and for the purposes of Clause F6, means that the *specified feature* is visible to a person who— (a) is 10 metres from it, or the greatest distance from it that it is possible to go in the open space surrounding it, whichever is the lesser; and (b) has sight that is not defective, or is corrected (for example, by an optical appliance). Amend 11 Sep 2010	**Code**
Reflectance The ratio of the flux reflected from a surface to the flux incident on it.	**AS/VM G7, G8**
Regional authority means— (a) a *regional council*; or (b) a *unitary authority*	**BA04**
Regional council has the meaning given to it by section 5(1) of the Local Government Act 2002.	**BA04**
Registrar has the meaning given to it by section 282 of the *Building Act 2004*.	**BA04**
Regulations means regulations in force under the *Building Act 2004*.	**BA04**
Regulator A device which automatically regulates the pressure or volume of gas passing through it to a predetermined level.	**AS/VM G10, AS/VM G11**
Reinforcement Any form of reinforcing rod, bar or mesh that complies with the relevant requirements of NZS 3109. Amend 11 Sep 2010	**Simple House**
Relevant boundary Relevant *boundary* means the *boundary* of an *allotment* that is *other property* in relation to the *building* in question and from which is measured the separation between the *building* and that *other property*; and for the *external wall* of any *building*, the *relevant boundary* is the nearest of— (a) a *boundary* of a freehold *allotment*, except that if the *other property* is a *road*, *railway line*, or public *open space*, the *relevant boundary* is the *boundary* on the far side of that other *property*; or (b) a *boundary* of a cross-lease or a company lease or a licence, except that if the *other property* is *open space* to which the lessee or licensee of the *building* in question has an exclusive right of access and occupation or to which 2 or more occupiers of the *building* in question have rights of access and occupation, the *relevant boundary* is the *boundary* on the far side of that other *property*; or (c) a *boundary* shown on a unit plan (but excluding a *boundary* between a principal unit and its accessory unit), except that if the *other property* is open space and is common property, the *relevant boundary* is the *boundary* on the far side of that *other property*. Amend 13 Feb 2014	**AS/VM C**

COMMENT:

1. Where an easement, such as a right of way, occurs within an *allotment*, the *relevant boundary* shall remain the same as if the easement did not exist.
2. *Boundaries* within a cross-lease or company lease or licence are shown on a survey plan. In some cases the *boundary* is the *external wall* or roof of a *building*.
3. The unit title *boundaries* of principal units, accessory units, and common property are shown in the unit plan. A *boundary* is frequently an internal or *external wall*, an upper floor, or the roof of a *building*.

Definition	Source
4. A wall along a *boundary* between two *allotments* is called a "party wall" when the *owners* of the *allotments* each have legal rights in respect of that wall registered by way of easements on one or both titles. An internal wall between cross-leases, company leases, or unit titles, or between one of them and common property, is not generally called a party wall but in that case also the lessees, unit title holders, or corporate body concerned each have legal rights in respect of that wall. Such a wall separates areas which are *other property* in relation to each other, but the wall itself is part of each property. The *fire* protection consequence of that legal concept is that such a wall can be regarded as a *fire separation* providing protection against horizontal *fire* spread in each direction. In other words, that wall may provide the appropriate *FRR* instead of each property having its own wall of that *FRR*.	
Relief vent A *vent pipe* which is connected to a *discharge stack* below the lowest branch connection and which connects at its upper end to the *discharge stack vent* or terminates as an open vent.	**AS/VM G13**
Amend 13 Feb 2014 **Required safe egress time (RSET)** Time required for escape. This is the calculated time period required for an individual occupant to travel from their location at the time of ignition to a *place of safety*.	**AS/VM C**
Reservoir Body of water impounded by one or more *dams* or dikes, inclusive of its shores and banks and of any facility or installation necessary for its operation.	**DG**
Response Time Index (RTI) The measure of the reaction time to a *fire* phenomenon of the sensing element of a *fire safety system*.	
Amend 11 Sep 2010 **Ribbon board** Includes **soffit plate**. A horizontal *framing* timber secured to, or checked into, the edges of *studs* and supporting *eaves bearers*.	**Simple House**
Ridge beam A single beam that supports *rafters* of a *skillion roof*.	**Simple House**
Amend 13 Feb 2014 **Risk group** The classification of a building or firecells within a building according to the use to which it is intended to be put.	**AS/VM C**
Amend 11 Sep 2010 **Risk group A**, for the purposes of performance F6.3.4 and performance F6.3.5, means *buildings*— (a) whose occupants are required to remain in the *building* until the main lighting system is restored; or (b) whose *evacuation time* is longer than 90 minutes.	**Code**
Risk group B, for the purposes of performance F6.3.4 and performance F6.3.5, means *buildings*— (a) whose *evacuation time* is 30 minutes or longer but not longer than 90 minutes; or (b) whose occupant load is more than 1 000.	**Code**
Risk group C, for the purposes of performance F6.3.4, means *buildings* not in *risk group A* or *risk group B*.	**Code**
Reservoir capacity Total or gross storage capacity of the *reservoir* at full supply level.	**DG**
Risk matrix A table that allows the calculation of a *risk score* by the allocation and summing of scores for a range of design and location factors applying to a specific *building* design.	**AS/VM E2**

Definition	Source
Risk score An aggregated numerical score for a proposed *building* as defined by E2/AS1.The *risk score* is determined by completion of the *risk matrix*.	**AS/VM E2**
Road has the meaning ascribed to it by section 315 of the Local Government Act 1974 and includes a public place and also includes a motorway.	**AS/VM C/LGA**
Rodding point A removable cap at ground level through which access may be made for cleaning and inspecting the drainage system.	**AS/VM E1, G13**
Amend 12 Oct 2011 **Roof** That part of a *building* having its upper surface exposed to the outside and at an angle of 60° or less to the horizontal.	**AS/VM E2**
Amend 11 Sep 2010 **Roof** That part of the *building* having its upper surface exposed to the outside and at an angle of between 10° and 35° to the horizontal. See **skillion roof**.	**Simple House**
Amend 12 Oct 2011 **Roof underlay** An absorbent permeable building paper that absorbs or collects condensation or water in association with *roof cladding* performance.	**AS/VM E2**
Roof underlay An absorbent, permeable paper that absorbs or collects condensation or water that may penetrate the *roof cladding*. The *roof underlay* shall have the properties in Table 23 of the *Acceptable Solution* E2/AS1 for Building Code Clause E2 External Moisture: (a) absorbency of 100 g/m^2 or greater (b) vapour resistance 7 MN s/g or less (c) water resistance of 100 mm or greater (d) pH of extract of between 6.0 and 9.0 (e) shrinkage no more than 0.5% Amend 11 Sep 2010 (f) mechanical edge tear and tensile strength to AS/NZS 4200.	**Simple House**
Room-sealed appliance An appliance designed so that air for combustion neither enters from, nor combustion products enter into, the room in which the appliance is located.	**CD-G4**
Amend 11 Sep 2010 **Running bonds**, See **bond**	**Simple House**

S

Definition	Source
Saddle flashing A *flashing* used to weatherproof the junction between a horizontal and vertical surface.	**AS/VM E2**
Safe path That part of an *exitway* which is protected from the effects of *fire* by *fire separations*, *external walls*, or by distance when exposed to open air.	**Code**
Safe place A place, outside of and in the vicinity of a single *building* unit, from which people may safely disperse after escaping the effects of a *fire*. It may be a place such as a street, *open space*, public space or an *adjacent building* unit. **COMMENT:** The Fire Safety and Evacuation of Buildings Regulations 2006 use the term *'place of safety'* and allow the *place of safety* to be within the *building* provided that it is protected with a sprinkler system. Amend 13 Feb 2014	**AS/VM C**
Safety colour (green, red or yellow) A colour of specified properties to which a safety meaning is attributed.	**AS/VM F8**

Definition	Source
Safety glass means a glass so treated or combined with other materials as to reduce the likelihood of injury to *persons* when it is cracked or broken.	**AS/VM F2**
Safety shut-off system An arrangement of valves and associated control systems which shuts off the supply of gas when required by a device which senses an unsafe condition.	**AS/VM G10**
Safety sign A particular type of sign which comprises a geometric form and a *safety colour*, together with a *safety symbol* or text (that is, words, letters, numbers or a combination of these) and gives a particular safety message.	**AS/VM F8**
Safety symbol means a graphic symbol used in a *safety sign*.	**AS/VM F8**
Sanitary appliance An appliance which is intended to be used for *sanitation*, but which is not a *sanitary fixture*. Included are machines for washing dishes and clothes.	**Code**
Sanitary fixture Any *fixture* which is intended to be used for *sanitation*.	**Code**
Sanitation The term used to describe the activities of washing and/or excretion carried out in a manner or condition such that the effect on health is minimised, with regard to dirt and infection.	**Code**
Scaffolding used in the course of the *construction* process, means any structure, framework, swinging stage, suspended *scaffolding*, or boatswain's chair, that is of a temporary nature and that is used or intended to be used for: the support or protection of workers engaged in, or in connection with *construction* work for the purpose of carrying out that work, or the support of materials used in connection with the work; and includes any plank, coupling, fastening, fitting, or device used in connection with the *construction*, erection, or use of *scaffolding*.	**BA04**
Scupper An opening in a *parapet* or *enclosed balustrade* to allow water to drain into a rainwater head.	**AS/VM E2**
Sealant A flexible neutral cure sealant for gap filling and weatherproofing that complies with: (a) Type F, Class 20 LM or 25 LM of ISO 11600, or (b) low modulus Type II Class A of Federal Specification TT-S-00230C.	**Simple House**
Secondary element A *building element* not providing load bearing capacity to the structure and if affected by *fire*, instability or collapse of the *building* structure will not occur.	**AS/VM B2, C**
Secondary flow path The path over which *surface water* will follow if the drainage system becomes overloaded or inoperative.	**AS/VM E1**
Secondary private stairway A *private stairway* other than a *main* or *minor private stairway*, intended to provide access to another floor containing only bedrooms, bathroom or similar accommodation.	**AS/VM D1**
Separating element Barrier that exhibits fire *integrity*, *structural adequacy*, thermal *insulation*, or a combination of these for a period of time under specified conditions (in a fire resistance test).	
Service ramp means a ramp that is used, or intended to be used, infrequently by service personnel to gain access to spaces for the purposes of maintenance and the movement of goods.	**AS/VM D1**

Amend 11 Sep 2010

Definition	Source
Service stairway means a *stairway* that is used, or intended to be used, infrequently by service personnel to gain access to spaces for the purposes of maintenance and the movement of goods.	**AS/VM D1**
Sewer A *drain* that is under the control of, or maintained by, a *network utility operator*.	**Code**
Amend 12 Oct 2011 **Sill support bar** A bar or mechanism complying with EM6, E2/VM1 tests, and Clause B2 of the *Building Code*, and used to support the weight of aluminium window and door joinery that is installed over drained cavities.	**AS/VM E2**
Amend 11 Sep 2010 **Simple house** A house that is described in Section 1 of this [SH/AS1] *Acceptable Solution*.	**Simple House**
Sitework means work on a *building* site, including earthworks, preparatory to, or associated with the *construction*, *alteration*, demolition, or removal of a *building*.	**BA04**
Amend 11 Sep 2010 **Skillion roof** A pitched *roof* where the ceiling *lining* is parallel and close to the *roof cladding*. The *roof* may be mono-pitch or may consist of more than one *roof* plane. These *roofs* may have *rafters* exposed below the ceiling.	**Simple House**
Smokecell A space within a *building* which is enclosed by an envelope of *smoke separations*, or *external walls*, roofs, and floors.	**AS/VM C**
Smoke control door A *doorset* that complies with Appendix C, C6.1.2 of **C/AS1–C/AS6**.	**AS/VM C**
Smoke lobby That portion of an *escape route* within a *firecell* that precedes a *safe path* or an *escape route* through an adjoining *building* which is protected from the effects of smoke by *smoke separations*.	**AS/VM C**
Smoke production rate Amount of smoke produced per unit time in a *fire* or *fire* test.	**AS/VM C**
Smoke separation Any *building element* able to prevent the passage of smoke between two spaces. *Smoke separations* shall: a) Be a smoke barrier complying with BS EN 12101 Part 1, or b) Consist of rigid *building elements* capable of resisting without collapse: i) a pressure of 0.1 kPa applied from either side, and ii) self weight plus the intended vertically applied live loads, and c) Form an imperforate barrier to the spread of smoke, and d) Be of *non-combustible construction*, or achieve a *FRR* of 10/10/-, except that non-*fire resisting glazing* may be used if it is toughened or laminated *safety glass*.	**AS/VM C**

COMMENT:

The pressure requirement is to ensure rigidity and is not a smoke leakage requirement.

Walls and floors, whether *constructed* of sheet linings fixed to studs or joists, or of concrete, glazing, metal or fired clay, need only be inspected by someone experienced in *building construction* to judge whether the *construction* is tight enough to inhibit the passage of smoke.

Item d) is intended to ensure that the *smoke separation* will continue to perform as an effective barrier when exposed to *fire* or smoke for a short period during *fire* development.

Amend 13 Feb 2014

Definition	Source
Amend 13 Feb 2014 There is no requirement for *smoke control doors* or other closures in *smoke separations* to meet the provisions of item d)	
Socket outlet An accessory fixed to a wall or ceiling and designed to accept a plug that extends the electrical supply to an appliance by means of a flexible cable.	**AS/VM G2**
Soffit bearer See **eaves bearer**.	**Simple House**
Amend 11 Sep 2010 **Soffit plate** See **ribbon board**.	**Simple House**
Soft edge A compatible soft edging seamed onto *flashings* to provide closure to profiled *cladding*.	**AS/VM E2**
Soil fixture A *sanitary fixture* constructed to receive solid and/or liquid excreted human waste. It includes bedpan disposal units, slop sinks, urinals, water closet pans, and water-flushed sanitary towel disposal units.	**AS/VM G1, G13**
Sound transmission class (STC) A single number rating derived from measured values of transmission loss in accordance with classification ASTM E 413, Determination of Sound Transmission Class. It provides an estimate of the performance of a partition in certain common sound insulation situations.	**Code**
Amend 11 Sep 2010 **Spacing** or **spaced** The distance at which members are spaced, measured centre to centre.	**Simple House**
Amend 11 Sep 2010 **Spans** See **member span** and **support span**.	**Simple House**
Amend 12 Oct 2011 **Specific design** Design and detailing for compliance with the *Building Code*, of a proposed part or parts of a *building* which are not shown in this Acceptable Solution.	**AS/VM E2**
Amend 11 Sep 2010 **Specific design** Design and detailing of a proposed *building* or parts of a *building*, demonstrating compliance with the Building Code, that shall be provided to the *building consent authority* for assessment and approval as part of the *building consent* process. *Buildings*, or parts of *buildings*, requiring *specific design* are beyond the scope of the *Simple House Acceptable Solution*.	**Simple House**
Amend 13 Feb 2014 **Specific extinction area of smoke** Extinction area of smoke produced by a test specimen in a given time period, divided by the mass lost from the test specimen in the same time period.	**AS/VM C**
Amend 11 Sep 2010 **Specified features**, for the purposes of Clause F6, means the following: (a) *building elements* that may act as obstructions: (b) safety features required under clauses of the *Building Code* other than Clause F6 (for example, *handrails* required under Clause D1): (c) changes in direction: (d) stairs and ramps: (e) escape doors: (f) entries to a *safe place.*	**Code**

Definition	Source
Specified intended life has the meaning given to it by section 113(3) of the Building Act 2004. Section 113(3) states: "(3) In subsection (2), **specified intended life**, in relation to a building, means the period of time, as stated in an application for a building consent or in the consent itself, for which the building is proposed to be used for its intended use."	**BA04**
Specified system— (a) means a system or feature that— (i) is contained in a *building*; and (ii) contributes to the proper functioning of the *building* (for example, an automatic sprinkler system); And (iii) is declared by the Governor-General, by Order in Council, to be a *specified system* for the purposes of this Act; and (b) includes a cable car.	**BA04**
Spread of flame index (SFI) That index number for spread of flame which is determined according to the *standard test* method for measuring the properties of lining materials.	**AS/VM C**
Spillway Weir, channel, conduit, tunnel, gate or other structure designed to permit discharges from the reservoir.	**DG**
Stability In the context of *fire* protection is the support provided to a *building element* having a *FRR*, intended to avoid premature failure due to structural collapse as a result of applied load, dead and live loads or as a result of any additional loads caused by *fire*. (Amend 13 Feb 2014)	**AS/VM C**
Stairway A series of steps or stairs with or without landings, including all necessary *handrails* and giving access between two different levels.	**AS/VM C, D1**
Stainless steel flashings Stainless steel *flashings* shall be: (a) minimum thickness of 0.45 mm, and (b) Type 304 or 316 stainless steel in accordance with Table 1 of ISO/TS 15510. (Amend 11 Sep 2010)	**Simple House**
Stanchion A connecting device, fixed into the structure of a *building*, that provides support for *handrails*, aerials and similar structures.	**AS/VM E2**
Standards means specifications for *building* materials, methods, processes or practices that provide a basis for determining consistent and acceptable minimum levels of quality, performance, safety and reliability.	**HB**

COMMENT:

Standards are developed by organisations that are recognised by the Government.
In New Zealand, standards are developed by a trading arm of the Standards Council, a crown entity operating under the Standards Act 1988. In Australia, standards are developed by Standards Australia, which is recognised through a memorandum of understanding with the Commonwealth Government.

Definition	Source
Standard test A test method which is recognised as being appropriate for the *fire* protection properties being assessed.	**AS/VM C**
COMMENT: Amend 13 Feb 2014 A list of *standard test* methods is given in Appendix C of C/AS1–C/AS6.	
Standard year For the purposes of determining natural lighting, the hours between 8 am and 5 pm each day with an allowance being made for daylight saving.	**Code**
Statutory authority means an authority or organisation that has the statutory power to classify or register land or *buildings* for any purpose.	**BA04**
Stopend A turn-up at the upper edge of profiled metal *cladding*, or at the end of gutters and some types of *flashings*.	**AS/VM E2**
COMMENT: A *stopend* assists the control of moisture by ensuring any moisture reaching the edge of the roofing is deflected from further entry.	
Storage water heater A *water tank* with an integral *water heater* for the storage of hot water.	**AS/VM G12**
Storey That portion of a *building* included between the upper surface of any floor and the upper surface of the floor immediately above, except the top *storey* shall be that portion of a *building* included between the upper surface of the topmost floor and the ceiling or roof above.	**AS/VM E2**
Strength reduction factor The factor by which the ultimate strength is multiplied to obtain the design strength.	**AS/VM B1**
COMMENT: NZS 4203: 1992 uses the terms ideal strength in place of ultimate strength, and dependable strength in place of design strength.	
Amend 11 Sep 2010 **Stretcher bonds**, See **bond**	**Simple House**
Structural adequacy In the context of the *standard test* for *fire* resistance, is the time in minutes for which a prototype specimen has continued to carry its applied load within defined deflection limits. Amend 13 Feb 2014	**AS/VM C**
Structural fire endurance rating (S) The *fire resistance rating* **(***FRR***)** intended to prevent *fire* spread or structural collapse for the complete burnout of the *firecell*.	**AS/VM C**
Stucco A wall *cladding system* formed from reinforced solid plaster over a rigid or non-rigid backing.	**AS/VM E2**
Stud A vertical *framing* timber.	**AS/VM E2**

Definition	Source
Suite A *firecell* providing residential accommodation for the exclusive use of one *person* or of several people known to one another. It comprises one or more rooms for sleeping and may include spaces used for associated domestic activities such as hygiene and cooking.	**AS/VM C, F7**

COMMENT:

Amend 13 Feb 2014

1. Bed numbers are limited to 6 in *risk group* SI or 12 in *risk group* SM in accordance with C/AS2 and C/AS3. Examples may be found in hotels, motels and residential care facilities, such as old people's homes or in hospices providing temporary family accommodation.
2. It is assumed that the social cohesion of the occupants by virtue of the personal relationship (as family members, friends or associates) would ensure that any individual, becoming aware of *fire*, would naturally assist others within the *firecell* to escape. The term *suite* does not apply to a group of bedrooms where each room is available to different "key-holders". In some cases a *suite* may be a single bedroom.

Definition	Source
Sump A chamber which is installed in the *drain* and incorporates features to intercept and retain silt, gravel and other debris.	**AS/VM E1**
Supervise, in relation to *building work*, means provide control or direction and oversight of the *building work* to an extent that is sufficient to ensure that the *building work*— (a) is performed competently; and (b) complies with the *building consent* under which it is carried out.	**BA04**
Amend 11 Sep 2010 — **Support span** A clear distance along a member between supports, measured in plan (horizontally).	**Simple House**
Surface finish The combination of a surface coating and substrate material on surfaces of *building elements* exposed to view. It can be an applied decorative coating or the uncoated *building element* itself. For interior surfaces the requirements are evaluated in terms of *a Group Number*. For exterior surfaces the requirements are evaluated in terms of rate of heat release as determined by Appendix C, Paragraph C6.1 of Acceptable Solutions **C/AS6–C/AS7**.	**AS/VM C**
Amend 13 Feb 2014 — **Surface spread of flame** Flame spread away from the source of ignition across the surface of a liquid or a solid.	**AS/VM C**
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.	**Code**

T

Definition	Source
Tailing dam *Dam* constructed to retain tailings or other waste materials from mining or industrial operations.	**DG**
Tailpipe A device placed at the low point of a gas piping system to collect condensate, and from which the condensate may be removed.	**AS/VM G10**

Definition	Source
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.	**BA04**
Territorial authority City or district council (as named in Schedule 2, Part 2 of the Local Government Act 2002) responsible for community wellbeing and development, environmental health and safety (including building control, civil defence, and environmental health matters), infrastructure (roading and transport, sewerage, water/stormwater), recreation and culture, and resource management including land use planning and development control.	**Simple House**
Theatre A place of assembly intended for the production and viewing of performing arts, and consisting of an auditorium and stage with provision for raising and suspending stage scenery above and clear of the working area.	**AS/VM C, F4** (Sep 07)
Thermal resistance The resistance to heat flow of a given component of a *building element*. It is equal to the air temperature difference (°C) needed to produce unit heat flux (W/m^2) through unit area (m^2) under steady conditions. The units are $°Cm^2/W$.	**Code**
Threshold A sill to an external door, or the floor under an internal door.	**AS/VM D1**
Tile batten See **purlin**.	**Simple House**
Top plate A plate placed over the top end of *studs*.	**Simple House**
Total thermal resistance The overall air-to-air *thermal resistance* across all components of a *building element* such as a wall, roof or floor. (This includes the surface resistances which may vary with environmental changes eg, temperature and humidity, but for most purposes can be regarded as having standard values as given in NZS 4214.)	**AS/VM E3, G5**
Total wall area, in relation to a *building*, means the sum (expressed in square metres) of the following: (a) the *wall area* of the *building*; and (b) the area (expressed in square metres) of all vertical glazing in *external walls* of the *building*.	**Code** **Simple House**
Town gas A manufactured gas.	**AS/VM G11**
Toxic environment An environment that contains *contaminants* that can contaminate the water supply in concentrations greater than those included in the New Zealand Drinking Water Standard 1995.	**AS/VM G12**
Trade means any trade, business, industry, profession, occupation, activity of commerce, or undertaking relating to— (a) the supply or acquisition of goods or services; or (b) the acquisition of *household units* or any interest in land.	**BA04**

Amend 11 Sep 2010 (margin notes beside Territorial authority (TA), Tile batten/Top plate, and Total wall area)

Definition	Source
Transverse flashing A roof *flashing* that runs across the roof slope, at right angles to the roof *cladding* profile.	**AS/VM E2**
Trap A chamber which is installed in the *drain* and incorporates features to intercept and retain floatable debris.	**AS/VM E1**
Trapezoidal A type of profiled metal *cladding* with symmetrical or asymmetrical crests, with troughs between the crests.	**AS/VM E2**
Travel distance Distance that is necessary for a person to travel from any point within a built environment to the nearest exit, taking into account the layout of walls, partitions and fittings.	**AS/VM C (C/VM2)**
Travel distance The length of the *escape route* as a whole or the individual lengths of its parts, namely: a) *open paths* and b) *safe paths*.	**AS/VM C (C/AS1–C/AS6)**

Amend 13 Feb 2014

Trickle ventilator A controllable ventilation opening through the external envelope to the outside to provide background ventilation.	**AS/VM G4**
Trimmer A member supporting the wall *framing* beneath, or over an opening in a *non-loadbearing wall* and carrying wind loads to the *trimmer studs*.	**Simple House**
Trimmer stud A *stud* located on the side of an opening.	**Simple House**

Amend 11 Sep 2010

Trough profile A type of profiled metal *cladding* comprising vertical ribs with flat, or lightly profiled pans between the ribs. Also known as ribbed, secret fixed or tray profile.	**AS/VM E2**

U

Underlay The material used behind a *roof* or *wall cladding*. Refer **Wall underlay** and **Roof underlay**.	**AS/VM E2**

Amend 12 Oct 2011

Unisex facilities Facilities available for use by either sex.	**AS/VM G1**

COMMENT:
Unisex facilities may also be described as both gender facilities.

Unitary authority has the meaning given to it by section 5(1) of the Local Government Act 2002.	**BA04/LGA**

Section 5(1) states:

> '**"unitary authority"** means a territorial authority that has the responsibilities, duties, and powers of a regional council conferred on it under—
> (a) the provisions of any Act; or
> (b) an Order in Council giving effect to a reorganisation scheme"

Universal access Where elements and spaces are accessible to and usable by people of all ages and abilities to the greatest extent possible.	**Simple House**

Amend 11 Sep 2010

Definition	Source
Unprotected area In relation to an *external wall* of a *building*, this means: a) Any part of the *external wall* which is not *fire* rated or has less than the required *FRR, and* b) Any part of the *external wall* which has combustible material more than 1.0 mm thick attached or applied to its external face, whether for cladding or any other purpose. **COMMENT:** *Unprotected area* includes non-*fire* rated windows, doors, or other openings, and non-*fire* rated *external wall construction.*	**Code**
uPVC flashings uPVC *flashings* shall be a minimum of 0.75 mm thick and: (a) comply with the requirements of the following Clauses of AS/NZS 4256: Part 2: ii) Clause 9.2 Impact resistance iii) Clause 9.3 Tensile strength iv) Clause 9.4 Colourfastness and impact resistance following ultraviolet light exposure. (b) where exposed to the weather, shall also comply with Section 8 of AS/NZS 4256: Part 2. (c) have a finish colour with a reflectance of 40% or more, when measured in accordance with ASTM C1549 or ASTM E903.	**Simple House**

Amend 13 Feb 2014

Amend 11 Sep 2010

V

Definition	Source
Valley board A board laid to support a *valley gutter*.	**Simple House**
Valley gutter A gutter running down the valley formed by the intersection of two pitched roof surfaces.	**AS/VM E2**
Valve vented storage water heater (unvented storage water heater) A *storage water heater* in which the required venting to the atmosphere is controlled by a valve.	**AS/VM G12**
Vapour barrier Sheet material or coating having a low water-vapour transmission, and used to minimise water-vapour penetration in *buildings*. *(Vapour barriers* are sometimes referred to as *damp-proof membranes.)*	**AS/VM B2**
Vent line A pipe or tube which conveys gas to a safe place outside the *building* from a gas pressure *regulator* relief valve.	**AS/VM G10**
Vent pipe A pipe for the purpose of protecting *water seals* that at its upper end is either open to the atmosphere or fitted with an *air admittance* valve and that at its lower end is connected to a *discharge pipe*.	**AS/VM G13**
Verification Method means a method by which compliance with the *Building Code* may be verified.	**BA04**
Visibility Maximum distance at which an object of defined size, brightness and contrast can be seen and recognised.	**AS/VM C**
VSG Visual stress graded, refers to verified timber that is initially sorted visually in accordance with NZS 3603. See also **MSG**.	**Simple House**

Amend 11 Sep 2010 (Valley board)

Amend 11 Sep 2010 (Visibility)

Amend 11 Sep 2010 (VSG)

W

Amend 12 Oct 2011

Wall refer **External wall.**	**AS/VM E2**
Wall area, in relation to a *building*, means the area (expressed in square metres) of internally-exposed *external walls*, including any door openings, of the *building*.	**Code**
Wall bracing element A section of wall that performs a *bracing* function.	**Simple House**
Wall underlay An absorbent synthetic wrap used as part of the wall *cladding system* to assist the control of moisture by ensuring moisture which may occasionally penetrate the wall *cladding* is directed back to the exterior of the *building*. The *wall underlay* shall have the properties in Table 23 of the *Acceptable Solution* E2/AS1 for Building Code Clause E2 External Moisture: (a) absorbency – no requirement (b) vapour resistance 7 MN s/g or less (c) water resistance of 20 mm or greater (d) pH of extract of between 6.0 and 9.0 (e) shrinkage no more than 0.5% (f) mechanical edge tear and tensile strength to AS/NZS 4200.	**Simple House**
Wall underlay A building paper, synthetic material or rigid sheathing used as part of the *wall cladding system* to assist the control of moisture by ensuring moisture which occasionally penetrates the *wall cladding* is directed back to the exterior of the *building*.	**AS/VM E2**
Waste pipe A *discharge pipe* that conveys the discharge from *waste water fixtures* to a *gully trap*.	**AS/VM G13**
Waste water fixture A *sanitary fixture* or *sanitary appliance* used to receive wastes, and which is not a *soil fixture*.	**AS/VM G13**
Water heater A device for heating water.	**AS/VM B2, G12**
Water main A water supply pipe that is under the control, or maintained by a *network utility operator.*	**Code**
Waterproof and waterproofing The complete and total resistance of a *building element* to the ingress of any moisture.	**AS/VM E2**
Water seal The depth of water that can be retained in a *water trap*.	**AS/VM G2, G13**
Water supply system Pipes, fittings and tanks used or intended to be used for the storage and reticulation of water from a *water main* or other water source to *sanitary fixtures, sanitary appliances* and fittings within a *building*.	**Code**
Water tank (vessel) A covered fixed container for storing hot or cold water.	**AS/VM G12**
Water trap A fitting designed to retain a depth of water that prevents foul air and gases escaping from the *plumbing system* or *foul water drainage system* and entering a *building*.	**AS/VM G2, G13**

Amend 11 Sep 2010

Amend 12 Oct 2011

Weathertightness and weathertight Terms used to describe the resistance of a *building* to the weather. *Weathertightness* is a state where water is prevented from entering and accumulating behind the *cladding* in amounts that can cause undue dampness or damage to the *building elements*. **AS/VM E2**

COMMENT:
The term *weathertightness* is not necessarily the same as *waterproof*. However, a *weathertight building*, even under severe weather conditions, is expected to limit moisture ingress to inconsequential amounts, insufficient to cause undue dampness inside *buildings* and damage to *building elements*. Moisture that may occasionally enter is able to harmlessly escape or evaporate.

Weathertightness and **weathertight** Terms used to describe the resistance of a *building* to the weather. **Simple House**

Wet area An area within a *building* supplied with water from a water supply system including bathrooms and showers, laundries, sanitary compartments and kitchen areas. **Simple House**

Amend 11 Sep 2010

Wetwall The exterior *cladding* on a wall with a *drained cavity*. **AS/VM E2**

Wharenui A communal meeting house having a large open floor area used for both assembly and sleeping in the traditional Maori manner. **AS/VM C, H1**

Wind zone Categorisation of wind force experienced on a particular site as determined in NZS 3604, Section 5. **AS/VM E2**

COMMENT:
Maximum ultimate limit state speeds are:

Low *wind zone* = wind speed of 32 m/s

Medium *wind zone* = wind speed of 37 m/s

High *wind zone* = wind speed of 44 m/s

Very high *wind zone* = wind speed of 50 m/s

Extra high *wind zone* = wind speed of 55 m/s.

Specific design is required for wind speeds greater than 55 m/s.

Amend 12 Oct 2011

Wire dog Galvanised or stainless steel wire, D or Z shaped nail, spiked at each end. Used for fixing timber together to resist uplift **Simple House**

Amend 11 Sep 2010

Working day means any day except— **BA04**

(a) Saturday, Sunday, Good Friday, Easter Monday, Anzac Day, the Sovereign's Birthday, Labour Day, and Waitangi Day; and

(b) the day observed in the appropriate area as the anniversary of the province of which the area forms a part; and

(c) a day in the period beginning on 20 December in any year and ending with the close of 10 January in the following year.

Yield Mass of a combustion product generated during combustion divided by the mass loss of the test specimen. **AS/VM C**

Amend 13 Feb 2014

Index

(Revised by Amendment 13)

This is a complete index for the New Zealand Building Code, Acceptable Solutions and Verification Methods

A

B

C

D

E

F

G

H

I

J K L

J

K

L

M

N

O

P

Q R

S

T

U

V

W

This document contains extracts of the New Zealand Building Code Clauses C1–C6 Protection from Fire and A3 Building Importance Levels. The full Building Code is contained in Schedule 1 of the Building Regulations 1992. These regulations can be downloaded from www.legislation.govt.nz

People using this document should check on a regular basis whether new versions have been published. The current version can be downloaded from www.dbh.govt.nz/compliance-documents Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the building controls system in New Zealand and the Building Code.

Defined words (italicised in the text) are explained in the Building Code Clause A2 Interpretation.

Enquiries about the content of this document should be directed to:

Department of
Building and Housing
Te Tari Kaupapa Whare

Department of Building and Housing
PO Box 10-729, Wellington.
Telephone 0800 242 243
Fax 04 494 0290
Email: info@dbh.govt.nz

Regulations are available from www.legislation.govt.nz

New Zealand Government

C1—OBJECTIVES OF CLAUSES C2 TO C6 (PROTECTION FROM FIRE)

Provisions	Limit on application
The objectives of clauses C2 to C6 are to: (a) safeguard people from an unacceptable risk of injury or illness caused by *fire*, (b) protect *other property* from damage caused by *fire*, and (c) facilitate firefighting and rescue operations.	

C2—PREVENTION OF FIRE OCCURRING

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C2.1 Fixed appliances using controlled combustion and other fixed equipment must be designed, constructed, and installed in *buildings* in a way that reduces the likelihood of illness or injury due to *fire* occurring.	
PERFORMANCE	
C2.2 The maximum surface temperature of *combustible building materials* close to fixed appliances using controlled combustion and other fixed equipment when operating at their design level must not exceed 90°C.	
C2.3 Fixed appliances using controlled combustion and other fixed equipment must be designed, constructed and installed so that there is a low probability of explosive or hazardous conditions occurring within any spaces in or around the *building* that contains the appliances.	

C3—FIRE AFFECTING AREAS BEYOND THE FIRE SOURCE

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C3.1 *Buildings* must be designed and constructed so that there is a low probability of injury or illness to persons not in close proximity to a *fire source*.	
C3.2 *Buildings* with a *building height* greater than 10 m where upper floors contain sleeping uses or *other property* must be designed and constructed so that there is a low probability of external vertical fire spread to upper floors in the *building*.	Clause C3.2 does not apply to importance level 1 *buildings*.
C3.3 *Buildings* must be designed and constructed so that there is a low probability of *fire* spread to *other property* vertically or horizontally across a *relevant boundary*.	

C3—FIRE AFFECTING AREAS BEYOND THE FIRE SOURCE (continued)

Provisions	Limit on application
PERFORMANCE	
C3.4 (a) materials used as internal surface linings in the following areas of *buildings* must meet the performance criteria specified below:	Clause C3.4 does not apply to *detached dwellings*, within *household units* in *multi-unit dwellings*, or *outbuildings* and *ancillary buildings*.

Area of *building*	**Performance determined under conditions described in ISO 9705: 1993**	
	***Buildings* not protected with an automatic *fire* sprinkler system**	***Buildings* protected with an automatic *fire* sprinkler system**
Wall/ceiling materials in sleeping areas where care or detention is provided	Material Group Number 1-S	Material Group Number 1 or 2
Wall/ceiling materials in exitways	Material Group Number 1-S	Material Group Number 1 or 2
Wall/ceiling materials in all *occupied spaces* in importance level 4 *buildings*	Material Group Number 1-S	Material Group Number 1 or 2
Internal surfaces of ducts for *HVAC systems*	Material Group Number 1-S	Material Group Number 1 or 2
Ceiling materials in crowd and sleeping uses except *household units* and where care or detention is provided	Material Group Number 1-S or 2-S	Material Group Number 1 or 2
Wall materials in crowd and sleeping uses except *household units* and where care or detention is provided	Material Group Number 1-S or 2-S	Material Group Number 1, 2, or 3
Wall/ceiling materials in occupied spaces in all other locations in *buildings*, including *household units*	Material Group Number 1, 2, or 3	Material Group Number 1, 2, or 3
External surfaces of ducts for *HVAC systems*	Material Group Number 1, 2, or 3	Material Group Number 1, 2, or 3
Acoustic treatment and pipe insulation within airhandling plenums in sleeping uses	Material Group Number 1, 2, or 3	Material Group Number 1, 2, or 3

C3—FIRE AFFECTING AREAS BEYOND THE FIRE SOURCE (continued)

Provisions	Limit on application
(b) floor surface materials in the following areas of *buildings* must meet the performance criteria specified below:	

Area of *building*	**Minimum critical radiant flux when tested to ISO 9239-1: 2010**	
	***Buildings* not protected with an automatic *fire* sprinkler system**	***Buildings* protected with an automatic *fire* sprinkler system**
Sleeping areas and exitways in *buildings* where care or detention is provided	4.5 kW/m^2	2.2 kW/m^2
Exitways in all other *buildings*	2.2 kW/m^2	2.2 kW/m^2
Firecells accommodating more than 50 persons	2.2 kW/m^2	1.2 kW/m^2
All other occupied spaces except *household units*	1.2 kW/m^2	1.2 kW/m^2

(c) suspended flexible fabrics and membrane structures used in the construction of *buildings* must have properties resulting in a low probability of injury or illness to persons not in close proximity to a *fire source*.

C3.5 *Buildings* must be designed and constructed so that fire does not spread more than 3.5 m vertically from the *fire source* over the external cladding of multi-level *buildings*.

C3.6 *Buildings* must be designed and constructed so that in the event of *fire* in the building the received radiation at the *relevant boundary* of the property does not exceed 30 kW/m^2 and at a distance of 1 m beyond the relevant boundary of the property does not exceed 16 kW/m^2.

C3—FIRE AFFECTING AREAS BEYOND THE FIRE SOURCE (continued)

Provisions	Limit on application
C3.7 External walls of *buildings* that are located closer than 1 m to the *relevant boundary* of the property on which the *building* stands must either: (a) be constructed from materials which are not *combustible building materials*, or (b) for *buildings* in importance levels 3 and 4, be constructed from materials that, when subjected to a radiant flux of 30 kW/m^2, do not ignite for 30 minutes, or (c) for *buildings* in Importance Levels 1 and 2, be constructed from materials that, when subjected to a radiant flux of 30 kW/m^2, do not ignite for 15 minutes.	
C3.8 *Firecells* located within 15 m of a *relevant boundary* that are not protected by an automatic *fire* sprinkler system, and that contain a *fire load* greater than 20 TJ or that have a floor area greater than 5,000 m^2 must be designed and constructed so that at the time that firefighters first apply water to the *fire*, the maximum radiation flux at 1.5 m above the floor is no greater than 4.5 kW/m^2 and the smoke layer is not less than 2 m above the floor.	
C3.9 *Buildings* must be designed and constructed with regard to the likelihood and consequence of failure of any *fire safety* system intended to control *fire* spread.	

C4—MOVEMENT TO PLACE OF SAFETY

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C4.1 *Buildings* must be provided with:	
(a) effective means of giving warning of *fire*, and	
(b) visibility in *escape routes* complying with clause F6.	
C4.2 *Buildings* must be provided with means of escape to ensure that there is a low probability of occupants of those buildings being unreasonably delayed or impeded from moving to a *place of safety* and that those occupants will not suffer injury or illness as a result.	
PERFORMANCE	
C4.3 The *evacuation time* must allow occupants of a building to move to a *place of safety* in the event of a fire so that occupants are not exposed to any of the following:	
(a) a *fractional effective dose* of carbon monoxide greater than 0.3:	
(b) a *fractional effective dose* of thermal effects greater than 0.3:	
(c) conditions where, due to smoke obscuration, visibility is less than 10 m except in rooms of less than 100 m^2 where visibility may fall to 5 m.	
C4.4 Clause C4.3(b) and (c) do not apply where it is not possible to expose more than 1 000 occupants in a *firecell* protected with an automatic *fire* sprinkler system.	
C4.5 Means of escape to a *place of safety* in *buildings* must be designed and constructed with regard to the likelihood and consequence of failure of any *fire safety systems.*	

C5—ACCESS AND SAFETY FOR FIREFIGHTING OPERATIONS

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C5.1 *Buildings* must be designed and constructed so that there is a low probability of firefighters or other emergency services personnel being delayed in or impeded from assisting in rescue operations and performing firefighting operations.	
C5.2 *Buildings* must be designed and constructed so that there is a low probability of illness or injury to firefighters or other emergency services personnel during rescue and firefighting operations.	
PERFORMANCE	
C5.3 *Buildings* must be provided with access for fire service vehicles to a hard-standing from which there is an unobstructed path to the *building* within 20 m of: (a) the firefighter access into the *building*, and (b) the inlets to automatic fire sprinkler systems or fire hydrant systems, where these are installed.	Performance requirements in clauses C5.3 to C5.8 do not apply to *backcountry huts, detached dwellings*, within *household units* in *multi-unit dwellings*, or to *outbuildings*, and *ancillary buildings*.
C5.4 Access for fire service vehicles in accordance with clause C5.3 must be provided to more than 1 side of *firecells* greater than 5,000 m^2 in floor area that are not protected by an automatic fire sprinkler system.	
C5.5 *Buildings* must be provided with the means to deliver water for firefighting to all parts of the *building*.	
C5.6 *Buildings* must be designed and constructed in a manner that will allow firefighters, taking into account the firefighters' personal protective equipment and standard training, to: (a) reach the floor of fire origin, (b) search the general area of fire origin, and (c) protect their means of egress.	

C5—ACCESS AND SAFETY FOR FIREFIGHTING OPERATIONS (continued)

Provisions	Limit on application
C5.7 *Buildings* must be provided with means of giving clear information to enable firefighters to: (a) establish the general location of the *fire*, (b) identify the *fire safety systems* available in the *building*, and (c) establish the presence of *hazardous substances* or process in the *building*.	
C5.8 Means to provide access for and safety of firefighters in *buildings* must be designed and constructed with regard to the likelihood and consequence of failure of any *fire safety systems*.	

C6—STRUCTURAL STABILITY

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C6.1 Structural systems in *buildings* must be constructed to maintain structural stability during *fire* so that there is:	
(a) a low probability of injury or illness to occupants,	
(b) a low probability of injury or illness to *fire* service personnel during rescue and firefighting operations, and	
(c) a low probability of direct or consequential damage to adjacent *household units* or *other property*.	
PERFORMANCE	
C6.2 Structural systems in *buildings* that are necessary for structural stability in *fire* must be designed and constructed so that they remain stable during *fire* and after *fire* when required to protect *other property* taking into account:	
(a) the *fire* severity,	
(b) any automatic fire sprinkler systems within the *buildings*,	
(c) any other active *fire safety systems* that affect the *fire* severity and its impact on structural stability, and	
(d) the likelihood and consequence of failure of any *fire safety systems* that affect the *fire* severity and its impact on structural stability.	
C6.3 Structural systems in *buildings* that are necessary to provide firefighters with safe access to floors for the purpose of conducting firefighting and rescue operations must be designed and constructed so that they remain stable during and after *fire*.	
C6.4 Collapse of building elements that have lesser *fire* resistance must not cause the consequential collapse of elements that are required to have a higher *fire* resistance.	

CLAUSE A3—BUILDING IMPORTANCE LEVELS

For the purposes of clause C, a *building* has one of the importance levels set out below:

Importance level	Description of building type	Specific structure
Importance level 1	*Buildings* posing low risk to human life or the environment, or a low economic cost, should the *building* fail. These are typically small non-habitable *buildings*, such as sheds, barns, and the like, that are not normally occupied, though they may have occupants from time to time.	• Ancillary *buildings* not for human habitation • Minor storage facilities • Backcountry huts
Importance level 2	*Buildings* posing normal risk to human life or the environment, or a normal economic cost, should the *building* fail. These are typical residential, commercial, and industrial *buildings*.	• All *buildings* and facilities except those listed in importance levels 1, 3, 4, and 5
Importance level 3	*Buildings* of a higher level of societal benefit or importance, or with higher levels of risk-significant factors to *building* occupants. These *buildings* have increased performance requirements because they may house large numbers of people, vulnerable populations, or occupants with other risk factors, or fulfil a role of increased importance to the local community or to society in general.	• *Buildings* where more than 300 people congregate in 1 area • *Buildings* with primary school, secondary school, or daycare facilities with a capacity greater than 250 • *Buildings* with tertiary or adult education facilities with a capacity greater than 500 • Health care facilities with a capacity of 50 or more residents but not having surgery or emergency treatment facilities • Jails and detention facilities • Any other *building* with a capacity of 5 000 or more people • *Buildings* for power generating facilities, water treatment for potable water, wastewater treatment facilities, and other public utilities facilities not included in importance level 4

CLAUSE A3—BUILDING IMPORTANCE LEVELS (continued)

Importance level	Description of building type	Specific structure
Importance level 3 (continued)		• *Buildings* not included in importance level 4 or 5 containing sufficient quantities of highly toxic gas or explosive materials capable of causing acutely hazardous conditions that do not extend beyond property boundaries
Importance level 4	*Buildings* that are essential to post-disaster recovery or associated with hazardous facilities.	• Hospitals and other health care facilities having surgery or emergency treatment facilities • *Fire*, rescue, and police stations and emergency vehicle garages • *Buildings* intended to be used as emergency shelters • *Buildings* intended by the owner to contribute to emergency preparedness, or to be used for communication, and operation centres in an emergency, and other facilities required for emergency response • Power generating stations and other utilities required as emergency backup facilities for importance level 3 structures • *Buildings* housing highly toxic gas or explosive materials capable of causing acutely hazardous conditions that extend beyond property boundaries • Aviation control towers, air traffic control centres, and emergency aircraft hangars • *Buildings* having critical national defence functions • Water treatment facilities required to maintain water pressure for fire suppression

CLAUSE A3—BUILDING IMPORTANCE LEVELS (continued)

Importance level	Description of building type	Specific structure
Importance level 4 (continued)		• Ancillary *buildings* (including, but not limited to, communication towers, fuel storage tanks or other structures housing or supporting water or other *fire* suppression material or equipment) required for operation of importance level 4 structures during an emergency
Importance level 5	*Buildings* whose failure poses catastrophic risk to a large area (eg, 100 km^2) or a large number of people (eg, 100 000).	• Major dams • Extremely hazardous facilities

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington.6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

ISBN (online) 978-1-98-857008-2

Document status

The most recent version of this document (Amendment 2), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 5 November 2020 and supersedes all previous versions.

The previous edition of this Acceptable Solution C/AS2, as amended, will cease to have effect on 3 November 2021.

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 Acceptable Solution or Verification Method at any time. Up-to-date versions of Acceptable Solutions and Verification Methods are available from www.building.govt.nz

C: Document History

	Date	Alterations	
First edition	27 June 2019		
Amendment 1 (Errata 1)	Effective from 22 October 2019 until 3 November 2021	p. 34, Table 1.1 p. 43, Table 2.2b p. 44, Table 2.2c	
Amendment 2	5 November 2020	p. 18 Contents pp. 19-21 References pp. 22–24, 26–27, 30–32 Definitions pp. 34, 36 Part 1 pp. 41, 48 Part 2	pp. 50, 57–58, 64–79, 82–87 Part 3 pp. 89–90, 95–100, 105, 108–118, Part 4 pp. 121–124, 128–136, 139–143 Part 5 pp 146–147 Part 7 pp. 155, 158 Appendix C

C1—OBJECTIVES OF CLAUSES C2 TO C6 (PROTECTION FROM FIRE)

Provisions	Limit on application
The objectives of clauses C2 to C6 are to: (a) safeguard people from an unacceptable risk of injury or illness caused by *fire*, (b) protect *other property* from damage caused by *fire*, and (c) facilitate firefighting and rescue operations.	

C2—PREVENTION OF FIRE OCCURRING

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C2.1 Fixed appliances using controlled combustion and other fixed equipment must be designed, constructed, and installed in *buildings* in a way that reduces the likelihood of illness or injury due to *fire* occurring.	
PERFORMANCE	
C2.2 The maximum surface temperature of *combustible building materials* close to fixed appliances using controlled combustion and other fixed equipment when operating at their design level must not exceed 90°C.	
C2.3 Fixed appliances using controlled combustion and other fixed equipment must be designed, constructed and installed so that there is a low probability of explosive or hazardous conditions occurring within any spaces in or around the *building* that contains the appliances.	

C3—FIRE AFFECTING AREAS BEYOND THE FIRE SOURCE

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C3.1 *Buildings* must be designed and constructed so that there is a low probability of injury or illness to persons not in close proximity to a *fire source*.	
C3.2 *Buildings* with a *building height* greater than 10 m where upper floors contain sleeping uses or *other property* must be designed and constructed so that there is a low probability of external vertical fire spread to upper floors in the *building*.	Clause C3.2 does not apply to importance level 1 *buildings*.
C3.3 *Buildings* must be designed and constructed so that there is a low probability of *fire* spread to *other property* vertically or horizontally across a *relevant boundary*.	

C3—FIRE AFFECTING AREAS BEYOND THE FIRE SOURCE (continued)

Provisions	Limit on application
PERFORMANCE **C3.4** (a) materials used as internal surface linings in the following areas of *buildings* must meet the performance criteria specified below:	Clause C3.4 does not apply to *detached dwellings*, within *household units* in *multi-unit dwellings*, or *outbuildings* and *ancillary buildings*.

Area of *building*	**Performance determined under conditions described in ISO 9705: 1993**	
	***Buildings* not protected with an automatic *fire* sprinkler system**	***Buildings* protected with an automatic *fire* sprinkler system**
Wall/ceiling materials in sleeping areas where care or detention is provided	Material Group Number 1-S	Material Group Number 1 or 2
Wall/ceiling materials in exitways	Material Group Number 1-S	Material Group Number 1 or 2
Wall/ceiling materials in all *occupied spaces* in importance level 4 *buildings*	Material Group Number 1-S	Material Group Number 1 or 2
Internal surfaces of ducts for *HVAC systems*	Material Group Number 1-S	Material Group Number 1 or 2
Ceiling materials in crowd and sleeping uses except *household units* and where care or detention is provided	Material Group Number 1-S or 2-S	Material Group Number 1 or 2
Wall materials in crowd and sleeping uses except *household units* and where care or detention is provided	Material Group Number 1-S or 2-S	Material Group Number 1, 2, or 3
Wall/ceiling materials in occupied spaces in all other locations in *buildings*, including *household units*	Material Group Number 1, 2, or 3	Material Group Number 1, 2, or 3
External surfaces of ducts for *HVAC systems*	Material Group Number 1, 2, or 3	Material Group Number 1, 2, or 3
Acoustic treatment and pipe insulation within airhandling plenums in sleeping uses	Material Group Number 1, 2, or 3	Material Group Number 1, 2, or 3

C3—FIRE AFFECTING AREAS BEYOND THE FIRE SOURCE (continued)

Provisions	Limit on application
(b) floor surface materials in the following areas of *buildings* must meet the performance criteria specified below:	

Area of *building*	Minimum critical radiant flux when tested to ISO 9239-1: 2010	
	***Buildings* not protected with an automatic *fire* sprinkler system**	***Buildings* protected with an automatic *fire* sprinkler system**
Sleeping areas and exitways in *buildings* where care or detention is provided	4.5 kW/m^2	2.2 kW/m^2
Exitways in all other *buildings*	2.2 kW/m^2	2.2 kW/m^2
Firecells accommodating more than 50 persons	2.2 kW/m^2	1.2 kW/m^2
All other occupied spaces except *household units*	1.2 kW/m^2	1.2 kW/m^2

(c) suspended flexible fabrics and membrane structures used in the construction of *buildings* must have properties resulting in a low probability of injury or illness to persons not in close proximity to a *fire source*.

C3.5 *Buildings* must be designed and constructed so that fire does not spread more than 3.5 m vertically from the *fire source* over the external cladding of multi-level *buildings*.

C3.6 *Buildings* must be designed and constructed so that in the event of *fire* in the building the received radiation at the *relevant boundary* of the property does not exceed 30 kW/m^2 and at a distance of 1 m beyond the relevant boundary of the property does not exceed 16 kW/m^2.

C3—FIRE AFFECTING AREAS BEYOND THE FIRE SOURCE (continued)

Provisions	Limit on application
C3.7 External walls of *buildings* that are located closer than 1 m to the *relevant boundary* of the property on which the *building* stands must either: (a) be constructed from materials which are not ***combustible building materials***, or (b) for *buildings* in importance levels 3 and 4, be constructed from materials that, when subjected to a radiant flux of 30 kW/m^2, do not ignite for 30 minutes, or (c) for *buildings* in Importance Levels 1 and 2, be constructed from materials that, when subjected to a radiant flux of 30 kW/m^2, do not ignite for 15 minutes.	
C3.8 *Firecells* located within 15 m of a *relevant boundary* that are not protected by an automatic *fire* sprinkler system, and that contain a *fire load* greater than 20 TJ or that have a floor area greater than 5,000 m^2 must be designed and constructed so that at the time that firefighters first apply water to the *fire*, the maximum radiation flux at 1.5 m above the floor is no greater than 4.5 kW/m^2 and the smoke layer is not less than 2 m above the floor.	
C3.9 *Buildings* must be designed and constructed with regard to the likelihood and consequence of failure of any *fire safety* system intended to control *fire* spread.	

C4—MOVEMENT TO PLACE OF SAFETY

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C4.1 *Buildings* must be provided with:	
(a) effective means of giving warning of *fire*, and	
(b) visibility in *escape routes* complying with clause F6.	
C4.2 *Buildings* must be provided with means of escape to ensure that there is a low probability of occupants of those buildings being unreasonably delayed or impeded from moving to a *place of safety* and that those occupants will not suffer injury or illness as a result.	
PERFORMANCE	
C4.3 The *evacuation time* must allow occupants of a building to move to a *place of safety* in the event of a fire so that occupants are not exposed to any of the following:	
(a) a *fractional effective dose* of carbon monoxide greater than 0.3:	
(b) a *fractional effective dose* of thermal effects greater than 0.3:	
(c) conditions where, due to smoke obscuration, visibility is less than 10 m except in rooms of less than 100 m^2 where visibility may fall to 5 m.	
C4.4 Clause C4.3(b) and (c) do not apply where it is not possible to expose more than 1 000 occupants in a *firecell* protected with an automatic *fire* sprinkler system.	
C4.5 Means of escape to a *place of safety* in *buildings* must be designed and constructed with regard to the likelihood and consequence of failure of any *fire safety systems.*	

C5—ACCESS AND SAFETY FOR FIREFIGHTING OPERATIONS

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C5.1 *Buildings* must be designed and constructed so that there is a low probability of firefighters or other emergency services personnel being delayed in or impeded from assisting in rescue operations and performing firefighting operations.	
C5.2 *Buildings* must be designed and constructed so that there is a low probability of illness or injury to firefighters or other emergency services personnel during rescue and firefighting operations.	
PERFORMANCE	
C5.3 *Buildings* must be provided with access for fire service vehicles to a hard-standing from which there is an unobstructed path to the *building* within 20 m of: (a) the firefighter access into the *building*, and (b) the inlets to automatic fire sprinkler systems or fire hydrant systems, where these are installed.	Performance requirements in clauses C5.3 to C5.8 do not apply to *backcountry huts, detached dwellings*, within *household units* in *multi-unit dwellings*, or to *outbuildings*, and *ancillary buildings*.
C5.4 Access for fire service vehicles in accordance with clause C5.3 must be provided to more than 1 side of *firecells* greater than 5,000 m^2 in floor area that are not protected by an automatic fire sprinkler system.	
C5.5 *Buildings* must be provided with the means to deliver water for firefighting to all parts of the *building*.	
C5.6 *Buildings* must be designed and constructed in a manner that will allow firefighters, taking into account the firefighters' personal protective equipment and standard training, to: (a) reach the floor of fire origin, (b) search the general area of fire origin, and (c) protect their means of egress.	

C5—ACCESS AND SAFETY FOR FIREFIGHTING OPERATIONS (continued)

Provisions	Limit on application
C5.7 *Buildings* must be provided with means of giving clear information to enable firefighters to: (a) establish the general location of the *fire*, (b) identify the *fire safety systems* available in the *building*, and (c) establish the presence of *hazardous substances* or process in the *building*.	
C5.8 Means to provide access for and safety of firefighters in *buildings* must be designed and constructed with regard to the likelihood and consequence of failure of any *fire safety systems*.	

C6—STRUCTURAL STABILITY

Provisions	Limit on application
FUNCTIONAL REQUIREMENT	
C6.1 Structural systems in *buildings* must be constructed to maintain structural stability during *fire* so that there is:	
(a) a low probability of injury or illness to occupants,	
(b) a low probability of injury or illness to *fire* service personnel during rescue and firefighting operations, and	
(c) a low probability of direct or consequential damage to adjacent *household units* or *other property*.	
PERFORMANCE	
C6.2 Structural systems in *buildings* that are necessary for structural stability in *fire* must be designed and constructed so that they remain stable during *fire* and after *fire* when required to protect *other property* taking into account:	
(a) the *fire* severity,	
(b) any automatic fire sprinkler systems within the *buildings*,	
(c) any other active *fire safety systems* that affect the *fire* severity and its impact on structural stability, and	
(d) the likelihood and consequence of failure of any *fire safety systems* that affect the *fire* severity and its impact on structural stability.	
C6.3 Structural systems in *buildings* that are necessary to provide firefighters with safe access to floors for the purpose of conducting firefighting and rescue operations must be designed and constructed so that they remain stable during and after *fire*.	
C6.4 Collapse of building elements that have lesser *fire* resistance must not cause the consequential collapse of elements that are required to have a higher *fire* resistance.	

CLAUSE A3—BUILDING IMPORTANCE LEVELS

For the purposes of clause C, a *building* has one of the importance levels set out below:

Importance level	Description of building type	Specific structure
Importance level 1	*Buildings* posing low risk to human life or the environment, or a low economic cost, should the *building* fail. These are typically small non-habitable *buildings*, such as sheds, barns, and the like, that are not normally occupied, though they may have occupants from time to time.	• Ancillary *buildings* not for human habitation • Minor storage facilities • Backcountry huts
Importance level 2	*Buildings* posing normal risk to human life or the environment, or a normal economic cost, should the *building* fail. These are typical residential, commercial, and industrial *buildings*.	• All *buildings* and facilities except those listed in importance levels 1, 3, 4, and 5
Importance level 3	*Buildings* of a higher level of societal benefit or importance, or with higher levels of risk-significant factors to *building* occupants. These *buildings* have increased performance requirements because they may house large numbers of people, vulnerable populations, or occupants with other risk factors, or fulfil a role of increased importance to the local community or to society in general.	• *Buildings* where more than 300 people congregate in 1 area • *Buildings* with primary school, secondary school, or daycare facilities with a capacity greater than 250 • *Buildings* with tertiary or adult education facilities with a capacity greater than 500 • Health care facilities with a capacity of 50 or more residents but not having surgery or emergency treatment facilities • Jails and detention facilities • Any other *building* with a capacity of 5 000 or more people • *Buildings* for power generating facilities, water treatment for potable water, wastewater treatment facilities, and other public utilities facilities not included in importance level 4

CLAUSE A3—BUILDING IMPORTANCE LEVELS (continued)

Importance level	Description of building type	Specific structure
Importance level 3 (continued)		• *Buildings* not included in importance level 4 or 5 containing sufficient quantities of highly toxic gas or explosive materials capable of causing acutely hazardous conditions that do not extend beyond property boundaries
Importance level 4	*Buildings* that are essential to post-disaster recovery or associated with hazardous facilities.	• Hospitals and other health care facilities having surgery or emergency treatment facilities • *Fire*, rescue, and police stations and emergency vehicle garages • *Buildings* intended to be used as emergency shelters • *Buildings* intended by the owner to contribute to emergency preparedness, or to be used for communication, and operation centres in an emergency, and other facilities required for emergency response • Power generating stations and other utilities required as emergency backup facilities for importance level 3 structures • *Buildings* housing highly toxic gas or explosive materials capable of causing acutely hazardous conditions that extend beyond property boundaries • Aviation control towers, air traffic control centres, and emergency aircraft hangars • *Buildings* having critical national defence functions • Water treatment facilities required to maintain water pressure for fire suppression

CLAUSE A3—BUILDING IMPORTANCE LEVELS (continued)

Importance level	Description of building type	Specific structure
Importance level 4 (continued)		• Ancillary *buildings* (including, but not limited to, communication towers, fuel storage tanks or other structures housing or supporting water or other *fire* suppression material or equipment) required for operation of importance level 4 structures during an emergency
Importance level 5	*Buildings* whose failure poses catastrophic risk to a large area (eg, 100 km^2) or a large number of people (eg, 100 000).	• Major dams • Extremely hazardous facilities

Contents

References

For the purposes of New Zealand Building Code compliance, the New Zealand and other Standards, and other documents referred to in this Acceptable Solution (primary reference documents) shall be the editions, along with their specific amendments, listed below. Where the primary reference documents refer to other Standards or other documents (secondary reference documents), which in turn may also refer to other Standards or other documents, and so on (lower order reference documents), then the applicable version of these secondary and lower order reference documents shall be the version in effect at the date that the primary reference document was published.

		Where quoted
Standards New Zealand		
NZS/BS 476:-	Fire tests on building materials and structures	
Part 21:1987	Methods for determination of the fire resistance of loadbearing elements of construction	C5.1.1
Part 22:1987	Methods for determination of the fire resistance of non-loadbearing elements of construction	C5.1.1
AS/NZS 1668:-	The use of ventilation and air conditioning in buildings	
Part 1: 1998	Fire and smoke control in multi-compartment buildings *Amend: 1*	3.10.4, 3.10.5, A2.1.1, Table 2.2
AS/NZS 2918: 2001	Domestic solid fuel burning appliances – installation	7.1.1, 7.1.2, 7.3.3, 7.5.5, 7.5.12
AS/NZS 3837: 1998	Method of test for heat and smoke release rates for materials and properties using an oxygen consumption calorimeter *Amend: 1*	C7.1.1
NZS 4232:-	Performance criteria for fire resisting closures	
Part 2: 1988	Fire resisting glazing systems	Definitions
NZS 4332: 1997	Non-domestic passenger and goods lifts	6.3.3, Table 2.2
NZS 4510: 2008	Fire hydrant systems for buildings *Amend: 1*	6.3.2, A2.1.1, Table 2.2
NZS 4512: 2010	Fire detection and alarm systems in buildings	2.2.2, 4.15.6, 6.2.1, A2.1.1, C6.1.6, Table 2.2
NZS 4515: 2009	Fire sprinkler systems for life safety in sleeping occupancies (up to 2000 m^2)	Definitions, 2.3.13, 6.2.1, B3.1.1, Tables 2.2 and 2.2a
NZS 4520: 2010	Fire resistant doorsets	4.2.4, 4.16.6, C6.1.1
NZS 4541: 2013	Automatic fire sprinkler systems	Definitions, 2.3.13, 5.2.2, 6.2.1, B2.1.1, Tables 2.2 and 2.2a

Amend 2
Nov 2020

Amend 2
Nov 2020

		Where quoted
Standards Australia		
AS 1366:-	Rigid cellular plastics sheets for thermal insulation	
Part 1: 1992	Rigid cellular polyurethane (RC/PUR) *Amend: 1*	4.17.2
Part 2: 1992	Rigid cellular polyisocyanurate (RC/PIR)	4.17.2
Part 3: 1992	Rigid cellular polystyrene – moulded (RC/PS-M) *Amend: 1*	4.17.2
Part 4: 1989	Rigid cellular polystyrene – extruded (RC/PS-E)	4.17.2
AS 1530:-	Methods for fire tests on building materials, components and structures	
Part 1: 1994	Combustibility test for materials	Definitions, C4.1.1
Part 2: 1993	Test for flammability of materials	4.17.8, 4.17.9, C3.1
Part 4: 2005	Fire-resistance tests of elements of building construction	4.5.9, C5.1.1
AS 1682:-	Fire Dampers	
Part 1: 1990	Specification	4.16.12, 4.16.14
Part 2: 1990	Installation	4.16.12, 4.16.14
AS 1691: 1985	Domestic oil-fired appliances – installation	7.3.1, 7.3.2
AS 4072:-	Components for the protection of openings in fire-resistant separating elements	
Part 1: 2005	Service penetrations and control joints *Amend: 1*	C5.1.2
AS 4254:-	Ductwork for air-handling systems in buildings	
Part 1: 2012	Flexible duct	Table 4.4
Part 2: 2012	Rigid duct	Table 4.4
AS 5113: 2016	Classification of external walls of buildings based on reaction-to-fire performance *Amend: 1*	5.8.3
AS ISO 9705: 2003	Fire tests – Full scale room test for surface products	Table C1.1
International Standards Organisation		
ISO 5660:-	Reaction-to-fire tests – Heat release, smoke production and mass loss rate	
Part 1: 2002	Heat release rate (cone calorimeter method)	C4.1.2, C7.1.1, C7.1.2, Table C1.1
Part 2: 2002	Smoke production rate (dynamic measurement)	C4.1.2, Table C1.1

Amend 2
Nov 2020

Amend 2
Nov 2020

		Where quoted
ISO 9239:-	Reaction to fire tests for flooring	
Part 1: 2010	Determination of the burning behaviour using a radiant heat source	4.17.3, C2.1
ISO 9705: 1993	Fire tests – Full scale room test for surface products	C4.1.2, Table C1.1
British Standards Institution		
BS 8414:-	Fire performance of external cladding systems	
Part 1: 2015	Test method for non-loadbearing external cladding sytems applied to the masonry face of a building *Amend: 1 (2017)*	5.8.3
Part 2: 2017	Test method for non-loadbearing external cladding sytems fixed to and supported by a structural steel frame *Amend: 1 (2017)*	5.8.3
BS EN 12101:-	Smoke and heat control systems	
Part 1: 2005	Specification for smoke barriers	Definitions
BS EN 13501:-	Fire classification of construction products and building elements	
Part 1: 2018	Classification using test data from reaction to fire tests	Definitions, C4.1.1, Table C1.1
National Fire Protection Association		
NFPA 285: 2019	Standard fire test method for evaluation of fire propagation characteristics of exterior wall assemblies containing combustible components	5.8.3
American Society for Testing and Materials		
ASTM D 2898: 2010	Standard practice for accelerated weathering of fire-retardant-treated wood for fire testing	C7.1.3
BRE Global		
BRE 135: 2013	Fire performance of external thermal insulation for walls of multi-storey buildings – Third Edition	5.8.3
New Zealand Legislation		
Education (Early Childhood Services) Regulations 2008		Table 1.2
Hazardous Substances and New Organisms Act 1996		Definitions, 1.1.6
Health and Safety at Work (Hazardous Substances) Regulations 2017		1.1.6
Australian Building Codes Board		
National Construction Code (NCC) 2015		Table C1.1

Amend 2 Nov 2020

Amend 2 Nov 2020

Amend 2 Nov 2020

Amend 2 Nov 2020

Amend 2 Nov 2020

Amend 2 Nov 2020

Definitions

Access route	A continuous route that permits people and goods to move between the apron or *construction* edge of the *building* to spaces within a *building*, and between spaces within a *building*.
Accessible	Having features to permit use by *people with disabilities*.
Accessible route	An *access route* usable by *people with disabilities*. It shall be a continuous route that can be negotiated unaided by a wheelchair user. The route shall extend from street *boundary* or car parking area to those spaces within the *building* required to be *accessible* to enable *people with disabilities* to carry out normal activities and processes within the *building*.
Adjacent building	A nearby *building*, including an adjoining *building*, whether or not erected on *other property*.
Allotment	Has the meaning given to it by section 10 of the Building Act 2004.
Amend 2 Nov 2020 Backcountry hut	A *building* that— a) is located on land that is administered by the Department of Conservation for conservation, recreational, scientific, or other related purposes, including any land administered under any of the following: i) the Conservation Act 1987; ii) the National Parks Act 1980; iii) the Reserves Act 1977; and b) is intended to provide overnight shelter to any person who may visit and who carries his or her own food, bedding, clothing, and outdoor equipment; and c) contains only basic facilities, which may include (but are not limited to) any or all of the following: i) sleeping platforms or bunks; ii) mattresses; iii) food preparation surfaces; iv) appliances for heating; v) appliances for cooking; vi) toilets; and d) has been certified by the Director-General as being in a location that wheelchair users are unlikely to be able to visit; and e) is intended to be able to sleep— i) no more than 20 people in its backcountry hut sleeping area; and ii) no more than 40 people in total; and f) does not contain any connection, except by radiocommunications, to a network utility operator.
Basement	Any *firecell* or part of a *firecell* below the level of the lowest *final exit*.
Boundary	Any *boundary* that is shown on a survey plan that is approved by the Surveyor-General and deposited with the Registrar-General of Land, whether or not a new title has been issued.

Building	Has the meaning given to it by sections 8 and 9 of the *Building Act 2004*. For the purposes of this Acceptable Solution and notwithstanding the definition of *building*, a number of separated *buildings* cannot be taken as a single *firecell*.
Building Act 2004 (the Building Act)	The principal legislation dealing with *building* controls in New Zealand.
Building Code	The regulations made under section 400 of the *Building Act 2004*.
Building consent	Means a consent to carry out *building* work granted by a *building consent authority* under section 49 of the *Building Act 2004*.
Building consent authority	Has the meaning ascribed to it by section 7 of the *Building Act 2004.*
Amend 2 Nov 2020 Building element	Any structural and non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, drains, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.
Building height	The vertical distance between the floor level of the lowest *occupied space* above the ground and the top of the highest occupied floor, but not including spaces located within or on the roof that enclose stairways, lift shafts, or machinery rooms.
Cavity barrier	A *construction* provided to close openings within a *concealed space* against the passage of *fire*, or to restrict the spread of *fire* within such spaces.
Chimney	A *non-combustible* structure which encloses one or more *flues*, *fireplaces* or other heating appliances.
Chimney back	The *non-combustible* wall forming the back of a *fireplace*.
Chimney breast	The front *fireplace* wall *construction* above the *fireplace* opening.
Chimney jambs	The side walls of a *fireplace*.
Combustible	See *non-combustible*.
Communal service functions (Amend 2 Nov 2020)	Spaces that provide day to day service function to support the sleeping areas and are higher *fire* risk than *direct support functions.* These are generally enclosed spaces which include but are not limited to offices, waiting rooms, lounges, stores, dining rooms, laundries and kitchens.
Concealed space	Any part of the space within a *building,* excluding *protected shafts*, that cannot be seen from an *occupied space*.
Construct	In relation to a *building*, includes to design, build, erect, prefabricate, and relocate the *building*; and construction has a corresponding meaning.
Damp-proof course	A strip of durable vapour barrier placed between *building elements* to prevent the passage of moisture from one element to another.
Damper blade	A component of a *fire damper* that closes off the airway within a *fire damper* upon detection of *fire* or smoke.

Dead end	That part of an *open path* where escape is possible in only one direction.
Direct support function	Activities that provide support to the primary use of a space that are open areas of low risk and *fire load* which may include but are not limited to reception desks, nurses stations, kiosks, tea bays, sanitary facilities and mail boxes (sanitary facilities may be enclosed to provide appropriate privacy).
Doorset	A complete assembly comprising a door leaf or leaves including any glazed or solid panels adjacent to or over the leaves within the door frame including hardware or other inbuilt features; and a door frame, if any, with its fixings to the wall and, for a sliding or tilting door, all guides and their respective fixings to the lintel, wall or sill.
Early childhood centre (ECC)	Premises used regularly for the education or care of three or more children (not being children of the persons providing the education or care, or children enrolled at a school being provided with education or care before or after school) under the age of six years old— a) by the day or part of a day; but b) not for any continuous period of more than seven days. ECC does not include home based early childhood services.
Escape height	The height between the floor level in the *firecell* being considered and the floor level of the required *final exit* which is the greatest vertical distance above or below that *firecell*. Where the firecell contains *intermediate floors*, or upper floors within *household units* the escape height shall be measured from the floor having the greatest vertical separation from the *final exit*.
Escape route	A continuous unobstructed route from any *occupied space* in a *building* to a *final exit* to enable occupants to reach a *safe place*, and shall comprise one or more of the following: *open paths* and *safe paths*. Note that doors in an escape route are not considered to be obstructions provided they comply with this Acceptable Solution and D1/AS1.
Exitway	All parts of an *escape route* protected by *fire* or *smoke separations*, or by distance when exposed to open air, and terminating at a *final exit*.
External wall	Any exterior face of a *building* (including a roof) within 30° of vertical, consisting of *primary* and/or *secondary elements* intended to provide protection against the outdoor environment, but which may also contain *unprotected areas*.
Final exit	The point at which an *escape route* terminates by giving direct access to a *safe place*.
Fire	The state of combustion during which flammable materials burn producing heat, toxic gases, or smoke or flame or any combination of these.

Amend 2 Nov 2020

Amend 2 Nov 2020

Firecell	Any space including a group of contiguous spaces on the same or different levels within a *building*, which is enclosed by any combination of *fire separations*, *external walls*, roofs, and floors. Floors, in this context, include ground floors and those in which the underside is exposed to the external environment (eg when cantilevered). Note that internal floors between *firecells* are *fire separations*.
Fire damper	A device with a specified *FRR* complete with fixings and operating mechanism for automatically closing off an airway where it passes through a *fire separation*. An airway may be a duct, plenum, ceiling space, roof space or similar *construction* used for the passage of ventilating air.
Fire door	A doorset, single or multi-leaf, having a specific *fire resistance rating*, and in certain situations a smoke control capability, and forming part of a *fire separation*. The door, in the event of *fire*, if not already closed, will close automatically and be self-latching.
Fire hazard	The danger of potential harm and degree of exposure arising from— a) the start and spread of *fire*; and b) the smoke and gases that are generated by the start and spread of *fire*.
Fire load	The sum of the net calorific values of the *combustible* contents which can reasonably be expected to burn within a *firecell*, including furnishings, built-in and removable materials, and *building elements*. The calorific values shall be determined at the ambient moisture content or humidity.
Fireplace	A space formed by the c*himney back*, the *chimney jambs*, and the *chimney breast* in which fuel is burned for the purpose of heating the room into which it opens.
Fire resistance rating (FRR)	The term used to describe the minimum *fire* resistance required of *primary* and *secondary elements* as determined in the *standard test* for *fire* resistance, or in accordance with a specific calculation method verified by experimental data from standard *fire* resistance tests. It comprises three numbers giving the time in minutes for which each of the criteria *structural adequacy*, *integrity* and *insulation* are satisfied, and is presented always in that order. There are two types of *FRR: life rating* and *property rating*.
Fire resisting closure	A *fire* rated device or assembly for closing an opening through a *fire separation*. A *fire resisting closure* is intended to include *fire doors*, *fire* windows or access panels. In this context the opening may be used to permit passage of people or goods, or to transmit light, but does not include an opening to permit the passage of *building* services.
Fire resisting glazing	Fixed or openable glazing, complete with frame and fixings, mullions, transoms and glazing beads, with a specified *FRR* and complying with NZS 4232.2.
Fire retardant	A substance or a treatment, incorporated in or applied to a material, which suppresses or delays the combustion of that material under specified conditions.

Fire safety systems	The combination of all active and passive protection methods used in a *building* to— a) warn people of an emergency; and b) provide for safe evacuation; and c) provide for access by, and the safety of, firefighters; and d) restrict the spread of *fire*; and e) limit the impact of *fire* on *structural stability*.
Fire separation	Any *building element* which separates *firecells* or *firecells* and *safe paths*, and provides a specific *fire resistance rating*.
Fire shutter	A *fire* rated device, complete with fixings and operating mechanism, for automatically closing off an opening in a *fire separation* or *protected shaft*.
Fire stop	A material or method of *construction* used to restrict the spread of *fire* within or through *fire separations*, and having a *FRR* no less than that of the *fire separation*. Fire stops are mainly used to seal around penetrations, but can also be used to seal narrow gaps between building elements.
Fixture	An article intended to remain permanently attached to and form part of a *building*.
Flammability index (FI)	That index number for flammability, which is determined according to the *standard test* method for flammability of thin flexible materials.
Flue	The passage through which the products of combustion are conveyed to the outside.
Flue liner	Pipes or linings of *fire* clay, metal or *fire* brick that surrounds *flues*.
Flue system	A series of interconnecting *flue* pipe casings which form a safe passage (*flue*) for conveying products of combustion from within an appliance to the outside of a *building* or structure.
Foamed plastics	*Combustible* foamed plastic polymeric materials of low density (typically less than 100 kg/m^3) and classified as cellular polymers which are manufactured by creating a multitude of fine void (typically 90 to 98%) distributed more or less uniformly throughout the product. Examples of *foamed plastics* are latex foams, polyethylene foams, polyvinyl chloride foams, expanded or extruded polystyrene foams, phenolic foams, ureaformaldehyde foams, polyurethane foams and polychloropene foams.
Group Number	The classification number for a material used as a finish, surface, lining, or attachment to a wall or ceiling within an *occupied space* and determined according to the *standard test* methods for measuring the properties of lining materials. The method for determining a Group Number is described in C/VM2 Appendix A.

Amend 2
Nov 2020

Group sleeping area	A *firecell* containing communal sleeping accommodation for a specified number of people who may or may not be known to one another.
Handrail	A rail to provide support to, or assist with the movement of a person.
Hazardous	Creating an unreasonable risk to people of bodily injury or deterioration of health.
Hazardous substance	Has the meaning ascribed to it by section 2 of the Hazardous Substances and New Organisms Act 1996.
Hearth	The insulating floor under the *fire* and in front and at the sides of the *fireplace*.
Hold-open device	A device which holds a *smoke control door* or *fire* door open during normal use, but is released by deactivating the device by an automatic *fire* detection system, allowing the door to close automatically under the action of a self-closing device.
Household unit	a) means a *building* or group of *buildings*, or part of a *building* or group of *buildings*, that is— i) used, or intended to be used, only or mainly for residential purposes; and ii) occupied, or intended to be occupied, exclusively as the home or residence of not more than 1 household; but b) does not include a hostel, boarding house, or other specialised accommodation.
HVAC	An abbreviation for heating, ventilating and air-conditioning.
Insulating material	A material that has a thermal conductivity of less than 0.07 W/mK.
Insulation	In the context of *fire* protection, the time in minutes for which a prototype specimen of a *fire separation,* when subjected to the *standard test* for *fire* resistance, has limited the transmission of heat through the specimen.
Integrity	In the context of *fire* protection, the time in minutes for which a prototype specimen of a *fire separation,* when subjected to the *standard test* for *fire* resistance, has prevented the passage of flame or hot gases. The precise meaning of *integrity* depends on the type of *building elements* being treated and how it is defined in the *standard test* being used.

Intended use	In relation to a *building*,— a) includes any or all of the following: i) any reasonably foreseeable occasional use that is not incompatible with the intended use; ii) normal maintenance; iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but b) does not include any other maintenance and repairs or rebuilding.
Intermediate floor	Any upper floor within a *firecell* which because of its configuration provides an opening allowing smoke or *fire* to spread from a lower to an upper level within the *firecell*.
Life rating	The *fire resistance rating* to be applied to elements of *construction* that allows movement of people from their location in a *building* to a *safe place*.
Limited combustible	A material that does not comply with the requirements for a *non-combustible* material and is classified as A2 in accordance with BS EN 13501-1.
Means of escape from fire	In relation to a *building* that has a floor area— a) means continuous unobstructed routes of travel from any part of the floor area of that *building* to a place of safety; and b) includes all active and passive protection features required to warn people of *fire* and to assist in protecting people from the effects of *fire* in the course of their escape from the *fire*.
Multi-unit dwelling	Applies to a *building* or use which contains more than one separate household or family.
Non-combustible	Material either— a) composed entirely of glass, concrete, steel, brick/block, ceramic tile, or aluminium; or b) classified as non-combustible when tested to AS 1530.1; or c) classified as A1 in accordance with BS EN 13501-1.
Notional boundary	The *boundary* which for *fire* safety purposes, is assumed to exist between two *buildings* on the same property under a single land title. The *notional boundary* is not permitted to be located any closer than 1.0 metre to any unprotected areas within the *external wall* of the *building* that is receiving the radiation where orientated at less than 90°.
Occupant load	The greatest number of people likely to occupy a particular space within a *building*. It is determined by: a) dividing the total floor area by the m^2 per person (occupant density) for the activity being undertaken, or b) for sleeping areas, counting the number of sleeping (or care) spaces, or c) for fixed seating areas, counting the number of seats.
Occupied space	Any space within a *building* in which a *person* will be present from time to time during the *intended use* of the *building*.
Open path	That part of an *escape route* (including *dead ends*) within a *firecell* where occupants may be exposed to *fire* or smoke while making their escape.

Amend 2 Nov 2020 (Limited combustible)

Amend 2 Nov 2020 (Non-combustible)

Open space	Land on which there are, and will be, no *buildings* and which has no roof over any part of it other than overhanging eaves.
Other property	Any land or *buildings* or part of any land or *buildings*, that are: a) not held under the same *allotment*; or b) not held under the same *ownership*; and c) includes a *road.*
Owner	In relation to land and any *buildings* on the land— a) means the *person* who— i) is entitled to the rack rent from the land; or would be so entitled if the land were let to a tenant at a rack rent; and b) includes— i) the *owner* of the fee simple of the land; and ii) for the purposes of Building Act sections 32, 44, 92, 96, 97, and 176(c), any person who has agreed in writing, whether conditionally or unconditionally, to purchase the land or any leasehold estate or interest in the land, or to take a lease of the land, and who is bound by the agreement because the agreement is still in force.
Penetration	A *building element* passing through an opening in a *fire separation*. A *penetration* may include, but is not limited to: pipes, cables, ducts, hoses, drains, cable trays, ropes, data outlets, power outlets, hatches, glazing, structural bracing etc.
People with disabilities	People whose ability to use *buildings* is affected by mental, physical, hearing or sight impairment.
Place of safety	Either— a) a *safe place*; or b) a place that is inside a *building* and meet the following requirements: i) the place is constructed with *fire separations* that have fire resistance sufficient to withstand burnout at the point of the fire source; and ii) the place is in a *building* that is protected by an automatic fire sprinkler system that complies with NZS 4541 or NZS 4515 as appropriate to the *building's* use; and iii) the place is designed to accommodate the intended number of persons; and iv) the place is provided with sufficient means of escape to enable the intended number of persons to escape to a *safe place* that is outside a *building*.
Primary element	A *building element* providing the basic loadbearing capacity to the structure, and which if affected by fire may initiate instability or premature structural collapse.
Property rating	The *fire resistance rating* to be applied to elements of *construction* that allows for protection of *other property*.
Protected shaft	A space, other than a *safe path*, enclosed by *fire separations* or *external walls* used to house *building* services, lifts, or conveyors which pass from one *firecell* to another.
Railway line	Has the meaning ascribed to it by section 4 of the Railways Act 2005.

Relevant boundary	The *boundary* of an *allotment* that is *other property* in relation to the *building* in question and from which is measured the separation between the *building* and that *other property*; and for the *external wall* of any *building*, the *relevant boundary* is the nearest of— a) a *boundary* of a freehold *allotment*, except that if the *other property* is a *road*, *railway line*, or public *open space*, the *relevant boundary* is the *boundary* on the far side of that other *property*; or b) a *boundary* of a cross-lease or a company lease or a licence, except that if the *other property* is *open space* to which the lessee or licencee of the *building* in question has an exclusive right of access and occupation or to which 2 or more occupiers of the *building* in question have rights of access and occupation, the *relevant boundary* is the *boundary* on the far side of that other *property*; or c) a *boundary* shown on a unit plan (but excluding a *boundary* between a principal unit and its accessory unit), except that if the *other property* is *open space* and is common property, the *relevant boundary* is the *boundary* on the far side of that *other property*. Refer also to *notional boundary* for *buildings* on the same property under a single land title.
Risk group	The classification of a *building* or *firecells* within a *building* according to the use to which it is intended to be put.
Road	Has the meaning ascribed to it by section 315 of the Local Government Act 1974 and includes a public place and also includes a motorway.
Safe path	That part of an *exitway* which is protected from the effects of *fire* by *fire separations*, *external walls*, or by distance when exposed to open air.
Safe place	A place, outside of and in the vicinity of a single *building* unit, from which people may safely disperse after escaping the effects of a *fire*. It may be a place such as a street, *open space*, public space or an *adjacent building* unit.
Safety glass	Means glass so treated or combined with other materials as to reduce the likelihood of injury to persons when it is cracked or broken.
Secondary element	A *building element* not providing load bearing capacity to the structure and if affected by *fire*, instability or collapse of the *building* structure will not occur.
Smokecell	A space within a *building* which is enclosed by an envelope of *smoke separations*, or *external walls*, roofs, and floors.
Smoke control door	A *doorset* that complies with Appendix C, C6.1.2 of this Acceptable Solution.
Smoke damper	A *fire damper* whose closing action is initiated by the detection of smoke.
Smoke lobby	That portion of an *escape route* within a *firecell* that precedes a *safe path* or an *escape route* through an adjoining *building* which is protected from the effects of smoke by *smoke separations*.

Amend 2
Nov 2020

Smoke separation	Any *building element* able to prevent the passage of smoke between two spaces. *Smoke separations* shall: Be a smoke barrier complying with BS EN 12101 Part 1, or comply with the following a) Consist of rigid *building elements* capable of resisting without collapse: i) a pressure of 0.1 kPa applied from either side, and ii) self-weight plus the intended vertically applied live loads, and b) Form an imperforate barrier to the spread of smoke, and c) Be of non-combustible construction, or achieve a FRR of 10/10/-, except that non-fire resisting glazing may be used if it is toughened or laminated safety glass.
Stability	In the context of *fire* protection is the support provided to a *building element* having a *FRR*, intended to avoid premature failure due to structural collapse as a result of applied load, dead and live loads or as a result of any additional loads caused by *fire*.
Stairway	A series of steps or stairs with or without landings, including all necessary *handrails* and giving access between two different levels.
Standard test	A test method which is recognised as being appropriate for the *fire* protection properties being assessed. Refer Appendix C for a list of *standard test* methods.
Structural adequacy	In the context of the *standard test* for *fire* resistance, is the time in minutes for which a prototype specimen has continued to carry its applied load within defined deflection limits. The *fire* design load should be as specified in B1/VM1.
Suite	A *firecell* providing residential accommodation for the exclusive use of one *person* or of several people known to one another. It comprises one or more rooms for sleeping and may include spaces used for associated domestic activities such as hygiene and cooking. A *suite* may include transient or educational accommodation.
Surface finish	The combination of a surface coating and substrate material on surfaces of *building elements* exposed to view. It can be an applied decorative coating or the uncoated *building element* itself. For interior surfaces the requirements are evaluated in terms of a *Group Number*.
Theatre	A place of assembly intended for the production and viewing of performing arts, and consisting of an auditorium and stage with provision for raising and suspending stage scenery above and clear of the working area.
Travel distance	The length of the *escape route* as a whole or the individual lengths of its parts, namely: a) *open paths*, and b) *safe paths*.

Amend 2
Nov 2020

Amend 2 Nov 2020

Unprotected area	In relation to an *external wall* of a *building*, means: a) Any part of the *external wall* which is not *fire* rated or has less than the required *FRR, and* b) Any part of the *external wall* which has *combustible* material more than 1.0 mm thick attached or applied to its external face, whether for cladding or any other purpose. *Unprotected areas* include non-*fire* rated windows, doors, or other openings, and non-*fire* rated *external wall construction*.
Wharenui	A communal meeting house having a large open floor area used for both assembly and sleeping in the traditional Māori manner.

Part 1: General

CONTENTS

1.1 Introduction and scope

This Acceptable Solution is one of three Acceptable Solutions that provide a means of establishing compliance with NZBC Clauses C1 to C6 Protection from Fire. It can be used for the *building* activities covered by *risk groups* specified in Paragraph 1.1.1 and described in Table 1.1.

For ***risk group* SH**, please refer to Acceptable Solution C/AS1.

For *backcountry huts*, please refer to Acceptable Solution BCH/AS1.

Where a specific *risk group (or risk groups)* is mentioned in a subheading and/or within the text of a paragraph, that requirement applies only to the specified *risk group(s),* and does not apply to other *risk groups.*

Words in *italic* are defined at the front of this document.

Appendices to this Acceptable Solution are part of, and have equal status to, the Acceptable Solution.

Figures and *risk group* icons are informative only; the wording of the paragraphs takes precedence.

Risk group icons

SH SM SI CA WB WS VP

Solid red circles

Applies to particular *risk group* requirements

SH SM SI CA WB WS VP

White circles with red bar

Requirement excludes the particular *risk group*

Table 1.1	Risk groups: scope and limitations	
	Risk group	**Applies to**
C/AS1	**SH*** Buildings with sleeping (residential) and outbuildings (Out of scope for this Acceptable Solution)	**Detached dwellings with a single *household unit* such as**: stand-alone houses **Low-rise *multi-unit dwellings* where each *household unit* has its own *escape route* that is independent of all other *household units* such as:** Attached townhouses. Stacked *household units* where there is no more than one *household unit* above another with each *household unit* having a single storey and an *escape height* less than 4.0 m. **Detached dwellings where fewer than six people (not including members of the residing family) pay for accommodation such as:** boarding houses, homestays, bed and breakfast. **Outbuildings**.
Acceptable Solution C/AS2	**SM** Sleeping (non-institutional)	**Permanent accommodation such as:** Apartment *buildings* and other *buildings* which consist of more than one *household unit* (other than low-rise *multi-unit dwellings* in the scope of ***risk group* SH**). **Transient accommodation such as:** Hotels, motels, serviced apartments, hostels, backpackers, cabins at holiday parks. *Buildings* where six or more people pay for accommodation (such as boarding houses/homestays/ bed and breakfast). *Wharenui* and other community sleeping spaces such as halls (even if used occasionally). Sheltered housing such as refuges, reintegration for prisoners, homeless shelters etc. **Educational accommodation such as:** University halls of residence, school boarding hostels etc.
	SI Care or detention	**Care activities such as:** Institutions, hospitals including outpatients and day procedures (excluding special care facilities such as operating theatres, intensive care units, prisons, delivery and recovery rooms and hyperbaric chambers or other such places that require stay in place strategies). Aged care facilities. Residential care in institutions, hospices. Medical day treatment: i.e. medical centres and dental practices using sedation or treatment rooms where people are unable to self-evacuate without assistance; e.g. for dialysis or chemotherapy. Care in the community houses and homes. **Detention facilities (excluding prisons) such as:** Police stations, court *buildings* and hospitals with detention facilities.
	CA Public access and educational facilities	**Crowd activities such as:** Halls, *theatres* and cinemas. Recreation and event centres (including tiered seating for up to 2000 people and with any primary egress for more than 100 people at the level of the playing surface). Educational institutions without sleeping including schools and *early childhood centres*. Churches and other places of worship. Restaurants and cafes, shops and shopping malls. Exhibition, retail areas including car showrooms and trade fair space. Public libraries with less than 2.4 m storage height. Spaces for viewing open air activities (does not include spaces below a grandstand), open grandstands, roofed but unenclosed grandstand, uncovered fixed seating). **Personal service activities such as:** Dentists, doctors (except as included within ***risk group* SI**), banks, beautician and hairdressing salons.
	WB Business, commercial and low level storage	**Professional activities such as:** Offices (including professional services such as law and accountancy practices). Laboratories, workshops (including mechanics workshops). May contain storage with a capable height of storage of less than 3.0 m. **Industrial activities such as:** Factories, processing and manufacturing plants (excluding *foamed plastics*) with a capable height of storage of less than 3.0 m. **Storage activities such as:** *Buildings* or parts of *buildings* capable of storage no more than 5.0 m in height. Warehouses and storage *buildings* (other than those listed above), capable of storage more than 5.0 m in height, but a height to the apex no greater than 8.0 m and total floor area of no more than 4200 m². Temperature controlled storage with a capable height of storage of less than 3.0 m, other than some limited areas in processing areas, or up to a maximum area of 500 m² with a maximum capable of storage height of 5.0 m. **Intermittently occupied buildings (other than outbuildings) such as:** Light aircraft hangers, *buildings* containing fixed plant and or fixed machinery and spray painting operations, whether or not in a spray booth.

Amend 2 Nov 2020

Amend 2 Nov 2020

Errata 1 Oct 2019

Table 1.1	Risk groups: scope and limitations	
	Risk group	**Applies to**
Acceptable Solution C/AS2	WS High level storage or potential for fast fire growth	**Storage activities such as:** Warehouses with a capable height of storage of over 5.0 m or over 8.0 m to the apex and total floor area greater than 4200 m². Temperature controlled storage outside of the scope of ***risk group*** **WB**. **Service activities such as:** Trading and bulk retail wholesalers with a storage height greater than 3.0 m. Supermarkets with shelving over 3.0 m in height. Exhibition, retail areas and trade fair space with a storage height greater than 3.0 m.
	VP Vehicle storage and parking	**Vehicle parking – within a building or a separate building including:** Car parking *buildings*. Vehicle parking or stacking within *buildings*. Goods vehicle parking. Service vehicle and unloading areas. Car storage warehouses.

Note:

* *Risk group* SH is outside the scope of this Acceptable Solution. Refer to C/AS1.

Scope

SH **1.1.1** The scope of this Acceptable Solution is restricted to all *risk groups* listed in Table 1.1 except for ***risk group*** **SH** (refer to C/AS1). It covers *buildings* or parts of *buildings* where people:

SM a) Sleep (SM), and

SI b) Are unable to self-evacuate without assistance through requiring special care or treatment, or they are restrained, or their liberties are restricted (SI), and

CA c) Congregate, participate in group activities or where professional services or retail are provided (CA), and

WB d) Work (WB), and

WS e) Store goods and other materials (WS), and

VP f) Park vehicles (VP).

These activities are described in Table 1.1.

Outside the scope of this Acceptable Solution

1.1.2 *Buildings* with complex features are outside the scope of this Acceptable Solution. Complex features include:

a) Atriums, and

b) *Intermediate floors,* other than limited area *intermediate floors,* and

SI c) Operating theatres, intensive care units, hyperbaric chambers, delivery rooms, and recovery rooms (SI), and

CA d) Recreation and event centres (with tiered seating for more than 2000 people) (CA), and

e) *Buildings* more than 20 storeys high, and

f) Prison *buildings*.

Buildings that have features for which solutions are not provided within this Acceptable Solution are also deemed to be complex.

1.1.3 If the Acceptable Solution cannot be followed in full, use Verification Method C/VM2 or an alternative solution to demonstrate compliance.

1.1.4 Other than where permitted for ***risk group*** **SI** and for *early childhood centres*, this Acceptable Solution allows for an 'all out' evacuation strategy. It does not provide features to facilitate a delayed evacuation strategy.

SI **1.1.5 *Risk group* SI** invariably requires a *fire* safety strategy involving delayed initiation of evacuation and movement to a *place of safety* within the *building*. However, this Acceptable Solution does not provide for *building* features that would be required for a stay-in-place strategy. This applies to activities such as:

a) Operating theatres, and

b) Intensive care units, and

c) Hyperbaric chambers, and

d) Delivery rooms, and

e) Recovery rooms.

The control of hazardous substances is not covered by this Acceptable Solution

1.1.6 This Acceptable Solution does not provide for any use, storage or processing of *hazardous substances*. Compliance with NZBC Clause F3, the Hazardous Substances and New Organisms Act 1996, and the Health and Safety at Work (Hazardous Substances) Regulations 2017 shall also be ensured where applicable in addition to the requirements of this Acceptable Solution.

Amend 2 Nov 2020

1.2 Using this Acceptable Solution

1.2.1 The process for using this Acceptable Solution shall be as follows.

Step 1: Determine which risk group applies

a) Determine the *risk group* for each of the activities carried out in the *building* (refer to Table 1.1 and Paragraph 1.1.1). If the activity is not listed explicitly, choose the nearest suitable *risk group*.

b) If there is more than one *risk group* for a *firecell*, determine its primary *risk group* (see Paragraph 1.2.2: this is the one with the most onerous *fire* safety requirements).

c) Apply this Acceptable Solution for any *firecell* by following steps 2 and 3.

d) Then apply the relevant parts of this Acceptable Solution for *firecells*.

Step 2: Determine the parameters for the various risk groups

a) Establish the relevant *building* measurements (these will include *building height,* floor area, wall openings and distances to *relevant boundaries*).

b) Work out the *occupant loads* for the relevant *occupied spaces* (refer to Paragraph 1.4).

Step 3: Satisfy the fire safety requirements

Satisfy the *fire* safety requirements of this Acceptable Solution (refer to Parts 2-7), based on the *occupant loads* and on the *building's* dimensions and features where required.

Primary risk groups

1.2.2 If a *building* contains a number of different activities which individually may be categorised in different *risk groups*, the *risk group* designated for a particular *firecell* within a *building* shall be that of the primary *risk group*. The primary *risk group* shall be that one within the *firecell* that has the most onerous *fire* safety requirements. Other *risk groups* may be able to be incorporated within the same space provided these are ancillary to, and support, the primary *risk groups*.

1.2.3 Depending on the particular *building* and the uses or activities within that *building*, there may be several primary *risk groups*, with one or more on each floor.

1.3 Alterations to buildings

1.3.1 This Acceptable Solution may be used to determine the compliance of *building work* (in relation to an existing *building*).

1.4 Calculating occupant loads

Occupant load

1.4.1 *The occupant load* shall be determined from the *risk group* and number of people in each space of the *building*. The *occupant load* may need to be evaluated not only for each *risk group* but also for:

a) A space or open floor area involving one or more activities, and

b) A floor containing more than one *risk group*, and

c) A single *firecell*, and

d) Each floor within a *firecell*.

1.4.2 *Occupant loads* shall be calculated from the occupant densities given in Table 1.2 based on the floor area of the part of the *building* housing the activity. The occupant densities in Table 1.2 already allow for a proportion of the floor area appropriate to the activity being occupied by furniture, partitions, *fixtures* and associated equipment. If a *building* space has alternative activity uses, the activity having the greatest occupant density shall be used. If an activity is not specifically described in Table 1.2, the nearest reasonable description shall be used.

1.4.3 Duplication shall be avoided by:

a) Ensuring that, where people may be involved in more than one activity, they are counted only once, and

b) Not including an *occupant load* for *exitways*, or for the *occupant load* determined for areas such as lift lobbies or sanitary facilities that are used intermittently by people already counted elsewhere in the *building*.

Fixed seating

1.4.4 *Occupant load* assessment shall take account of the actual arrangement and number of seats for fixed seating (see Paragraph 3.7.4). Where additional floor area abuts the fixed seating, additional occupants are permitted in that floor area based on standing space density, provided the *escape route* is not obstructed.

Bed spaces

1.4.5 The requirements of this Acceptable Solution account for the fact that other people may be present in the *building* or *firecell* and additional calculations are not required when an *occupant load* is derived by bed spaces (i.e. for ***risk groups* SM** and **SI**).

SI **1.4.6** For the purposes of ***risk group* SI** the term ‘bed’ means the number of people that are under care or detention. It can include people on:

a) Beds, or

b) Recliner or lounge chairs, or

c) Dentist chairs, or

d) Treatment tables, or

e) Any other furniture where an occupant may be for a period of treatment, in care or detention.

Justification for exceptions

1.4.7 If, in a particular situation, the *occupant load* derived from Table 1.2 is clearly more than that which will occur, the basis of any proposal for a lesser *occupant load* shall be substantiated to the *building consent authority*.

1.4.8 If the maximum *occupant load* is greater than that calculated from Table 1.2, the higher number shall be used as the basis for the *fire* safety design and will need to be justified to the *building consent authority*.

Table 1.2	**Occupant densities**
Activity	**Occupancy density (m^2/ person)**
Aircraft hangars	50
Airports – baggage areas	2
– waiting areas, check in	1.4
– terminal space	10
Area without seating or aisles	1
Art galleries, museums	4
Bar sitting areas	1
Bar standing areas	0.5
Bleachers, pews or bench-type seating	0.45 linear m per person
Boiler rooms, plant rooms	30
Bulk storage including racks and shelves	100
Bulk retail (trading stores, supermarkets etc)	5
Call centres	7
Care and detention	Bed spaces, see Paragraph 1.4.6
Classrooms	2
Commercial kitchens	10
Commercial laboratories, laundries	10
Computer server rooms	25
Consulting rooms (doctors, dentists, beauty therapy)	5
Dance floors	0.6
Day care centres	4
Dining, restaurant and cafeteria spaces	1.25
Early childhood centres	Based on Education (Early Childhood Services) Regulations 2008 plus the number of staff
Exhibition areas, trade fairs	1.4
Fitness centres/weights rooms	5
Gaming, casino areas	1
Heavy industry	30
Indoor games areas, bowling alleys	10
Interview rooms	5
Libraries: stack areas	10
Libraries: other areas	7
Lobbies and foyers	1
Mall areas used for assembly uses	1
Manufacturing and process areas	10
Meeting rooms	2.5
Office spaces	10

Table 1.2	Occupant densities
Activity	**Occupancy density (m^2/ person)**
Parking buildings, garages	50
Personal service facilities	5
Reading or writing rooms and lounges	2
Retail spaces and pedestrian circulation areas including malls and arcades	3.5
Retail spaces for furniture, floor coverings, large appliances, building supplies and Manchester	10
Reception areas	10
Showrooms	5
Sleeping non institutional	Bed spaces
Space with fixed seating	As number of seats
Space with loose seating	0.8
Space with loose seating and tables	1.1
Sports halls	3
Stadiums and grandstands	0.6
Staffrooms and lunchrooms	5
Stages for theatrical performances	0.8
Standing space	0.4
Swimming pools (water surface area)	5
Swimming pools: surrounds and seating	3
Teaching laboratories	5
Technology classrooms (e.g. woodwork, metalwork, food science and sewing)	10
Workrooms, workshops	5

Part 2: Firecells, fire safety systems and fire resistance ratings

CONTENTS

2.1 Provision of firecells

Firecell floor area limits

2.1.1 The floor area of *firecells* shall be limited in accordance with Table 2.1.

Table 2.1 Firecell floor area limits (m^2)

Risk group	Unsprinklered	Sprinklered
SM	500	Unlimited[1]
SI	n/a	500
CA	5000	Unlimited[1]
WB	5000[2]	Unlimited[1]
WS	n/a	Unlimited[1]
VP	5000[2]	Unlimited[1]

Notes:

1. Except where the *Acceptable Solution* requires *fire separations* or other area limitations
2. When 15 m or greater from a *relevant boundary*, the *firecell* floor area is unlimited, except where the *Acceptable Solution* requires *fire separations* or other area limitations

2.2 Fire safety systems

2.2.1 *Fire safety system* types, as defined in Table 2.2, shall be provided throughout *firecells* and be as specified in:

SM SI
- Table 2.2a for ***risk groups*** **SM** and **SI**, and

CA
- Table 2.2b for ***risk group*** **CA**, and

WB WS
- Table 2.2c for ***risk groups*** **WB** and **WS**, and

VP
- Table 2.2d for ***risk group*** **VP.**

A direct connection to Fire and Emergency New Zealand is not required if automatic heat or smoke detection systems are provided in addition to the systems required by this Acceptable Solution.

CA
Additional requirements for early childhood centres

2.2.2 In addition to Paragraph 2.2.1, the *fire safety systems* required for *firecells* in *early childhood centres* shall be as follows:

a) In single storey *early childhood centres,* dedicated sleeping areas shall be protected with supplementary smoke detectors. The alarm system and any smoke detection system shall comply with NZS 4512.

b) Where the *escape height* of the *early childhood centre* is greater than 2.0 m:

i) a Type 7 system shall be installed throughout the *building*, and

ii) at least two separate *places of safety* shall be provided, and

iii) each *place of safety* shall be separated with *fire separations* designed to the *property rating* and have direct access to a *safe path* or *final exit*.

Amend 2
Nov 2020

Buildings containing more than one firecell

2.2.3 Where there is more than one *firecell* the following design sequence shall be used to determine the *fire safety systems* for other *firecells* in the *building* (see Figure 2.1).

Step 1 Determine the *risk groups* associated with each *firecell* within the *building* (refer Table 1.1 and Paragraphs 1.2.1 and 1.2.2).

Step 2 Determine the *escape height* in metres of each *firecell.*

Step 3 Determine the *occupant load* for each *firecell* in accordance with Paragraph 1.4.

Step 4 Taking into consideration the notes within Tables 2.2a, 2.2b, 2.2c and 2.2d and Paragraph 2.2.2 determine the *fire safety systems* required to protect each *risk group*.

Step 5 For each *risk group,* insert the *fire safety system* ascertained in Step 4 into Table 2.3 column 1 and determine the *fire safety system* for the other *risk groups* in the *building* from Table 2.3 column 2.

VP
2.2.4 For ***risk group*** **VP** *firecells* that require a *fire* sprinkler system (refer to Table 2.2d), the *fire* sprinkler system does not need to be extended throughout the remainder of the *building* where the ***risk group*** **VP** *firecells* are *fire separated* from the adjacent *firecells*. The *fire separation* between adjacent *firecells* is required to be provided with the greater of the *property rating* of the adjacent *firecells* (refer to Table 2.4).

Step 6 Based on the *fire safety systems* ascertained in Step 5, determine the most onerous requirements from Tables 2.2a, 2.2b, 2.2c, 2.2d and 2.3.

Table 2.2	Fire safety systems specified in this Acceptable Solution	
System Type	System description	Relevant Standards for installation
1	Domestic smoke alarm	Acceptable Solution F7/AS1
2	Manual *fire* alarm system	NZS 4512
3	Automatic *fire* alarm system activated by heat detectors and manual call points	NZS 4512
4	Automatic *fire* alarm system activated by smoke detectors and manual call points	NZS 4512
5	Automatic fire alarm system with modified smoke detection and manual call points	NZS 4512 and Acceptable Solution F7/AS1
6	Automatic *fire* sprinkler system with manual call points	NZS 4541 and NZS 4512
7	Automatic *fire* sprinkler system with smoke detection and manual call points	NZS 4541 or NZS 4515 and NZS 4512
9	Smoke control in air handling system	AS/NZS 1668.1 and NZS 4512
15	Fire and Emergency New Zealand lift control	NZS 4332
18	*Building fire* hydrant system	NZS 4510

Table 2.2a	Minimum fire safety systems by type required for sleeping uses, risk groups SM and SI					
Risk group	Occupant type	Escape height (metres)				
		0	< 4	≥ 4 to < 10	≥ 10 to < 25	≥ 25
SM	Permanent	1, 2[1], 18[4]	1, 2[1], 18[4]	1, 2[1], 18[4]	5, 15, 18[4]	5, 7, 9, 15, 18
	Transient	5[2], 18[4]	5, 18[4]	5, 18[4]	5, 15, 18[4]	5, 7, 9, 15, 18
	Education	5, 7, 9, 18[4]	5, 7, 9, 18[4]	5, 7, 9, 18[4]	5, 7, 9, 15, 18[4]	5, 7, 9, 15, 18
SI	Care or Detention	7[3], 9, 18[4]	7[3], 9, 18[4]	7[3], 9, 18[4]	7[3], 9, 15, 18[4]	7[3], 9, 15, 18

Notes:

***Fire safety system* types are as defined in Table 2.2.**

1. This system is not required where the *escape route* serves no more than 10 beds or the exit doors from sleeping area *firecells* open directly into a *safe place* or external *safe path*. Direct connection to Fire and Emergency New Zealand is not required if a phone is available for 111 calls.
2. This system is not required where either the *escape routes* serve no more than 10 beds, or the exit doors from individual units open directly into a *safe place* or external *safe path*. Where a Type 5 system is not required, each unit shall be provided with Type 1 smoke alarms.
3. Water supplies for the sprinkler system may be a single supply which may be a public reticulated main, except if there are more than 100 people receiving hospital care or in detention, the water supply for the sprinkler system shall be a dual supply and shall comply with NZS 4541 or NZS 4515, with one of the supplies being independent of the public reticulated main.
4. Not required where the height from Fire and Emergency New Zealand vehicular access to any floor is less than 15 m and Fire and Emergency New Zealand hose run distance to any point on any floor is less than 75 m, as measured from Fire and Emergency New Zealand vehicular access.

Errata 1
Oct 2019

Table 2.2b	Minimum fire safety systems by type required for crowd uses, risk group CA[1]					
Risk group	Occupant load	Escape height (metres)				
		0	< 4	≥ 4 to < 10	≥ 10 to < 25	≥ 25
CA	< 100	$2^{2,3}$, 18^{6}	2^{3}, 18^{6}	$4^{4,5}$, 9, 18^{6}	$4^{4,5}$, 9, 15, 18^{6}	7, 9, 15, 18
	100 to 250	2^{3}, 18^{6}	2^{3}, 18^{6}	$4^{4,5}$, 9, 18^{6}	$4^{4,5}$, 9, 15, 18^{6}	7, 9, 15, 18
	251 to ≤ 1000	$4^{4,5}$, 18^{6}	$4^{4,5}$, 18^{6}	$4^{4,5}$, 9, 18^{6}	$4^{4,5}$, 9, 15, 18^{6}	7, 9, 15, 18
	> 1000	7, 9, 18^{6}	7, 9, 18^{6}	7, 9, 18^{6}	7, 9, 15, 18^{6}	7, 9, 15, 18

Notes:

Fire safety system types are as defined in Table 2.2.

1. Refer to Paragraph 2.2.2 for additional requirements that apply to *early childhood centres*.
2. This system is not required in single level *buildings* where the *escape route* serves no more than 50 people.
3. Provided the use is not as a cinema or *theatre*, a Fire and Emergency New Zealand connection is not required if a phone is available for 111 calls.
4. Where the environment is challenging for smoke detection, the Type 4 system may be substituted with a Type 3 system with supplementary smoke detection.
5. May be substituted with a Type 6 system where the *building's occupant load* does not exceed 500, each floor is a *firecell*, *intermediate floors* comply with Paragraph 4.13.4, and there are no sleeping area *firecells* within the *building*.
6. Not required where the height from Fire and Emergency New Zealand vehicular access to any floor is less than 15 m and Fire and Emergency New Zealand hose run distance to any point on any floor is less than 75 m, as measured from Fire and Emergency New Zealand vehicular access.

Errata 1
Oct 2019

Table 2.2c Minimum fire safety systems by type required for working uses, risk groups WB and WS

Risk group	Occupant load	Escape height (metres)				
		0	< 4	≥ 4 to < 10	≥ 10 to < 25	≥ 25
WB	< 100	2[1,2,3], 18[7]	2[2,3], 18[7]	4[4,5], 9, 18[7]	4[4,5], 9, 15, 18[7]	7, 9, 15, 18
	100 to 250	4[4,5,6], 18[7]	4[4,5,6], 18[7]	4[4,5], 9, 18[7]	4[4,5], 9, 15, 18[7]	7, 9, 15, 18
	251 to ≤ 1000	4[4,5,6], 18[7]	4[4,5,6], 18[7]	4[4,5], 9, 18[7]	4[4,5], 9, 15, 18[7]	7, 9, 15, 18
	> 1000	7, 9, 18[7]	7, 9, 18[7]	7, 9, 18[7]	7, 9, 15, 18[7]	7, 9, 15, 18
WS	≤ 1000	6, 18[7]	6, 18[7]	6, 18[7]	6, 15, 18[7]	6, 15, 18
	> 1000	7, 18[7]	7, 18[7]	7, 18[7]	7, 15, 18[7]	7, 15, 18

Notes:

Fire safety system **types are as defined in Table 2.2.**

1. This system is not required in single level *buildings* (excluding storage *buildings* with a storage height greater than 3.0 m) where the *escape route* serves no more than 50 people.
2. A Type 3 system is required where the storage height exceeds 3.0 m.
3. A Fire and Emergency New Zealand connection is not required if a phone is available for 111 calls.
4. Where the environment is challenging for smoke detection, the Type 4 system may be substituted with a Type 3 system with supplementary smoke detection.
5. May be substituted with a Type 6 system where the *building's occupant load* does not exceed 500, each floor is a *firecell*, *intermediate floors* comply with Paragraph 4.13.4, and there are no sleeping area *firecells* within the *building*.
6. A Type 3 system is permitted to be provided in *firecells* used for storage where the storage height is over 3.0 m.
7. Not required where the height from Fire and Emergency New Zealand vehicular access to any floor is less than 15 m and Fire and Emergency New Zealand hose run distance to any point on any floor is less than 75 m, as measured from Fire and Emergency New Zealand vehicular access.

Table 2.2d Minimum fire safety systems by type required for vehicle parking, risk group VP

Risk group	Escape height (metres)		Vehicle stacker
	< 10	≥ 10	
VP	2[1,2,3], 18[4]	3[3], 15, 18[4]	6, 18[4]

Notes:

Fire safety system **types are as defined in Table 2.2.**

1. This system is not required if there are fewer than 50 occupants and fewer than 10 vehicles.
2. If ***risk group*** **VP** is within a *building* that is protected with an automatic *fire* alarm system, the ***risk group*** **VP** *firecell* must have at the minimum a Type 3 system.
3. This need not be connected to Fire and Emergency New Zealand.
4. Not required where the height from Fire and Emergency New Zealand vehicular access to any floor is less than 15 m and Fire and Emergency New Zealand hose run distance to any point on any floor is less than 75 m, as measured from Fire and Emergency New Zealand vehicular access.

Table 2.3 **Required types of fire safety systems for other firecells within the building**
Read this table in conjunction with Paragraph 2.2.3

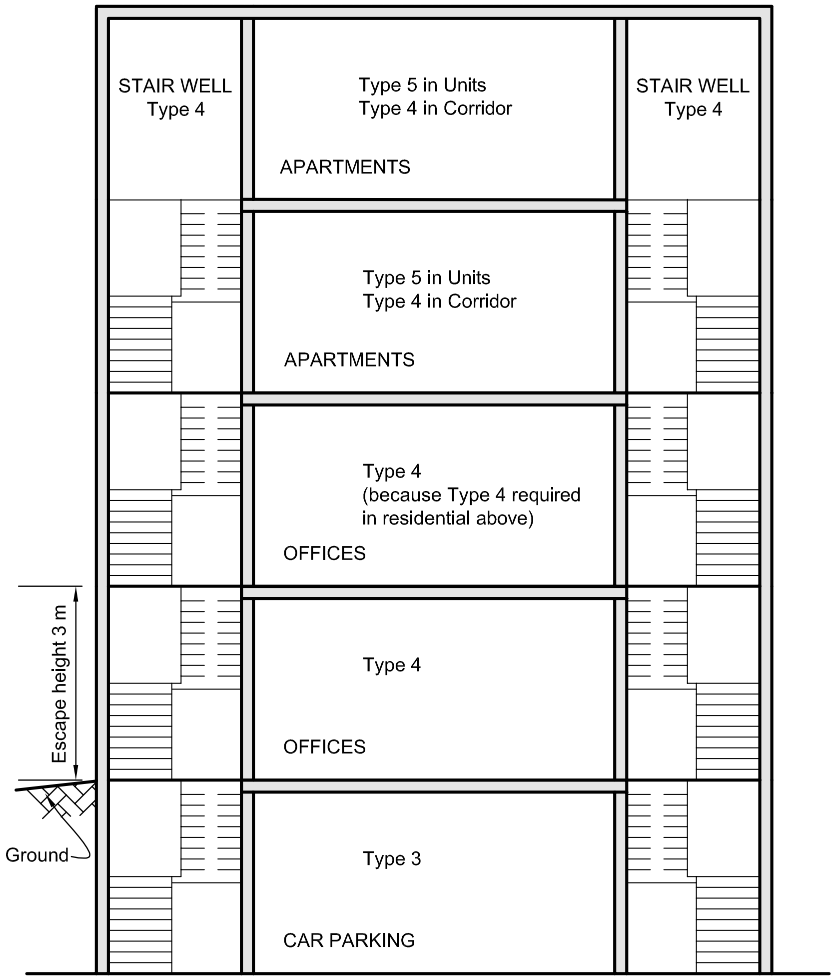
Column 1		Column 2			
Primary risk group and alarm type required by Tables 2.2a, 2.2b, 2.2c and 2.2d		Minimum type required within other firecells on the same or other floors within the building			
		SM	CA	WB	VP
SM [3]	1, 2	1, 2	4^1	4^1	3
	5	5	4^1	4^1	3
	7	7	7^1	7^1	6^2
SI	7	5, 7	7	7	6
CA	2	2^3	2	2	2
	3	3^3	3	3	3
	4	5	4^1	4^1	3
	6	5, 7	6	6	6^2
	7	5, 7	7^1	7^1	6^2
WB	2	2^3	2	2	2
	3	3^3	3	3	3
	4	5	4^1	4^1	3
	6	5, 7	6	6	6^2
	7	5, 7	7^1	7^1	6^2
WS	6	5, 7	6	6	6^2
	7	5, 7	7^1	7^1	6^2
VP	2	2^3	2	2	2
	3	3^3	3	3	3
	6	5, 7	6^1	6^1	6

Notes:

The systems derived from this table show the minimum type of systems required as dictated by other *risk groups* within the *building*. Please read this table in conjunction with Tables 2.2a, 2.2b, 2.2c and 2.2d when defining the systems required within the *building*.

1. Can be changed from a Type 4 to Type 3 system, or from a Type 7 to Type 6 system if the *firecell* is challenging for smoke detection where permitted in Tables 2.2b or 2.2c.
2. Can be changed to a Type 3 if the ***risk group* VP** *firecell* is *fire separated* from the remainder of the *building* by the *building's property rating* in accordance with Paragraph 2.3.
3. Refer to Table 2.2a for additional requirements system to be provided within ***risk group* SM**.

Figure 2.1 **Fire safety systems throughout a building**
Paragraph 2.2.3



More than one risk group on a floor

2.2.5 If there is more than one *risk group* on one floor level, the *fire* safety requirements will depend on whether the *risk groups* occupy the same *firecell*, or whether the floor is divided by *fire separations* into different *firecells*.

2.2.6 Where *fire separations* are not needed between different *risk groups* on the same floor level, the *fire safety systems* adopted for the *firecell* shall be those of the primary *risk group* (as defined in Paragraph 1.2.2).

Same risk group on different floors

2.2.7 Where *firecells* containing the same *risk group* occur at different levels in the same *building*, the *fire safety systems* for the *firecell* having the most onerous requirements shall be applied to all *firecells* of that *risk group*.

Activation of emergency warning systems

2.2.8 The alarm systems required in a *building* shall be configured to alert all *building* occupants in the event of *fire*. This does not apply to the activation of the local smoke detection component of a Type 5 system.

SI **2.2.9** In ***risk group* SI** alerting all *building* occupants in the event of *fire* is not required where it is deemed appropriate to alert management and staff without notifying other occupants.

2.3 Fire resistance ratings

FRR values

2.3.1 Unless explicitly stated otherwise in this Acceptable Solution, the *fire resistance ratings (FRRs)* that apply for each *risk group* shall be in accordance with Table 2.4.

2.3.2 Structural elements in a single storey *building* need not be *fire* rated if *FRRs* are not required for any other reason.

2.3.3 If there is more than one *risk group* on one floor in the *building*, the highest required *FRR* shall be applied to common spaces and shared *escape routes* for that floor level.

General requirements for FRRs

2.3.4 *FRRs* shall apply to the sides of *primary elements* and *secondary elements* which are exposed to *fire*.

2.3.5 When different *FRRs* apply on each side of a *fire separation*, being a wall, the higher rating shall apply to both sides.

2.3.6 Floors shall have an *FRR* for exposure from the underside.

2.3.7 The *FRR* of a *primary element* integral with a *fire separation* shall be no less than that of the *fire separation*.

2.3.8 Except as stated in Paragraph 2.3.9, areas of *external wall* not permitted to be *unprotected areas* shall be *fire* rated from the inside only.

2.3.9 Areas of *external wall* not permitted to be *unprotected areas* shall be rated for *fire* exposure from both sides equally where:

a) Walls are within 1 m of a *relevant boundary*, or

b) The *building height* is more than 10 m, or

SM SI c) The *final exit* is two or more floor levels below any ***risk group* SM** or **SI** occupancy.

2.3.10 *Building elements* shall have an *FRR* no less than that of any *building element* to which they provide support within the *firecell* or in any adjacent *firecell*.

2.3.11 Structural framing members connected to *building elements* with an *FRR* shall be rated at no less than the *building elements* to which they are connected. Alternatively their connections and supports shall be designed so that their collapse during *fire* will not cause collapse of the *fire* rated elements.

Applying insulation component in FRR

2.3.12 *Insulation* ratings shall apply to:

a) All *fire separations,* except as noted in Paragraph 2.3.13, and

b) Parts of *external walls* that are not permitted to be *unprotected areas,* and

c) Parts of *external walls* which are adjacent to an external *exitway* where it is a single *means of escape from fire* (refer to Paragraph 3.11.2 to determine when a *fire* rating is required).

2.3.13 *Insulation* ratings are not required to apply to:

a) Glazing that is exempt in accordance with Paragraph 4.2, *or* Amend 2 Nov 2020

b) Elements where sprinklers are installed throughout the *building*, in accordance with either NZS 4541 or NZS 4515 as appropriate, or

c) *Fire stops* in accordance with Paragraph 4.4.5, or

d) *Fire dampers* and *damper blades* in accordance with Paragraph 4.16.12, or

e) *Fire resisting glazing* in accordance with Paragraph 5.4.2. Amend 2 Nov 2020

Table 2.4 Life and property ratings in minutes

Risk group	Unsprinklered		Sprinklered	
	Life	Property	Life	Property
SM	60	60	30	30
SI	n/a	n/a	60	60
CA	60[1]	120	30[1]	60
WB	60[1]	120 (180[2])	30[1]	60 (90[2])
WS	n/a	n/a	60[1]	180
VP	60[1]	60	30[3]	30[3]

Notes:

1. When the *escape height* is greater than 10 m the *exitways* shall have *fire separations* with an *FRR* meeting the *property rating* (refer to Paragraph 4.9.2).
2. Where the *building* is less than 15 m to the *relevant boundary* and the storage height is greater than 3.0 m the *FRR* shall be 90 minutes where sprinklered and 180 minutes where unsprinklered.
3. The sprinkler system can be substituted for cross ventilation in accordance with Paragraph 4.1.3.

Part 3: Means of escape

CONTENTS

3.1 General principles

3.1.1 All *buildings* shall have *means of escape from fire* which include *escape routes*. An *escape route* (see Figure 3.1) shall provide protection to any occupant escaping to a *safe place* from a *fire* within a *building*.

3.1.2 The components of an *escape route*, in ascending order of protection, are the:

a) *Open paths,* and

b) *Exitways* (these may comprise of *smoke lobbies* and *safe paths*), and

c) *Final exits* (see Figure 3.1).

Two or more of these components will be necessary, depending on the total *travel distance*.

An *escape route* shall not pass from a higher to lower level of protection in the direction of escape.

3.1.3 Provided the allowable lengths of *open paths* are not exceeded, an *escape route* may comprise only an *open path* and *final exit*.

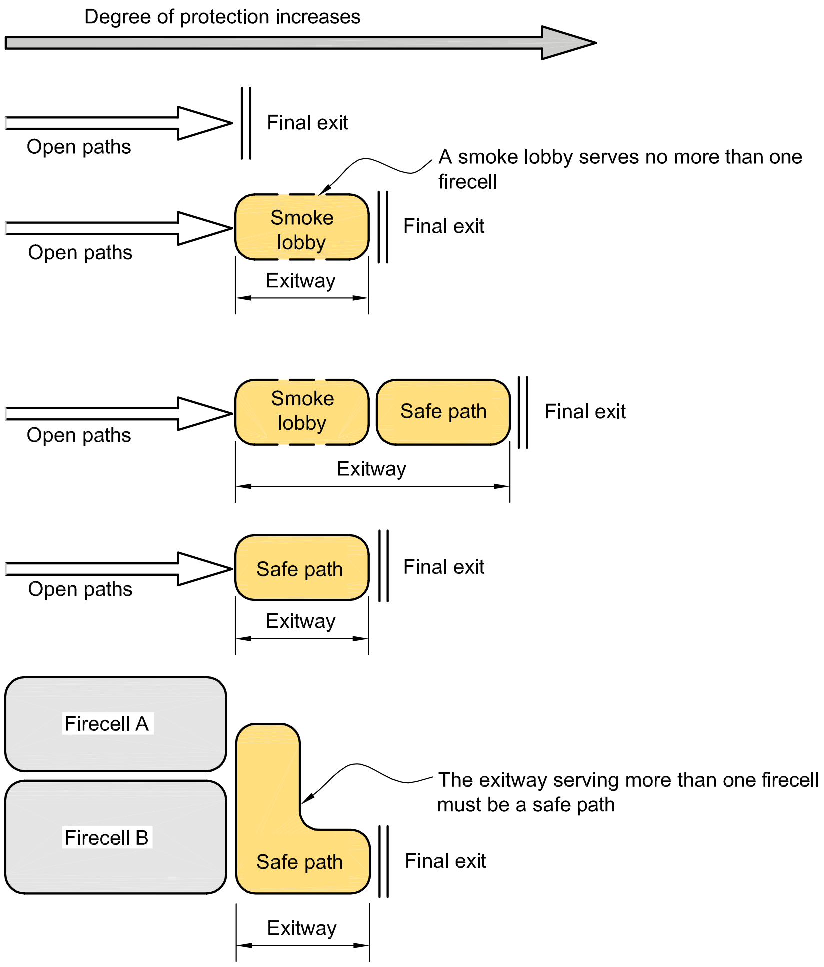
3.1.4 *Escape routes* shall comply with NZBC Clause D1. Ramps, stairs, ladders, landings, *handrails*, doors, vision panels and openings shall comply with Acceptable Solution D1/AS1. Amend 2 Nov 2020

3.2 Number of escape routes

3.2.1 Except where Paragraph 3.13 allows the use of single *escape routes*, every *occupied space* in a *building* shall be served by two or more *escape routes* (see Figure 3.2).

3.2.2 The minimum number of *escape routes* from a floor level, except in those situations where single *escape routes* are permitted (see Paragraph 3.13), shall be in accordance with Table 3.1.

Figure 3.1 **Escape routes**
Paragraphs 3.1.1 and 3.1.2



Note:
The *final exit* is where the *escape route* enters a *safe place*. This might be beyond the exit door from the *building*.

Table 3.1 Minimum number of escape routes from a floor level or firecell

Risk group	Number of occupants										
	≤50	51–100	101–150	151–200	201–250	251–300	301–500	501–1000	1001–2000	2001–4000	4001–7000
SM	1*	2	3	3	4	4					
SI	2	3	3	4	4						
CA	1*	2	2	2	2	2	2	3	4	5	6
WB	1*	2	2	2	2	2	2	3	4	5	6
WS	1*	2	2	2	2	2	2	3	4	5	
VP	1*	2	2	2	2	2	2	3	4	5	6

Note:

* Refer to Paragraphs 3.13.1 to 3.13.6 for limitations.

Table 3.1a Minimum clear width of escape routes, excluding ladders (mm)
Paragraphs 3.3.2 and 3.15.5

Risk group	Element	Open path[1]		Exitway	
		Horizontal	Vertical	Horizontal	Vertical
SM	Escape Route	850	1000	1000	1000
	Door	760	760	875	875
SI	Escape Route	850[2]	1000	1200	1500
	Door	760[2]	760	950	1200
CA WB WS VP	Escape Route	850	1000	1000	1000
	Door	760	760	875	875

Notes:

1. *Escape route* widths may be reduced for single *escape routes* as permitted by Paragraph 3.3.2c) ii).
2. Additional minimum clear widths are provided in Paragraph 3.15.5 a) and f) where the movement of beds is required.

d) **Provision for unusable escape routes:** except where *dead ends* and single *escape routes* are permitted, in unsprinklered *firecells* the total required width shall still be available should the widest of the *escape routes* be unusable due to the location of the *fire* or any other reason (see Figure 3.3).

e) **Sprinkler concession:** if the *firecell* is sprinklered, requirement d) does not apply (i.e. it is not necessary to provide extra width to allow for the possibility that one *escape route* may be unusable).

f) **Horizontal escape route with a single direction of escape:** this shall be wide enough at any point to take the full *occupant load* from all contributing *occupied spaces*. However, the *escape route* may have its width increased progressively as it passes the exit from each *occupied space* (see Figure 3.4).

g) **Horizontal escape route with two directions of escape:** this shall have sufficient width for the full length of the route to allow for the *occupant load* from all contributing *occupied spaces*. However, this shall not apply if the requirements of Paragraph 3.7.14 e) are met for escape through adjacent *firecells*.

h) **Intermediate floors:** for *firecells* containing an *intermediate floor*, both the vertical and horizontal parts of the *open path escape route* shall be wide enough to take the full *occupant load* from all contributing *occupied spaces*.

i) **Vertical safe path widths:** Vertical *safe paths* shall have minimum widths at any point determined only by the largest total *occupant load* passing that point in the direction of escape from:

i) any single level (where not part of an *intermediate floor firecell)*

ii) all levels in a *firecell* where it spans more than one level.

SM CA j) **Marae buildings using traditional Māori construction materials in risk groups SM and CA:** where applying the exception permitted in Paragraph 4.17.6 i), the *escape route* widths required by Paragraph 3.3.2 shall be doubled.

k) **Basements:** if an *escape route* from upper floors is joined at the level of a *final exit* by an *escape route* from a *basement* or lower floors, the *escape route* width at the point they combine shall be increased to accommodate the *occupant loads* from both directions (see Figure 3.5).

l) **Ladders:** the width requirements of Paragraph 3.3.2 c) do not apply to ladders where their use is permitted in this Acceptable Solution.

CA m) **Fixed or loose seating in risk group CA:** the width requirements of Paragraph 3.3.2 a) to e) do not apply to fixed or loose seating.

Handrails and limitations to stairway widths

3.3.3 For safe evacuation on stairs, all *stairways* shall have at least one *handrail*. Furthermore:

a) *Stairways* in *escape routes* wider than 1500 mm shall have *handrails* on both sides, and

b) *Stairways* in *escape routes* wider than 2000 mm (see Figure 3.6) shall also be provided with intermediate *handrails* which are equally spaced and which provide a width not greater than 1500 mm for each section of the *stairway*.

3.3.4 If the *escape height* exceeds 35 m, no more than 1500 mm shall be credited to the width of any *stairway* when calculating *stairway* capacity for an *escape route*.

Curved and spiral stairs

3.3.5 Where curved or spiral stairs form part of an *escape route*, the required width of such stairs is to be measured across the tread where the tread depth meets the requirements for the tread depth in Acceptable Solution D1/AS1.

Amend 2
Nov 2020

Obstructions

3.3.6

Amend 2
Nov 2020

The following minor obstructions are acceptable within the width of an *escape route*:

a) **Minor projections** complying with the requirements of Acceptable Solution D1/AS1 such as signs, switches, alarm sounders and similar projections, and

b) **Handrails** complying with Acceptable Solution D1/AS1 and projecting no more than 100 mm into the width, and *handrails* subdividing wide *stairways* that reduce the width by no more than 100 mm (see Paragraph 3.3.3), and

c) **Door assemblies** which reduce the width of an *exitway* by no more than 125 mm when the door is fully open (see Figure 3.23), or as permitted by Table 3.1a, and

CA d) In ***risk group* CA** fixed seating (at the start of an *escape route*) which complies with the requirements of Paragraph 3.7.4 and Table 3.3 for the width of aisles and space between rows.

3.3.7 Except as permitted by Paragraph 3.15.7, *escape routes* shall not be obstructed by access control systems.

Amend 2
Nov 2020

d) **Multiple escape routes:** if two or more *escape routes* are required, *open path* lengths from any point on a floor to no fewer than two exits from the *firecell* shall not exceed the lengths specified in Table 3.2.

e) **Marae buildings using traditional Māori construction materials:** when applying the exception permitted in Paragraph 4.17.6 (i), the permitted length of the *open path* specified in Table 3.2 shall be halved.

f) **Termination:** an *open path* ends either at:

i) the start of an *exitway*, or

ii) *a final exit*, or

iii) the point where the *escape route* passes into an adjacent *firecell* on the same level (see Paragraph 3.7.13).

Intermediate floors

3.4.3 On *intermediate floors* (see Figure 3.8), the *open path* length shall be taken as 1.5 times the measured length in accordance with Paragraph 3.4.2 c). However, the measured length may be used where the *intermediate floor* is a *smokecell* and an *escape route* is available from the *intermediate floor* without passing through any lower space in the same *firecell*.

Stairs and ladders

3.4.4 Stairs and ladders occurring in an *open path* (see Figure 3.9) shall have their *open path* length taken as:

a) **For straight and curved stairs:** the plan length measured on the stair centreline multiplied by 1.2, plus the plan length of each landing,

b) **For spiral stairs:** twice the vertical height, and

c) **For ladders:** three times the vertical height.

Sloping floors and ceilings

3.4.5 The *open path* length permitted by Table 3.2 shall be reduced by 50% in any space where the following conditions apply:

a) Both the floor and the ceiling slope in the same direction at an angle of more than 4° from the horizontal, and any *escape route* from the space is up the slope, and

b) The clear ceiling height at any point is less than 4.0 m, and

c) The *occupant load* in the space is more than 50, and

d) The space is unsprinklered.

Escape through adjoining building

3.4.6 An *escape route* may be via an adjoining *building* (see Figure 3.10), provided the following conditions are satisfied:

a) The *escape route* through the adjoining *building* meets all *escape route* requirements for the *occupant load* from the *fire* affected *building* requiring to use that route, and

b) Unless the *escape route* passes directly to a *safe path* in the adjoining *building*, access shall be through a *smoke lobby* before passing through the *external walls*, and

c) The opening through the *external wall* having the higher *FRR has a fire door* with an *FRR* of no less than that wall, and

d) *Escape routes* in the adjoining *building* comply with the *Building Code* and have sufficient capacity to carry the *occupant load* from the *building* or *buildings* being evacuated, and

e) The *escape route* does not re-enter the first *building* at any point, and is freely available at all times.

Table 3.2	**Travel distances on open paths (metres)** Paragraph 3.4									
Risk group	No system and Type 2 system		Type 3 system		Type 4 and Type 5* systems		Type 6 system		Type 7 system	
	Dead end open path	Total open path	Dead end open path	Total open path	Dead end open path	Total open path	Dead end open path	Total open path	Dead end open path	Total open path
SM	20	50			30	75	30	75	40	100
SI									20	50
CA	20	50	20	50	40	100	40	100	50	120
WB	25	60	35	75	50	120	50	120	75	150
WS							50	120	75	180
VP	35	90	45	110			70	180		

Notes:

If *open path* length increases for a Type 4 system are being applied, where Acceptable Solution F7/AS1 allows heat detectors to be substituted for smoke detectors, not less than 70% of the *firecell* shall be protected with smoke detectors.

If smoke and heat detection systems are installed in order to extend permissible travel distance in accordance with this table and are not a requirement of Paragraph 2.2.1 then Fire and Emergency New Zealand connection is not required.

* Type 5 system only for ***risk group*** **SM**.

3.5 Escape from basements

3.5.1 Except in cases where there are two or more *escape routes* serving only the *basement firecells* and each terminates in a *safe place*, *safe paths* serving *basement firecells* shall be preceded by a *smoke lobby* that shall have a plan area in accordance with Paragraph 3.9.2 (see Figure 3.11).

3.6 Open paths

Number and size

3.6.1 *Open paths* shall satisfy the specific requirements of Paragraphs 3.6.2, 3.6.3 and 3.7 where they apply to a particular *building*.

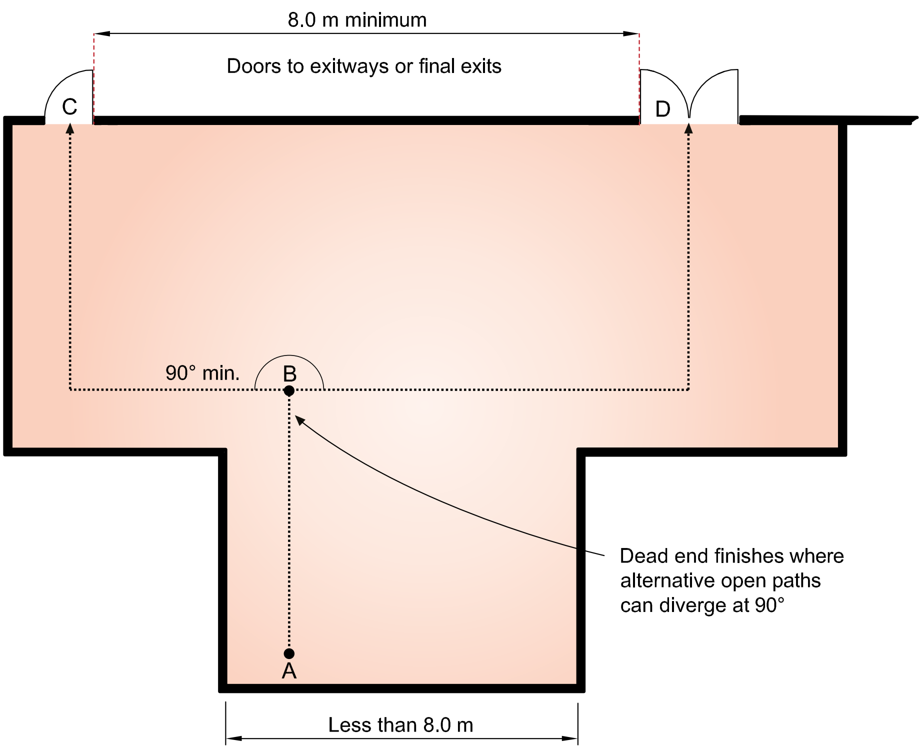
Open path separation

3.6.2 If two or more *open paths* are required, they shall be separated from each other, and remain separated until reaching an *exitway* or *final exit* (see Figure 3.12). Separation shall be achieved by diverging (from the point where two *escape routes* are required), at an angle of no less than 90° until separated by:

a) A distance of at least 8.0 m, or

b) *Smoke separations* and *smoke control doors*.

Figure 3.12 **Alternative open path separation**
Paragraph 3.6.2



Alternative open paths must continue at minimum of 90° divergence until separated by at least 8.0 m.
Path ABC = less than total open path
Path ABD = less than total open path

Exception for education buildings

Amend 2 Nov 2020 CA **3.6.3** If a *building* houses classrooms, laboratories and/or spaces used for home economics, art and crafts, workshops or similar teaching activities, one *open path* may be via a connecting corridor and the alternative *open path* may be via connecting doors between adjacent teaching spaces. In such cases, the separation requirements of Paragraph 3.6.2 need not apply provided that:

a) The number of occupants in each teaching space does not exceed 100, and

b) The *escape route* does not pass through a space which may be locked.

3.7 Special cases of open paths

Passing into an adjacent firecell

Amend 2 Nov 2020 **3.7.1** If an *escape route* passes through a number of *fire separations* it is permitted to continue as an *open path* provided the cumulative *travel distance* does not exceed the permitted distance specified in Table 3.2.

Amend 2 Nov 2020 **3.7.2** An *open path* may pass into an adjacent *firecell* on the same level (see Figure 3.15) and recommence as a new *open path* provided that:

a) All *firecells* on the *escape route* have no fewer than two directions of escape, separated as required by Paragraph 3.6.2, and

b) Adjacent *firecells* into which evacuation may take place have an available floor area to accommodate not only their own occupants, but also the occupants from the adjacent *firecell*. This shall be calculated on the basis of the *occupant load* of the two *firecells* with not less than 1.0 m^2 of space provided for each occupant. Refer to Paragraph 4.6.2 for additional requirements for ***risk group* SI**, and

c) Each *firecell* has at least one other *escape route* independent of the route into the adjacent *firecell*. This other route may be by way of a *final exit* or via a third *firecell* provided that the exit from that third *firecell* is independent of exits from the other two *firecells*, and

d) The *escape route* does not pass through more than three *fire separations* before entering an *exitway* or *final exit*, and

e) The *escape route* width meets the requirements of Paragraph 3.3.2 for the *firecell* on the *escape route* that has the greatest *occupant load*.

Separate tenancy

3.7.3 *Open paths* shall only pass through spaces containing different tenancies if doors leading to an *exitway* or *final exit* can be readily opened by all persons for whom the *open path* is their *escape route* Amend 2 Nov 2020

Amend 2 Nov 2020

Table 3.3	**Walkways in fixed seating** Paragraph 3.7.6	
Minimum walkway width (mm)	Maximum number of seats in any row	
	One aisle	Aisles both sides
300	7	14
340	9	16
380	9	18
420	10	20
460	11	22
500	12	24

Escape via an intermediate floor

Amend 2 Nov 2020

SI

3.7.4 For all ***risk groups* excluding SI**, an *open path* may pass from a *firecell* on to an *intermediate floor* and recommence as an *open path* provided that:

a) Where two or more *escape routes* are required from that *firecell*, only one *escape route* shall be via the *intermediate floor,* and

b) The *intermediate floor open path* length shall not exceed the requirements of Paragraph 3.4.3, and

c) The *intermediate floor* is served by at least two *escape routes*, separated as required by Paragraph 3.6.2, and terminating at any of the following:

i) separate *firecells*,
ii) separate *exitways*, or
iii) *final exits.*

Open paths via unenclosed stairs

Amend 2 Nov 2020

SM

3.7.5 In ***risk group* SM**, unenclosed stairs (stairs which are not *smoke separated* or *fire separated* from other spaces) in *escape routes*, other than those within a *household unit* or *suite*, shall not exceed a height of 4.0 m within the *firecell*. Where the height exceeds 4.0 m, the *escape route* from that level shall be a *safe path* until it reaches a *final exit*.

Fixed seating

Amend 2 Nov 2020

3.7.6 Fixed seating (except for within *household units* or *suites*) which includes seating that is moveable or foldaway, shall be arranged so that:

a) Direct access to the aisles is available, and

b) The number of seats in a row is no greater than that specified in Table 3.3, and

c) The clear walkway width between rows is no less than that specified in Table 3.3, and

d) The area occupied by each seat plus the walkway in front of it has a total dimension of at least 760 mm from seat back to seat back measured horizontally at right angles to the rows of seats (see Figure 3.13). The seat width must be at least:

i) 500 mm where arms are provided (see Figure 3.13), and

ii) 450 mm where arms are not provided.

Loose seating

Amend 2 Nov 2020

3.7.7 Except for within *household units* or *suites*, loose seating is permitted only on level floors. The layout shall follow the requirements of Paragraphs 3.7.9 to 3.7.14.

Amend 2 Nov 2020

3.7.8 Where the number of seats exceed 250, loose seating shall be interconnected to prevent overturning.

Aisles

Amend 2 Nov 2020

3.7.9 Except within *household units* or *suites*, aisles serving fixed or loose seating (see Figure 3.14) shall provide access to *final exits* or *escape routes*. The width of the *final exits* or *escape routes* shall be the greater of the:

Amend 2 Nov 2020

a) Aisle width as required by Paragraph 3.7.10, or

b) Width required by Paragraph 3.3.2.

3.7.10 Aisle widths shall be no less than:

a) 750 mm when serving up to 60 seats,

b) 900 mm when serving over 60 seats on one side only, or

c) 1100 mm in all other cases.

The minimum width shall occur at:

d) If discharge is in one direction only, the point furthest from the exit door in aisles, or

e) If discharge is in two directions, the mid-length of an aisle to separate cross-aisles or to separate exit doors.

There is nothing to prevent an aisle being made wider than the minimum required. However, to avoid restrictions, this shall be done only in the direction of travel.

Amend 2 Nov 2020

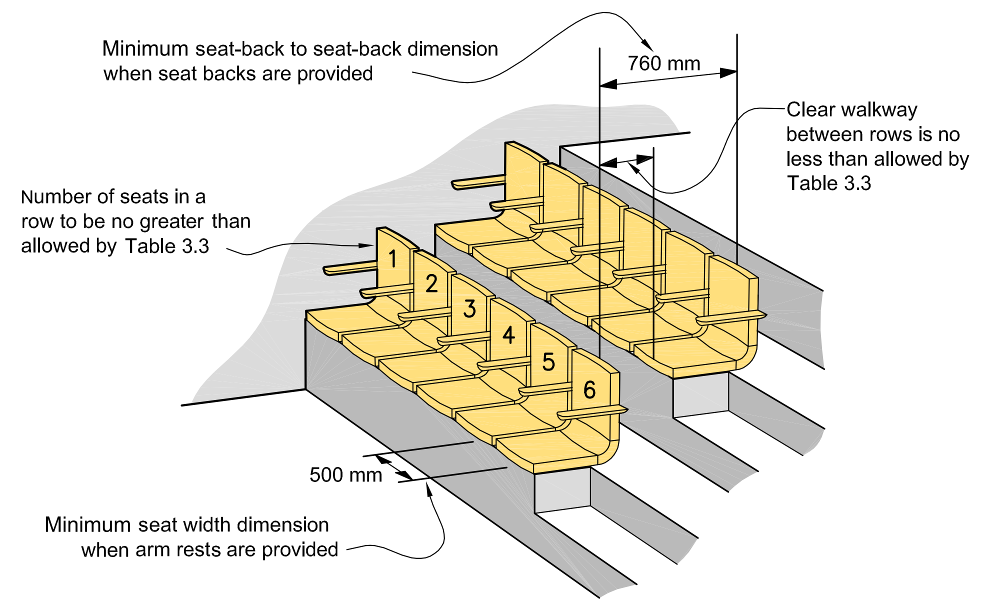
3.7.11 Each cross-aisle shall have a width of no less than that of the widest aisle it serves plus 50% of the sum of the widths of all other aisles served.

Amend 2 Nov 2020

3.7.12 The *travel distance* from any seat to an adjacent *firecell,* a *final exit,* or *exitway* shall be no greater than allowed for an *open path* in Table 3.2. If there are sloping ceilings and floors, refer to Paragraph 3.4.5 for further restrictions.

Amend 2
Nov 2020

Figure 3.13 **Fixed seating – with backs**
Paragraph 3.7.6 d)



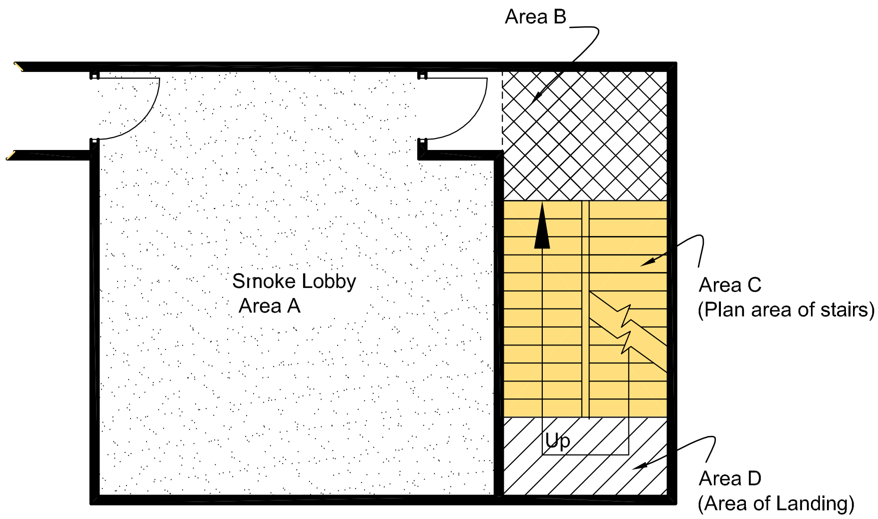
Amend 2
Nov 2020

3.7.13 Any side of an aisle that does not provide access to seating shall have barriers complying with Acceptable Solution F4/AS1 and *handrails* complying with Acceptable Solution D1/AS1.

Amend 2
Nov 2020

3.7.14 Steps in aisles shall have consistent riser heights and tread depths, both complying with the requirements of Acceptable Solution D1/AS1. Landing lengths in aisles shall be equal in each block of seating between cross-aisles, but may be less than the minimum length required by Acceptable Solution D1/AS1.

Figure 3.16 **Sizing of smoke lobbies**
Paragraph 3.9.2



Size of smoke lobby (Area A) required =
Number of persons to be accommodated x 0.25 minus (Area B + Area C + Area D)
The size shall be at least that required by D1/AS1

3.8 Dead ends

Amend 2 Nov 2020

3.8.1 A *dead end* terminates where the *escape route* reaches a point in the *open path* which offers alternative directions of travel, or at a *final exit* or an *exitway*.

No more than 50 occupants

Amend 2 Nov 2020

3.8.2 A *dead end* shall not serve an *occupant load* greater than 50.

Ladders

Amend 2 Nov 2020

SM SI

3.8.3 For all ***risk groups*** **excluding SM** and **SI**, the *escape route* from a *dead end* may be a ladder complying with Acceptable Solution D1/AS1 if it serves only support activities or provides the same function in support of other *risk groups*, and only if the *occupant load* does not normally exceed four.

Ladders are not permitted as *escape routes* in any other circumstances (see also Paragraph 3.4.4).

3.9 Exitways

3.9.1 *Exitways* consist of either: *smoke lobbies*, or *safe paths*, or both. Amend 2 Nov 2020

Smoke lobbies – floor area

3.9.2 If a *smoke lobby* is required preceding a vertical safe path (see Paragraphs 3.5.1, 3.9.3 and 3.13.1 and Figures 3.11 and 3.16), its floor area shall be calculated for the *occupant load* using that *smoke lobby* and its size shall be at least that required by the doors and opening requirements of D1/AS1, on the basis that:

a) Part of the *occupant load* will be accommodated in the vertical *safe path* between the level being considered and the next level in the direction of escape, with the remaining occupants accommodated in the *smoke lobby*, and

b) The occupant density for calculating the required holding area shall be 0.25 m^2 per person. The usable floor area within the stairwell shall be taken as the area of the first landing, plus the plan area of the flights of stairs between the two floor levels, plus the areas of any intermediate landings. Additional space shall be provided for door swings.

Smoke lobbies – exitways from upper and intermediate floors

SM CA **3.9.3** For ***risk groups*** **SM** and **CA**, entrances to vertical safe paths shall be preceded by *smoke lobbies* (refer to Paragraph 3.9.2 for the required area of the *smoke lobby*) except where:

a) The *safe path* from an upper floor or *intermediate floor* serves only that floor, or

b) The *firecell* is sprinklered, or

c) The *occupant load* of the *firecell* is less than 150, or

d) The vertical *safe path* is preceded by a horizontal *safe path*.

Safe paths

3.9.4 *Escape routes* from *firecells* shall enter directly into a *safe path* or *final exit*, except where Paragraphs 3.7.13 and 3.7.14 permit *open paths* to continue from one *firecell* to another.

3.9.5 *Safe paths* shall be separated from each other, and from all spaces by:

a) *Fire separations*, or

b) If they are external to the *building*, by distance or appropriate *construction* (see Paragraph 3.11).

SI SM **3.9.6** Except where the conditions for escape via an external *escape route* (see Paragraph 3.11) or successive *open paths*

Amend 2 Nov 2020 (see Paragraphs 3.7.1 and 3.7.2) apply, exit doors from **sleeping area *firecells*** shall open directly onto:

a) A horizontal *safe path*, or

b) A *final exit*.

Safe path length restrictions

3.9.7 There is no limit on the length of a vertical *safe path*. Horizontal *safe paths* shall be no longer than specified in Table 3.4.

Safe path termination

3.9.8 Horizontal *safe paths* shall terminate at any of the following:

a) The entrance to an internal *stairway* which is a separate *safe path*, or

b) An external balcony leading to either an open or enclosed *stairway*, or

c) An opening in an *external wall* which enters on to a bridge leading to an open or enclosed *stairway*, or

d) A *final exit*.

Safe path separation, glazing and smoke separation

3.9.9 *Fire doors* with smoke control capability shall be provided where *open paths* and horizontal *safe paths* provide access to internal vertical *safe paths*.

3.9.10 Glazing in *safe paths* shall comply with the requirements of Paragraph 4.2.

SI **3.9.11** For ***risk group*** **SI** only, at least half the *safe paths* shall terminate in a *safe place* without being combined with an *escape route* from any other *risk group*.

3.10 Control of exitway activities

3.10.1 *Exitways* shall not be used for:

a) Any storage of goods, solid waste or solid waste containers, or

b) Entry points to solid waste chutes, or

c) The location of furniture or other *combustibles*, or

d) Storage of cloaks or linen, or

e) A cleaner's cupboard not *fire separated* from the *exitway*, or

f) The location of an electrical switchboard or similar, or

g) Any activity (other than as permitted by Paragraph 3.10.2).

3.10.2 Some activities are permitted in an *exitway* if:

a) An alternative *escape route* is available from all *firecells* served by the *safe path* in which the activities occur, and

b) For *buildings:*

i) with an *occupant load* of not more than 500, where a Type 4 or 5 system is installed, or

ii) with an *occupant load* of more than 500 where a Type 7 system is installed, and

Amend 2 Nov 2020

c) The *escape route* is not impeded by the activity or the occupants involved in that activity, and

d) Those activities:

i) are visible to users of the *exitway*, except in the case of sanitary fixtures, and

ii) are a *direct support function* of the *risk group* served by the *exitway*, and

iii) occupy a total floor area of not more than 6.0 m^2 except in the case of sanitary fixtures.

Lifts

3.10.3 A passenger lift, but not a goods lift, may be located in a vertical *safe path* containing a *stairway* provided the following conditions are satisfied:

a) The lift shaft and all its openings are located entirely within a single *firecell* containing the vertical *safe path*, and

b) Passenger access into and from the lift car takes place entirely within the *safe path*, and

c) No other activity occurs within the vertical *safe path*, and

d) The lift is provided with a machine room that is a separate *firecell*, and the openings for lift ropes through the *fire separation* are as small as practicable, and any *penetrations*, such as for electrical cables, are *fire stopped* (refer to Paragraph 4.4 for *fire stopping*).

3.10.4 Lift landings shall not open into or be located between *open paths* (see Figures 3.17 and 3.18) and shall either be provided with a *smoke lobby* separated from all other areas or have lift landing doors with smoke control capability. This requirement does not apply if the *building* is protected with a Type 7 system or the lift shaft has a pressurisation system designed to AS/NZS 1668.1. The lift doors shall be as specified in Paragraphs 4.16.3 and 4.16.11.

3.10.5 In situations not described in Paragraphs 3.10.3 or 3.10.4, lift landings in unsprinklered *buildings* shall either open into a *smoke lobby* or the lift shaft shall be provided with a pressurisation system designed to AS/NZS 1668.1. Any *smoke lobby* shall not be part of the horizontal *safe path* (i.e. the horizontal *safe path* shall not pass through the *smoke lobby*). See Figure 3.18. The lift doors shall be as specified in Paragraphs 4.16.3 and 4.16.11.

Table 3.4	Travel distances on horizontal safe paths (metres)									
Risk group	No system and Type 2 system		Type 3 system		Type 4 and Type 5 systems		Type 6 system		Type 7 system	
	Single direction	More than one direction	Single direction	More than one direction	Single direction	More than one direction	Single direction	More than one direction	Single direction	More than one direction
SM	25	180			40	Unlimited	40	Unlimited	50	Unlimited
SI									20	150
CA	20	150			40	Unlimited	40	Unlimited	60	Unlimited
WB	25	180			50	Unlimited	50	Unlimited	80	Unlimited
WS							50	Unlimited	75	Unlimited
VP	25	180	45	110			50	Unlimited		

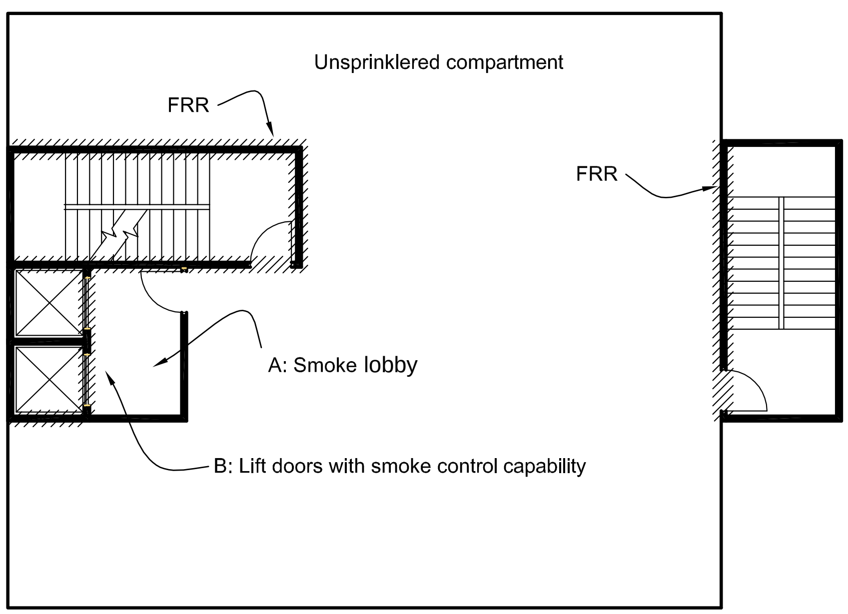
Notes:

If *open path* length increases for a Type 4 or Type 7 system are being applied, where Acceptable Solution F7/AS1 allows heat detectors to be substituted for smoke detectors, not less than 70% of the *firecell* shall be protected with smoke detectors.

It is not permitted to substitute the smoke detection in *exitways*.

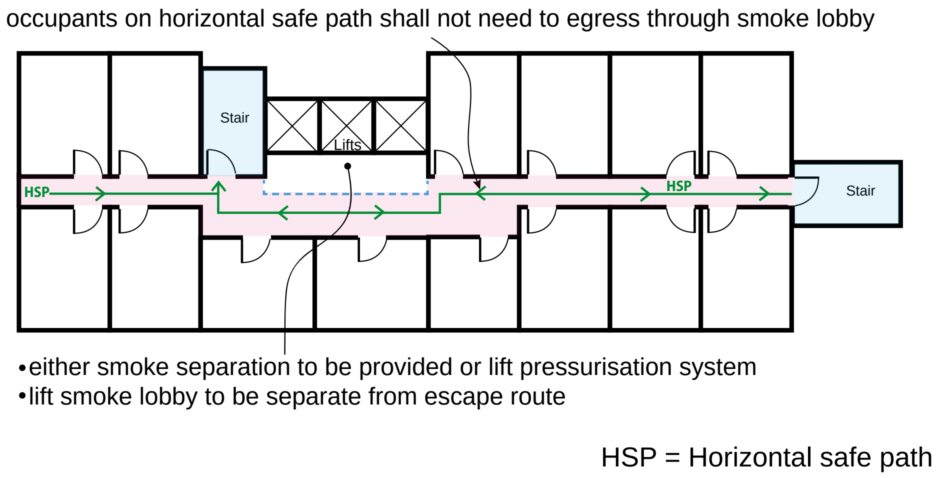
If smoke and heat detection systems are installed in order to extend permissible *travel distance* in accordance with this table and are not a requirement of Paragraph 2.2.1 then Fire and Emergency New Zealand connection is not required.

Figure 3.17 Lifts and smoke lobby on open path
Paragraph 3.10.4



NOTE: Either A or B required

Figure 3.18 **Lifts and smoke separations when landing on an unsprinklered horizontal safe path**
Paragraph 3.10.5



3.11 External escape routes

3.11.1 If an *escape route* enters a space exposed to the open air (e.g. an open *stairway*, a balcony, across a roof or a ground level path), it shall meet the requirements of a *safe path* between that point and the *final exit*. *Safe path* separation requirements shall be achieved by providing either distance or *fire* rated *construction* between the *escape route* and *adjacent firecells*, as specified in Paragraphs 3.11.2 to 3.11.5.

Amend 2 Nov 2020

Separation by distance

3.11.2 Separation by distance shall be achieved as follows:

a) If there is only one direction of escape, roofs and *external walls* shall not have *unprotected areas* closer to an external *escape route* than:

i) 2.0 m if unsprinklered (see Figure 3.19), or

ii) 1.0 m if all *firecells* passed by the external *escape route* are sprinklered, or

b) The *escape route* shall be located so that it diverges from *external walls* (see Paragraph 3.11.3), or

Amend 2 Nov 2020

c) Where alternative directions of escape are provided from the point where the *escape route* passes through an *external wall* and becomes an external *escape route* (refer to Paragraph 3.11.3 b)), *unprotected areas* are permitted.

Amend 2 Nov 2020

Amend 2 Nov 2020

Amend 2 Nov 2020

3.11.3 For an *escape route* which passes through an opening in an *external wall*, parts of the *external wall* need not be *fire* rated if:

a) The direction of escape to a single *final exit* diverges from the *external wall* at an angle of no less than 45° in plan, or

b) The directions of escape to alternative *final exits* diverge from each other at an angle of no less than 90° in plan and the *escape routes* subsequently do not both pass the same *firecell* (other than the *firecell* from which they originated), or

c) Where *household units* and *suites* have full height glazing adjacent to a balcony which may be the only means of access and egress. The balcony shall provide the occupants with more than one *escape route* from the exit door, enabling them to escape without passing a unit containing a *fire*, or

d) For shopfronts, if the *final exit* is onto the footpath it is not required to be *fire* rated.

Separation by fire rated construction

3.11.4 Except where the separation distance requirements of Paragraphs 3.11.2 and 3.11.3 are achieved: Amend 2 Nov 2020

a) *External walls* and roofs adjacent to external *escape routes* shall comply with the *FRR* requirements of Paragraphs 5.3 and 5.7.3 to 5.7.5 and have no *unprotected areas*, except that glazing for *safe paths* complying with Paragraph 4.2 shall be permitted, and

b) If the *escape route* is a balcony with a single direction of escape, and the vertical distance between the underside of the balcony and the closest *unprotected area* in the *external wall* below is less than 5.0 m (see Figure 3.20), balcony barriers shall:

i) have no openings, and

SI ii) for ***risk group* SI** be protected with a material having a *Group Number* of 1, and

SI iii) for all other ***risk groups* (SM, CA, WB, WS** and **VP)** achieve a *Group Number* no greater than 2, and

Figure 3.19 **Single external escape routes, unsprinklered building**
Paragraph 3.11.2(a)

Amend 2 Nov 2020

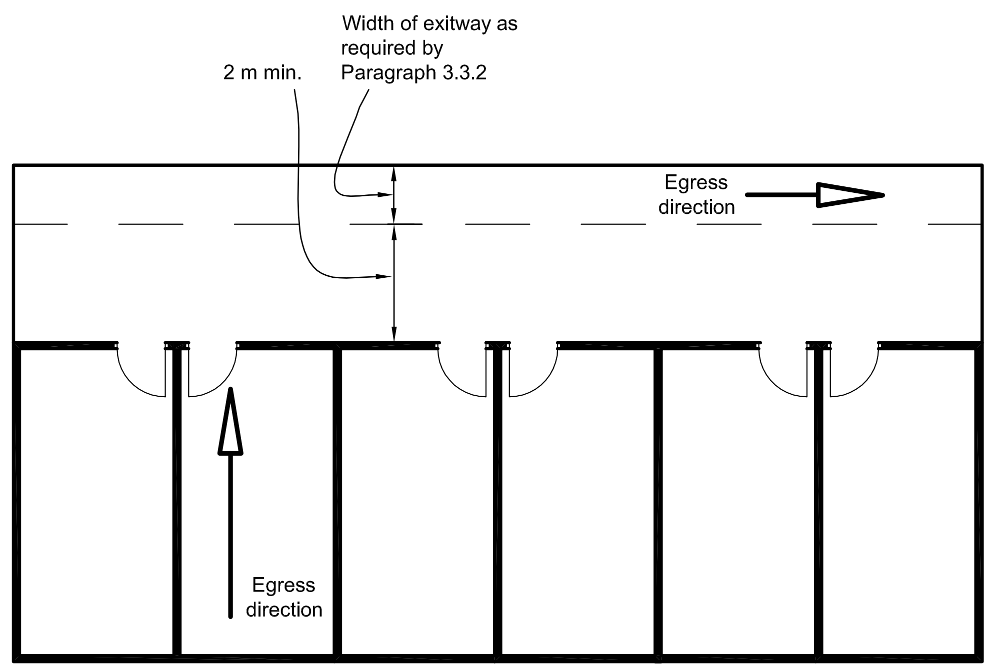
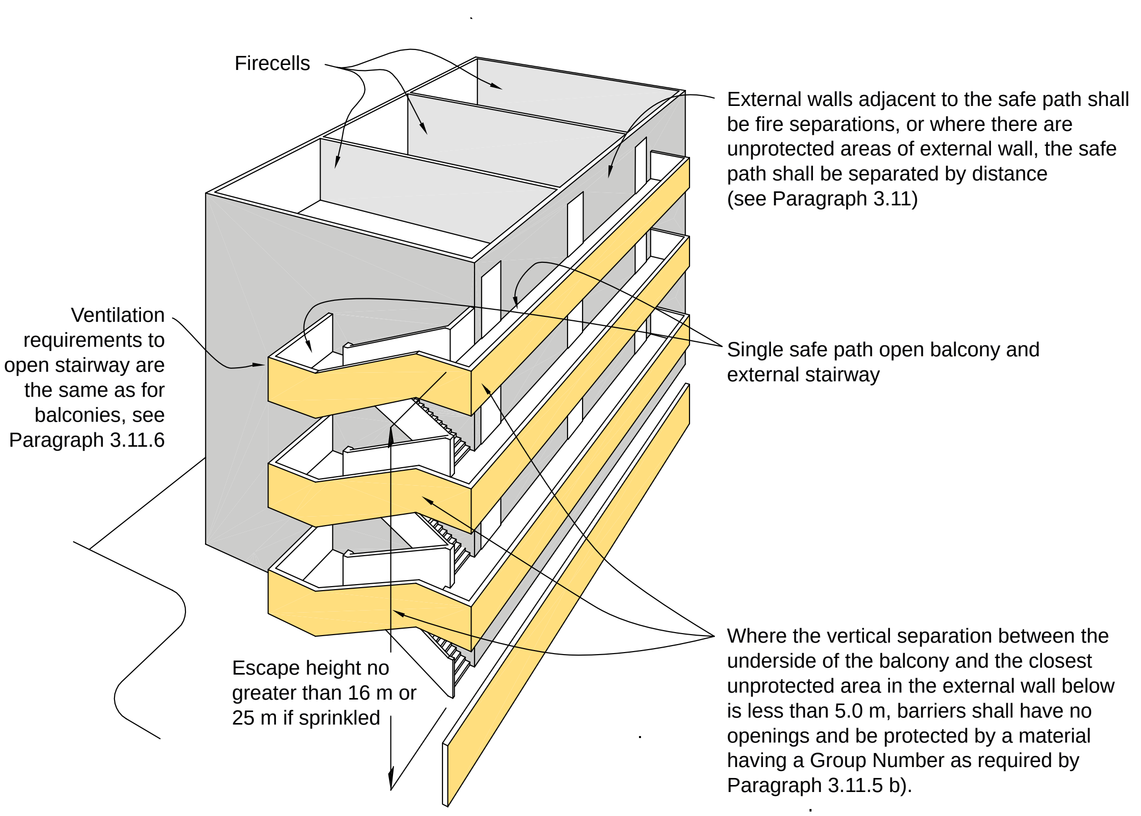


Figure 3.20 **Single escape routes – direct access to balcony and stairway**
Paragraph 3.11.5



c) If the vertical separation between the underside of an external *escape route* and *unprotected areas* in the *external wall* below is less than 5.0 m:

i) the floor of an external *escape route* closer to an *external wall* than required by Paragraph 3.11.2 shall have an *FRR* of no less than required by Paragraph 2.3, and

ii) treads and risers of stairs on external *escape routes* shall either be constructed from a material which has a critical radiant flux of no less than 2.2 kW/m^2 or shall be protected on the underside with a material having a *Group Number* of no greater than 2, and

d) If a single *escape route* comprises external horizontal and internal vertical *safe paths*, a *smoke separation* shall be provided between them.

Ventilation openings

3.11.5 The open area of a balcony or bridge shall be no less than 50% of the balcony floor area, and shall be evenly distributed along the open sides and any approach ramp (see Figure 3.21). Where an *escape route* on a balcony is served by an open *stairway*, similar ventilation shall be provided on the *stairway*. Open sides shall not be enclosed, except that a fixed open grille may be used if it provides the required free air space. Amend 2 Nov 2020

Open air auditoriums

CA **3.11.6** For ***risk group*** **CA** open tiered seating decks shall: Amend 2 Nov 2020

a) Have the number of *escape routes* required by Table 3.2 for the *occupant load*, and

b) Comply with Paragraphs 3.7.4 to 3.7.12 for aisles and walkways between seats (Table 3.3 seat numbers are permitted to be doubled in this use), and

c) Have *exitways* spaced at no more than:

i) 60 m apart where the space below the seating deck is required to be *fire separated* (see Paragraph 4.8.2), or

ii) 20 m apart where the space below requires no *fire separation*, and

d) Be served by *escape routes* completely open to the air where the seating deck is not a *fire separation*.

3.11.8 If the seating deck is required to be a *fire separation*, an *escape route* may pass through the deck and the space below, provided that part of the *escape route* is a *safe path* with an *FRR* in accordance with Paragraph 2.3.

3.12 Final exits

Final exit separation

CA WB VP **3.12.1** For ***risk groups* CA**, **WB** and **VP**, *final exits* which open onto the same *safe place* shall be spaced no closer than 5.0 m centre to centre. This applies to both internal and external *exitways*.

3.13 Single escape routes

SI **3.13.1** Single *escape routes* shall only be permitted if:

a) The *dead end open path* length does not exceed the limits specified in Table 3.2, and

b) For all ***risk groups* excluding SI**, the total *occupant load* from all *firecells* on each level served by the *escape route* is no greater than 50, and

c) The *escape height* is no greater than:

i) 10 m if unsprinklered, or

Amend 2 Nov 2020 ii) 25 m if sprinklered, and

d) There are no more than two *basement* levels and the vertical *safe path* from the *basement* levels is preceded by a *smoke lobby* (see Figure 3.11), and Amend 2 Nov 2020

e) In *buildings* with two or more floors, the vertical *safe path* is preceded by a *smoke lobby* on all floors except the topmost floor (refer to Paragraph 3.9.2 to determine the *smoke lobby* floor area).

Risk group CA

CA **3.13.2** In ***risk group* CA**, a single *escape route* from the *firecell* is permitted provided that, in addition to the requirements of Paragraph 3.13.1, the number of preschool children per floor receiving child care (including those using workshops and dining rooms) is not greater than 10.

Risk group WS

WS **3.13.3** In ***risk group* WS**, a single *escape route* from the *firecell* is permitted provided that, in addition to the requirements of Paragraph 3.13.1, the *firecell* is on the ground floor.

Risk group SM

SM **3.13.4** In ***risk group* SM**, a single *escape route* from a floor is permitted provided that, in addition to the requirements of Paragraph 3.13.1:

a) The number of *people with disabilities* on any floor is not greater than 10, and

b) The *escape route* within each *firecell* terminates at a *final exit* or opens onto a *safe path* which complies with the requirements of Paragraphs 3.9.4 to 3.9.11, and

c) The particular requirements for *stairways*, balconies and split level *exitways*, given in Paragraphs 3.7.3 and 3.13.5, are satisfied, and

d) The length of any *safe path* on a floor does not exceed the maximum *dead end* length permitted by Table 3.2.

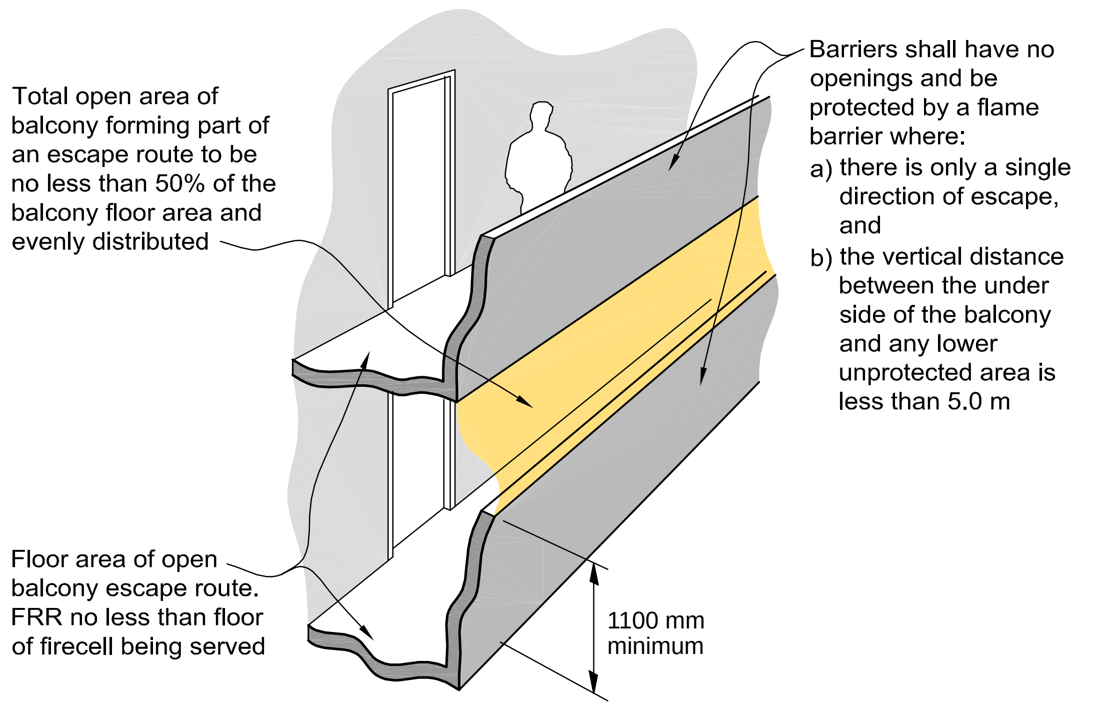
SM **3.13.5** In ***risk group* SM**, balconies, bridges and external *stairways* (see Figure 3.20) may be part of a single external *escape route* where:

a) The *escape height* is no greater than 16 m if unsprinklered, or 25 m if sprinklered, and

b) The *escape route* on the balcony, bridge and *stairway* meets the requirements of Paragraph 3.11 for protection, *construction* and ventilation, and

c) The *external wall* within 3.0 m of the *stairway* is provided with an *FRR* in accordance with Paragraph 2.3, or the length of any bridge between the *external wall* and *stairway* is no less than 3.0 m.

Figure 3.21 **Open balconies**
Paragraph 3.11.5 and 3.11.6



SM **3.13.6** In ***risk group* SM**, where a *building* is effectively of single storey *construction* but contains individual *household units* at slightly different levels (see Figure 3.22), a single internal *escape route* is permitted provided that:

a) The *escape route* is a *safe path* leading directly to a *final exit*, and

b) The difference in floor level between the *final exit* and any exit from a *household unit* is not greater than 2.0 m. The *safe path* is considered to be a horizontal *safe path* in this instance.

SM **3.13.7** In ***risk group* SM**, where the level difference is greater than 2.0 m, the relevant provisions for stairs (refer to Paragraphs 3.13.4 and 3.13.5) shall apply.

3.14 Special conditions for safe paths

SM **3.14.1** *Safe paths* from ***risk group*** **SM** may also serve other *risk groups* where:

a) A single *escape route* complying with Paragraph 3.13 is permitted, or

b) Alternative *escape routes* which are *safe paths* are provided.

These requirements shall also apply to all *firecells* on lower floors using the same *escape routes*.

3.15 Doors subdividing escape routes

Door closers and latching

3.15.1 Except as permitted by Paragraph 3.15.7 (revolving doors, automatic doors and access control systems), doors on *escape routes* shall satisfy the following requirements:

a) They shall be hinged or pivoted on one vertical edge only, except that sliding doors may be used where the space, including an *exitway*, has an *occupant load* of less than 20. Roller shutter doors or tilt doors shall not be used as *escape routes* width unless they are open at all times the space is occupied. A roller shutter door or tilt door is permitted to be the only *access route* to an intermittently *occupied space* where the roller shutter door is open at all times the space is occupied, and

b) *Fire* and *smoke control doors* shall be self-closing, and the self-closing device shall either be:

i) active at all times, or

ii) activated by releasing a *hold-open device* in response to operation of a smoke detector (see Paragraph 3.15.10), or

iii) a self-closer that is activated by operation of a smoke detector but allows the door to swing freely at other times. The smoke detector requirements shall be the same as for a *hold-open device* (see Paragraph 3.15.10), and

c) If such doors are required to be secure, they shall be fitted with simple fastenings that can be readily operated from the direction approached by people making an escape complying with Paragraph 3.15.14, and

d) They shall not be fitted with any locking devices unless these comply with Paragraph 3.15.2, and

e) They shall have door handles which satisfy the requirements of Acceptable Solution D1/AS1 for use by *people with disabilities*, and

f) They shall be *constructed* to ensure that the forces required to open these doors do not exceed those able to be applied:

i) with a single hand to release the latch (where fitted), and

ii) using two hands to set the door in motion, and

iii) using a single hand to open the door to the minimum required width.

Locking devices

3.15.2 If the *building* is occupied, locking devices shall:

a) Be clearly visible, located where such a device would be normally expected and, in the event of *fire*, designed to be easily operated without a key or other security device and allow the door to open in the normal manner. If the operation of a locking device is unusual, such as the pressing of a button close to the door, it shall have signage that complies with NZBC Clause F8, and

Amend 2 Nov 2020

b) Not prevent or override the direct operation of panic fastenings fitted to any door, and

c) If they are of an electromechanical type, in the event of a power failure or door malfunction, either:

i) automatically switch to the unlocked fail-safe condition, or

ii) be readily opened by an alternative method satisfying the requirements of Paragraph 3.15.2 a), and

d) If the *escape height* is greater than 25 m occupants in the vertical *safe path* shall be able to re-enter a floor at a maximum interval of 4 floors. Doors required to be unlocked from the *safe path* side may be unlocked at all times or only when the *fire* alarm is activated. Doors designated as available for entry shall have signage indicating their status.

Direction of opening

Amend 2 Nov 2020 **3.15.3** Doors shall be hung to open in the direction of escape if the door serves a room or area with more than 50 occupants. This includes doors:

a) Located on an *open path*

b) Leading into, or within an *exitway*

Amend 2 Nov 2020 c) At *final exits*.

If escape is in either direction, doors shall be capable of swinging both ways.

Amend 2 Nov 2020 For manual sliding doors, see Paragraph 3.15.1.

SI **3.15.4** In ***risk group* SI**, manual doors (excluding bedroom doors) used for the passage of beds in care and detention activities shall be capable of swinging in both directions.

Degree and width of opening

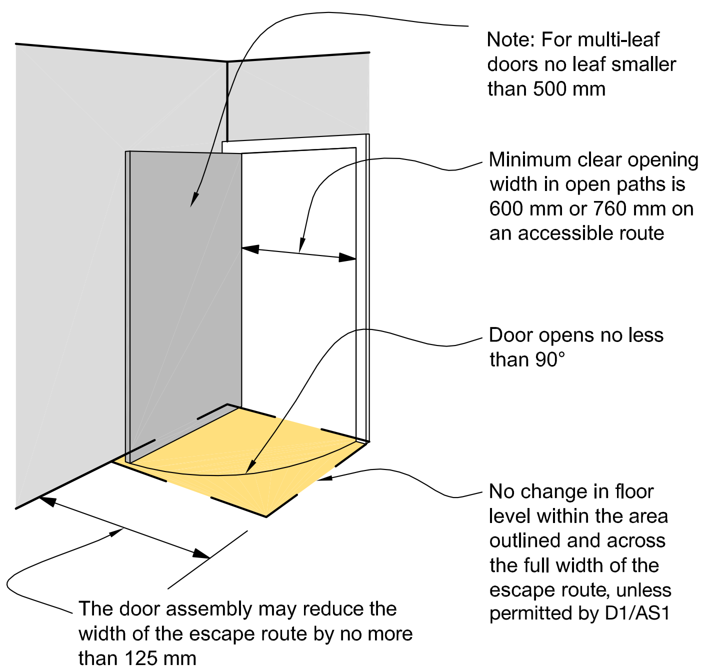
3.15.5 Doors on *escape routes* (see Figure 3.23) shall satisfy the following requirements:

a) In *open paths*, provide an unobstructed opening width of no less than 760 mm (Table 3.1a) or 950 mm where the movement of beds is required and, when multi-leaf, have no single leaf less than 500 mm wide. The minimum door opening width may be reduced to 600 mm if it is not required to be an *accessible route*, and

b) Within *exitways* (including entry and *final exit* doors), reduce the minimum *exitway* width required by Paragraph 3.3 by no more than permitted under Table 3.1a.

c) Open no less than 90°, and

Figure 3.23 **Degree and width of openings**
Paragraph 3.3.6 d) and 3.15.5



d) Open onto a floor area which:

   i) extends for a distance of no less than the arc of the door swing, and

   ii) is at the same level on both sides of the door for the full width of the *escape route* unless permitted by D1/AS1, and

e) When opened, not cause the door swing to obstruct the minimum required width of any *escape route* (see Figure 3.24), and

Amend 2 Nov 2020

f) In the case of care patients the doors shall be of sufficient width to allow the passage of a bed and essential patient life support equipment.

Vision panels

3.15.6 Vision panels shall be provided on doors which:

a) Are hung to swing both ways, or

b) Subdivide corridors used in *escape routes*, or

c) Lead into, or are within *exitways*, except where:

   i) the door is the egress for a sleeping space (such as a ward bedroom or *suite*), or a sanitary facility for use by a single person, or

   ii) the door serves an unoccupied space, such as a closet.

Amend 2 Nov 2020

Revolving doors, automatic doors and access control systems

3.15.7 Revolving doors (see Figure 3.25 (a)), automatic doors (of all types) and access control systems shall:

a) Not be allowed across an *escape route* at any point leading into or within an *exitway*, but

b) Be allowed in an *open path* or at a *final exit*, provided that in the event of a power failure or malfunction, the doors or access control systems continue to provide a safe *means of escape from fire* without reducing the required width by automatically opening and remaining open, or being readily pushed to the outward open position by the *building* occupants in an emergency (see Figure 3.25).

3.15.8 Paragraph 3.15.7 b) need not apply if alternative swing doors of the required width are provided immediately adjacent to the revolving or sliding doors. Refer to Paragraph 3.16 for signage requirements.

Hold-open devices

3.15.9 Smoke detector activated *hold-open devices* shall be fitted to *fire doors* or *smoke control doors* required:

a) Between *open paths* and *exitways* if the *occupant load of the building* is greater than 1000, and

b) For subdividing long corridors (refer to Paragraph 4.12), and

c) In *fire separations* where an *escape route* passes into an adjacent *firecell* (refer to Paragraph 3.7.13), and

d) In locations where, due to the type or volume of occupant traffic using the doors, the doors may be kept open by unauthorised means, and

e) In *early childhood centres* located on upper floors of multi-storey *buildings*.

3.15.10 Detectors for releasing *hold-open devices* shall be smoke detectors which are:

a) Integral with the *hold-open device* and comply with Appendix C6.1.6, or

b) Located on the ceiling adjacent to the *doorset* on both sides of the *doorset*, or

c) Part of an automatic smoke detection system on both sides of the *doorset*.

Delayed action unlocking devices

3.15.11 Delayed action unlocking devices on *escape routes* shall be installed only if:

a) The *firecell* is protected by a Type 4 or Type 7 system, and

b) *Fire* alarm activation instantly overrides any delay, and

c) The delay in operation does not exceed 15 seconds, and

d) Signage warning of the delay in operation and complying with F8/AS1 is provided.

Panic fastenings

CA **3.15.12** In retail areas serving more than 500 occupants and in crowd activities (as described by ***risk group* CA**) of more than 100 people, panic fastenings shall be fitted on doors on the *escape route* including *exitways* and *final exits.*

Amend 2 Nov 2020 | **3.15.13** Panic fastenings are latching devices which shall meet the following requirements:

a) The actuating portion shall consist of a horizontal bar or panel which shall extend across no less than half the width of the door leaf, and be located between 800 mm and 1200 mm above the floor, and

b) When a horizontal force of that able to be applied using one hand to the bar or panel the door lock shall release allowing the door to swing open freely.

Simple fastenings

3.15.14 Doors on *escape routes* (whether or not the doors are *fire doors*) shall be fitted with simple fastenings that can be easily operated from the direction from which people approach when making their escape.

3.16 Signs

3.16.1 All *building* features shall have signs complying with F8/AS1.

Part 4: Control of internal fire and smoke spread

CONTENTS

4.1 Firecells

4.1.1 Adjoining *firecells* are required to be *fire separated* from each other by the highest:

a) *Life rating* specified in Paragraph 2.3 if both *firecells* are under common ownership, or

b) *Property rating* specified in Paragraph 2.3 if both *firecells* are under different ownership, or a property boundary exists between the two *firecells*, or where explicitly stated in this Acceptable Solution.

Firecells shall be *fire separated* from each other by the higher of the two *FRRs* if the adjoining *firecell* has a higher *FRR* (refer to Paragraph 2.3).

Firecells in vehicle parking

VP **4.1.2** ***Risk group* VP** *firecells* shall be separate *firecells* within the *building* and: Amend 2 Nov 2020

a) *Firecells* shall be *fire separated* from other *firecells* by either:

i) the *fire resistance rating* specified in Table 2.4 if the *firecell* is categorised in ***risk group* VP**, or

ii) the higher of the two *fire resistance ratings* specified in Table 2.4 if it is categorised in any other *risk group*, and

b) Within the ***risk group* VP** *firecell*, all floors (including *intermediate floors*) and their supporting structures shall achieve a *fire resistance rating* of at least the *life rating*. The *property rating* shall be used where necessary to achieve protection from spread of *fire* to neighbouring property (see Figure 4.1), and Amend 2 Nov 2020

Amend 2 Nov 2020 c) Within the ***risk group* VP** *firecell*, where the parking spaces and other areas of that *firecell* are unit titled, it is permitted to have the parking spaces (and an associated storage area limited to plan area of 3.0 m^2 and maximum height 3.0 m) unseparated from adjacent titles, and

Amend 2 Nov 2020 d) Within the ***risk group* VP** *firecell*, other spaces (such as a ticket office, a gate booth or a storeroom not greater than 10 m^2) are permitted when they are necessary for the operation of the ***risk*** Amend 2 Nov 2020 ***group* VP** *firecell*, and

e) Service vehicle and unloading areas may be part of other support activity *firecells*.

Natural cross ventilation in vehicle parking

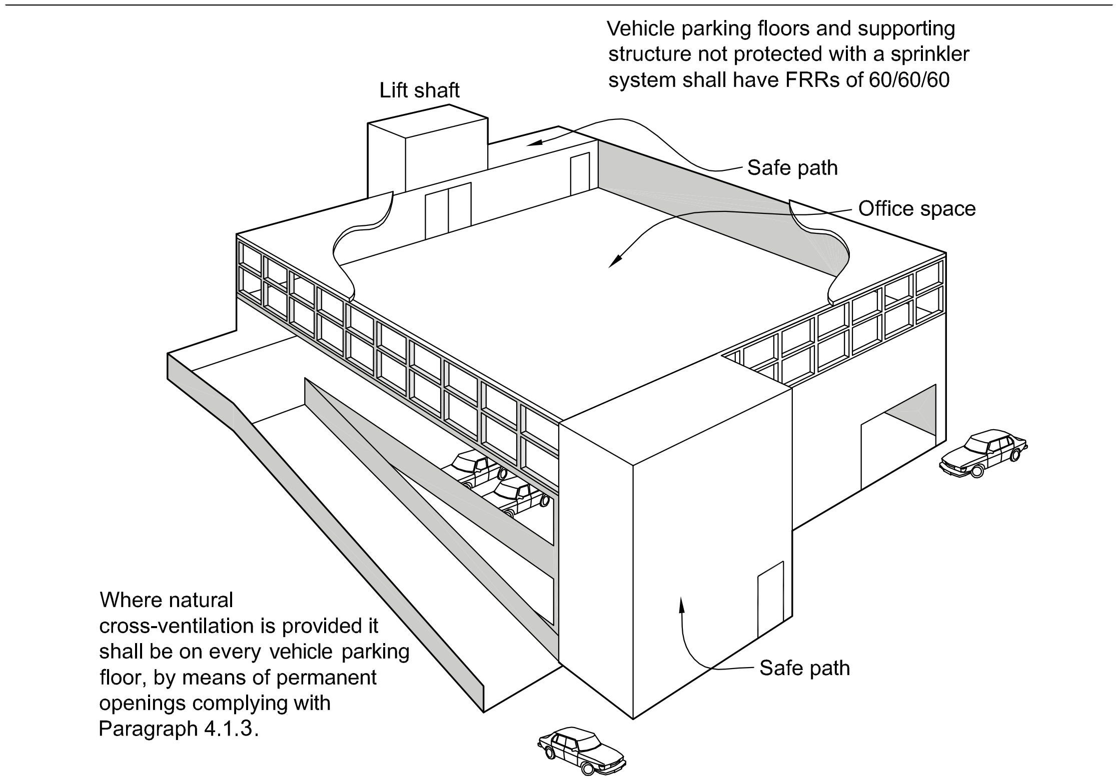
VP **4.1.3** In ***risk group* VP** where a *firecell* is unsprinklered and there is parking for more than 10 vehicles, each of those *firecells* within that *building* must have natural cross ventilation (see Figure 4.1). This shall be achieved by providing perimeter walls on each floor with permanent openings to the outside environment. The size of those openings shall either be:

a) no less than 50% of the wall area in each of any two opposing walls, or

b) no less than 50% of the total perimeter wall area, with those openings distributed uniformly along at least half the total perimeter wall length.

4.1.4 Where natural cross ventilation or sprinklers are provided the limitations of Paragraph 4.13.4 to 4.13.6 on *intermediate floor* area do not apply.

Figure 4.1 **Vehicle parking**
Paragraphs 4.1.2 and 4.1.3



4.2 Glazing in fire and smoke separations

4.2.1 Glazing in *fire separations* shall be fixed *fire resisting glazing* having the same *FRR* values for *integrity* and *insulation* as the *fire separation,* except where uninsulated glazing is permitted within vision panels or for sprinklered *buildings* (refer to Paragraph 2.3.13).

4.2.2 Uninsulated *fire resisting glazing* having the same *integrity* value as the *fire separation* is permitted in all sprinklered *buildings*.

4.2.3 There is no restriction on the area of glazing in *smoke separations* (including *smoke lobbies*). Non-*fire resisting glazing* may be used if it is toughened or laminated *safety glass*. Glazing shall have at least the same smoke-stopping ability as the *smoke separation*.

Fire doors and smoke control doors

4.2.4 Glazing in *fire doors* shall be *fire resisting glazing* having the same *integrity* value as the door. If the door requires an *insulation* value, an uninsulated vision panel may be used without downgrading the *insulation* value of the door. Vision panels shall comply with NZS 4520.

4.2.5 Glazing in *smoke control doors* shall meet the requirements for *smoke separations.*

4.3 Structural stability during fire

Stability of building elements having an FRR

4.3.1 To avoid premature failure the structural *stability* of primary *building elements* with an *FRR* is to be retained for the duration of that *FRR*.

Primary elements located entirely within a *firecell* and providing support to *fire separations* may need to be evaluated for *fire* exposure from multiple sides simultaneously.

4.3.2 During a *fire*, *primary elements* shall resist collapse under:

a) The design dead and live loads required by NZBC Clause B1, and Amend 2 Nov 2020

b) Any additional loads caused by the *fire.*

Unrated primary elements permitted

4.3.3 In many cases *primary elements* are rated for *structural adequacy*, and sometimes for *integrity* and *insulation*. However, *primary elements* need not have an *FRR* where any of the following circumstances exist:

a) They are located outside an *external wall* which is 2.0 m or more from the *relevant boundary*, and are shielded from the effects of *fire* by protected areas of the wall (see Figure 4.2), or

b) They are added to strengthen an existing *building* and are required only to carry horizontal loads induced by wind or earthquake.

Providing vertical stability

4.3.4 *Building elements* required to have an *FRR* shall have their vertical *stability* provided in one or more of the following ways:

a) *Primary elements* in a vertical orientation (e.g. walls and columns) shall be rated for *structural adequacy,* and/or

b) *Primary elements* in a horizontal orientation (e.g. floors and beams) shall be supported by *primary elements* with at least an equivalent *structural adequacy* rating.

4.4 Fire stopping

Introduction

4.4.1 The continuity and effectiveness of *fire separations* shall be maintained around *penetrations*, and in gaps between or within *building elements*, by the use of *fire stops*.

Fire stops

4.4.2 *Fire stops* shall have an *FRR* of no less than that required for the *fire separation* within which they are installed, and shall be tested in accordance with Appendix C C5.1.

4.4.3 *Fire stops* and methods of installation shall be identical to those of the prototype used in tests to establish their *FRR*.

4.4.4 The material selected for use as *fire stops* shall have been tested for the type and size of the gap or *penetration*, and for the type of material and *construction* used in the *fire separation*.

4.4.5 A *fire stop* for a *penetration* is not required to have an *insulation* rating if means are provided to keep *combustible* materials at a distance of 300 mm away from the *penetration* and the *fire stop* to prevent ignition.

4.5 Firecell construction

4.5.1 Each of the *building elements* enclosing a *firecell* is permitted to have a different *FRR*, as this rating will depend on the characteristics of the *firecell*, the reason for the *FRR*, and the *risk groups* contained on either side of any *fire separation*.

4.5.2 Except where *intermediate floors* are permitted, each floor in a multi-storey *building* shall be a *fire separation*.

4.5.3 *Fire separations* and *smoke separations* shall have no openings other than:

a) For closures such as *fire doors, smoke control doors*, *fire* or smoke curtains, *fire shutters*, *fire dampers* and *smoke dampers*, and

b) *Penetrations* complying with Paragraph 4.4, and

c) For glazing permitted by Paragraph 4.2.

4.5.4 *Firecell* and *smokecell* effectiveness shall be maintained by ensuring continuity of *fire separations* and *smoke separations* at separation junctions, and around joints where closures, *protected shafts* and *penetrations* occur.

Junctions of fire separations

4.5.5 Where *fire separations* meet other *fire separations* or *external walls*, they shall either be bonded together or have the junction *fire stopped* over its full length (see Figures 4.3, 4.4 and 4.12).

4.5.6 Where one *fire separation* is a wall and the other a floor, the wall/floor junction shall be *constructed* with the *FRR* required for the higher rated element.

Junctions with roof

4.5.7 Vertical *fire separations* and *external walls* shall either:

a) Terminate as close as possible to the external roof cladding and *primary elements* providing roof support, with any gaps fully *fire stopped* (see Figures 4.3 and 4.4), or

b) Extend not less than 450 mm above the roof to form a parapet.

Ceiling space firecells

4.5.8 Large roof or ceiling spaces may be *constructed* as separate *firecells* above more than one occupied *firecell* provided that the ceiling is a *fire separation* rated from below. In this situation, vertical *fire separations* in the *firecell* below need terminate only at the ceiling.

Sealing of gaps

4.5.9 To avoid the passage of smoke through *fire separations* and *smoke separations*, gaps shall be sealed with *fire* resistant materials complying with AS 1530.4 in their intended application if they are located:

a) In *smoke separations*, and between *fire separations* and *smoke separations*, or

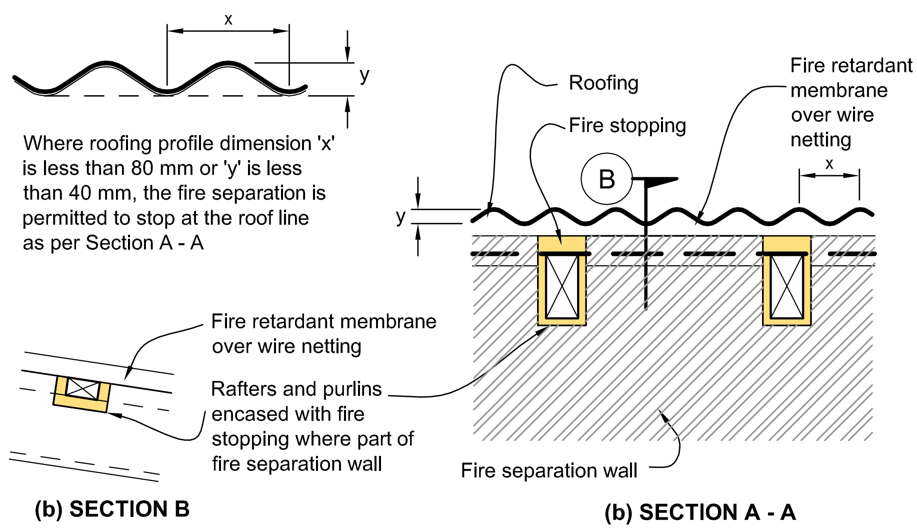
b) Around glazing in *smoke separations*, or

c) Between *fire separations* and unrated parts of *external walls*, or

d) Between *smoke separations* and unrated parts of *external walls*.

4.5.10 Gaps around *penetrations* shall be *fire stopped* (see Paragraph 4.4).

Figure 4.4 **Junction of fire separations – 2**
Paragraphs 4.5.5, 4.5.7 and 4.15.3



4.6 Specific requirements for sleeping areas

Group sleeping areas

Amend 2 Nov 2020

SI SM

4.6.1 *Group sleeping areas* in ***risk groups*** **SM** or **SI** shall be *fire separated* from each other and from other sleeping and non-sleeping areas with a *FRR* in accordance with Paragraph 2.3.

.

SM

4.6.2 In ***risk group*** **SM**, a *group sleeping area* shall contain no more than:

a) 40 beds if unsprinklered, or

Amend 2 Nov 2020

b) 160 beds if sprinklered.

SM

4.6.3 In ***risk group*** **SM**, a *group sleeping area* may contain non-*fire rated* partitions if:

a) The *group sleeping area* contains no more than 40 beds, whether or not sprinklers are installed, and

b) The partitions do not fully enclose any *occupied space* in the *group sleeping area*, and have at least one side open, and

c) All *occupied spaces* within the *group sleeping area* are available to all occupants at any time, and

d) The openings between the partitions as well as any other part of the *open path* must be unobstructed, and

e) WCs, urinals, baths, showers or bidets may be fully enclosed.

See Figure 4.5(a)

SI

4.6.4 For ***risk group*** **SI**, if there is only one *group sleeping area*, or the *group sleeping areas* are not adjacent to one another, the *group sleeping area* shall contain no more than 12 beds. Amend 2 Nov 2020

Where there are two or more *group sleeping areas* and these are adjacent to one another, each *group sleeping area* shall contain no more than 20 beds and have sufficient space to accommodate, in an emergency, the beds from an adjacent *group sleeping area*.

SI **4.6.5** In ***risk group* SI**, a *group sleeping area* may be subdivided with full height *smoke separations* including *smoke control doors* which need not be fitted with self- closers. See Figure 4.5(b)

SI **4.6.6** In ***risk group* SI**, a *group sleeping area* may be subdivided with non-*fire rated* partitions if it contains no more than 6 beds. See Figure 4.5(c)

Amend 2 Nov 2020

Direct support functions

SM SI **4.6.7** *Direct support functions* may be included in a *group sleeping area* without *fire* or *smoke separations*. *Direct support functions* may include sanitary facilities and tea making activities for use by the occupants, but may not include cooking facilities.

Communal service functions for group sleeping areas

SM SI **4.6.8** *Communal service functions* shall be separated from *group sleeping areas* or *suites* with *fire separations* having an *FRR* in accordance with Paragraph 2.3.

Suites

SM **4.6.9** A *suite* shall be a separate *firecell* with *fire separations* with an *FRR* in accordance with Paragraph 2.3.

A *group sleeping area* may be subdivided to form *suites*.

4.6.10 A *suite* shall contain no more than 12 beds.

4.6.11 A *suite* may be subdivided with non-*fire rated construction* to provide separate spaces for sleeping, cooking, or sanitary facilities.

Amend 2 Nov 2020

Household units

SM **4.6.12** A *household unit* shall be a single *firecell* separated from every other *firecell* by *fire separations* having an *FRR* in accordance with Paragraph 2.3.

4.6.13 A *household unit* may contain one or more floors provided that the *open path* length provisions of Table 3.2 are satisfied.

Vehicles

SM SI **4.6.14** Service vehicle and unloading areas within a *building* with ***risk group* SM** or **SI** shall be a separate *firecell* complying with the requirements of ***risk group* VP**.

SM **4.6.15** Where a vehicle parking garage associated with ***risk group* SM** is provided solely for the use of the occupants of an individual *household unit*, the garage may be included within the *household unit firecell*.

Where parking is provided for vehicles of occupants of more than one *household unit*, the parking area shall be a separate *firecell* complying with the requirements of ***risk group* VP**.

Amend 2 Nov 2020

Special care facilities

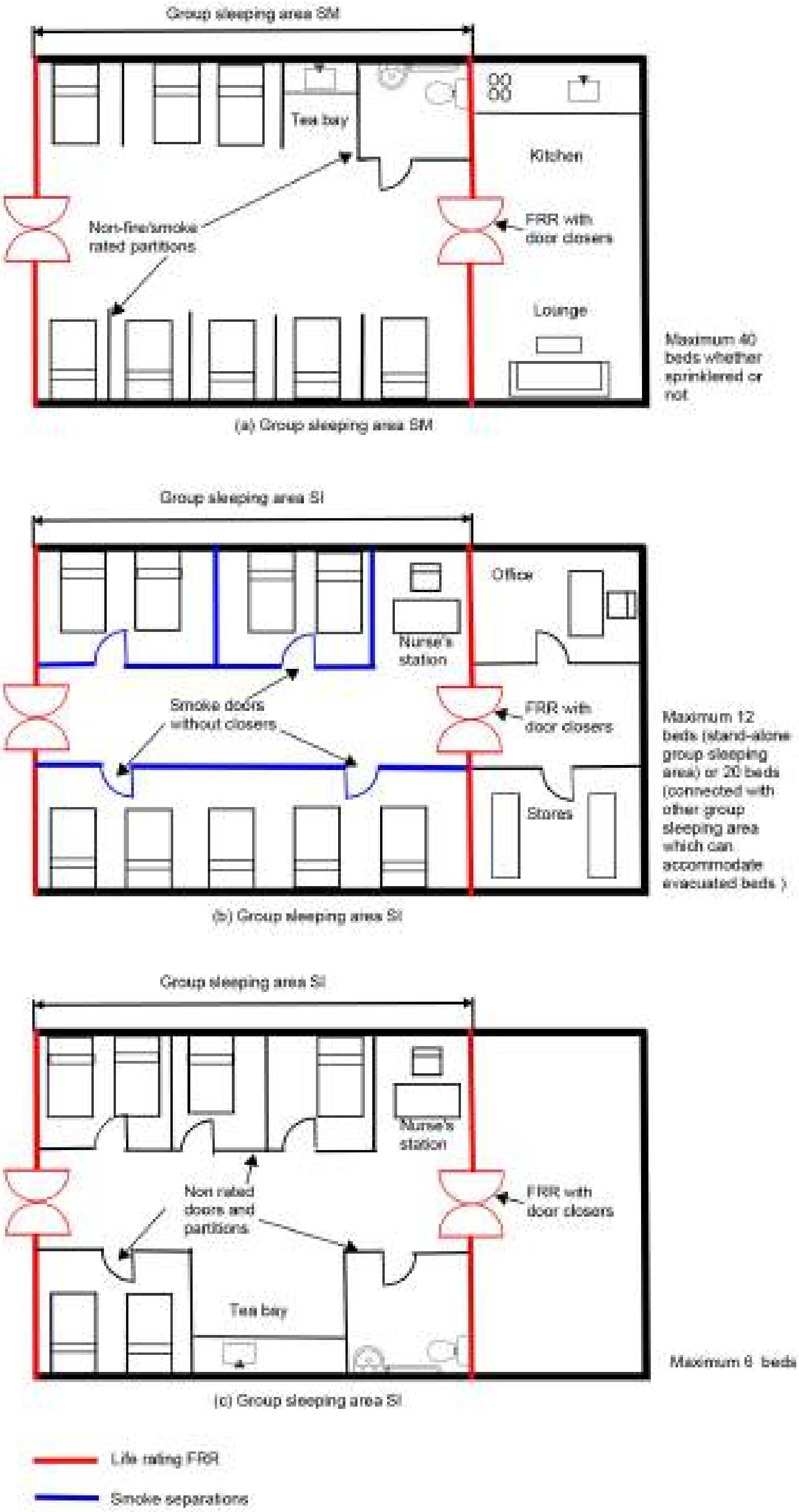
SI **4.6.16** Spaces where procedures using sedation (including dentistry and dialysis) are carried out require longer evacuation times. Such spaces shall be either:

a) Contained in separate *firecells* having *fire separations* with an *FRR* of no less than 60 minutes, or

b) Grouped together within a *firecell* which is separated from other activities by *fire separations* with an *FRR* of no less than 60 minutes. Within that *firecell*, each space shall be separated from adjacent spaces by *smoke separations*.

Amend 2 Nov 2020

Figure 4.5 **Group sleeping areas**
Paragraph 4.6



Amend 2
Nov 2020

Amend 2
Nov 2020

4.7 Specific requirements for theatres, exhibition areas and retail spaces

Theatres

CA **4.7.1** In every unsprinklered *theatre* where the *occupant load* in the auditorium is greater than 500, the stage area (including workshops, storerooms, scenery docks, property, wardrobe or painting rooms used in connection with the *theatre*), shall be separated from the auditorium by a proscenium wall meeting the requirements of a *fire separation* having an *FRR* of no less than 30/30/30. Where the stage and supporting areas are sprinklered, the proscenium wall and curtain may be a *smoke separation*.

Closures in theatre proscenium walls

CA **4.7.2** The opening in the proscenium wall shall be provided with a smoke curtain, *fire* curtain or *fire shutter* (as required by Paragraph 4.7.1), that when released, shall lower under gravity in a fail safe manner. An emergency release device shall be located in the stage area on both sides of the opening.

CA **4.7.3** If a sprinkler system is not installed, uninsulated glazing is not permitted in *fire* rated proscenium walls.

Theatre stages

CA **4.7.4** *Theatres* with an *occupant load* of greater than 1000 shall satisfy the following requirements:

a) The stage area shall have roof vents of no less than 5% of the stage floor area, located at the highest point above centre stage. These vents shall have a positive device to keep them closed, and may be of the counterbalanced shutter type, inclined falling type, centre pivot sash type or counterbalanced skylight type, and they shall be held normally in a closed position by a heat sensing device installed below the vent opening and its controls, but above the discharge of any sprinkler head in the vicinity, and

b) Vents shall be capable of being operated by a manual control located near the stage safety curtain release, and

c) The heat sensing device required by a) above shall be interlocked with any heating or ventilating system, so that when activated, it closes all *fire dampers* in all ducts passing through the proscenium wall.

Exhibition and retail areas

CA WS WB **4.7.5** If the *occupant load* for a sales, exhibition or trade fair space is greater than 500, then any adjacent storage areas in which goods are received, unpacked, stored or packed for dispatch, any areas used for workshops, and any areas used for the storage of display material or similar items, shall be *smokecells* separated from the display and sales areas. Amend 2 Nov 2020

4.8 Tiered seating in risk group CA

CA **4.8.1** If any enclosed, useable space beneath permanent, tiered seating is not sprinklered it shall be a *firecell* with an *FRR* in accordance with Paragraph 2.3.

CA **4.8.2** If any enclosed, usable space beneath permanent tiered seating is sprinklered, it will not need to be a separate *firecell*. However, the supporting structure for the permanent tiered seating shall have an *FRR* in accordance with Paragraph 2.3.

CA **4.8.3** Temporary and retractable tiered seating shall not require an *FRR*, provided the space beneath the seating is not used for storage.

4.10 Intermittent activities

Support activities

4.10.1 Intermittent activities providing direct support to a primary activity of another *risk group* may be included with the other *risk group* and do not require *fire* or *smoke separation*, unless these activities are provided for enclosed waste storage or vehicle parking. The *fire safety systems* required for each *risk group* shall also apply throughout these spaces. If these spaces are required to be separate *firecells*, they shall have *fire separations* with *FRRs* in accordance with Paragraph 2.3.

SI For intermittent activities that provide *direct support functions* within ***risk group* SI** refer to Paragraph 4.6.3.

Solid waste storage

4.10.2 Solid waste storage areas shall be enclosed when located adjacent to *occupied spaces*; except within ***risk group* VP** where these areas may be unenclosed.

Enclosed solid waste storage areas within any *firecell* shall themselves be a separate *firecell* separated from adjacent *firecells* by *fire separations* having an *FRR* of no less than either the *life rating* or, if located on a *relevant boundary,* the *property rating*.

(Refer to Paragraphs 4.11.5 and 4.11.6 for waste chutes.)

Plant, boiler and incinerator rooms

4.10.3 Any space within a *building* (see Figure 4.7) containing an incinerator plant, boiler or machinery which uses solid fuel, gas or petroleum products as the energy source (but excluding space and local water heating appliances) shall be a separate *firecell*. The *firecell* shall be *fire separated* with an *FRR* of no less than 45 minutes where the *building* is sprinklered or no less than 90 minutes for all other cases.

Plant, boiler and incinerator rooms in all *risk groups* shall have:

a) At least one *external wall,* and

b) Either external access that may be at any floor level including the roof or alternative internal access that shall be via a *smoke lobby* that is protected with a heat detector connected to a *fire* alarm system, and

c) Floor levels no lower than the ground level outside the *external walls* if gas is the energy source.

4.10.4 If a building services plant is contained in a *building* which is solely for the purposes of containing such plant, and that *building* is separated by 3.0 m or more from any *adjacent building*, only Paragraph 4.10.3 c) shall apply. Amend 2 Nov 2020

d) *Fire dampers* serving a ventilation duct and complying with requirements for *fire resisting closures,* or

e) *Penetrations* which satisfy Paragraph 4.4 for *fire stopping*, or

f) Fittings with an *FRR* of no less than that required for the shaft.

Solid waste and linen chutes

4.11.5 Solid waste and linen chutes which pass from one *firecell* to another shall be *protected shafts* or contained within a *protected shaft*.

In unsprinklered *buildings* each chute shall be equipped with automatic sprinkler heads connected to any water supply pipe capable of meeting the minimum design criteria for the selected sprinkler head. These sprinklers shall be installed at the top of each chute and in the space into which the chute discharges. The minimum residual pressure in the water supply pipe shall be 50 kPa with two sprinkler heads operating.

4.11.6 Solid waste and linen chutes shall have no inlet or discharge openings within an *exitway.*

4.12 Long corridor subdivision

4.12.1 Long corridors shall be subdivided by *smoke separations* and *smoke control doors* (see Figure 4.9) which shall be evenly spaced along these corridors and no further apart than the distance specified in Table 4.1 for each *risk group.*

4.13 Floors

4.13.1 Floors in *buildings* shall be *fire separations* (see Figure 4.8) except if any of the following conditions are satisfied:

a) Where the floor is an *intermediate floor* within a *firecell* (refer to Paragraphs 4.13.3 and 4.13.8 for *FRR* requirement), or

b) The floor is the lowest floor above an unoccupied subfloor space, and complies with Paragraph 4.14.1.

4.13.2 Floors only need to be rated from the underside. The *FRR* of a floor shall be that rating applicable to the *firecell* directly below the floor.

Table 4.1 **Long corridor subdivision (metres)**
Paragraph 4.12.1

Risk group	Safe path	Open path
SM	80[1]	40[1]
SI	120	60
CA	80[1]	40[1]
WB	80[1]	40[1]
WS	120	60
VP	80[1]	40[1]

Note:
1) These lengths may be increased by 50% if the *building* is sprinklered.

Intermediate floors

4.13.3 *Intermediate floors*, including their supporting *primary elements* and stairs, shall have *FRRs* of at least 30 minutes.

4.13.4 The maximum combined area of *intermediate floors* within a *firecell* shall be the lowest of:

a) 20% of the area of the *firecell* floor not including the area of the *intermediate floors* if the *intermediate floors* are enclosed or partitioned, or 40% of the area of the *firecell* floor, not including the area of the *intermediate floors* if the *intermediate floors*:

i) are completely open, or

ii) the *building* has a Type 4 or 7 system, or

b) A total floor area that accommodates no more than 100 occupants based upon the *occupant load* of the space (refer to Paragraph 1.4).

SI SM **4.13.5** *Firecells* containing *direct support functions* to a sleeping *firecell* shall have only one *intermediate floor*.

4.13.6 Where there are two or more *intermediate floors*, the height difference between *intermediate floors* shall not exceed 1.0 m.

WS WB **4.13.7** In warehouse *firecells* that contain storage at a height of more than 3.0 m, *intermediate floors* shall be limited to a total area of 35 m^2.

SM **4.13.8** The requirements for *intermediate floors* within Paragraphs 4.13.3 to 4.13.7 do not apply within *household units* and *suites* in ***risk group* SM**.

Flytowers, walkways and similar structures serving non-sleeping area firecells

4.13.9 Intermittently occupied structures such as flytowers, walkways, maintenance platforms, ladders, and gantries that are not used by the public are not required to be *fire* rated provided no more than 10 persons have access concurrently.

Basement floors

4.13.10 *Basement firecells* shall be separated from one another, and from the lowest *firecell* above ground level, by *fire separations* having *FRRs* in accordance with Paragraph 2.3.

4.14 Subfloor spaces

4.14.1 In *buildings* with an unoccupied subfloor space between the ground and lowest floor (see Figure 4.10), the floor shall have an *FRR* in accordance with Paragraph 2.3 except that no *FRR* is required if the following conditions are satisfied:

a) Vertical *fire separations* and *external walls* extend down to ground level and enclose the space, and

b) Access is available only for intermittent servicing of plumbing, drainage or other static services, and

c) The space is not used for storage and does not contain any installation such as machinery or heating appliances which could create a *fire hazard*, except when *fire separated* from the rest of the subfloor space and the floor level above.

4.15 Concealed spaces

4.15.1 The spread of *fire* in *concealed spaces* and cavities shall be avoided by ensuring that voids do not pass from one *firecell* to another, and by blocking off smaller voids with *cavity barriers* or, where appropriate, by using *fire stops* (see Paragraph 4.4).

Concealed spaces within firecells

4.15.2 An upper *concealed space* may be used as an air handling plenum (see Figure 4.11) if the following requirements are satisfied:

a) The upper *concealed space* does not extend into another *firecell*, and

b) The ceiling and its supports and surfaces within the *concealed space* are *non-combustible*, and

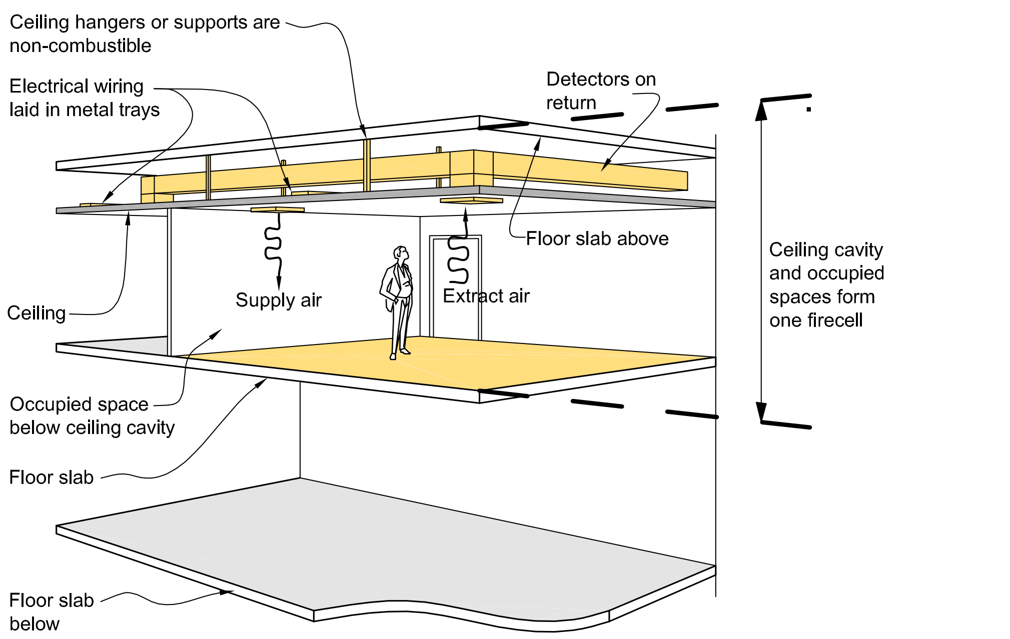
c) Electrical wiring is supported clear of the ceiling members and other equipment, and

d) Any material used such as pipe insulation or acoustic insulation complies with the requirements of Table 4.4, and

e) Where the air handling plenum is used as an air supply path, a Type 4 alarm system is installed with detectors in all return air ducts, and

f) Where the air handling plenum is used as an air supply path, detector activation causes the ventilation system to shut down as required by Paragraph 4.18.1.

Figure 4.11 Concealed spaces within firecells
Paragraph 4.15.2



Notes:
1. Type 4 system is required
2. If the plenum is used as an air supply path see Paragraphs 4.15.2 (e) and (f) for automatic fire detection and alarm requirements
3. If the firecell is required to have smoke control in the air handling system (Type 9 system), see Appendix A, Paragraph A 2.1.1 for necessary fire detection and alarm systems

Cavity barriers in walls and floors

4.15.3 Any *concealed space* which may be a path for *fire* spread within internal walls or floors which are *fire separations*, or within *external walls*, shall have *cavity barriers* or be *fire stopped* (see Paragraph 4.4) at all common junctions (see Figures 4.3 and 4.4).

Exceptions to cavity barrier requirements

4.15.4 *Cavity barriers* are not required below a floor next to the ground if the *concealed space* is:

a) Less than 1.0 m in height, or

b) Not normally accessed and has no openings through which litter can accumulate.

Amend 2
Nov 2020

Cavity barrier construction

4.15.5 *Cavity barriers* shall:

a) Not reduce the *FRR* required for the element within which they are installed, and

b) Where practical, be tightly fitted and mechanically fixed to rigid *construction*, but if this is not possible gaps shall be *fire stopped*, and

c) Be fixed in a way that avoids impairment of their *fire separation* function as a result of:

i) *building* movement due to subsidence, shrinkage or thermal change, or

ii) collapse or failure of their components or fixings, or of abutting materials and any *penetrations* during a *fire*.

Restriction of roof and ceiling space areas in unsprinklered *firecells*

SM CA **4.15.6** For ***risk groups*** **SM** and **CA**, unsprinklered *firecells*, roof space and ceiling space areas shall be subdivided by *fire separations* to prevent the hidden spread of *fire*.

Any space between ceilings and roofs or floors above shall not exceed:

a) 400 m^2 in area, measured at ceiling level, or

b) 30 m in either length or width.

This requirement does not apply where the ceiling space is a separate *firecell*. In CA ***risk group*** **CA** only, subdivision may be substituted for detection in accordance with NZS 4512.

4.15.7 The *fire separations* used for subdivision shall have an *FRR* in accordance with Paragraph 2.3 and shall extend from the ceiling to the underside of the external roof cladding or floor above. Any gaps shall be *fire stopped* as specified in Paragraph 4.4.

4.15.8 If openings in the *fire separations* are required for service access or any other reason, they shall be fitted with *fire resisting closures*. Gaps around service *penetrations* shall be *fire stopped*.

Table 4.2	Insulation and smoke stop capability of closures in fire and smoke separations Paragraph 4.16	
Risk group	Unsprinklered	Sprinklered
SM	-/*/30sm	-/*/-sm
SI		-/*/-sm
CA	-/*/30sm	-/*/-sm
WB	-/*/30sm	-/*/-sm
WS		-/*/-sm
VP	-/*/30sm	-/*/-sm

Amend 2
Nov 2020

Notes:

Except as permitted by Paragraphs 4.16.11 – 4.16.13.

* *Integrity* value of the *life rating* or *property rating* as required by this Acceptable Solution.

4.16 Closures in fire and smoke separations

Amend 2
Nov 2020

4.16.1 If activities within a *building* require openings in *fire separations* or *smoke separations* (e.g. for the passage of people, goods, services or light), closures to those openings shall have the *insulation* and smoke control performance as required by Table 4.2, in addition to the integrity performance as required by Table 2.4.

4.16.2 *Doorsets* which are required to be:

a) *Fire doors* shall comply with Appendix C C6.1.1,

b) *Smoke control doors* shall, except as allowed by Paragraph 4.16.3, comply with Appendix C C6.1.2, and

c) *Fire doors* with smoke control capability shall comply with both a) and b).

4.16.3 *Doorsets* installed in *fire separations* between *firecells* and vertical *safe paths* or *protected shafts* shall have smoke seals on all edges, except that smoke seals may be omitted:

a) At the sill of *doorsets*, and

b) For lifts, if either:

i) the *firecell* is sprinklered and has an automatic smoke detection system, or

ii) a *smokecell* is placed between the doors and the rest of the *firecell*, other than when the lift shaft is permitted to be in the vertical *safe path*.

Fire door and smoke control door installation

4.16.4 *Fire doors* and *smoke control doors* shall be installed in accordance with Paragraph 3.15.

Doorset markings

4.16.5 *Doorsets* shall be clearly marked to show their *FRR* and, if required, to show their smoke stopping capability. Other signage requirements shall be as specified in Paragraph 3.16.

4.16.6 Markings and labelling shall, in all other respects, comply with NZS 4520.

Glazing in doors

4.16.7 Glazing in *fire doors* and *smoke control doors* shall comply with Paragraph 4.2.

Smoke control doors

4.16.8 *Smoke control doors* complying with Paragraphs 4.16.2 to 4.16.7 shall be provided:

a) At *smoke separations* in vertical *safe paths,* and

b) Where a corridor or an *escape route* passes through a *smoke separation* (see Figure 4.9), and

Amend 2
Nov 2020

c) Between an *open path* and a *smoke lobby* (see Figure 4.13).

Amend 2
Nov 2020

Fire doors

4.16.9 *Fire doors* shall be provided:

a) Between an *open path* and a *safe path* (see Figures 4.13 and 4.14), and

Amend 2
Nov 2020

b) Between a *smoke lobby* and a *safe path* (see Figure 4.13), and

Amend 2
Nov 2020

c) Where the *escape route* passes through a *fire separation* (see Figure 4.14) or into an adjoining *building* (see Figure 3.10), and

Amend 2
Nov 2020

d) Where the *escape route* passes through a *fire separation* which isolates the *safe path* from levels below the *final exit* (see Figure 4.15), and

Amend 2
Nov 2020

e) In *fire separations* between vertical and horizontal portions of internal *safe paths*.

Amend 2
Nov 2020

Amend 2
Nov 2020

Protected shaft access panels

4.16.10 Access panels to *protected shafts* shall have the *fire* resistance performance as required by Paragraph 4.16.1 and shall be capable of being opened only with a special tool.

Lift landing doors

4.16.11 Other than where Paragraph 3.10.3 for a passenger lift within a vertical *safe path* applies, *doorsets* for lift landing doors opening into lift shafts which are *protected shafts* shall be *fire doors* complying with Paragraphs 4.16.1 to 4.16.3 except that an *insulation* rating is not required. Lift landing doors need not be *fire* rated from the shaft side.

Fire and smoke dampers

4.16.12 Any duct (unless fully enclosed by *construction* with an *FRR* no less than required for the *fire separation*) that passes through a *fire separation* shall not reduce the *fire* resistance of the *construction* through which the duct passes. Where a *fire damper* is used to maintain the required *fire* resistance it shall:

a) Comply with AS 1682.1 and AS 1682.2, and

b) Have a *fire integrity* and *insulation* rating no less than that of the *fire separation*, except that the *damper blade* is not required to have an *insulation* rating if the *building* is sprinkler protected or means are provided to prevent *combustible* materials being placed closer than 300 mm to the *fire damper* and air duct, and

c) Be readily accessible for servicing.

4.16.13 Where evacuation is delayed, ventilation ducts that pass through a *fire separation* to a *place of safety* within the *building* must be provided with a *smoke damper*.

4.16.14 Where a *smoke damper* is used to maintain the *smoke separating* function, it shall comply with with AS 1682.1 and AS 1682.2 and be actuated on alarm activation.

Fire shutters

4.16.15 A service opening in a *fire separation* (for stairs, conveyor, forklift access or similar installation) which is not used as part of an *escape route* may be fitted with a *fire shutter*. Amend 2 Nov 2020

4.16.16 The *fire shutter* shall be automatically activated by a signal from a smoke detector.

4.16.17 A *fire shutter* shall include a device to retard the rate of closing to no more than 150 mm per second.

4.17 Interior surface finishes, floor coverings and suspended flexible fabrics

Surface finish requirements for walls and ceilings

4.17.1 *Surface finish* requirements shall be as specified in Table 4.3 for walls and ceilings.

Foamed plastics and combustible insulating materials

4.17.2 If *foamed plastics building* materials or *combustible insulating materials* form part of a wall or ceiling system, the completed system shall achieve a *Group Number* as specified in Table 4.3 and the *foamed plastics* shall comply with the flame propagation criteria as specified in AS 1366 Parts 1–4 for the material being used. This requirement does not apply to *building elements* listed in Paragraph 4.17.6.

Flooring

4.17.3 Flooring shall be either *non-combustible* or, when tested to ISO 9239-1, shall have a critical radiant flux of not less than that specified in Table 4.5 (refer to Appendix C2.1).

4.17.4 Paragraph 4.17.3 shall apply to flexible finishes such as carpets, vinyl sheet or tiles, and to finished or unfinished floor surfaces.

Wood and wood products in floors

4.17.5 In addition to the requirements of Paragraph 4.17.3, where floors in multi-storey *buildings* are *fire separations* and where the flooring material is made of wood products (which include boards manufactured from wood fibres or chips bound by an adhesive) the flooring material shall have either a thickness of no less than nominally 20 mm, or the floor assembly shall have an *FRR* of -/30/30 when exposed to *fire* from the flooring side.

Exceptions to surface finish requirements

4.17.6 *Surface finish* requirements do not apply to:

a) Small areas of non-conforming product within a *firecell* with a total aggregate surface area not more than 5.0 m^2, or

b) Electrical switches, outlets, cover plates and similar small discontinuous areas, or

c) Pipes and cables used to distribute power or services, or

d) *Handrails* and general decorative trim of any material such as architraves, skirtings and window components, including reveals, provided these do not exceed 5% of the surface area of the wall or ceiling they are part of, or

e) *Damp-proof courses,* seals, caulking, flashings, thermal breaks and ground moisture barriers, or

f) Timber joinery and structural timber *building elements constructed* from solid wood, glulam or laminated veneer lumber. This includes heavy timber columns, beams, portals and shear walls not more than 3.0 m wide, but does not include exposed timber panels or permanent formwork on the underside of floor/ceiling systems, or

g) Individual *doorsets,* or

h) Continuous areas of permanently installed openable wall partitions having a surface area of not more than 25% of the divided room floor area or 5.0 m^2, whichever is less, or

i) Marae *buildings* using traditional Māori *construction* materials (eg, tukutuku and toetoe panels), or

CA j) In ***risk group* CA** only, uniformly distributed roof lights where:

   i) the total area does not exceed 15% of the ceiling area (in plan), and

   ii) the minimum floor to ceiling height is not less than 6.0 m, and

   iii) the roof lights achieve a *Group Number* not greater than 3.

CA Educational buildings

4.17.7 Unsprinklered *firecells* containing classrooms, passageways and corridors of educational *buildings* need not comply with Table 4.3 provided all the following conditions are satisfied:

a) The *occupant load* is less than 250, and

b) The *firecells* are at ground floor level and are served by at least two *exitways* or *final exits*, and

c) The material *Group Number* is no more than 2–S for surfaces 1.2 m or more above floor level, and

d) The material *Group Number* is no more than 3 for surfaces less than 1.2 m above floor level.

Suspended flexible fabrics

4.17.8 When tested to AS 1530.2, suspended flexible fabrics shall, within all *occupied spaces* including *exitways*:

a) Have a *flammability index* of no greater than 12, and

b) When used as underlay to roofing or exterior cladding that is exposed to view, have a *flammability index* of no greater than 5.

Membrane structures

4.17.9 The fabric of structures such as tents, marquees or canopies shall be tested to AS 1530.2 and shall achieve a *flammability index* of no greater than 12.

4.17.10 The requirements for membrane structures need not apply to small *occupant loads* such as camping tents and horticultural applications.

Building services

4.17.11 Where air ducts are contained wholly within a *protected shaft*, provided the shaft does not also contain lifts, only the interior *surface finish* of the air duct is required to comply with Table 4.4.

4.17.12 The surfaces of *building* services shall be as per Table 4.4.

Trampers' huts

4.17.13 In trampers' huts (that are not *backcountry huts* as defined in BCH/AS1) used for overnight accommodation in remote locations, wall and ceiling linings with a maximum *Group Number* of 3 are acceptable provided that:

a) The *occupant load* is no greater than 20, and

b) All sleeping spaces have no fewer than two *escape routes*.

4.18 Building services plant

4.18.1 Where smoke control in air handling systems is required to prevent the recirculation of smoke through an air handling system to other *firecells* in a *building*, these systems shall be as specified in Appendix A A2.1.

Amend 2
Nov 2020

Table 4.3 **Internal surface finishes**
Paragraph 4.17

Fire protection	Maximum permitted Group Number				
	Exitways and Importance Level 4 buildings: walls and ceilings	Sleeping spaces where care or detention is provided: walls and ceilings	Other sleeping spaces (excluding within household units) and crowd spaces: ceiling surfaces	Other sleeping spaces (excluding within household units) and crowd spaces: wall surfaces	All other occupied spaces: walls and ceilings
Unsprinklered	1-S	1-S	2-S	2-S	3
Sprinklered	2	2	2	3	3

Amend 2
Nov 2020

Table 4.4 **Surfaces of building services**
Paragraphs 4.17.11 and 4.17.12

Building services	Maximum permitted Group Number	
	Spaces not protected with an automatic fire sprinkler system	Spaces protected with an automatic fire sprinkler system
Internal faces of ducts for *HVAC* systems and kitchen exhaust ducts[1]	1-S	2
External faces of ducts, acoustic treatment and pipe insulation within *exitways*[1]	1-S	2
Acoustic treatment and pipe insulation within sleeping uses	3	3
External faces of ducts for *HVAC* systems[1]	3	3

Notes:

1. Surfaces of rigid and flexible ductwork for *HVAC* systems may be assigned a material *Group Number* of 1-S when the ductwork complies with the *fire* hazard properties set out in AS 4254.

Table 4.5 **Critical radiant flux requirements for flooring (kW/m²)**
Paragraph 4.17.3

Risk group	Area of building					
	Exitways in all buildings and sleeping areas and treatment rooms in risk group SM, SI		Non-sleeping firecells accommodating more than 50 people		All other occupied spaces, other than household units	
	Sprinklered	Unsprinklered	Sprinklered	Unsprinklered	Sprinklered	Unsprinklered
SM	2.2	2.2	1.2	2.2	1.2	1.2
SI	2.2	4.5	1.2		1.2	
CA	2.2	2.2	1.2	2.2	1.2	1.2
WB	2.2	2.2	1.2	2.2	1.2	1.2
WS	2.2		1.2		1.2	
VP	2.2	2.2	1.2	2.2	1.2	1.2

Part 5: Control of external fire spread

CONTENTS

5.1 Fire separation for buildings with more than one title

5.1.1 Where a *building* is subdivided so that it straddles more than one title, it shall be separated from:

a) The part of the *building* on an adjacent title by *fire separations* having an *FRR* meeting the *property rating* in accordance with Paragraph 2.3, and

b) Any external area in common, unless Paragraph 5.1.2 applies, by *external walls* complying with Paragraph 5.3 except that, if roofed, the area in common shall be a *firecell* separated from adjacent titles by *fire separations* meeting the *property rating* in accordance with Paragraph 2.3.

5.1.2 Where a *building* is subdivided (as in Paragraph 5.1.1 a)), and all the titles and any areas in common are sprinklered, the requirements for *fire separations* of Paragraph 5.1.1 b) need not apply. However, the requirements for separation of *exitways* in Paragraphs 4.9.2 and 4.9.3, and sleeping areas in Paragraph 4.6 shall still apply.

VP **5.1.3** Refer to Paragraph 4.1.2 for allowances in vehicle parking areas of *buildings* separated into multiple titles.

5.2 Horizontal fire spread from external walls

Separation

5.2.1 Specific separation requirements for *unprotected areas* in *external walls* shall be applied in the following circumstances:

a) If, due to the configuration of a single *building* or the siting of other *buildings* on the same property, *external walls* of adjacent *firecells* are exposed to each other at an angle of less than 90°, and one or both *firecells* contain sleeping *risk groups* or *exitways*, or

b) If there are *unprotected areas* in *external walls* facing a *relevant boundary* to *other property* at an angle of less than 90°.

5.2.2 Protection shall be achieved by using one or more of the following approaches:

a) Provide a sprinkler system complying with NZS 4541 with a Class A or Class B2 water supply. This dispensation does not apply to parts of the *external wall* within 1.0 m of the *relevant boundary*, or where the *external wall* is of a *firecell* used for storage with a storage height greater than 3.0 m, or

b) Distance separation (refer to Paragraph 5.5), or

c) Limiting *unprotected areas* in *external walls* (refer to Paragraph 5.5), or

d) Using *fire resisting glazing* (refer to Paragraph 5.4).

5.2.3 Where the intersection angle of the *building* and the *relevant boundary* is 90° or greater, there are no requirements and an *unprotected area* of 100% is permitted for the *external wall.*

5.2.4 If a wall or part of a wall is less than 1.0 m from the *relevant boundary,* a combination of small *unprotected areas* and *fire resisting glazing* is permitted as detailed in Paragraph 5.4.

5.2.5 Table 5.2 applies only to the permitted *unprotected area* in *external walls* 1.0 m or more from the *relevant boundary*. This can be combined with the areas of *fire resisting glazing* and small *unprotected areas* in Paragraph 5.4.

5.2.6 Regardless of the method adopted, all parts of an *external wall* other than allowable *unprotected areas* shall have the appropriate *FRR* as specified by the relevant parts of this Acceptable Solution.

Analysis required for all external walls

5.2.7 The analysis shall be done for all *external walls* of the *building* to check the permitted *unprotected area* in each wall.

Notional boundary – firecells on the same property

5.2.8 For specific separation requirements for *unprotected areas* in *external walls of firecells* in the same *building*, or in separate *buildings* on the same property, a *notional boundary* shall be used instead of the *relevant boundary*. In such cases, when applying Tables 5.1, 5.2 and 5.3, the words *relevant boundary* shall be interpreted as *notional boundary*.

5.2.9 Where one or both *firecells* on the same property contain sleeping *risk groups* or *exitways*, analysis shall be done separately for each *firecell* with respect to the same *notional boundary*.

5.3 FRRs of external walls

5.3.1 *Building elements* that are part of an *external wall* that is required to be *fire* rated shall be *fire* rated as required by Paragraph 2.3. If a *safe path* has an *external wall*, that wall may be 100% unprotected provided any walls between the *safe path* and adjacent *firecells* have an *FRR* determined using the *property rating.*

5.3.2 Any part of an *external wall* enclosing a *firecell* and not permitted to be an *unprotected area* shall have an *FRR* in accordance with Paragraph 2.3. If the *external wall* is less than 1.0 m from the *relevant boundary* the wall shall be *fire* rated to protect from both directions.

5.3.3 When the *unprotected area* of an *external wall* is permitted to be 100%, but the *primary elements* in the line of that wall are required to be *fire rated*, the rating of those *primary elements* shall be no less than the *life rating* in accordance with Paragraph 2.3.

5.4 Small openings and fire resisting glazing

5.4.1 *External wall construction* shall meet the following requirements:

a) Small *unprotected areas* no greater than 0.1 m^2 (referred to as Type A areas) and areas of *fire resisting glazing* (referred to as Type B areas) shall be located to comply with Figure 5.1, and — Amend 2 Nov 2020

b) The remainder of the wall shall be *fire* rated in accordance with Paragraph 5.5.

5.4.2 The *fire resisting glazing* shall be rated for *integrity*, and the *FRR* of both the glazing and the *external wall* shall be in accordance with Paragraph 2.3. — Amend 2 Nov 2020

Size and spacing of Type A and Type B areas

5.4.3 Type A areas shall be no greater than 0.1 m^2. Type B areas shall be no greater than permitted by Table 5.1 according to the distance from the *relevant boundary*. — Amend 2 Nov 2020

5.4.4 There is no limitation on the spacing between adjacent Type A and Type B areas which occur in different *firecells*. Within a *firecell* the following requirements shall apply (refer to Figure 5.1):

a) Type A areas shall be no closer, both vertically and horizontally, than 1.5 m to another Type A or to a Type B area,

b) Type B areas shall be no closer to one another, vertically or horizontally, than the dimensions X or Y shown on Figure 5.1, and

c) Where Type B areas are staggered, rather than being aligned vertically or horizontally, the shortest distance, in any direction, between adjacent areas shall be no less than the greater of the X and Y measurements.

5.5 Table method for external walls

5.5.1 The table method for *external walls* is a means of satisfying the requirements of this Acceptable Solution for the control of external *fire* spread and shall be applied to *external walls* of *building*s which are parallel to or angled at less than 90° to the *relevant boundary*.

The maximum *unprotected area* for *external walls* shall be specified in:

SM SI a) Table 5.2a for ***risk groups* SM** and **SI**, and

CA b) Table 5.2b for ***risk group* CA**, and

WB VP c) Table 5.2c for ***risk group* WB** professional activities, industrial activities, and intermittently occupied *buildings* and ***risk group* VP**, and

WB d) Table 5.2d for ***risk group* WB** storage activities, and

WS e) Table 5.2e for ***risk group* WS**.

Tables 5.2a, 5.2b, 5.2c, 5.2d and 5.2e are split into three parts according to the angle incident between the subject wall and the *relevant boundary* (see Figure 5.2 and Figure 5.3).

Amend 2 Nov 2020

5.5.2 The table method shall be used to determine the percentage of *unprotected area* in the *external wall* of each *firecell* depending on the distance to the *relevant boundary* from the closest *unprotected area*.

5.5.3 Tables 5.2a, 5.2b, 5.2c, 5.2d and 5.2e can also be used to determine the required distance from the *relevant boundary to* the closest *unprotected area* where the percentage of *unprotected area* has previously been determined. Select the appropriate percentage (under the rectangle width column) and read the permitted distance to the *relevant boundary* from the left hand column of Table 5.2. Amend 2 Nov 2020

5.5.4 Tables 5.2a, 5.2b, 5.2c, 5.2d and 5.2e do not contain the exact measurements for the *firecell* being considered, use the next highest value for percentage area or next lowest value for *boundary* distance. Amend 2 Nov 2020

5.5.5 The largest individual *unprotected area* in the *external wall* and distance to any adjacent *unprotected areas* shall be restricted to the maximum dimensions specified in Table 5.3 (for the applicable *risk group*).

CA VP WB WS **5.5.6** In ***risk groups* CA**, **WB**, **WS** and **VP**, where the *firecell* is wider than 30 m, the *external wall* shall be divided into a number of 30 m widths and each of these can be assessed separately when considering the size of the largest individual *unprotected* area specified in Table 5.3.

5.5.7 As an alternative to the table method, C/VM2 Appendix C: Methodology for design scenario HS: Horizontal fire spread (Tabular Data) can be used. For the C/VM2 Appendix C method, the *unprotected area* tables and the wing/return wall tables must be used together.

Amend 2 Nov 2020

Amend 2 Nov 2020

Table 5.1	Maximum permitted areas of fire resisting glazing (m²) Paragraph 5.4.2							
Minimum distance to relevant boundary (m)	Risk groups							
	SM[1]	CA		WB & VP Professional activities, industrial activities, and intermittently occupied building and risk group VP		WB Storage activities		WS
	Un-sprinklered	Un-sprinklered	Sprinklered	Un-sprinklered	Sprinklered	Un-sprinklered	Sprinklered	Sprinklered
0.0	1.0	1.0	5.0	1.0	5.0	1.0	1.0	1.0
0.1	1.0	1.0	6.5	1.0	6.0	1.0	1.0	1.0
0.2	1.0	1.0	7.5	1.0	7.5	1.0	1.0	1.0
0.3	1.0	1.0	9.0	1.0	9.0	1.0	1.0	1.0
0.4	1.0	1.0	10.0	1.0	10.0	1.0	1.5	1.5
0.5	1.5	1.0	11.0	1.0	11.0	1.0	2.5	2.5
0.6	2.0	1.0	13.0	1.0	13.0	1.0	3.5	3.5
0.7	3.0	1.5	14.0	1.5	14.0	1.0	5.0	5.0
0.8	3.5	2.0	15.0[3]	2.0	15.0[3]	1.0	6.5	6.5
0.9	5.0	3.0		2.5		1.5	7.5	7.5
1.0	6.0	3.5		3.5		1.5	8.5	8.5
1.1	7.5	4.5		4.0		2.0	9.5	9.5
1.2	8.5	5.5		5.5		2.5	10.0	10.0
1.3	10.0	7.0		7.0		3.0	11.0	11.0
1.4	12.0	8.0		8.0		3.5	12.0	12.0
1.5	13.0	8.5		8.5		4.0	13.0	13.0
1.6	14.0	9.5		9.5		5.0	14.0	14.0
1.7	15.0[2]	10.0		10.0		5.5	15.0[3]	15.0[3]
1.8		10.0		10.0		6.0		
1.9		11.0		11.0		6.5		
2.0		12.0		12.0		7.0		
2.1		13.0		13.0		7.5		
2.2		14.0		14.0		8.0		
2.3		15.0[3]		15.0[3]		8.5		
2.4						9.0		
2.5						9.5		
2.6						10.0		
2.7						11.0		
2.8						11.0		
2.9						12.0		

Amend 2 Nov 2020

continued

Table 5.1 Maximum permitted areas of fire resisting glazing (m²) /continued
Paragraph 5.4.2

Amend 2 Nov 2020

Minimum distance to relevant boundary (m)	Risk groups							
	SM [1]	CA		WB & VP Professional activities, industrial activities, and intermittently occupied building and risk group VP		WB Storage activities		WS
	Un-sprinklered	Un-sprinklered	Sprinklered	Un-sprinklered	Sprinklered	Un-sprinklered	Sprinklered	Sprinklered
3.0						12.0		
3.1						13.0		
3.2						14.0		
3.4						15.0[3]		

Amend 2 Nov 2020

Notes:

SM SI 1. For sprinklered *firecells* in ***risk groups*** **SM** and **SI** there is no limit on the permitted area of *fire resisting glazing*.

SM 2. For unsprinklered *firecells* in ***risk group*** **SM** there is no limit on the permitted area of *fire resisting glazing* at distances greater than 1.7 m from the *relevant boundary*.

SM SI 3. For all ***risk groups*** **other than SM** and **SI** the maximum permitted area of *fire resisting glazing* is 15 m².

Table 5.2a **Maximum percentage of unprotected area for external walls for risk groups SM and SI**
Paragraphs 5.2.8, 5.5.1 a), 5.5.3, 5.5.4

Risk group	Minimum distance to relevant boundary (m)[1]	Percentage of wall area allowed to be unprotected											
		Angle between wall and relevant boundary ≤ 45°				Angle between wall and relevant boundary > 45° to ≤ 60°				Angle between wall and relevant boundary > 60° to < 90°			
		Width of unsprinklered firecell (m)		Width of sprinklered firecell (m)		Width of unsprinklered firecell (m)		Width of sprinklered firecell (m)		Width of unsprinklered firecell (m)		Width of sprinklered firecell (m)	
		≤ 5	> 5	≤ 5	> 5	≤ 5	> 5	≤ 5	> 5	≤ 5	> 5	≤ 5	> 5
SM	< 1	0	0	0	0	0	0	0	0	0	0	0	0
	1	35	30	70	60	45	33	90	66	55	35	100	70
	2	55	40	100	80	70	45	100	90	85	55		100
	3	80	55		100	95	65		100	100	80		
	4	100	70			100	90				100		
	5		90				100						
	6		100										
SI	< 1			0	0			0	0			0	0
	1			70	60			90	66			100	70
	2			100	80			100	90				100
	3				100				100				

Notes:

1. See Figure 5.3

Amend 2
Nov 2020

Amend 2
Nov 2020

Table 5.2b **Maximum percentage of unprotected area for external walls for risk group CA**
Paragraphs 5.2.8, 5.5.1 b), 5.5.3 and 5.5.4

Risk group	Minimum distance to relevant boundary (m)[1]	Percentage of wall area allowed to be unprotected											
		Angle between wall and relevant boundary ≤ 45°				Angle between wall and relevant boundary > 45° to ≤ 60°				Angle between wall and relevant boundary > 60° to < 90°			
		Width of unsprinklered firecell (m)		Width of sprinklered firecel (m)		Width of unsprinklered firecell (m)		Width of sprinklered firecel (m)		Width of unsprinklered firecell (m)		Width of sprinklered firecell (m)	
		≤ 10	> 10	≤ 10	> 10	≤ 10	> 10	≤ 10	> 10	≤ 10	> 10	≤ 10	> 10
	< 1	0	0	0	0	0	0	0	0	0	0	0	0
	1	20	20	40	40	20	20	40	40	23	20	46	40
	2	22	20	44	40	25	20	50	40	30	22	60	44
	3	25	25	50	50	30	25	60	60	39	25	78	50
	4	30	30	60	60	40	30	80	60	50	30	100	60
	5	40	30	80	60	50	30	100	60	64	40		80
	6	45	35	90	70	60	40		80	79	45		90
	7	55	40	100	80	70	45		90	90	55		100
CA	8	65	45		90	85	50		100	100	65		
	9	75	50		100	95	55				75		
	10	90	55			100	65				90		
	11	100	65				75				100		
	12		70				85						
	13		80				95						
	14		90				100						
	15		95										
	16		100										

Notes:

Amend 2 Nov 2020

1. See Figure 5.3

Table 5.2c **Maximum percentage of unprotected area for external walls for risk group WB professional activities, industrial activities, and intermittently occupied buildings and risk group VP**
Paragraphs 5.2.8, 5.5.1 c), 5.5.3 and 5.5.4

Risk group	Minimum distance to relevant boundary (m)[1]	Percentage of walls allowed to be unprotected											
		Angle between wall and relevant boundary ≤ 45°				Angle between wall and relevant boundary > 45° to ≤ 60°				Angle between wall and relevant boundary > 60° to < 90°			
		Width of unsprinklered firecell (m)		Width of sprinklered firecell (m)		Width of unsprinklered firecell (m)		Width of sprinklered firecell (m)		Width of unsprinklered firecell (m)		Width of sprinklered firecell (m)	
		≤ 10	> 10	≤ 10	> 10	≤ 10	> 10	≤ 10	> 10	≤ 10	> 10	≤ 10	> 10
	< 1	0	0	0	0	0	0	0	0	0	0	0	0
	1	20	20	40	40	20	20	40	40	25	20	50	40
	2	25	25	50	50	30	25	60	50	35	25	70	50
	3	30	30	60	60	40	30	80	60	40	30	80	60
	4	40	35	80	70	50	35	100	70	50	40	100	80
WB	5	50	40	100	80	65	40		80	60	50		100
VP	6	60	50		100	80	50		100	75	60		
	7	75	55			90	60			90	75		
	8	90	60			100	70			100	90		
	9	100	70				80				100		
	10		80				90						
	11		90				100						
	12		100										

Notes:

1. See Figure 5.3

Amend 2
Nov 2020

Table 5.2d **Maximum percentage of unprotected area for external walls for risk group WB storage activities**
Paragraphs 5.2.8, 5.5.1 d), 5.5.3 and 5.5.4

Risk group	Minimum distance to relevant boundary (m)[1]	Percentage of wall area allowed to be unprotected					
		Angle between wall and relevant boundary ≤ 45°		Angle between wall and relevant boundary > 45° to ≤ 60°		Angle between wall and relevant boundary > 60° to < 90°	
		Width of unsprinklered firecell (Any width)	Width of sprinklered firecell (Any width)	Width of unsprinklered firecell (Any width)	Width of sprinklered firecell (Any width)	Width of unsprinklered firecell (Any width)	Width of sprinklered firecell (Any width)
WB	< 1	0	0	0	0	0	0
	1	10	20	15	30	15	30
	2	15	30	15	35	15	35
	3	20	40	20	40	20	40
	4	20	45	25	50	25	50
	5	25	50	25	55	30	60
	6	30	60	30	60	35	70
	7	35	70	35	70	40	80
	8	40	80	45	90	50	100
	9	40	85	50	100	55	
	10	45	90	55		65	
	11	50	100	60		70	
	12	60		70		80	
	13	65		80		90	
	14	70		85		100	
	15	100		100			

Notes:

1. See Figure 5.3

Amend 2
Nov 2020

Table 5.2e **Maximum percentage of unprotected area for external walls for risk group WS**
Paragraphs 5.2.8, 5.5.1 e), 5.5.3and 5.5.4

Risk group	Minimum distance to relevant boundary (m)[1]	Percentage of wall area allowed to be unprotected					
		Angle between wall and relevant boundary ≤ 45°		Angle between wall and relevant boundary > 45° to ≤ 60°		Angle between wall and relevant boundary > 60° to < 90°	
		Width of sprinklered firecell (m)		Width of sprinklered firecell (m)		Width of sprinklered firecell (m)	
		≤ 20	> 20	≤ 20	> 20	≤ 20	> 20
WS	< 1	0	0	0	0	0	0
	1	20	20	25	20	25	20
	2	30	25	30	30	30	25
	3	30	30	35	30	35	30
	4	35	35	40	35	40	35
	5	40	40	45	40	50	40
	6	45	40	50	45	60	50
	7	50	50	60	50	70	60
	8	60	55	65	60	85	65
	9	65	60	80	65	100	75
	10	70	65	90	75		90
	11	80	70	100	80		100
	12	90	80		90		
	13	100	85		100		
	14		95				
	15		100				

Notes:
1. See Figure 5.3

Amend 2
Nov 2020

Amend 2
Nov 2020

Table 5.3 **Maximum size of largest permitted single unprotected area in external walls**
Paragraphs 5.2.8, 5.5.5 and 5.5.6

Risk group	Minimum distance to relevant boundary (m)[1]	Unsprinklered firecell		Sprinklered firecell	
		Maximum largest single unprotected area (m²)	Minimum distance to adjacent unprotected areas (m²)	Maximum largest single unprotected area (m²)	Minimum distance to adjacent unprotected areas (m²)
SM	1	1.0	1.0	15	1.5
	2	6.0	1.5	35	2.5
	3	13	4.5	60	3.5
	4	20	5.5	96	4.0
	5	29	6.5	139	4.5
	6	40	7.5	No restriction	No restriction
SI	1			15	1.5
	2			35	2.5
	3			60	3.5
CA WB VP	1	1.0	0.5	15	1.5
	2	4.0	1.0	35	2.5
	3	10	5.0	60	3.5
	4	16	7.0	96	4.0
	5	23	8.0	139	4.5
	6	31	8.5	No restriction	No restriction
	7	40	9.5	No restriction	No restriction
	8	51	11	No restriction	No restriction
	9	64	13	No restriction	No restriction
	10	77	13.5	No restriction	No restriction
WS	1			15	1.5
	2			35	2.5
	3			60	3.5
	4			96	4.0
	5			139	4.5
	6			No restriction	No restriction

Notes:
1. See Figure 5.3

Amend 2
Nov 2020

5.6 Horizontal fire spread from roofs and open sided buildings

WB VP **5.6.1** For ***risk groups* WB** and **VP**, in *buildings* other than offices and laboratories where the roof of an unsprinklered *firecell* is within 1.0 m of a *relevant boundary*, horizontal *fire* spread shall be resisted by either:

a) *Fire* rating (for *fire* exposure from below) that part of the roof within 1.0 m of the *relevant boundary*. The *FRR* shall be based on the *property rating* for the *firecell*, except that *insulation* is not required, or

b) Extending the wall, being a *fire separation* along or adjacent to the *relevant boundary*, no less than 450 mm above the roof to form a parapet.

Parapets for unsprinklered firecells

5.6.2 Where sprinklers are not provided, and an area of roof within 1.5 m of the *relevant boundary* is used for storage of *combustible* materials or vehicle parking, a parapet shall be provided which extends no less than 1.5 m above the roof level with an *FRR* according to the *property rating* of Paragraph 2.3. For ***risk group* VP** this parapet shall have an *FRR* of no less than 30 minutes.

Roof projections

5.6.3 If the *external wall* is required to have an *FRR*, the eaves projection shall be *constructed* with the same *FRR* as the *external wall*. Alternatively, the *external wall* shall be extended to the underside of the roof and the eaves need not be *fire* rated (see Figure 5.4).

5.6.4 If the *external wall* is not required to have an *FRR*, roof eaves projecting from that wall need not be *fire* rated provided that no part of the eaves *construction* is closer than 650 mm to the *relevant boundary*.

5.6.5 If the *external wall*, on its own, is not required to have an *FRR*, but roof eaves extend to within 650 mm of the *relevant boundary*, the total eaves *construction* and the *external wall* from which they project shall have *FRR*s in accordance with Paragraph 2.3 (see Figure 5.4).

Eaves *construction* includes the guttering or spouting and any other projections from the eaves, although guttering or spouting need not be *fire rated*. Amend 2 Nov 2020

Open sided buildings

5.6.6 An open sided *building* may be either a detached *building* or connected to another *building* (see Figure 5.5). For the open sided *building* to be deemed 'detached', the horizontal distance between the other *building* and the roof of the open sided *building* shall be no less than:

a) 1.0 m for a roof area exceeding 40 m^2, or

b) 0.3 m for a roof no greater than 40 m^2.

5.6.7 Open sided *buildings* (see Figure 5.5), having only a single floor level may be *constructed* with *external walls* having 100% *unprotected area* provided that they:

a) Have no less than two sides completely open to the environment, and

b) Where attached to another *building*, both *buildings* are under the control of the same occupancy, and

c) For roof areas > 40 m^2, open sided *buildings* shall be no closer to a *relevant boundary* than:

   i) 1.0 m if in ***risk groups* SM**, **SI**, **CA** or **WS**, or

   ii) 3.0 m if in ***risk groups* WB** or **VP**, and

d) For roof areas ≤ 40 m^2, open sided *buildings* shall be no closer than 0.3 m to the *relevant boundary*.

5.6.8 Where the requirements of Paragraph 5.6.7 cannot be achieved the applicable *external wall/s* shall comply with all the requirements for the horizontal *fire* spread from *external walls* in accordance with Paragraph 5.2.

Floor projections

5.6.9 If a floor projects beyond the face of any part of an *external wall* which requires a *property rating*, or any part of the projection is closer than 1.0 m to the *relevant boundary*, the floor projection shall have the same *FRR* as the floor inside the *external wall*, and exposed exterior faces of the projection shall comply with Paragraph 5.8.

5.7 Vertical fire spread

Roofs

SM SI **5.7.1** Sleeping ***risk groups SM*** and ***SI***, *other property* and external *exitways* shall be protected against vertical *fire* spread from roofs.

5.7.2 Protection against *fire* spread shall be achieved using one or more of the following methods:

a) Separation by distance, and/or

b) *Fire* rating the adjoining *external wall*, and/or

c) *Fire* rating all or part of the roof, including its supporting structure, against the threat of *fire* from the underside, and/or

d) Installing sprinklers in the *firecell* below the roof.

External exitways over roofs

5.7.3 Subject to Paragraph 3.11, when an external *exitway* crosses a roof or is above or adjacent to a roof on the same or another *building*, the roof within 3.0 m of any part of the *exitway* and all supporting elements shall have an *FRR* in accordance with Paragraph 2.3.

Primary elements

5.7.4 *Primary elements* providing support to an area of *fire* rated roof shall have an *FRR* of no less than that of the roof.

5.7.5 When supporting an unrated roof:

a) *Primary elements* such as columns or walls which are required to be *fire* rated shall be rated from floor level to the underside of the roof framing members, and

b) Any roof framing members connected to these *fire* rated columns or walls shall also be rated if their collapse in *fire* would cause the consequential collapse of the rated columns or walls.

Fire spread from an adjacent lower roof

5.7.6 *Fire* spread from a roof close to and lower than an *external wall* in the same *building* (as the lower roof), or in an *adjacent building* on the same title shall be avoided by compliance with Paragraph 5.7.7 where *firecells* behind the wall contain:

a) *Other property*, or

SM SI b) Either ***risk group*** **SI** or **SM**, or

c) *Exitways*.

5.7.7 Where the distance between any part of an *external wall* and a lower roof is less than 9.0 m vertically or 5.0 m horizontally (see Figure 5.6), protective measures shall be applied either to the roof as specified in Paragraph 5.7.8 or to the wall as specified in Paragraph 5.7.9.

5.7.8 Roof protection shall be achieved by:

a) Providing sprinklers throughout the *building*, or

b) *Constructing* that part of the roof within 5.0 m horizontally of the wall, with an *FRR* in accordance with Paragraph 2.3 of the *firecell* below the roof.

5.7.9 *External wall* protection above an adjacent lower roof shall be provided by *constructing* the critical part of the wall (closer to the roof than 9.0 m vertically or 5.0 m horizontally (see Figure 5.6)) with an *FRR* in accordance with Paragraph 2.3.

External fire spread between different levels of the same building

5.7.10 Except where *firecells* are sprinklered, *unprotected areas* in *external walls* shall be protected against vertical *fire* spread if any of the following conditions occur:

SM a) An *escape height* of 4.0 m or more in ***risk group* SM**, or

CA WB VP b) *Exitways* with an *escape height* of 4.0 m or more in ***risk group* CA** or 10 m or more in ***risk groups* WB** and **VP**, or

c) *Firecells* containing retail areas having an *escape height* of 7.0 m or more, or

d) *Firecells* containing *other property* located one above the other.

5.7.11 If the conditions described in Paragraph 5.7.10 occur, *unprotected areas* (see Figure 5.7) in the *external walls* of the *firecells* shall be separated by no less than:

a) 1500 mm where any parts of the *unprotected areas* are vertically aligned above one another, or

b) 900 mm where the *unprotected areas* on one level are horizontally offset from those on the other level.

Spandrels and apron projections

5.7.12 Spandrels may be omitted where an apron projecting no less than 600 mm is *constructed*. Table 5.4 specifies the acceptable combinations of apron projection and spandrel height.

Figure 5.7 **Separation of unprotected areas**
Paragraph 5.7.11

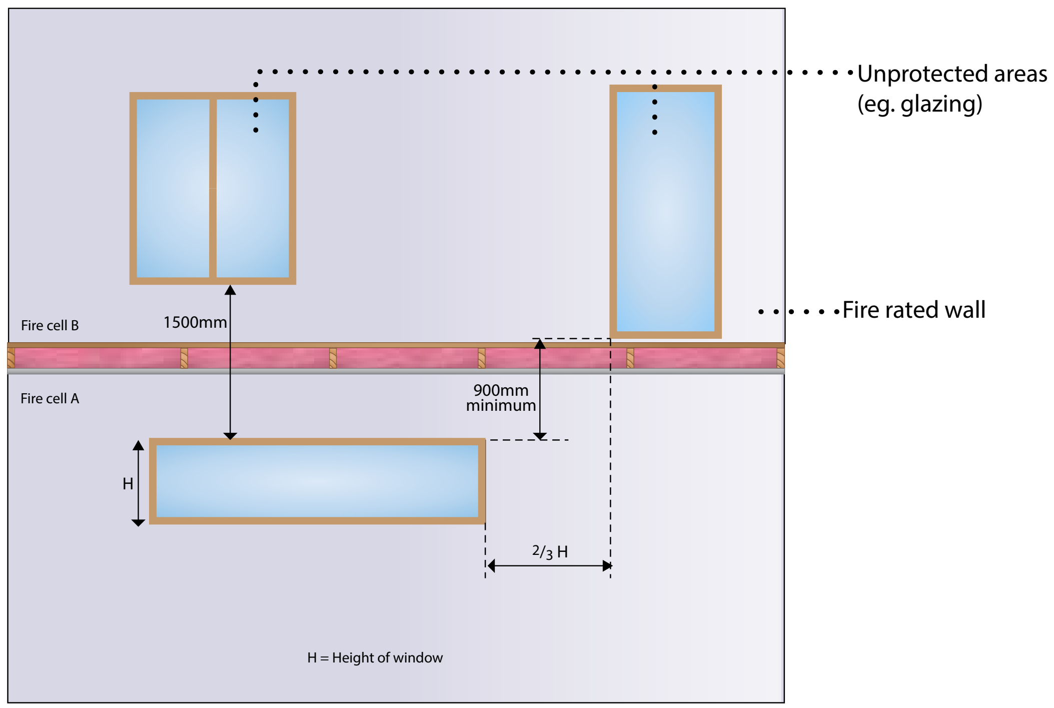


Table 5.4	Combination of aprons and spandrels
Apron projection (mm)	**Spandrel height (mm)**
0	1500
300	1000
450	500
600	0

5.7.13 Aprons shall extend horizontally beyond the outer corners of the *unprotected area* by no less than the apron projection distance. Aprons and spandrels shall have *FRR*s of no less than that of the floor separating the upper and lower *firecells*. Spandrels shall be rated from both sides. Aprons need only be rated from the underside.

Roof storage

5.7.14 Storage of *combustible* materials on a roof is not permitted within 1.5 m of a higher *external wall* if the *adjacent building* above contains sleeping *risk groups*.

Roof vehicle parking

VP **5.7.15** Where a roof used for vehicle parking is within 1.5 m of a higher *external wall* and the adjacent *building* above contains sleeping occupancies, *external wall* protection above the adjacent lower roof shall be provided by *constructing* the part of the wall (that is closer to the roof than 3.0 m vertically or 1.5 m horizontally) with an *FRR* of no less than that required from Table 2.3.

VP **5.7.16** Vertical distances shall be measured for vehicle parking from the *building* roof level. (See Paragraph 5.6.2 for parapet protection against horizontal *fire* spread.)

Amend 2
Nov 2020

5.8 External cladding systems

External wall cladding materials

5.8.1 Where *external walls* are located less than 1.0 m from a *relevant boundary*, cladding materials shall be:

a) *Non-combustible* or *limited combustible* materials; or

b) Tested in accordance with the relevant *standard test* in Appendix C C7.1 and achieve a Type A classification.

SI **5.8.2** For *buildings* containing ***risk group* SI**, where *external walls* are located more than 1.0 m from a *relevant boundary*, cladding materials shall be:

a) *Non-combustible* or *limited combustible* materials; or

b) Tested in accordance with the relevant *standard test* in Appendix C C7.1 and achieve a Type A or Type B classification.

5.8.3 In addition to the requirements in Paragraphs 5.8.1 and 5.8.2, where multi-level *buildings* have a *building height* of 10 m or more, cladding materials shall be:

a) *Non-combustible* or *limited combustible* materials; or

b) Tested in accordance with the relevant *standard test* in Appendix C C7.1 and achieve a Type A classification; or

c) Part of an entire *external wall* cladding system that complies with Paragraph 5.8.4.

Amend 2 Nov 2020

Amend 2 Nov 2020

External wall cladding systems for multi-level buildings with a building height ≥ 25 m

5.8.4 The entire *external wall* cladding system shall be:

a) *Non-combustible* or *limited combustible* materials; or

b) Classified in accordance with AS 5113 and achieve a EW classification; or

c) Tested in accordance with BS 8414-1 and satisfy the acceptance criteria in BR 135; or

d) Tested in accordance with BS 8414-2 and satisfy the acceptance criteria in BR 135; or

e) Tested in accordance with NFPA 285 and pass, and cladding materials shall be:

   i) *non-combustible* or *limited combustible* materials; or

   ii) tested in accordance with the relevant standard test in Appendix C C7.1 and achieve a Type A classification.

Cavity barriers

5.8.5 The spread of *fire* through cavities in an *external wall* shall be avoided by providing *cavity barriers* at each floor level. *Cavity barriers* shall comply with the requirements in Paragraphs 4.15.3 to 4.15.5. Amend 2 Nov 2020

Part 6: Firefighting

CONTENTS

6.1 Fire and Emergency New Zealand vehicular access

6.1.1 If *building*s are located remotely from the street boundaries of a property, pavements situated on the property and likely to be used by Fire and Emergency New Zealand vehicles to reach a hard-standing shall:

a) Be able to withstand a laden weight of up to 25 tonnes with an axle load of 8 tonnes or have a load-bearing capacity of no less than the public roadway serving the property, whichever is the lower, and

b) Be trafficable in all weathers, and

c) Have a minimum width of 4.0 m, and

d) Provide a clear passageway of no less than 3.5 m in width and 4.0 m in height at site entrances, internal entrances and between *building*s, and

e) Provide access to a hard-standing from which there is an unobstructed path to the *building* within 20 m of:

i) the firefighter access into the *building*, and

ii) the inlets to *fire* sprinkler systems or *building fire* hydrant systems, where these are installed.

SI **6.1.2** For ***risk group* SI** only, the following requirements shall be met in addition to those in Paragraph 6.1.1:

a) Roadway pavements shall withstand a vehicle of multiple axles spaced at no less than 2.5 m centres, and each carrying 8.2 tonnes, and

b) Where a property includes two or more *buildings*, any one of which has a *building height* greater than 7.0 m, roadway widths shall be no less than 6.5 m, corners and bends shall have a minimum radius of 12.5 m and turning areas shall be a minimum of 25 m from wall to wall, and

c) Hard-standings shall be provided adjacent to any *building* having a *building height* greater than 7.0 m.

SI **6.1.3** For ***risk group* SI** only, the location and extent of hard-standings shall be determined in consultation with Fire and Emergency New Zealand.

6.2 Information for firefighters

6.2.1 If *fire* alarm or sprinkler systems are installed, the control panel shall be located in a position close to the Fire and Emergency New Zealand attendance point and in accordance with NZS 4512, NZS 4515 and NZS 4541 as appropriate.

6.2.2 If *hazardous substances* are present in the *building,* warning signage in accordance with F8/AS1 shall be displayed.

6.3 Firefighting facilities

6.3.1 The control features of *fire safety systems* shall be located at a position with ready access from street level and protected from the effects of *fire* including debris falling from upper floors.

Fire hydrant system

6.3.2 *Building fire* hydrant systems shall be installed as specified in Paragraph 2.2 and shall meet the requirements of NZS 4510.

Fire and Emergency New Zealand lift control

6.3.3 Fire and Emergency New Zealand lift control is required if the *escape height* exceeds 10 m. The control of lifts under *fire* conditions shall comply with NZS 4332.

Part 7: Prevention of fire occurring

CONTENTS

The design, *construction* and/or installation of certain types of fixed appliances using controlled combustion and other fixed equipment is specified as follows.

7.1 Solid fuel appliances

7.1.1 AS/NZS 2918, with the modifications given in Paragraph 7.1.2, is an Acceptable Solution for the installation of:

a) Domestic solid fuel burning appliances installed in either domestic or commercial situations, and

b) *Flue systems*.

7.1.2 Modifications to AS/NZS 2918

Delete Paragraph 3.8 and substitute the following:

"3.8 Seismic restraint

The appliance and the floor protector shall be mechanically fixed to the floor itself.

The test seismic force shall be taken as the application of a horizontal force equal to 0.40 times the appliance weight acting in any direction at the mid height of the combustion chamber. The appliance shall not move, tilt or be dislodged from its installed position during the application of the test force.

The weight of the flue system and a wetback, if fitted, shall not be included in the test."

Delete Section 7 and substitute the following:

"7.1 Ventilation

Ventilation shall be in accordance with Acceptable Solution G4/AS1.

7.2 Water heating equipment

Water heating appliances installed in conjunction with the heating appliance shall be vented and shall comply with Acceptable Solution G12/AS1."

7.2 Gas-burning appliances

7.2.1 Gas-burning appliances must be installed in accordance with NZBC Clause G11.

Amend 2
Nov 2020

7.3 Oil-fired appliances

7.3.1 AS 1691, with the modifications given in Paragraph 7.3.2, is an Acceptable Solution for the installation of domestic oil-fired appliances.

7.3.2 Modifications to AS 1691

Delete Paragraph 2.2.3 and substitute the following:

"2.2.3 Electrical equipment

Electrical equipment shall comply with Acceptable Solution G9/AS1 or Verification Method G9/VM1."

Delete "CSIRO durability Class 2 or better" from Paragraph 3.1.2 (b) and substitute "H5 treatment".

Delete the Note to Paragraph 3.1.2 (d).

Delete Paragraph 3.1.4 and substitute the following:

"3.1.4 Stability

The appliance shall be mechanically fixed to the building.

The test seismic force on the fuel tank shall be taken as the application of a horizontal force in kilograms numerically equal to 0.40 times the tank volume in litres acting at the centre of the tank. The test seismic force on the appliance shall be taken as the application of a horizontal force equal to 0.40 times the appliance operating weight acting at the centre of the appliance.

The appliance and the fuel tank shall resist their respective seismic forces with no significant movement."

Delete the words "without specific approval" from Paragraph 3.2.8 (b).

Delete Paragraph 5.1.1.

Add the following Note to 5.2.2:

"Note: Refer to Acceptable Solution G4/AS1 for ventilation requirements."

7.3.3 AS/NZS 2918 Sections 2 and 4 are also Acceptable Solutions for the installation of *flues* for domestic oil-fired appliances.

7.4 Electrical fire safety

7.4.1 Electrical installations in *buildings* must be installed in accordance with NZBC Clause G9.

Amend 2
Nov 2020

Table 7.1	Minimum acceptable dimensions of chimneys		
Chimney construction	Chimney jamb and chimney back thickness		Chimney breasts and side gathering and chimney wall thickness above the level of the gather, excluding linings (mm)
	Excluding filling and flue liner (mm)	Including filling and flue liner (mm)	
Concrete	170	255	170
Brickwork	155	230	155
Precast pumice concrete	85	170	85

7.5 Open fires

Chimneys

7.5.1 *Chimneys* shall be *constructed* in accordance with Table 7.1 and Figure 7.1. They shall have:

a) *Fireplaces* lined with *fire* bricks having a thickness of no less than 50 mm

b) *Fireplace* joints of *non-combustible* material and shall be sealed against air leakage

c) *Chimney* brickwork of no less than a single skin of brick 90 mm thick plus a 65 mm thick layer of grout, and

d) An expansion gap provided in *chimneys* containing *flue liners*. These *flue liners* shall be wrapped in a *combustible* material of thickness no less than 0.25 mm (e.g. heavy-quality *building* paper) to prevent the grout filling from bonding with the *flue liner*.

7.5.2 Cross-sectional areas of *flues* shall be no less than 0.03 m^2 for an open *fireplace* (see Figure 7.2).

7.5.3 *Flue liners* shall be one of the following types:

a) Clay *flue liners* with rebated or socketed joints, or

b) Imperforate clay pipes with socketed joints, or

c) High alumina cement and kiln-burnt aggregate pipes, with rebated or socketed joints, or steel collars around joints.

The *flue liner*s shall be fitted with the sockets or rebates uppermost to prevent condensate running out, and to prevent any caulking material from being adversely affected. Joints between the *flue liners*, and any space between *flue liners* and the masonry, shall be filled with weak mortar or insulating concrete (see Figure 7.2(a)).

7.5.4 *Flue liners* are not required for:

a) Brick *chimneys* if *constructed* of two 90 mm skins of brickwork with a 65 mm grout-filled gap between (see Figure 7.2 b)), or

b) Ordinary concrete *chimneys*, or

c) Precast pumice concrete *chimneys*.

7.5.5 Clearance above roofs shall be in accordance with AS/NZS 2918 Figure 4.9.

7.5.6 Every *fireplace* shall have a separate *flue*.

7.5.7 *Flue* joints shall be of *non-combustible* material and sealed against air leakage.

7.5.8 *Hearths* for *fireplaces* shall:

a) Be *constructed* of fully grouted stones, bricks or concrete of no less than 50 mm total thickness,

b) Extend no less than 230 mm on each side of the *fireplace* opening, and no less than 380 mm forward of the *fireplace* opening, and

c) Have no *combustible* material closer than the clearances given in Paragraph 7.5.8 b) from the upper and lower surfaces of the *hearth*.

7.5.9 Clearances between a *chimney* and any *combustible* material (see Figure 7.3) shall be no less than:

a) 200 mm at any opening in the *flue*, or at the *fireplace* opening, and

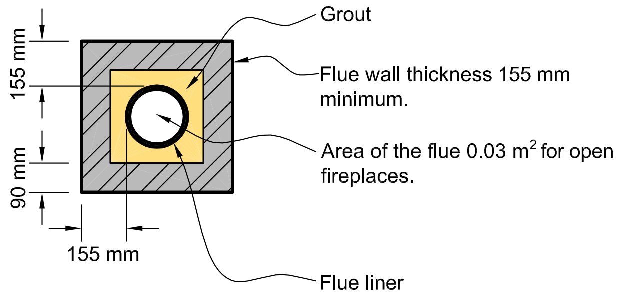
b) 200 mm above or below the upper surface of the *hearth*, and 75 mm from the lower surface of the *hearth*.

7.5.10 *Hearth* edges are to be separated from *combustible* material with *insulating material* having a minimum service operating temperature of 150°C.

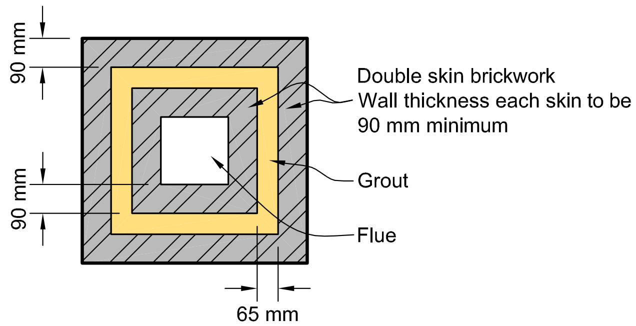
7.5.11 A ventilated space of no less than 50 mm shall be provided between the outer face of a *fireplace*, *chimney* or *flue* and any *combustible* material.

7.5.12 AS/NZS 2918 Sections 2 and 4 are also Acceptable Solutions for the installation of *flues* from open *fires*.

Figure 7.2 **Brick chimney flues – sections**
Paragraphs 7.5.2 and 7.5.4



(a) With flue liner



(b) Without flue liner

Appendix A (normative): Fire safety systems

A1.1 Fire alarm and sprinkler systems

A1.1.1 *Fire* alarm systems used in *fire safety systems* shall satisfy the requirements of Acceptable Solution F7/AS1. *Fire* sprinkler systems used in *fire safety systems* shall, except where specified, also satisfy the requirements of Appendix B.

A1.2 Requirements common to alarm systems

A1.2.1 All fire alarm systems (except for domestic smoke alarm systems), unless otherwise specified and regardless of their means of activation, shall be provided with a means of communication with Fire and Emergency New Zealand in accordance with Acceptable Solution F7/AS1.

A2.1 Fire safety system descriptions

A2.1.1 The following text provides a brief description of *fire safety systems* not otherwise described in Acceptable Solution F7/AS1. See F7/AS1 for descriptions of *fire* alarm systems Types 1, 2, 3, 4, 5, 6 and 7, and Table 2.2 of this Acceptable Solution.

Type 9 – Smoke control in air-handling systems

Where smoke control is required in relation to heating, ventilating or air conditioning systems, it shall comply with the requirements of either:

a) AS/NZS 1668.1 for *HVAC* system shutdown and interface with any Type 4 or 7 system, or

b) NZS 4512 to provide ancillary function output for *HVAC* system shutdown if a Type 4 or 7 alarm system is used as a means of smoke detection.

Type 15 – Fire and Emergency New Zealand Lift Control

The control of lifts under *fire* conditions shall comply with NZS 4332.

Type 18 – Fire hydrant systems for buildings

Fire hydrant systems shall comply with NZS 4510.

Appendix B (normative): Fire sprinkler systems

B1.1 Introduction

B1.1.1 Wherever sprinklers are required by this Acceptable Solution, they shall comply with the relevant New Zealand Standard, amended as shown in Paragraphs B2.1 and B3.1.

B2.1 Automatic fire sprinkler systems

B2.1.1 **NZS 4541** is amended as follows:

Clause 103 Definitions

Sprinkler system A system including:

(a) to (i) No change.

(j) Delete.

(k) Delete.

(l) No change.

Clause 205 Delete entire clause.

Clause 209 Delete entire clause.

Clause 1203 Routine Surveys

Clause 1203.1

Delete first two paragraphs and replace with:

> "It is important that a sprinkler system at all times complies with this Standard as amended by Paragraph B2.1 of Appendix B to C/AS2 in all respects. To ensure that building alterations, changes in process or storage patterns or progressive deterioration of system components do not prejudice system compliance, a comprehensive survey shall be carried out biennially at intervals not exceeding 28 months. Such surveys shall be carried out by an independent qualified person."

B3.1 Residential fire sprinkler systems

B3.1.1 **NZS 4515** is amended as follows:

Clause 1.5 Definitions

Sprinkler system A system including:

(a) to (g) No change.

(h) Delete.

Clause 1.11 Delete entire clause.

Clause 2.1.2 Delete.

Clause 2.1.3 Delete.

Appendix C (normative): Test methods

C1.1 General

This Appendix contains test methods for confirming that specific *building elements* satisfy relevant provisions of this Acceptable Solution for Protection from Fire. It includes both established *standard tests* and other test methods for *building elements* in situations where *standard tests* are unavailable.

If these specific *building elements* have been tested to a version of a Standard in force at the date of testing and a later version of that Standard has been incorporated by reference in this Acceptable Solution, retesting is not required.

C2.1 Flammability of floor coverings

Materials shall be assigned a critical radiant flux via either:

a) Testing to ISO 9239 Reaction to fire tests for flooring– Part 1: Determination of the burning behaviour using a radiant heat source, or

b) Adequacy, determined through following the methodology in C/VM2 Appendix B Table B1.

C3.1 Flammability of suspended flexible fabrics and membrane structures

Materials shall be assigned a *flammability index* when tested to:

a) AS 1530 Methods for fire tests on building materials and structures – Part 2: Test for flammability of materials.

C4.1 Properties of lining materials

C4.1.1 Combustibility test

Materials shall be classified as:

a) *Non-combustible* or *combustible* when tested to AS 1530 Methods for fire tests on building materials and structures – Part 1: Combustibility test for materials; or Amend 2 Nov 2020

b) *Non-combustible* when classified as A1 in accordance with BS EN 13501-1 Fire classification of construction products and building elements – Part 1:2018 Classification using test data from reaction to fire tests; or

c) *Limited combustible* when classified as A2 in accordance with BS EN 13501-1 Fire classification of construction products and building elements – Part 1:2018 Classification using test data from reaction to fire tests. Amend 2 Nov 2020

C4.1.2 Material for internal surface linings shall be given a *Group Number* in accordance with Appendix A of C/VM2 via one the following methods:

a) Testing to ISO 5660 Reaction-to-fire tests – Part 1: Heat release rate (cone calorimeter method), and Part 2 Smoke production rate (dynamic method), or

b) Testing to ISO 9705 Fire tests – Full scale room test for surface products, or

c) Equivalency determined through an approved alternative test or classification method as provided in Table C1.1, or

d) Adequacy may be determined by applying the values in Table C1.2.

Table C1.1	Alternative test or classification standards for Group Numbers	
Requirements according to C/VM2 Appendix A using ISO 9705 or ISO 5660	**Australian requirements according to NCC Specification C1.10 Clause 4 using AS ISO 9705**	**European Classification using EN 13501-1**
Group Number 1-S	Group Number 1, and a smoke growth rate index not more than 100	Class A1, A2 or Class B and smoke production rating s1 or s2
Group Number 1	Group Number 1	Class A1, A2 or B
Group Number 2-S	Group Number 2, and a smoke growth rate index not more than 100	Class C and smoke production rating s1 or s2
Group Number 2	Group Number 2	Class C
Group Number 3	Group Number 3	Class D
Group Number 4	Group Number 4	Class E and F

Table C1.2	Specified performances for some substrate and coating combinations	
Coating (coating in good condition and well adhered to substrate)	**Substrate**	**Group Number**
Waterborne or solvent borne paint coatings ≤ 0.4 mm thick Polymeric films ≤ 0.2 mm thick	Concrete and masonry ≥ 15 mm thick Sheet metal ≥ 0.4 mm thick Fibre-cement board ≥ 6.0 mm thick Porcelain, ceramic, glass, solid stone or similar tiles	1-S
Waterborne or solvent borne paint coatings ≤ 0.4 mm thick	Gypsum plasterboard with or without paper facing ≥ 9.5 mm thick	2-S
Waterborne or solvent borne paint coatings, varnish or stain ≤ 0.4 mm thick ≤ 100 g/m^2	Solid wood or wood product ≥ 9.0 mm thick ≥ 600 kg/m^3 for particle boards, or ≥ 400 kg/m^3 for all other wood and wood products	3
Note: The requirements of this table do not apply to metal faced panels with polymeric substrate.		

C5.1 Fire resistance

C5.1.1 *Primary elements* and *secondary elements*, closures and *fire stops* shall be assigned a *fire resistance rating (FRR)* when tested to:

a) AS 1530 Methods for fire tests on building materials and structures – Part 4: Fire resistance tests of elements of building construction, or

b) NZS/BS 476 Fire tests on building materials and structures – Parts 21 and 22.

C5.1.2 *Fire stops* shall be tested:

a) In circumstances representative of their use in service, paying due regard to the size of expected gaps to be *fire stopped*, and the nature of the *fire separation* within which they are to be used, and

b) In accordance with AS 4072: Components for the protection of openings in fire resistent separating elements – Part 1: Service penetrations and control joints.

C6.1 Fire doors and smoke control doors

C6.1.1 *Fire doors* shall be evaluated in circumstances representative of their use in service, and shall comply with NZS 4520 Fire-resistant doorsets.

Smoke control doors

C6.1.2 A door shall be deemed to be a *smoke control door* if, in addition to the requirements in this Acceptable Solution for *smoke control doors:*

a) The door is a *fire door* that is fitted with appropriate smoke seals, or

b) It is *constructed* with solid core leaves. Solid timber core leaves, when used, shall have a leaf thickness of no less than 35 mm, and

c) It is provided with smoke seals as required by this Acceptable Solution. Smoke seals shall be in continuous contact with the mating element, and located so as to minimise interruption by hardware, and

d) The frames are constructed of timber, and the jambs are no less than 30 mm thick, and

e) Any vision panel cut-outs are no less than 150 mm from the leaf edges, and

f) The maximum average clearances (excluding pre-easing) are

   i) Leaf to frame 3 mm

   ii) Leaf to leaf 5 mm

   iii) Leaf to top of any floor covering 10 mm, and

g) Any additional facings are adhesive fixed, and

h) It is provided with signage identifying it as a *smoke control door* in accordance with Acceptable Solution F8/AS1.

Frictional forces

C6.1.3 The forces required to open any *fire door* or *smoke control door* on an *escape route* shall not exceed 67 N to release the latch, 133 N to set the door in motion, and 67 N to open the door to the minimum required width. These forces shall be applied at the latch stile.

SI These requirements do not apply to horizontal sliding doors in ***risk group* SI** or to power-operated doors.

Self-closing provision

C6.1.4 All *fire* and *smoke control door* leaves shall be self-closing, and provision shall be made for the self-closing device to be adjustable during commissioning to satisfy the requirements of Paragraph C6.1.3 after installation.

C6.1.5 Where it is desirable in normal circumstances for a *fire door* or *smoke control door* to operate freely, it is acceptable to use a self-closer mechanism which activates in the event of *fire* but does not operate at other times.

Automatic smoke-sensing devices

C6.1.6 Automatic smoke-sensing devices complying with NZS 4512, if used, shall be positioned within the stream of air that passes the door when the *smoke control door* is fully open.

C7.1 Fire properties of external wall cladding systems

Amend 2 Nov 2020

C7.1.1 Cladding materials shall be classified using the values in Table C1.3 when tested in accordance with:

a) ISO 5660 Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 1: Heat release rate (cone calorimeter method), or

b) AS/NZS 3837 Method of test for heat and smoke release rates for materials and properties using an oxygen consumption calorimeter.

Amend 2 Nov 2020

C7.1.2 In addition to meeting the general requirements of ISO 5660 Part 1 or AS/NZS 3837, testing shall be in accordance with the following specific requirements:

Amend 2 Nov 2020

a) An applied external heat flux of 50 kW/m^2, and

b) A test duration of 15 minutes, and

c) The total heat release measured from start of the test, and

d) Sample orientation horizontal, and

e) Ignition initiated by the external spark igniter.

C7.1.3 Timber claddings which have a *fire retardant* treatment incorporated in or applied to them shall be subjected to the regime of accelerated weathering described in ASTM D 2898 Method B with the water flow rate from Method A before testing in accordance with the requirements of Paragraph C7.1.1.

C7.1.4 Claddings incorporating a metal facing with a melting point of less than 750°C covering a *combustible* core or insulant shall be tested as described in Paragraph C7.1.2 without the metal facing present.

Amend 2 Nov 2020

Table C1.3 Classification of cladding materials
C7.1.1

Cladding material type	Peak heat release rate (kW/m^2)	Total heat released (MJ/m^2)
Type A	≤ 100	≤ 25
Type B	≤ 150	≤50

Amend 2 Nov 2020

Using this Verification Method or Acceptable Solution

The Ministry of Business, Innovation and Employment may amend parts of this document at any time. People using this document should check on a regular basis whether new versions have been published. The current version can be downloaded from www.building.govt.nz

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 other ways of achieving compliance.

Defined words (italicised in the text) are explained in the Building Code Clause A2 and in the Definitions section of this document. Classified uses of buildings are explained in the Building Code Clause A1.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

The Ministry of Business, Innovation and Employment
PO Box 10-729, Wellington.6140
Telephone 0800 242 243
Email: info@building.govt.nz

ISBN: 978-0-478-38168-9 (print)
ISBN: 978-0-478-38169-6 (electronic)

Acceptable Solutions and Verification Methods are available from www.building.govt.nz

New Zealand Government

Status of C/VM1 and C/AS1

This Verification Method C/VM1 and the Acceptable Solution C/AS1 in this document provide a means of compliance with the New Zealand Building Code Clauses C1-C6 Protection from Fire. C/VM1 and C/AS1 are issued under section 22 of the Building Act 2004 respectively as a Verification Method and an Acceptable Solution.

This Verification Method and Acceptable Solution provide one way that can be used to show compliance with the New Zealand Building Code Clauses C1-C6 Protection from Fire. Other ways of complying with the Building Code are described, in general terms, in the preface of the New Zealand Building Code Handbook.

When can you use C/VM1 and C/AS1

This Acceptable Solution and Verification Method are effective from 5 November 2020. They can be used to show compliance with the Building Code Clauses C1-C6 Protection from Fire. They do not apply to building consent applications submitted before 5 November 2020.

The previous version, Amendment 4, of this Acceptable Solution and Verification Method can be used to show compliance with the Building Code Clauses C1-C6 Protection from Fire until 3 November 2021. It can be used for building consent applications submitted before 4 November 2021.

Document History

	Date	Alterations	
New document	Effective from 10 April 2012	C/VM1 and C/AS1 are a new publication that can be used to show compliance with the Building Code Clauses C1-C6 Protection from Fire.	
Amendment 1 (Errata 1)	Effective from 15 February 2013 until 18 June 2014	p. 5 Contents pp. 7–8 References p. 15 C/VM1 1.1.1 p. 17 C/AS1 Table 1.1	p. 19 C/AS1 1.3 pp. 25–26 C/AS1 5.1, 5.3.1, 5.3.2, 5.4, 5.5 p. 37 C/AS1 C4.1.2 and C5.1.1 p. 40 Index
Amendment 2	Effective from 19 December 2013 until 28 February 2015	p. 5 Contents p. 7 References p. 12 Definitions p. 17 C/AS1 1.1.1, Table 1.1 p. 18 C/AS1 Figure 1.1 p. 19 C/AS1 1.3 p. 21 C/AS1 Table 2.1 p. 22 C/AS1 3.4, Table 3.2	pp. 23–24 C/AS1 4.2, 4.3 pp. 25–26 C/AS1 5.1, 5.3.1, Table 5.1 p. 27 C/AS1 6.1 p. 29 C/AS1 7.2 p. 36 B2.1.1 p. 38 C6.1.2 p. 40 Index
Amendment 3	Effective from 1 July 2014 to 30 May 2017	p. 5 Contents pp. 7–8 References pp. 9 and 12 Definitions p. 17 C/AS1 1.1.1, Table 1.1 p. 19 C/AS1 1.3 p.20 C/AS1 2.2.1 p. 22 C/AS1 Table 3.2 pp.23–24 C/AS1 4.2, 4.3	pp.25–26 C/AS1 5.1, 5.3, Figure 5.1, Table 5.1 p. 27 C/AS1 6.1 p. 29 C/AS1 7.4 p. 37 C1.1, C2.1, C4.1.2, C5.1.1 p. 40 Index
Amendment 4	Effective from 1 January 2017 until 3 November 2021	p. 7 References p. 21 2.3.1 p. 22 C/AS1 Table 3.2	p. 25 C/AS1 5.1.2
Amendment 5	Effective from 5 November 2020	p. 5 Contents pp. 7–8 References pp. 9– 14 Definitions	pp. 16 – 19 C/AS1 1.1–1.3, Table 1.1 p. 39 Appendix C C.7.1.4 p. 40 Index

Contents

Amend 5 Nov 2020

Amends 2 and 3

Errata 1 Feb 2013

References

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

Standards New Zealand

		Where quoted	
NZS/BS 476:-	Fire tests on building materials and structures		
Part 21: 1987	Methods for determination of the fire resistance of loadbearing elements of construction	AS1 C5.1.1	
Part 22: 1987	Methods for determination of the fire resistance of non-loadbearing elements of construction	AS1 C5.1.1	
AS/NZS 1668:-	The use of ventilation and air conditioning in buildings	VM1 1.1.1	
Part 1: 1998	Fire and smoke control in multi-compartment buildings *Amend: 1* (Errata 1 Feb 2013)	AS1 A2.1.1	
AS/NZS 2918: 2001	Domestic solid fuel burning appliances – installation	AS1 7.1.1, 7.1.2, 7.3.3 7.5.5, 7.5.10 Comment, Figure 7.2	
NZS 4510: 2008	Fire hydrant systems for buildings *Amend: 1*	AS1 A2.1.1	
NZS 4512: 2010	Fire detection and alarm systems in buildings	AS1 Table 2.1, Table 3.2, A2.1.1, C6.1.6	
NZS 4514:2009 (Amend 4 Jan 2017)	Interconnected Smoke Alarms for houses	AS1 Table 3.2	
NZS 4515: 2009	Fire sprinkler systems for life safety in occupancies of less than 2000 m^2	AS1 6.1.1, Table 2.1, Table 3.2, Table 5.1, B3.1.1	Amends 2 and 3
NZS 4517: 2010	Fire sprinkler systems for houses	AS1 Table 3.2	
NZS 4520: 2010	Fire resistant doorsets	AS1 C6.1.1	
NZS 4541: 2013	Automatic fire sprinkler systems	B2.1.1	Amend 5 Nov 2020
AS/NZS 5601:-	Gas installation	AS1 7.2.1, 7.2.2	
Part 1: 2010	General installations *Amend: 1*		
AS/NZS 60598: 2001	Luminaires		
Part 2.2	Particular requirements – Recessed luminaires *Amend: AA* (Amend 2 Dec 2013)	AS1 7.4.1	

Standards Australia		Where quoted	
AS 1366:-	Rigid cellular plastics sheets for thermal insulation		
Part 1: 1992	Rigid cellular polyurethane (RC/PUR) *Amend: 1*	AS1 4.3	
Part 2: 1992	Rigid cellular polyisocyanurate (RC/PIR)	AS1 4.3	
Part 3: 1992	Rigid cellular polystyrene – moulded (RC/PS-M) *Amend: 1*	AS1 4.3	
Part 4: 1989	Rigid cellular polystyrene – extruded (RC/PS-E)	AS1 4.3	Amend 3 Jul 2014
AS 1530:-	Methods for fire tests on building materials, components and structures		
Part 1: 1994	Combustibility test for materials	Definitions, AS1 C4.1.1	
Part 2: 1993	Test for flammability of materials	AS1 C3.1	
Part 4: 2005	Fire-resistance tests of elements of building construction	AS1 C5.1.1	
AS 1691: 1985	Domestic oil-fired appliances – installation	AS1 7.3.1, 7.3.2	
AS 4072:-	Components for the protection of openings in fire-resistant separating elements		
Part 1: 2005	Service penetrations and control joints *Amend: 1*	AS1 C5.1.2	Errata 1 Feb 2013
European Standards			Errata 1 Feb 2013
International Standards Organisation			
ISO 5660:-	Reaction-to-fire tests – Heat release, smoke production and mass loss rate		
Part 1: 2002	Heat release rate (cone calorimeter method)	AS1 C4.1.2, C7.1.1, C7.1.2	Errata 1 Feb 2013
Part 2: 2002	Smoke production rate (dynamic measurement)	AS1 C4.1.2	Amend 5 Nov 2020
ISO 9239:-	Reaction to fire tests for flooring		
Part 1: 2010	Determination of the burning behaviour using a radiant heat source.	AS1 C2.1	
ISO 9705: 1993	Fire tests – Full scale room test for surface products	AS1 C4.1.2	Errata 1 Feb 2013
New Zealand Legislation			
Hazardous Substances and New Organisms Act 1996		AS1 1.14	Amend 5 Nov 2020

Definitions

The full list of definitions for italicised words may be found in the New Zealand Building Code Handbook.

Backcountry hut A *building* that—

a) is located on land that is administered by the Department of Conservation for conservation, recreational, scientifc, or other related purposes, including any land administered under any of the following:

i) the Conservation Act 1987;

ii) the National Parks Act 1980;

iii) the Reserves Act 1977; and

b) is intended to provide overnight shelter to any person who may visit and who carries his or her own food, bedding, clothing, and outdoor equipment; and

c) contains only basic facilities, which may include (but are not limited to) any or all of the following:

i) sleeping platforms or bunks;

ii) mattresses;

iii) food preparation surfaces;

iv) appliances for heating;

v) appliances for cooking;

vi) toilets; and

d) has been certifed by the Director-General as being in a location that wheelchair users are unlikely to be able to visit; and

e) is intended to be able to sleep—

i) no more than 20 people in its backcountry hut sleeping area; and

ii) no more than 40 people in total; and

f) does not contain any connection, except by radiocommunications, to a network utility operator.

Amend 5 Nov 2020

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

Comment:
Notwithstanding the definition of *building,* a number of separated *buildings* cannot be taken as a single *firecell* for the purposes of this Acceptable Solution.

Building Act 2004 (the Building Act) means the principal legislation dealing with building controls in New Zealand.

Comment:
The *Building Act* applies to the construction, alteration, and demolition of new and existing buildings throughout New Zealand.

Building Code means the regulations made under section 400 of the *Building Act 2004*.

Building element Any structural and non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.

Building height Building height means the vertical distance between the floor level of the lowest *occupied space* above the ground and the top of the highest occupied floor, but not including spaces located within or on the roof that enclose stairways, lift shafts, or machinery rooms.

Chimney A *non-combustible* structure which encloses one or more *flues*, *fireplaces* or other heating appliances.

Chimney back The *non-combustible* wall forming the back of a *fireplace*.

Chimney breast The front *fireplace* wall *construction* above the *fireplace* opening.

Chimney jambs The side walls of a *fireplace*.

Combustible See *non-combustible*.

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

Dead end That part of an open path where escape is possible in only one direction.

Comment:
A *dead end* ceases to exist where the *escape route* reaches a point in the *open path* which offers alternative directions of travel, or at a *final exit* or an *exitway*.

Doorset A complete assembly comprising a door leaf or leaves including any glazed or solid panels adjacent to or over the leaves within the door frame including hardware or other inbuilt features; and a door frame, if any, with its fixings to the wall and, for a sliding or tilting door, all guides and their respective fixings to the lintel, wall or sill.

Early childhood centre (ECC) means premises used regularly for the education or care of 3 or more children (not being children of the persons providing the education or care, or children enrolled at a school being provided with education or care before or after school) under the age of six—

a) by the day or part of a day; but

b) not for any continuous period of more than seven days.

ECC does not include home based early childhood services.

Escape height The height between the floorlevel in the *firecell* being considered and the floor level of the required *final exit* which is the greatest vertical distance above or below that *firecell*. Where the *firecell* contains *intermediate floors*, or upper floors within *household units* the *escape height* shall be measured from the floor having the greatest vertical separation from the *final exit*.

Amend 5 Nov 2020

Escape route A continuous unobstructed route from any *occupied space* in a *building* to a *final exit* to enable occupants to reach a *safe place*, and shall comprise one or more of the following: *open paths* and *safe paths*.

Note that doors in an *escape route* are not considered to be obstructions provided they comply with this Acceptable Solution and D1/AS1.

Amends 3 and 5

External wall Any exterior face of a *building* within 30° of vertical, consisting of *primary* and/or *secondary elements* intended to provide protection against the outdoor environment, but which may also contain *unprotected areas*.

Comment:
A roof is an *external wall* if within 30° of the vertical.

Final exit The point at which an *escape route* terminates by giving direct access to a *safe place*.

Amend 5 Nov 2020

Fire The state of combustion during which flammable materials burn producing heat, toxic gases, or smoke or flame or any combination of these.

Firecell Any space including a group of contiguous spaces on the same or different levels within a *building*, which is enclosed by any combination of *fire separations*, *external walls*, roofs, and floors.

Comment:
Floors, in this context, includes ground floors, and those in which the underside is exposed to the external environment (eg, when cantilevered). Note also that internal floors between *firecells* are *fire separations*.

Fire door A doorset, single or multi-leaf, having a specific *fire resistance rating*, and in certain situations a smoke control capability, and forming part of a *fire separation*. The door, in the event of *fire*, if not already closed, will close automatically and be self latching.

Fireplace A space formed by the c*himney back*, the *chimney jambs*, and the *chimney breast* in which fuel is burned for the purpose of heating the room into which it opens.

Fire resistance rating (FRR) The term used to describe the minimum *fire* resistance required of *primary* and *secondary elements* as determined in the *standard test* for *fire* resistance, or in accordance with a specific calculation method verified by experimental data from standard *fire* resistance tests. It comprises three numbers giving the time in minutes for which each of the criteria *structural adequacy*, *integrity* and *insulation* are satisfied, and is presented always in that order.

Comment:
Examples of FRRs are:

a) 60/60/30 indicating *structural adequacy* 60 minutes, *integrity* 60 minutes, *insulation* 30 minutes.

b) 30/-/- indicating *structural adequacy* 30 minutes, but no time requirement for *integrity* or *insulation*.

c) 60/30/x indicating *structural adequacy* of 60 minutes, *integrity* of 30 minutes, and a requirement for *insulation*.

Fire retardant A substance or a treatment, incorporated in or applied to a material, which suppresses or delays the combustion of that material under specified conditions.

Fire safety systems means the combination of all active and passive protection methods used in a *building* to—

(a) warn people of an emergency; and

(b) provide for safe evacuation; and

(c) provide for access by, and the safety of, firefighters; and

(d) restrict the spread of *fire*; and

(e) limit the impact of *fire* on structural stability

Fire separation Any *building element* which separates *firecells* or *firecells* and *safe paths*, and provides a specific *fire resistance rating*.

Fire stop A material or method of *construction* used to restrict the spread of *fire* within or through *fire separations*, and having a *FRR* no less than that of the *fire separation*.

Comment:
Fire stops are mainly used to seal around *penetrations*, but can also be used to seal narrow gaps between *building elements*.

Flammability index (FI) That index number for flammability, which is determined according to the *standard test* method for flammability of thin flexible materials.

Flue The passage through which the products of combustion are conveyed to the outside.

Flue liner Pipes or linings of *fire clay*, metal or *fire* brick that surrounds *flues*.

Flue system A series of interconnecting *flue* pipe casings which form a safe passage (*flue*) for conveying products of combustion from within an appliance to the outside of a *building* or structure.

Foamed plastics *Combustible* foamed plastic polymeric materials of low density (typically less than 100 kg/m^3) and are classified as cellular polymers which are manufactured by creating a multitude of fine void (typically 90 to 98%) distributed more or less uniformly throughout the product. Examples of *foamed plastics* are latex foams, polyethylene foams, polyvinyl chloride foams, expanded or extruded polystyrene foams, phenolic foams, ureaformaldehyde foams, polyurethane foams and polychloropene foams.

Comment:
1. *Foamed plastics* may be rigid or flexible, but rigid foams are the most common in *building* products. When burnt they tend to generate high levels of heat energy (kJ/kg) and varying quantities of smoke and other toxic gases depending on the nature and volume of the particular product.
2. Where doubt exists as to whether a *building* material is *foamed plastics*, an opinion should be sought from a *person* or organisation with appropriate skill and experience in *fire* engineering. That opinion should be included with the *building consent* application to the *building consent authority.*

Group Number The classification number for a material used as a finish, surface, lining, or attachment to a wall or ceiling within an *occupied space* and determined according to the *standard test* methods for measuring the properties of lining materials.

Comment:
The method for determining a Group Number is described in C/VM2 Appendix A.

Handrail A rail to provide support to, or assist with the movement of a *person*.

Hazardous substance has the meaning ascribed to it by section 2 of the Fire Service Act 1975 and section 2 of the Hazardous Substances and New Organisms Act 1996.

Hearth The insulating floor under the *fire* and in front and at the sides of the *fireplace*.

Household unit

(a) means a *building* or group of *buildings*, or part of a *building* or group of *buildings*, that is—

  (i) used, or intended to be used, only or mainly for residential purposes; and

  (ii) occupied, or intended to be occupied, exclusively as the home or residence of not more than 1 household; but

(b) does not include a hostel, boarding house, or other specialised accommodation.

HVAC An abbreviation for heating, ventilating and airconditioning.

Insulating material A material that has a thermal conductivity of less than 0.07 W/mK.

Insulation In the context of *fire* protection, the time in minutes for which a prototype specimen of a *fire separation,* when subjected to the *standard test* for *fire* resistance, has limited the transmission of heat through the specimen.

Integrity In the context of *fire* protection, the time in minutes for which a prototype specimen of a *fire separation,* when subjected to the *standard test* for *fire* resistance, has prevented the passage of flame or hot gases.

Comment:
The precise meaning of *integrity* depends on the type of *building elements* being treated and how it is defined in the *standard test* being used.

Amend 5 Nov 2020

Intermediate floor Any upper floor within a *firecell* which because of its configuration provides an opening allowing smoke or *fire* to spread from a lower to an upper level within the *firecell.*

Life rating The *fire resistance rating* to be applied to elements of *construction* that allows movement of people from their location in a *building* to a *safe place*.

Means of escape from fire In relation to a *building* that has a floor area,—

a) means continuous unobstructed routes of travel from any part of the floor area of that *building* to a place of safety; and

b) includes all active and passive protection features required to warn people of *fire* and to assist in protecting people from the effects of *fire* in the course of their escape from the *fire*.

Comment:
Means of escape include features providing visibility in *escape routes* complying with F6 and signs complying with F8.

Amend 2 Dec 2013

Multi-unit dwelling Applies to a *building* or use which contains more than one separate household or family.

Non-combustible Materials shall be classified as *combustible* or *non-combustible* when tested to AS 1530 Part 1.

Notional boundary The boundary which for *fire* safety purposes, is assumed to exist between two *buildings* on the same property under a single land title.

Amend 3 Jul 2014

Comment:
The *notional boundary* is assumed to exist in the space between the *buildings* and is positioned so that each of the *buildings* would comply with the provisions of the space separation having regards to the amount of its *unprotected area*. In practise if one of the *buildings* is existing, the position of the boundary will be set by the space separation factors for that *building*.

1. The siting of the new *building* which is adjacent to the existing *building* can be checked to see that it also complies, using a revised *notional boundary* location that is no closer than 1.0 metre from the existing *building*.

2. Where both *buildings* are new it is allowable to move the *notional boundary* between *buildings*. However in assessing *fire* spread from one *building* to the other and vice versa, the *notional boundary* should not be located any closer than 1.0 metre from the *building* that is receiving the radiation.

Occupant load The greatest number of people likely to occupy a particular space within a *building*. It is determined by:

a) dividing the total floor area by the m^2 per person (occupant density) for the activity being undertaken, or

b) for sleeping areas, counting the number of sleeping (or care) spaces, or

c) for fixed seating areas, counting the number of seats.

Comment:
See Paragraphs 1.4.5 (for fixed seating) and 1.4.6 (for sleeping areas) where appropriate.

Occupied space Any space within a *building* in which a *person* will be present from time to time during the *intended use* of the *building*.

Open path That part of an *escape route* (including *dead ends*) within a *firecell* where occupants may be exposed to *fire* or smoke while making their escape.

Owner In relation to land and any *buildings* on the land,—

(a) means the *person* who—

(i) is entitled to the rack rent from the land; or

(ii) would be so entitled if the land were let to a tenant at a rack rent; and

(b) includes—

(i) the *owner* of the fee simple of the land; and

Amend 3 Jul 2014

(ii) for the purposes of Building Act sections 32, 44, 92, 96, 97, and 176(c), any person who has agreed in writing, whether conditionally or unconditionally, to purchase the land or any leasehold estate or interest in the land, or to take a lease of the land, and who is bound by the agreement because the agreement is still in force.

Penetration A *building element* passing through an opening in a *fire separation*.

Comment:
A penetration may include, but is not limited to: pipes, cables, ducts, hoses, drains, cable trays, ropes, data outlets, power outlets, hatches, glazing, structural bracing etc.

Amend 2 Dec 2013

People with disabilities People whose ability to use *buildings* is affected by mental, physical, hearing or sight impairment.

Primary element A *building element* providing the basic loadbearing capacity to the structure, and which if affected by *fire* may initiate instability or premature structural collapse.

Comment:
Suspended floors in multi-storey *buildings* are *primary elements.*

Property rating The *fire resistance rating* to be applied to elements of *construction* that allows for protection of *other property.*

Relevant boundary Relevant *boundary* means the *boundary* of an *allotment* that is *other property* in relation to the *building* in question and from which is measured the separation between the *building* and that *other property*; and for the *external wall* of any *building*, the *relevant boundary* is the nearest of—

(a) a *boundary* of a freehold *allotment*, except that if the *other property* is a *road*, *railway line*, or public *open space*, the *relevant boundary* is the *boundary* on the far side of that other *property*; or

(b) a *boundary* of a cross-lease or a company lease or a licence, except that if the *other property* is *open space* to which the lessee or licensee of the *building* in question has an exclusive right of access and occupation or to which 2 or more occupiers of the *building* in question have rights of access and occupation, the *relevant boundary* is the *boundary* on the far side of that other *property*; or

(c) a *boundary* shown on a unit plan (but excluding a *boundary* between a principal unit and its accessory unit), except that if the *other property* is open space and is common property, the *relevant boundary* is the *boundary* on the far side of that *other property*.

Comment:

1. Where an easement, such as a right of way, occurs within an *allotment*, the *relevant boundary* shall remain the same as if the easement did not exist.
2. *Boundaries* within a cross-lease or company lease or licence are shown on a survey plan. In some cases the *boundary* is the *external wall* or roof of a *building*.
3. The unit title *boundaries* of principal units, accessory units, and common property are shown in the unit plan. A *boundary* is frequently an internal or *external wall*, an upper floor, or the roof of a *building*.

The Fire Safety and Evacuation of Buildings Regulations 2006 use the term *place of safety* and allow the *place of safety* to be within the *building* provided that it is protected with a sprinkler system. In this Acceptable Solution a *place of safety* can only be within a *building* in *Risk Group* SI.

4. A wall along a *boundary* between two *allotments* is called a "party wall" when the *owners* of the *allotments* each have legal rights in respect of that wall registered by way of easements on one or both titles. An internal wall between cross-leases, company leases, or unit titles, or between one of them and common property, is not generally called a party wall but in that case also the lessees, unit title holders, or corporate body concerned each have legal rights in respect of that wall. Such a wall separates areas which are *other property* in relation to each other, but the wall itself is part of each property. The *fire* protection consequence of that legal concept is that such a wall can be regarded as a *fire separation* providing protection against horizontal *fire* spread in each direction. In other words, that wall may provide the appropriate *FRR* instead of each property having its own wall of that *FRR*.

Risk group The classification of a *building* or *firecells* within a *building* according to the use to which it is intended to be put.

Safe place A place, outside of and in the vicinity of a single *building* unit, from which people may safely disperse after escaping the effects of a *fire*. It may be a place such as a street, *open space*, public space or an *adjacent building* unit.

Amend 5 Nov 2020

Secondary element A *building element* not providing load bearing capacity to the structure and if affected by *fire*, instability or collapse of the *building* structure will not occur.

Smokecell A space within a *building* which is enclosed by an envelope of *smoke separations*, or *external walls*, roofs, and floors.

Smoke control door A *doorset* that complies with Appendix C, C6.1.2 of this acceptable solution.

Stability In the context of *fire* protection is the support provided to a *building element* having a *FRR*, intended to avoid premature failure due to structural collapse as a result of applied load, dead and live loads or as a result of any additional loads caused by *fire.*

Standard test A test method which is recognised as being appropriate for the *fire* protection properties being assessed.

Comment:
A list of *standard test* methods is given in Appendix C.

Structural adequacy In the context of the standard test for *fire* resistance, is the time in minutes for which a prototype specimen has continued to carry its applied load within defined deflection limits.

Comment:
The *fire* design load should be as specified in B1/VM1.

Surface finish The combination of a surface coating and substrate material on surfaces of *building elements* exposed to view. It can be an applied decorative coating or the uncoated *building element* itself. For interior surfaces the requirements are evaluated in terms of a *Group Number*. For exterior surfaces the requirements are evaluated in terms of rate of heat release as determined by Appendix C, Paragraph C6.1.

Theatre A place of assembly intended for the production and viewing of performing arts, and consisting of an auditorium and stage with provision for raising and suspending stage scenery above and clear of the working area.

Amend 5 Nov 2020

Unprotected area In relation to an *external wall* of a *building*, this means:

a) Any part of the *external wall* which is not *fire* rated or has less than the required *FRR, and*

b) Any part of the *external wall* which has combustible material more than 1.0 mm thick attached or applied to its external face, whether for cladding or any other purpose.

Comment:
Unprotected area includes non-*fire* rated windows, doors, or other openings, and non-*fire* rated *external wall construction.*

Wharenui A communal meeting house having a large open floor area used for both assembly and sleeping in the traditional Māori manner.

Amend 5 Nov 2020

Verification Method C/VM1

1.1 Solid Fuel Appliances

Limiting heat transfer

Errata 1 Feb 2013

1.1.1 Compliance with NZBC Performances C2.2 and C2.3 may be verified for solid fuel burning appliances by meeting the appropriate test requirements of AS/NZS 2918.

Acceptable Solution C/AS1 Part 1: General

CONTENTS

1.1 Introduction and scope

This Acceptable Solution is one of three Acceptable Solutions that provide a means of establishing compliance with NZBC Clauses C1 to C6 Protection from Fire. It can be used for the *building* activities covered by *risk group* SH as specified in Paragraph 1.1.1 and described in Table 1.1.

For other *risk groups*, please refer to Acceptable Solution C/AS2.

For *backcountry huts*, please refer to Acceptable Solution BCH/AS1.

Notes shown under '**Comment**', occurring throughout this document, are for guidance purposes only and do not form part of this Acceptable Solution. Words in *italic* are defined at the front of this document.

Appendices to this Acceptable Solution have equal status to this Acceptable Solution. Note that the Appendices have been included in their entirety but not all requirements are relevant to *risk group* SH.

Figures are informative only; the wording of the paragraphs takes precedence.

Amend 5
Nov 2020

Comment:

1. Designing a *building* to provide *fire* safety involves decisions on both the *construction* materials and layout needed to reduce the risk to an acceptable level.
The risk is assessed according to: the number and mobility of the occupants (*occupant load* and *risk group* of the *building*); the activities undertaken within the *building*; and the nature of the *building* materials and contents. This assessment allows each *building* activity to be categorised in a *risk group*, which is the basis for determining *fire* safety features.

The *fire* safety requirements for *risk group* SH do not depend on the *occupant load* of the *firecells.*

2. Outbuilding is a classified use (Building Code Clause A1). The term applies to a *building* or use which may be included within each of the other classified uses but is not intended for human habitation, and is accessory to the principal use of associated buildings. Examples: a carport, farm building, garage, greenhouse, machinery room, private swimming pool, public toilet, or shed.

Amend 3
Jul 2014

Amends 1, 2, 3

Table 1.1	Risk groups: scope and limitations	
	Risk group	**Applies to**
C/AS1	**SH Buildings with sleeping (residential) and outbuildings**	**Detached dwellings with a single *household unit* such as**: stand-alone houses **Low-rise *multi-unit dwellings* where each *household unit* has its own *escape route* that is independent of all other *household units such as*:** Attached townhouses. Stacked *household units* where there is no more than one *household unit* above another with each *household unit* having a single storey and an *escape height* less than 4.0 m. **Detached dwellings where fewer than six people (not including members of the residing family) pay for accommodation such as**: boarding houses, homestays, bed and breakfasts **Outbuildings**
Acceptable Solution C/AS2	**SM* Sleeping (non-institutional)** (Out of scope for Acceptable Solution C/AS1)	**Permanent accommodation such as:** Apartment *buildings* and other *buildings* which consist of more than one *household unit* (other than low-rise *multi-unit dwellings* in the scope of *risk group* SH). **Transient accommodation such as:** Hotels, motels, serviced apartments, hostels, backpackers, cabins at holiday parks. *Buildings* where six or more people pay for accommodation (such as boarding houses/homestays/ bed and breakfast). *Wharenui* and other community sleeping spaces such as halls (even if used occasionally). Sheltered housing such as refuges, reintegration for prisoners, homeless shelters etc. **Educational accommodation such as:** University halls of residence, school boarding hostels etc.
	SI* Care or detention (Out of scope for Acceptable Solution C/AS1)	**Care activities such as:** Institutions, hospitals including outpatients and day procedures (excluding special care facilities such as operating theatres, intensive care units, prisons, delivery and recovery rooms and hyperbaric chambers or other such places that require stay in place strategies). Aged care facilities. Residential care in institutions, hospices. Medical day treatment: i.e. medical centres and dental practices using sedation or treatment rooms where people are unable to self-evacuate without assistance; e.g. for dialysis or chemotherapy. Care in the community houses and homes. **Detention facilities (excluding prisons) such as:** Police stations, court *buildings* and hospitals with detention facilities.
	CA* Public access and educational facilities (Out of scope for Acceptable Solution C/AS1)	**Crowd activities such as:** Halls, *theatres* and cinemas. Recreation and event centres (including tiered seating for up to 2000 people and with any primary egress for more than 100 people at the level of the playing surface). Educational institutions without sleeping including schools and *early childhood centres*. Churches and other places of worship. Restaurants and cafes, shops and shopping malls. Exhibition, retail areas including car showrooms and trade fair space. Public libraries with less than 2.4 m storage height. Spaces for viewing open air activities (does not include spaces below a grandstand), open grandstands, roofed but unenclosed grandstand, uncovered fixed seating). **Personal service activities such as:** Dentists, doctors (except as included within *risk group* SI), banks, beautician and hairdressing salons.
	WB* Business, commercial and low level storage (Out of scope for Acceptable Solution C/AS1)	**Professional activities such as:** Offices (including professional services such as law and accountancy practices). Laboratories, workshops (including mechanics workshops). May contain storage with a capable height of storage of less than 3.0 m. **Industrial activities such as:** Factories, processing and manufacturing plants (excluding *foamed plastics*) with a capable height of storage of less than 3.0 m. **Storage activities such as:** *Buildings* or parts of *buildings* capable of storage no more than 5.0 m in height. Warehouses and storage *buildings* (other than those listed above), capable of storage more than 5.0 m in height, but a height to the apex no greater than 8.0 m and total floor area of no more than 4200 m^2. Temperature controlled storage with a capable height of storage of less than 3.0 m, other than some limited areas in processing areas, or up to a maximum area of 500 m^2 with a maximum capable of storage height of 5.0 m. **Intermittently occupied buildings (other than outbuildings) such as:** Light aircraft hangers, *buildings* containing fixed plant and or fixed machinery and spray painting operations, whether or not in a spray booth.

Amend 5 Nov 2020

Table 1.1	Risk groups: scope and limitations	
	Risk group	**Applies to**
Acceptable Solution C/AS2	**WS* High level storage or potential for fast fire growth** (Out of scope for Acceptable Solution C/AS1)	**Storage activities such as:** Warehouses with a capable height of storage of over 5.0 m or over 8.0 m to the apex and total floor area greater than 4200 m^2. Temperature controlled storage outside of the scope of *risk group* WB. **Service activities such as:** Trading and bulk retail wholesalers with a storage height greater than 3.0 m. Supermarkets with shelving over 3.0 m in height. Exhibition, retail areas and trade fair space with a storage height greater than 3.0 m.
	VP* Vehicle storage and parking (Out of scope for Acceptable Solution C/AS1)	**Vehicle parking – within a building or a separate building including:** Car parking *buildings*. Vehicle parking or stacking within *buildings*. Goods vehicle parking. Service vehicle and unloading areas. Car storage warehouses.

Note:

* *Risk groups* SM, SI, CA, WB, WS and VP are outside the scope of Acceptable Solution C/AS1. Refer to C/AS2.

Amend 5 Nov 2020

Scope

1.1.1 The scope of this Acceptable Solution is restricted to *risk group* SH. This covers *buildings* where people sleep including multi-unit residential with some restrictions on height and outbuildings (as described in Clause A1 7.0 of NZBC).

Amend 2 Dec 2013

Amend 3 Jul 2014

This includes the following:

a) Single *household units,* and

b) Low-rise *multi-unit dwellings* with no more than one *household unit* above another (see Figure 1.1) and where each *household unit* has an *escape route* independent of all other *household units*, and including associated garages or carports whether or not they are part of the same *building*. Where there is one *household unit* above another, each *household unit* shall be a single storey and the *escape height* shall be less than 4.0 m, and

Amend 5 Nov 2020

c) Detached dwellings used as boarding houses for fewer than six people (not including members of the residing family), and

Amend 5 Nov 2020

d) Garages that are part of a *household unit*, and

e) Garages shared by more than one *household unit*. The garage shall be *fire separated* from each adjacent *household unit* with *fire* rated *construction* of 30/30/30, and

Amend 5 Nov 2020

f) Outbuildings.

Outside the scope of this Acceptable Solution

1.1.2 *Buildings* or parts of *buildings* in *risk groups* other than SH are outside the scope of this Acceptable Solution (refer to Table 1.1 for other *risk groups)*.

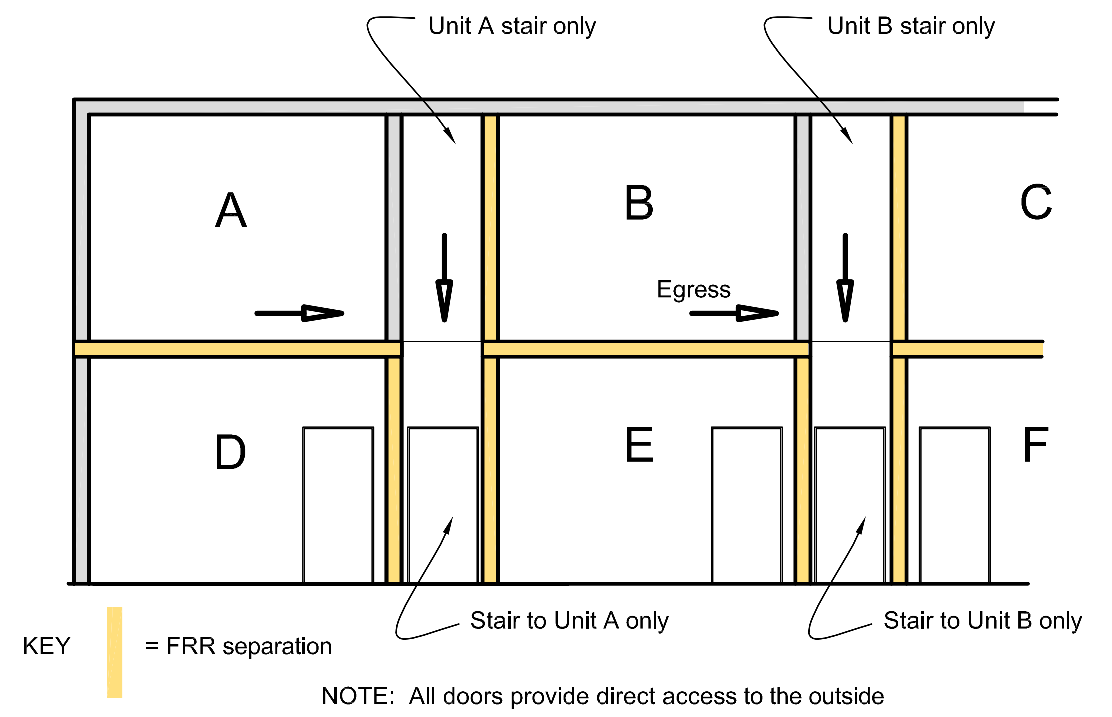
1.1.3 If this Acceptable Solution cannot be followed in full, use another path to demonstrate compliance.

The control of hazardous substances is not covered by this Acceptable Solution

1.1.4 This Acceptable Solution does not provide for any use, storage or processing of *hazardous substances*. Compliance with NZBC F3 and the Hazardous Substances and New Organisms Act 1996 shall be ensured where applicable in addition to the requirements of this Acceptable Solution.

Amend 5 Nov 2020

Figure 1.1 **Multi-unit dwellings in risk group SH**
Paragraph 1.1.1



Amend 2 Dec 2013

1.2 Using this Acceptable Solution

1.2.1 The process for using this Acceptable Solution shall be as follows.

Step 1: Determine which Acceptable Solution applies

Determine the *risk group* for each of the activities carried out in the *building* (refer to Table 1.1 and to Paragraph 1.1.1 of this Acceptable Solution). If the activity is not listed explicitly, choose the nearest suitable *risk group*. If the *building* contains a *risk group* other than SH, use another path to demonstrate compliance.

Apply this Acceptable Solution for buildings only containing risk group SH by following Steps 2 and 3.

Amend 5 Nov 2020

Step 2: Determine the parameters for risk group SH

Establish the relevant *building* measurements (these will include *building height*, floor plans, wall openings and distances to *relevant boundaries*).

Amend 5 Nov 2020

Comment:
Applying the Acceptable Solution depends largely on the basic *building* measurements as above. Therefore, you should determine these as accurately as possible before using this document.

Step 3: Satisfy the fire safety requirements

Satisfy the *fire* safety requirements of this Acceptable Solution (refer to Parts 2-7), based on the *building's* dimensions and features where required.

Amend 5 Nov 2020

1.3 Alterations and changes of use to buildings

1.3.1 This Acceptable Solution may be used to determine the compliance of building work (in relation to an existing building).

Errata 1 Feb 2013

Amends 2, 3, 5

Part 2: Firecells, fire safety systems and fire resistance ratings

CONTENTS

2.1 Provision of firecells

Firecell floor area limits

2.1.1 There are no requirements relating to *firecells* for *risk group* SH.

2.2 Fire safety systems

2.2.1 The *fire safety systems* required for *risk group* SH other than outbuildings are that each *household unit* shall be provided with Type 1 smoke alarms in accordance with Acceptable Solution F7/AS1. Alarm system types shall be as defined in Table 2.1. Amend 3 Jul 2014

Table 2.1	Fire safety systems specified in this Acceptable Solution	
Type of system	System description	Relevant Standards for installation
1	Domestic smoke alarm	Acceptable Solution F7/AS1
4	Smoke detection and alarm system with manual call points	NZS 4512
5	Enhanced smoke detection and alarm system with manual call points	NZS 4512
6	Automatic *fire* sprinkler system	NZS 4515
7	Automatic *fire* sprinkler system with smoke detection and alarm system	NZS 4515, NZS 4512

Amend 2
Dec 2013

2.3 Fire resistance ratings

FRR values

2.3.1 Unless explicitly stated otherwise in this Acceptable Solution, the *fire resistance ratings (FRRs)* that shall apply for this *risk group* are as follows:

Life rating = 30 minutes.

Property rating = 30 minutes.

Amend 4
Jan 2017

Comment:
Throughout this Acceptable Solution, minimum *FRRs* are specified for particular situations. It is therefore essential to check for specific requirements.

Part 3: Means of escape

CONTENTS

3.1 THIS PARAGRAPH DELIBERATELY LEFT BLANK

3.2 Number of escape routes

Risk group SH may be served by a single *escape route* provided the permitted *dead end open path* distance specified in Paragraph 3.4 is not exceeded.

3.3 Height and width of escape routes

There are no restrictions (other than those required by other Building Code Clauses) on the height and width of *escape routes* for *risk group* SH.

3.4 Length of escape routes

An *escape route* in outbuildings may be any length, but the lengths of *dead ends* and total *open paths* in other *buildings* to which this Acceptable Solution applies shall not exceed the distances given in Table 3.2. Amend 2 Dec 2013

Table 3.2 Travel distances on escape routes

	Type 1 system only	NZS 4514 Interconnected Smoke Alarms	NZS 4517 Sprinkler system with Type 1 (in single *household units* only)	NZS 4515 Sprinkler system with Type 1	NZS 4515 Sprinkler system and NZS 4512 Smoke detection system
Dead end open path	25 m	35 m	35 m	40 m	50 m
Total *open path*	60 m	75 m	75 m	90 m	120 m

Amends 2 & 4

For definition of system types, see Table 2.1.

If systems are installed in order to extend permissible travel distance in accordance with this table and are not a requirement of Paragraph 2.2.1 then Fire Service connection is not required. Amend 3 Jul 2014

Part 4: Control of internal fire and smoke spread

CONTENTS

Amends 2 and 3

4.1 Fire separations

Each *household unit,* including any garage and *escape routes* in *multi-unit dwellings,* shall be *fire separated* from other *household units* and any *escape routes* with *fire separations* having an *FRR* of no less than 30/30/30.

Comment:
An ancillary unit such as a granny flat is a separate *household unit* to the primary dwelling, and there must be a *fire separation* between it and the primary dwelling.

4.2 Surface finishes

Except where *foamed plastic building* materials or *combustible insulating materials* are used, there are no *surface finish* requirements in *risk group* SH.

Amend 2 Dec 2013
Amend 3 Jul 2014

4.3 Foamed plastics or combustible insulating materials

Amend 3 Jule 2014
Amend 2 Dec 2013

Where *foamed plastics* or *combustible insulating materials* form part of a wall or ceiling system, the completed system (see comment) shall achieve a *Group Number* of not more than 3. The *foamed plastics* shall comply with the flame propagation criteria as specified in AS 1366 for the type of material being used. The above requirements do not apply to the following *building elements*:

Amend 3 Jul 2014
Amend 2 Dec 2013

a) Small areas of non-conforming product within a firecell with a total aggregate surface area of not more than 5.0 m^2

b) Electrical switches, outlets, cover plates and similar small discontinuous areas

c) Pipes and cables used to distribute power or services

d) *Handrails* and general decorative trim of any material such as architraves, skirtings and window components, including reveals, provided these do not exceed 5% of the surface area of the wall or ceiling they are part of

Amend 2 Dec 2013

e) *Damp-proof courses*, seals, caulking, flashings, thermal breaks and ground moisture barriers

Amend 2
Dec 2013

g) Individual *doorsets*

h) Continuous areas of permanently installed openable wall partitions, having a surface area of not more than 25% of the divided room floor area or 5.0 m^2, whichever is the greater,

Comment:
The completed system may or may not include a surface lining product enclosing any insulation material from any adjacent *occupied space*. If a surface lining is not included, then the *foamed plastics* or *combustible insulating materials* when tested alone shall achieve a *Group Number* of 3, otherwise a surface lining is also required such that the completed system achieves a *Group Number* of 3 (see Appendix A of C/VM2). This paragraph applies to *foamed plastics building* materials whether exposed to view from the *occupied space* or enclosed.

Amend 3
Jul 2014

The method of assigning the *Group Number* to a material is specified in Verification Method C/VM2 Appendix A.

Part 5: Control of external fire spread

CONTENTS

5.1 Fire resistance ratings

5.1.1 Where the *building* is protected with a sprinkler system, *external walls* do not need an *FRR*.

Where the *building* is not protected with a sprinkler system, *external walls* shall have an *FRR* of no less than 30/30/30 in the following circumstances:

a) Outbuildings, single *household units* and attached side by side *multi-unit dwellings* where part of the *external wall* is less than 1.0 m and less than 90° from the *relevant boundary*. See Figure 5.1. The wall shall be *fire* rated to protect from both directions, and

Amend 2 Dec 2013

Errata 1 Feb 2013

b) *Multi-unit dwellings* located one above the other where the *external wall* is less than 5.0 m from the *relevant boundary*. If there are windows more than 1.0 m from the *relevant boundary* in a *household unit* wall requiring a *FRR*, the windows do not need to be *fire* rated

Amend 3 Jul 2014

Notional boundary – firecells on the same property

5.1.2 For *firecells* containing sleeping *risk groups* under common ownership in the same *building*, or in separate *buildings* on the same property, a *notional boundary* shall be used instead of the *relevant boundary*. The words *relevant boundary* shall be interpreted as *notional boundary*.

Amend 4 Jan 2017

Amend 3 Jul 2014

5.2 Roof projections

5.2.1 Where the *external wall* is required to have an *FRR*, the eaves projection shall either have an *FRR* of 30/30/30 or the wall shall be extended to the underside of the roof.

5.2.2 Where roof eaves extend from an otherwise unrated *external wall* to within 650 mm of the *relevant boundary*, the total eaves *construction* and the *external wall* from which they project shall have an *FRR* of no less than 30/30/30.

5.3 Protection from a lower roof in multi-unit dwellings

Amend 3 Jul 2014

5.3.1 *Fire* spread from a roof close to and lower than an *external wall* of an attached sleeping unit or attached *building* on *other property* shall be prevented by providing an *FRR* of 30/30/30 to either:

a) The part of the roof within 5.0 m horizontally of the wall, or

b) Any part of the wall within 9.0 m vertically of the roof.

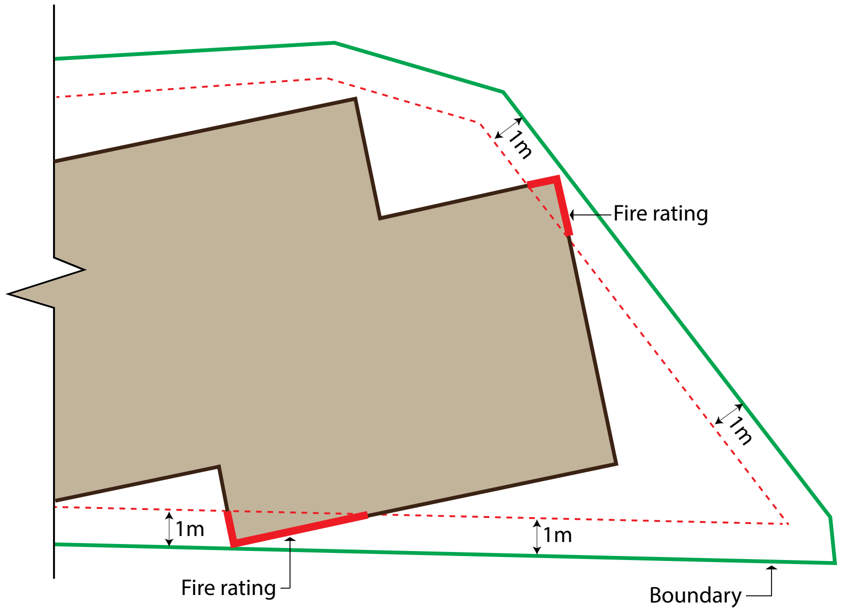
Amend 2 Dec 2013

5.3.2 *Fire* rating of the roof is not required if the *household unit* is protected with a sprinkler system complying with NZS 4515.

Errata 1 Feb 2013

Amend 3
Jul 2014

Figure 5.1 **Fire rating of external walls**
Paragraph 5.1



Errata 1
Feb 2013

5.4 Exterior surface finishes

External wall cladding systems shall be tested to the *standard test* described in Appendix C C7.1 and the peak rate of heat release and the total heat released shall not exceed the limits given in Table 5.1.

Errata 1
Feb 2013

These requirements do not apply if *surface finishes* are no more than 1 mm in thickness and applied directly to a *non-combustible* substrate.

5.5 Carports and similar construction

Errata 1
Feb 2013

A carport is permitted to have walls and roof with 100% *unprotected area* provided that all the following conditions are met:

a) At least two sides are completely open to the environment, and

b) The carport and adjacent *building* are under the same *ownership*, and

c) For a roof plan area of no more than than 40 m², no part of the roof is closer than 0.3 m to a *relevant boundary*.

Table 5.1 **Requirements for external wall claddings**

Errata 1
Feb 2013

Amend 2
Dec 2013

Amend 3
Jul 2014

Column A	Column B	Column C	Column D	
	Distance to *relevant boundary* (angle between wall and boundary is less than 90°)			
	Less than 1.0 m	Distance greater than or equal to 1.0 m and *building height* less than or equal to 10 m	Distance greater than or equal to 1.0 m and *building height* greater than 10 m	
			Unsprinklered	Sprinklered to NZS 4515
Peak heat release rate (kW/m^2)	100	No requirement	150	No requirement
Total heat released (MJ/m^2)	25	No requirement	50	No requirement
Note: Table 5.1 applies to separate *buildings*. It does not apply to *household units* within the same *building* whether they are side by side or one above the other.				

Part 6: Firefighting

CONTENTS

6.1 Fire Service vehicular access

6.1.1 If *buildings* that contain *multi-unit dwellings* with more than 2 units are located remotely from the steet boundaries of a property, pavements situated on the property and necessary to be used for vehicular access to a hard-standing within: Amend 3 Jul 2014

i) 75 m of any point in any unit contained in the *building* except if there is a sprinkler system complying with NZS 4515, and

ii) 20 m of any inlets to *fire* sprinkler or *building fire* hydrant systems, shall Amend 3 Jul 2014

Comment:
Access to *buildings* for *fire* appliances will be generally via public streets, but provision is needed on multi-*building* sites to enable appliances to reach the required hard-standing.

a) Be able to withstand a laden weight of up to 25 tonnes with an axle load of 8 tonnes or have a load-bearing capacity of no less than the public roadway serving the property, whichever is the lower, and

b) Be trafficable in all weathers, and

c) Have a minimum width of 4.0 m, and

d) Provide a clear passageway of no less than 3.5 m in width and 4.0 m in height at site entrances, internal entrances and between *buildings.* Amend 2 Dec 2013

Part 7: Prevention of fire occurring

CONTENTS

The design, *construction* and/or installation of certain types of fixed appliances using controlled combustion and other fixed equipment is specified as follows.

7.1 Solid fuel appliances

7.1.1 AS/NZS 2918, with the modifications given in Paragraph 7.1.2, is an Acceptable Solution for the installation of:

a) Domestic solid fuel burning appliances, installed in either domestic or commercial situations, and

b) *Flue systems.*

A normative Appendix is an integral part of this Standard.

7.1.2 Modifications to AS/NZS 2918

Delete paragraph 3.8 and substitute the following:

"3.8 Seismic restraint

The appliance and the floor protector shall be mechanically fixed to the floor itself.

The test seismic force shall be taken as the application of a horizontal force equal to 0.40 times the appliance weight acting in any direction at the mid-height of the combustion chamber. The appliance shall not move, tilt or be dislodged from its installed position during the application of the test force.

The weight of the flue system and a wetback, if fitted, shall not be included in the test."

Delete Section 7 and substitute the following:

"7.1 Ventilation

Ventilation shall be in accordance with Acceptable Solution G4/AS1.

7.2 Water heating equipment

Water heating appliances installed in conjunction with the heating appliance shall be vented and shall comply with Acceptable Solution G12/AS1."

7.2 Gas-burning appliances

7.2.1 For gas-burning appliances AS/NZS 5601.1 sections 6.7, 6.8 and 6.9 and Appendix H are Acceptable Solutions for the *construction* and installation of *flues* and sections 5.11, 6.2, 6.3 and 6.10 are Acceptable Solutions for the installation of appliances, with the modifications given in Paragraph 7.2.2.

7.2.2 Modifications to AS/NZS 5601.1

Delete paragraph 6.2.11 and substitute the following:

"6.2.11 Seismic restraint

Seismic restraint of appliances installed in buildings shall be designed in accordance with B1/VM1 Paragraphs 2.0 and 13.0."

Add a Note to 6.4 as follows:

"Ventilation requirements are contained in Acceptable Solution G4/AS1. The ventilation requirements of this Standard may exceed the performance requirements of NZBC G4."

Amend 2
Dec 2013

7.3 Oil-fired appliances

7.3.1 AS 1691, with the modifications given in Paragraph 7.3.2, is an Acceptable Solution for the installation of domestic oil-fired appliances.

7.3.2 Modifications to AS 1691

Delete paragraph 2.2.3 and substitute the following:

"2.2.3 Electrical equipment

Electrical equipment shall comply with Acceptable Solution G9/AS1 or Verification Method G9/VM1."

Delete "CSIRO durability Class 2 or better" from paragraph 3.1.2 (b) and substitute "H5 treatment".

Delete the Note to paragraph 3.1.2 (d).

Delete paragraph 3.1.4 and substitute the following:

"3.1.4 Stability

The appliance shall be mechanically fixed to the building.

The test seismic force on the fuel tank shall be taken as the application of a horizontal force in kilograms numerically equal to 0.40 times the tank volume in litres acting at the centre of the tank. The test seismic force on the appliance shall be taken as the application of a horizontal force equal to 0.40 times the appliance operating weight acting at the centre of the appliance.

The appliance and the fuel tank shall resist their respective seismic forces with no significant movement."

Delete the words "without specific approval" from paragraph 3.2.8 (b).

Delete paragraph 5.1.1.

Add Note to 5.2.2:

"Note: Refer to Acceptable Solution G4/AS1 for ventilation requirements."

7.3.3 AS/NZS 2918 Sections 2 and 4 are also Acceptable Solutions for the installation of *flues* for domestic oil-fired appliances.

7.4 Downlights

7.4.1 Recessed luminaires shall be one of the following types, as specified in AS/NZS 60598.2.2:

a) IC-F, or

b) IC, or

c) CA-80 or

d) CA-135.

Full compliance can only be achieved if the installation of the luminaire is in accordance with AS/NZS 60598.2.2.

Amend 3
Jul 2014

Comment:
There is a requirement for a clearance of 100 mm from recessed luminaires to insulation materials when installing insulation in existing *buildings* where the type of luminaire is undefined.

7.5 Open fires

Chimneys

7.5.1 *Chimneys* shall be *constructed* in accordance with Table 7.1 and Figure 7.1. They shall have:

a) *Fireplaces* lined with *fire* bricks having a thickness of no less than 50 mm

b) *Fireplace* joints of *non-combustible* material and shall be sealed against air leakage

c) *Chimney* brickwork of no less than a single skin of brick 90 mm thick plus a 65 mm thick layer of grout, and

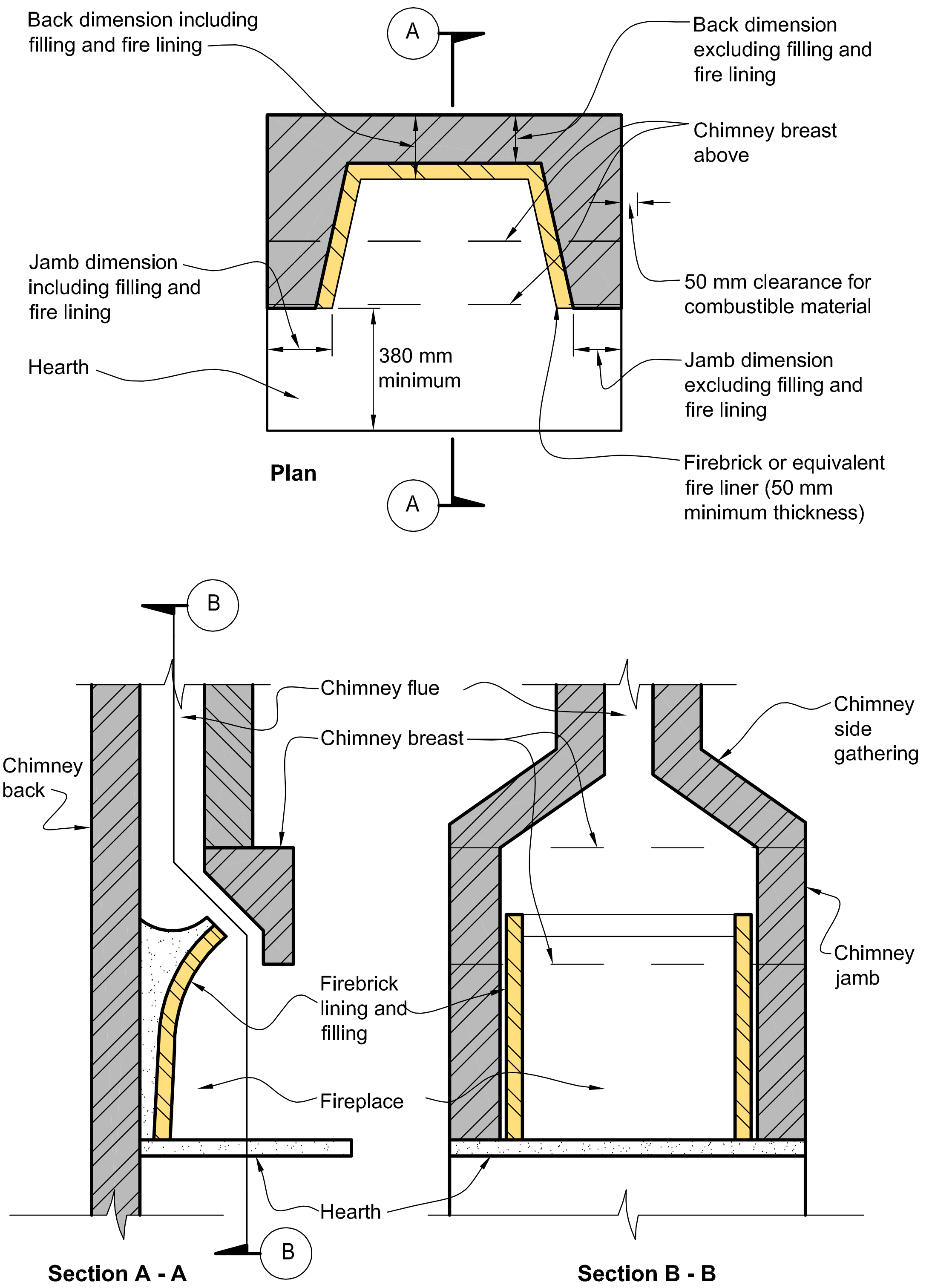
d) An expansion gap provided in *chimneys* containing *flue liners*. These *flue liners* shall be wrapped in a *combustible* material of thickness no less than 0.25 mm (for example heavy-quality *building* paper) to prevent the grout filling from bonding with the *flue liner*.

Table 7.1 Minimum acceptable dimensions of chimneys

Chimney construction	*Chimney jamb* and *chimney back* thickness		*Chimney breasts* and side gathering, and *chimney* wall thickness above the level of the gather, excluding linings (mm)
	Excluding filling and *flue liner* (mm)	Including filling and *flue liner* (mm)	
Concrete	170	255	170
Brickwork	155	230	155
Precast pumice concrete	85	170	85

7.5.2 Cross-sectional areas of *flues* shall be no less than 0.03 m^2 for an open *fireplace* (see Figure 7.2).

Figure 7.1 **Chimney terms and dimensions**
Paragraph 7.5



7.5.3 *Flue* linings shall be one of the following types:

a) Clay *flue liners* with rebated or socketed joints

b) Imperforate clay pipes with socketed joints

c) High alumina cement and kiln-burnt aggregate pipes, with rebated or socketed joints, or steel collars around joints.

The linings shall be fitted with the sockets or rebates uppermost to prevent condensate running out, and to prevent any caulking material from being adversely affected. Joints between the liners, and any space between liners and the masonry, shall be filled with weak mortar or insulating concrete (see Figure 7.2 (a)).

7.5.4 *Flue liners* are not required for:

a) Brick *chimneys* if *constructed* of two 90 mm skins of brickwork with a 65 mm grout-filled gap between (see Figure 7.2 b))

b) Ordinary concrete *chimneys*

c) Precast pumice concrete *chimneys*.

7.5.5 Clearance above roofs shall be in accordance with Figure 4.9 of AS/NZS 2918.

7.5.6 Every *fireplace* shall have a separate *flue*.

7.5.7 *Flue* joints shall be of *non-combustible* material and sealed against air leakage.

7.5.8 *Hearths* for *fireplaces* shall:

a) Be *constructed* of fully grouted stones, bricks or concrete of no less than 50 mm total thickness

b) Extend no less than 230 mm on each side of the *fireplace* opening, and no less than 380 mm forward of the *fireplace* opening, and

c) Have no *combustible* material closer than the clearances given in Paragraph 7.5.8 b) from the upper and lower surfaces of the *hearth*.

7.5.9 Clearances between a *chimney* and any *combustible* material (see Figure 7.3) shall be no less than:

a) 200 mm at any opening in the *flue*, or at the *fireplace* opening, and

b) 200 mm above or below the upper surface of the *hearth*, and 75 mm from the lower surface of the *hearth*.

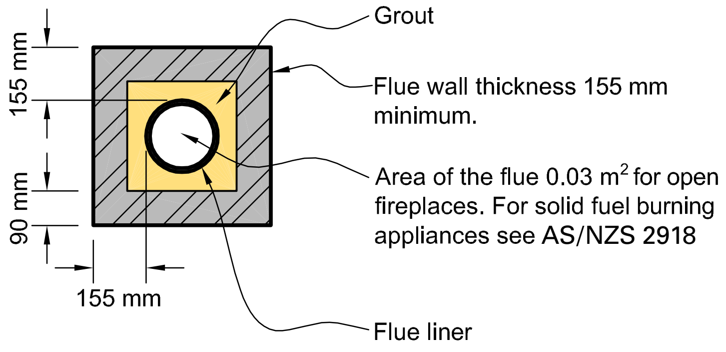
7.5.10 *Hearth* edges are to be separated from *combustible* material with insulating material having a minimum service operating temperature of 150°C.

Comment:
AS/NZS 2918 Appendix C gives a test method for heat-resistant and heat-tolerant materials.

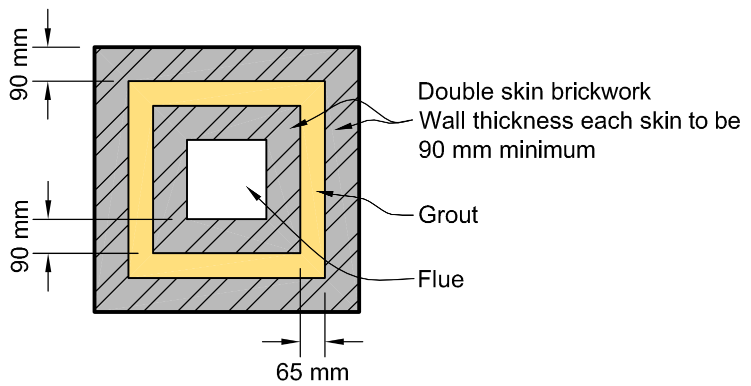
7.5.11 A ventilated space of no less than 50 mm shall be provided between the outer face of a *fireplace*, *chimney* or *flue* and any *combustible* material.

7.5.12 AS/NZS 2918 Sections 2 and 4 are also Acceptable Solutions for the installation of *flues* from open *fires*.

Figure 7.2 **Brick chimney flues – sections**
Paragraphs 7.5.2, 7.5.3 and 7.5.4

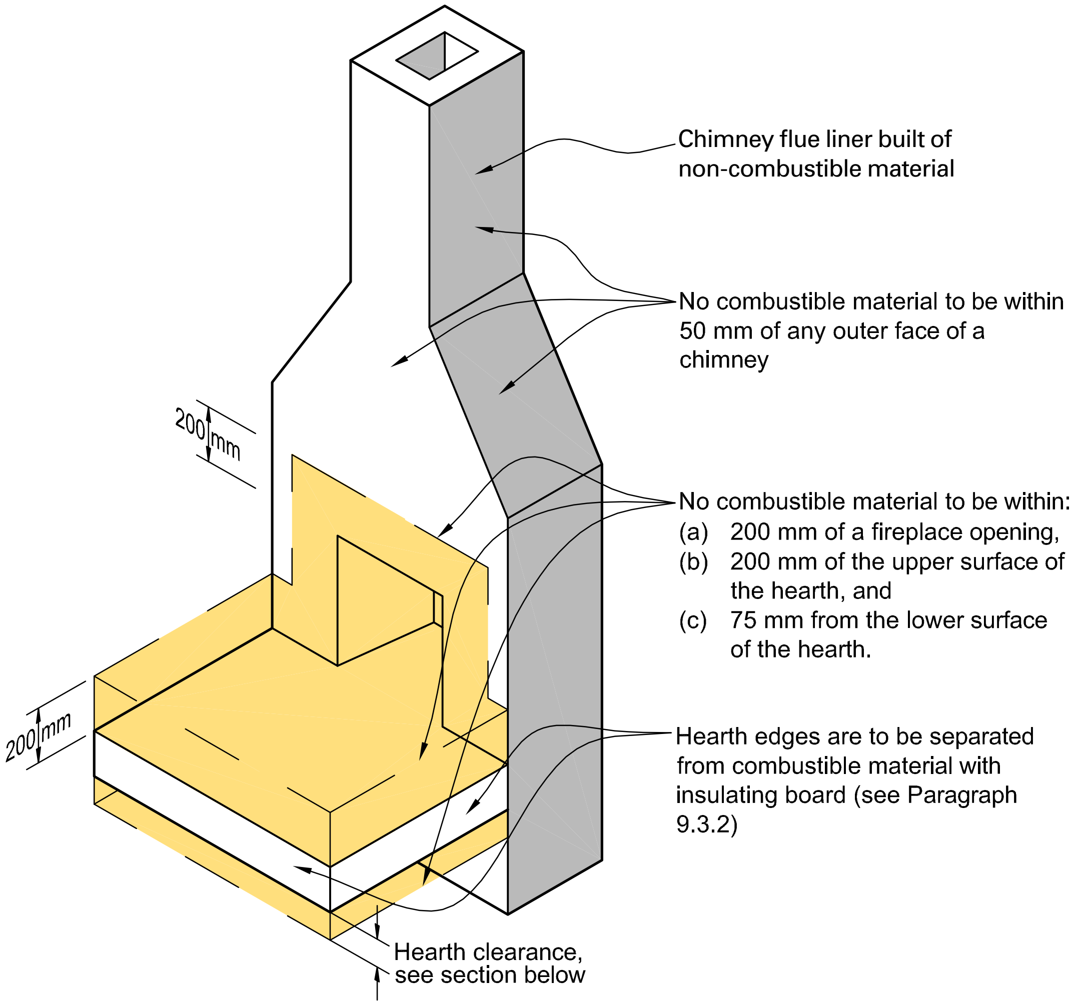


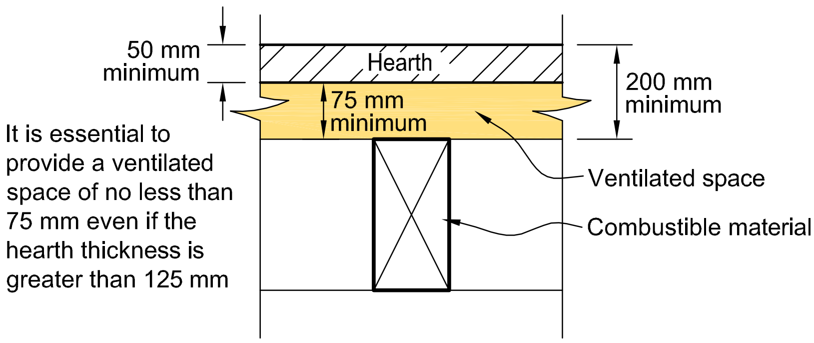
(a) With flue liner



(b) Without flue liner

Figure 7.3 **Clearances between a chimney and hearth, and combustible materials**
Paragraph 7.5.9





Section showing minimum dimensions

Appendix A (normative): Fire safety precautions

A1.1 Fire alarm and sprinkler systems

A1.1.1 *Fire* alarm systems used in *fire safety systems* shall satisfy the requirements of Acceptable Solution F7/AS1. *Fire* sprinkler systems used in the *fire safety systems* shall, except where specified, also satisfy the requirements of Appendix B.

A1.2 Requirements common to alarm systems

A1.2.1 Except for domestic smoke alarm systems and, where otherwise specified, each *fire* alarm system, regardless of method of activation, shall be provided with a means of communication with the Fire Service in accordance with Acceptable Solution F7/AS1.

A2.1 Fire safety system descriptions

A2.1.1 The following text provides a brief description of *fire safety systems* not otherwise described in Acceptable Solution F7/AS1. See F7/AS1 for descriptions of *fire* alarm systems Types 1, 2, 3, 4, 5, 6 and 7.

Type 9 – Smoke control in air handling systems

Where smoke control is required in relation to heating, ventilating or air conditioning systems, it shall comply with the requirements of either:

a) AS/NZS 1668: Part 1 and interface with any Type 4 or 7 system installed if it is self contained detection, control and provision of output signal/alarm, or

b) NZS 4512 to provide ancillary function output for control of the *HVAC* system if a Type 4 or 7 alarm system is used as a means of smoke detection.

Type 18 – Fire hydrant systems for buildings

Fire hydrant systems shall comply with NZS 4510.

Appendix B (normative): Fire sprinkler systems

B1.1 Introduction

B1.1.1 Wherever sprinklers are required by this Acceptable Solution, they shall comply with the relevant New Zealand Standard, amended as shown in Paragraphs B2.1 and B3.1.

B2.1 Automatic fire sprinkler systems

B2.1.1 NZS 4541 is amended as follows:

Clause 103 Definitions

Sprinkler system A system including:

(a) to (i) No change.

(j) Delete.

(k)Delete.

(l) No change.

Clause 205 Delete entire clause.

Amend 2 Dec 2013

Clause 209 Delete entire clause.

Clause 1203 Routine Surveys

Clause 1203.1 Delete first two paragraphs and replace with:

> "It is important that a sprinkler system at all times complies with this Standard as amended by Paragraph B2.1 of Appendix B to C/AS1 in all respects. To ensure that building alterations, changes in process or storage patterns or progressive deterioration of system components do not prejudice system compliance, a comprehensive survey shall be carried out biennially at intervals not exceeding 28 months. Such surveys shall be carried out by an independent qualified person."

Amend 2 Dec 2013

B3.1 Residential fire sprinkler systems

B3.1.1 NZS 4515 is amended as follows:

Clause 1.5 Definitions

Sprinkler system A system including:

(a) to (g) No change.

(h) Delete.

Clause 1.11 Delete entire clause.

Clause 2.1.2 Delete.

Clause 2.1.3 Delete.

Appendix C (normative): Test methods

C1.1 General

This Appendix contains test methods for confirming that specific *building elements* satisfy relevant provisions of the Acceptable Solutions for Protection from Fire. It includes both established *standard tests* and other test methods for *building elements* in situations where *standard tests* are unavailable.

Comment:
Regardless of the year of the Standard incorporated by reference in this Acceptable Solution, there is no intention to require the *building elements* listed here to be retested to the current edition of the relevant Standard when they have previously been tested to an earlier version of that Standard in force at the time of testing.

Amend 3 Jul 2014

C2.1 Flammability of floor coverings

Materials shall be assigned a critical radiant flux when tested to:

ISO 9239 Reaction to fire tests for flooring – Part 1: Determination of the burning behaviour using a radiant heat source.

Or in lieu of testing refer to Table B1 of Appendix B of C/VM2.

Amend 3 Jul 2014

C3.1 Flammability of suspended flexible fabrics and membrane structures

Materials shall be assigned a *flammability index* when tested to:

AS 1530 Methods for fire tests on building materials and structures –
Part 2: Test for flammability of materials.

C4.1 Properties of lining materials

C4.1.1 Combustibility test

Materials shall be classified as *non-combustible* or *combustible* when tested to:

AS 1530 Methods for fire tests on building materials and structures –
Part 1: Combustibility test for materials.

C4.1.2 Materials for internal surface linings shall be given a *Group Number* in accordance with Appendix A of C/VM2 and tested to either:

ISO 5660 Reaction-to-fire tests
Part 1 Heat release rate (cone calorimeter method), and
Part 2 Smoke production rate (dynamic method), or

ISO 9705 Fire tests – Full scale room test for surface products.

Errata 1 Feb 2013

Or in lieu of testing refer to Table A1 of Appendix A of C/VM2.

Amend 3 Jul 2014

C5.1 Fire resistance

C5.1.1 *Primary* and *secondary elements*, closures and *fire stops* shall be assigned a *fire resistance rating (FRR)* when tested to:

a) AS 1530 Methods for fire tests on building materials and structures –
Part 4: Fire resistance tests of elements of building construction, or

b) NZS/BS 476 Fire tests on building materials and structures – Parts 21 and 22.

Errata 1 Feb 2013

C5.1.2 *Fire stops* shall be tested:

a) In circumstances representative of their use in service, paying due regard to the size of expected gaps to be *fire stopped*, and the nature of the *fire separation* within which they are to be used, and

b) In accordance with AS 4072: Components for the protection of openings in fire-resistent separating elements –
Part 1: Service penetrations and control joints.

C6.1 Fire doors and smoke control doors

C6.1.1 *Fire doors* shall be evaluated in circumstances representative of their use in service, and shall comply with NZS 4520 Fire-resistant doorsets.

Smoke control doors

C6.1.2 A door shall be deemed to be a *smoke control door* if, in addition to the requirements in this Acceptable Solution for *smoke control doors*:

a) The door is a *fire door* that is fitted with appropriate smoke seals, or if:

b) It is *constructed* with solid core leaves. Solid timber core leaves, when used, shall have a leaf thickness of no less than 35 mm, and

Amend 2 Dec 2013

c) It is provided with smoke seals as required by this Acceptable Solution. Smoke seals shall be in continuous contact with the mating element, and located so as to minimise interruption by hardware, and

d) The frames are constructed of timber, and the jambs are no less than 30 mm thick, and

Amend 2 Dec 2013

e) Any vision panel cut-outs are no less than 150 mm from the leaf edges, and

f) The maximum average clearances (excluding pre-easing) are:

i) Leaf to frame 3 mm

ii) Leaf to leaf 5 mm

iii) Leaf to top of any floor covering 10 mm, and

g) Any additional facings shall be adhesive fixed, and

h) It is provided with signage identifying it as a *smoke control door* in accordance with Acceptable Solution F8/AS1.

Frictional forces

C6.1.3 The forces required to open any *fire door* or *smoke control door* on an *escape route* shall not exceed 67 N to release the latch, 133 N to set the door in motion, and 67 N to open the door to the minimum required width. These forces shall be applied at the latch stile. These requirements do not apply to horizontal sliding doors in *risk group* SI or to power-operated doors.

Self-closing provision

C6.1.4 All *fire* and *smoke control door* leaves shall be self-closing, and provision shall be made for the self-closing device to be adjustable during commissioning to satisfy the requirements of Paragraph C6.1.3 after installation.

C6.1.5 Where it is desirable in normal circumstances for a *fire door* or *smoke control door* to operate freely, it is acceptable to use a self-closer mechanism which activates in the event of *fire* but does not operate at other times.

Comment:

1. These circumstances can occur where people are under care. Leaving the door to the occupant's room (or *suite*) open reduces that occupant's feeling of isolation and permits ready observation by staff.
2. Self-closers can be an obstruction to the elderly and *people with disabilities*, who may have difficulty in opening the door against the pressure applied by the self-closer. Acceptable Solution C/AS3 Paragraph 4.6 describes situations where *smoke control doors* do not have to be self closing where they are used within a *group sleeping area* or *suite*.

Automatic smoke-sensing devices

C6.1.6 Automatic smoke-sensing devices complying with NZS 4512, if used, shall be positioned within the stream of air that passes the door when the *smoke control door* is fully open.

C7.1 Fire properties of external wall cladding systems

C7.1.1 *Fire* properties of *external wall* cladding systems shall be determined in accordance with:

ISO 5660 Reaction-to-fire tests –
Heat release, smoke production and mass loss rate –
Part 1: Heat release rate (cone calorimeter method).

C7.1.2 In addition to meeting the general requirements of ISO 5660 Part 1, testing shall be in accordance with the following specific requirements:

a) An applied external heat flux of 50 kW/m^2, and

b) A test duration of 15 minutes, and

c) The total heat release measured from start of the test, and

d) Sample orientation horizontal, and

e) Ignition initiated by the external spark igniter.

C7.1.3 Timber claddings which have a *fire retardant* treatment incorporated in or applied to them shall be subjected to the regime of accelerated weathering described in ASTM D 2898 Method B with the water flow rate from Method A before testing in accordance with the requirements of Paragraph C7.1.1.

C7.1.4 *External wall* cladding systems which comprise only materials which individually are classified as *non-combustible* may be deemed to satisfy all the requirements of Paragraph 5.4.

Amend 5 Nov 2020

Comment:
The *non-combustible* classification represents a more onerous performance level than those required by Paragraph 5.4 and is therefore acceptable. A *non-combustible* classification may be claimed only if the respective materials have been subjected to testing as described in Paragraph C7.1.1.

Amend 5 Nov 2020

C7.1.5 Claddings incorporating a metal facing with a melting point of less than 750°C covering a *combustible* core or insulant shall be tested as described in Paragraph C7.1.2 without the metal facing present.

Comment:
Aluminium has a melting point of less than 750°C.

Index C/VM1 and C/AS1

References are to the relevent paragraphs, figures or tables in **C/VM1 and C/AS1** unless otherwise stated. References to Appendices are prefixed by the Appendix letter.

Using this Verification Method

The Ministry of Business, Innovation and Employment may amend parts of this Verification Method at any time. People using this Verification Method should check on a regular basis whether new versions have been published. The current version can be downloaded from www.building.govt.nz

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

Defined words (italicised in the text) are explained in the Building Code Clause A2 and in the Definitions section of this Verification Method. Classified uses of buildings are explained in the Building Code Clause A1. Importance levels of building are buildings (italicised in the text) are explained in the Building Code Clause A3.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

The Ministry of Business, Innovation and Employment
PO Box 10-729, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

ISBN: 978-0-478-38164-1 (print)
ISBN: 978-0-478-38165-8 (electronic)

Acceptable Solutions and Verification Methods are available from www.building.govt.nz

New Zealand Government

Status of C/VM2

This Verification Method C/VM2, Framework for Fire Safety Design, provides a means of compliance with the New Zealand Building Code Clauses C1-C6 Protection from Fire. It is issued under section 22 of the Building Act 2004 as a Verification Method.

This Verification Method is one way that can be used to show compliance with the New Zealand Building Code Clauses C1-C6 Protection from Fire. Other ways of complying with the Building Code are described, in general terms, in the preface of the New Zealand Building Code Handbook.

When can you use C/VM2

This Verification Method is effective from 5 November 2020. It can be used to show compliance with the Building Code Clauses C1-C6 Protection from Fire. It does not apply to building consent applications submitted before 5 November 2020.

The previous version, Amendment 5, of this Verification Method can be used to show compliance with the Building Code Clauses C1-C6 Protection from Fire until 3 November 2021. It can be used for building consent applications submitted before 4 November 2021.

Document History

	Date	Alterations	
New document	Effective from 10 April 2012	C/VM2 is a new publication that can be used to show compliance with the Building Code Clauses C1-C6 Protection from Fire.	
Amendment 1 (Errata 1)	Effective from 30 April 2012	p. 11, 1.2 p. 13, Figure 1.1 a) p. 19, Figure 1.1 g)	p. 32, Table 2.3 p. 39, Table 3.3 p. 59, 4.9
Amendment 2 (Errata 2)	Effective from 15 February 2013 until 18 June 2014	p. 9 Definitions pp. 25–26 2.2.1 p. 33 Table 2.4 p. 40 3.2.4 p. 41 3.2.7	p. 58 4.8 p. 59 4.9 p. 61 4.10 p. 64 Index
Amendment 3	Effective from 19 December 2013 until 28 February 2015	p. 5 Contents p. 7 References p. 10 Definitions p. 15 Figure 1.1 c pp. 25–26 2.2.1 pp. 28–32 Tables 2.1, 2.2, 2.3 p. 35 Table 3.1	pp. 39–42 3.2.4, 3.4, Table 3.3 pp 49–64 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, Tables 4.1 and 4.2 pp. 66–68 A1.1, A1.4, A1.5, Table A1 p. 69 Index
Amendment 4	Effective from 1 July 2014 until 23 November 2017	p. 5–6 Contents pp. 7-8 References p. 10–10A Definitions p. 11–13 1.2, 1.3, Figure 1.1 pp. 14–23 Figure 1.1 p. 24 1.5, Table 1.1 pp. 25–28, 30–31, 33–33A 2.2.1, 2.4, 2.4.4, 2.5, Tables 2.1, 2.2 and 2.4 pp. 34–44 3.1, 3.2.4, 3.2.5, 3.2.6, 3.3, 3.4, 3.4.1, 3.6.1, 3.6.3, 3.6.5, Tables 3.1, 3.2, 3.3	p. 45 Part 4 Contents pp. 46–47 4.1, 4.2 pp. 50–52, 4.5 pp. 53–56, 4.6, Table 4.2 p. 59 4.7 pp. 61–62 4.8 p. 63 4.9 p. 65 4.10 pp. 69–70 A1.6, A1.7, Tables A.1 and A.2 p. 71 Appendix B, Table B1 p. 72 Index
Amendment 5	Effective from 24 November 2017 until 3 November 2021	pp. 11-12 1.2 Scope	
Amendment 6	Effective from 5 November 2020	pp. 5–6 Contents pp. 7–8A References pp. 9–10 Definitions p. 11 Part 1 Contents pp. 25–26, Part 2 Contents, 2.2.1	p. 34 Part 3 Contents pp. 50–56 4.5, 4.6, Table 4.1 pp. 72-91 New Appendix C p. 92 Index

Contents

Amend 4 Jul 2014

Amend 6 Nov 2020

Amend 4 Jul 2014

Amend 4 Jul 2014

Amend 4 Jul 2014

Amend 4 Jul 2014

Amend 3 Dec 2013

Amend 3 Dec 2013

Amend 4 Jul 2014

Amend 6 Nov 2020

Amend 4 Jul 2014

Amend 4 Jul 2014

Amend 6 Nov 2020

Amend 3 Dec 2013

Amend 4 Jul 2014

Amend 6 Nov 2020

Amend 6 Nov 2020

Figures

Amend 4 Jul 2014

Amend 6 Nov 2020

References

For the purposes of New Zealand Building Code compliance, the New Zealand and other Standards, and other documents referred to in this Verification Method (primary reference documents) shall be the editions, along with their specific amendments, listed below. Where the primary reference documents refer to other Standards or other documents (secondary reference documents), which in turn may also refer to other Standards or other documents, and so on (lower order reference documents), then the applicable version of these secondary and lower order reference documents shall be the version in effect at the date that the primary reference document was published.

Amend 6 Nov 2020

Standards New Zealand

NZS 4510: 2008	Fire hydrant systems for buildings *Amend: 1*	4.8	
NZS 4512: 2010	Fire detection and alarm systems in buildings	3.4	
NZS 4515: 2009	Fire sprinkler systems for life safety in sleeping occupancies (up to 2000 m^2)	Definitions	
NZS 4541: 2013	Automatic fire sprinkler systems	Definitions, 4.5	Amend 3 Dec 2013; Amend 6 Nov 2020
AS/NZS 3837: 1998	Method of test for heat and smoke release rates for materials and products using an oxygen consumption calorimeter *Amend: 1*	Table 4.1	Amend 3 Dec 2013; Amends 3 and 6

Standards Australia

AS 1366:-	Rigid cellular plastics sheets for thermal insulation		Amend 4 Jul 2014
Part 1: 1992	Rigid cellular polyurethane (RC/PUR) *Amend: 1*	4.7, A1.7	
Part 2: 1992	Rigid cellular polyisocyanurate (RC/PIR)	4.7, A1.7	
Part 3: 1992	Rigid cellular polystyrene – moulded (RC/PS-M) *Amend: 1*	4.7, A1.7	
Part 4: 1989	Rigid cellular polystyrene – extruded (RC/PS-E)	4.7, A1.7	
AS 1530:-	Methods for fire tests on building materials, components and structures		
Part 1: 1994	Combustibility test for materials	4.7	
Part 2: 1993	Test for flammability of materials	4.7	
Part 4: 2005	Fire resistance tests for elements of construction	2.4	
AS 4254:-	Ductwork for air-handling systems in buildings	4.7, A1.4	Amend 3 Dec 2013
Part 1: 2012	Flexible duct		
Part 2: 2012	Rigid duct		
AS 5113: 2016	Classification of external walls of buildings based on reaction-to-fire performance *Amend: 1*	4.6	Amend 6 Nov 2020

British Standards Institution

BS 7273:-	Code of practice for the operation of fire protection measures		
Part 4: 2007	Actuation of release mechanisms for doors	4.10	

Amends 3 and 4

	BS 8414:-	Fire performance of external cladding systems	
	Part 1: 2015	Test method for non-loadbearing external cladding systems applied to the masonry face of a building *Amend: 1 (2017)*	4.6
	Part 2: 2015	Test method for non-loadbearing external cladding systems fixed to and supported by a structural steel frame *Amend: 1 (2017)*	4.6
	BS EN 13501:-	Fire classification of construction products and building elements	
Amend 6 Nov 2020	Part 1: 2018	Classification using test data from reaction to fire tests	Definitions

International Standards Organisation

ISO 1182: 2010	Reaction to fire tests for products – Non-combustibility test	4.7	
ISO 5660:-	Reaction-to-fire tests		
Part 1: 2002	Heat release, smoke production and mass loss rate	4.7, A1.1, A1.2, A1.3, A1.7, Table 4.1	3, 4, 6
Part 2: 2002	Smoke production rate (dynamic measurement)	A1.1	
ISO 9239:-	Reaction to fire tests for floorings		
Part 1: 2010	Determination of the burning behaviour using a radiant heat source	4.7, B1.0 Table B1,	
ISO 9705: 1993	Fire tests – Full-scale room test for surface products	4.7, A1.1, A1.2, A1.7	
ISO 13571: 2007	Life-threatening components of fire Guidelines for the estimation of time available for escape using fire data.	2.2.1	Amend 4 Jul 2014
ISO 13784:-	Reaction-to-fire tests for sandwich panel building systems		
Part 1: 2002	Test method for small rooms	A1.1, A1.7	Amend 4 Jul 2014

Amend 6 Nov 2020

European Committee for Standardisation

Eurocode DD ENV 1991:-	Eurocode 1: basis of design and actions on structures,	
Part 2.2: 1996	Actions on structures exposed to fire	2.4 Comment, 2.4.4

National Fire Protection Association of America

NFPA 285: 2019	Standard fire test method for evaluation of fire propagation characteristics of exterior wall assemblies containing combustible components	4.6

Amend 6 Nov 2020

Australian Building Codes Board

International Fire Engineering Guidelines (IFEG): 2005	1.3 Comment	Amend 4 Jul 2014

BRE Global

Amend 6 Nov 2020 BR 135: 2013	Fire performance of external thermal insulation for walls of multistorey buildings – Third Edition	4.6

Society of Fire Protection Engineers

The Handbook of Fire Protection Engineering, 4th Edition,	National Fire Protection Association, Quincy, M.A, USA, 2008.	
	Gwynne, S.M.V, and Rosenbaum, E.R, "Employing the Hydraulic Model in Assessing Emergency Movement", Section 3 Chapter 13.	3.2 Comment 3.2.6 Comment
SFPE Engineering Guide to Predicting 1st and 2nd Degree Skin Burns	from Thermal Radiation, 2000	3.6.1

General publications

Fire Engineering Design Guide (Centre for Advanced	Engineering, 2008)	2.4.4 Comment

This page deliberately left blank

Definitions

The full list of definitions for italicised words may be found in the New Zealand Building Code Handbook.

Available safe egress time (ASET) Time available for escape for an individual occupant. This is the calculated time interval between the time of ignition of a fire and the time at which conditions become such that the occupant is estimated to be incapacitated (ie, unable to take effective action to escape to a *place of safety*).

Burnout Means exposure to fire for a time that includes fire growth, full development, and decay in the absence of intervention or automatic suppression, beyond which the fire is no longer a threat to building elements intended to perform loadbearing or fire separation functions, or both.

Amend 6 Nov 2020

Cavity barriers A *construction* provided to close openings within a *concealed space* against the passage of *fire*, or to restrict the spread of *fire* within such spaces.

Computational fluid dynamics (CFD) Calculation method that solves equations to represent the movement of fluids in an environment.

Design fire Quantitative description of assumed *fire* characteristics within the *design scenario*.

Design scenario Specific scenario on which a deterministic *fire safety engineering* analysis is conducted.

Detection time Time interval between ignition of a *fire* and its detection by an automatic or manual system.

Evacuation time Time interval between the time of warning of a *fire* being transmitted to the occupants and the time at which the occupants of a specified part of a *building* or all of the *building* are able to enter a *place of safety*.

Fire decay Stage of *fire* development after a *fire* has reached its maximum intensity and during which the *heat release rate* and the temperature of the *fire* are decreasing.

Fire growth Stage of *fire* development during which the *heat release rate* and the temperature of the *fire* are increasing.

Fire load Quantity of heat which can be released by the complete combustion of all the *combustible* materials in a volume, including the facings of all bounding surfaces (Joules).

Fire load energy density (FLED) *Fire load* per unit area (MJ/M^2).

Fire safety engineering Application of engineering methods based on scientific principles to the development or assessment of designs in the built environment through the analysis of specific *design scenarios* or through the quantification of risk for a group of *design scenarios*.

Flashover Stage of *fire* transition to a state of total surface involvement in a *fire* of *combustible* materials within an enclosure.

Fractional effective dose (FED) The fraction of the dose (of carbon monoxide (CO) or thermal effects) that would render a person of average susceptibility incapable of escape.

Comment:
The definition for FED has been modified from the ISO definition to be made specific for this Verification Method. The ISO definition is "Ratio of the exposure dose for an insult to that exposure dose of the insult expected to produce a specified effect on an exposed subject of average susceptibility."

Fully developed fire State of total involvement of *combustible* materials in a *fire*.

Heat of combustion Thermal energy produced by combustion of unit mass of a given substance (kJ/g).

Heat release Thermal energy produced by combustion (Joules).

Heat release rate (HRR) Rate of thermal energy production generated by combustion (kW or MW).

Importance level As specified in Clause A3 of the *Building Code*.

Incapacitated State of physical inability to accomplish a specific task. Errata 2 Feb 2013

Insulation In the context of *fire* protection, the time in minutes for which a prototype specimen of a *fire separation*, when subjected to the *standard test* for *fire* resistance, has limited the transmission of heat through the specimen.

Integrity In the context of *fire* protection, the time in minutes for which a prototype specimen of a *fire separation*, when subjected to the *standard test* for *fire* resistance, has prevented the passage of flame or hot gases.

> Comment:
> The precise meaning of *integrity* depends on the type of *building elements* being treated and how it is defined in the *standard test* being used.

Limited combustible A material that does not comply with the requirements for a *non-combustible* material and is classified as A2 in accordance with to BS EN 13501-1.

Non-combustible Material either—

a) composed entirely of glass, concrete, steel, brick/block, ceramic tile, or aluminium; or

b) classified as non-combustible when tested to AS 1530.1; or

c) classified as A1 in accordance with BS EN 13501-1.

Amend 6 Nov 2020

Optical density of smoke Measure of the attenuation of a light beam passing through smoke expressed as the logarithm to the base 10 of the opacity of smoke.

Opacity of smoke Ratio of incident light intensity to transmitted light intensity through smoke under specified conditions.

Place of safety means either—

a) a *safe place*; or

b) a place that is inside a *building* and meets the following requirements:

i) the place is constructed with *fire separations* that have *fire* resistance sufficient to withstand *burnout* at the point of the *fire source*; and

ii) the place is in a *building* that is protected by an automatic fire sprinkler system that complies with NZS 4541 or NZS 4515 as appropriate to the *building's* use; and

iii) the place is designed to accommodate the intended number of persons at a design occupant density – depending on the usage this shall not be less than 1.0 m^2 per person; and

Amends 3 and 4

iv) the place is provided with sufficient means of escape to enable the intended number of persons to escape to a *safe place* that is outside a *building*.

Pre-travel activity time Time period after an alarm or *fire* cue is transmitted and before occupants first travel towards an exit.

Required safe egress time (RSET) Time required for escape. This is the calculated time period required for an individual occupant to travel from their location at the time of ignition to a *place of safety*.

Response Time Index (RTI) The measure of the reaction time to a *fire* phenomenon of the sensing element of a *fire safety system*.

Safe place A place, outside of and in the vicinity of a single *building* unit, from which people may safely disperse after escaping the effects of a *fire*. It may be a place such as a street, *open space*, public space or an *adjacent building* unit.

> Comment:
> The Fire Safety and Evacuation of Buildings Regulations 2006 use the term *'place of safety'* and allow the *place of safety* to be within the *building* provided that it is protected with a sprinkler system.

Separating element Barrier that exhibits fire *integrity*, *structural adequacy*, thermal *insulation*, or a combination of these for a period of time under specified conditions (in a fire resistance test).

Smoke production rate Amount of smoke produced per unit time in a *fire* or *fire* test.

Smoke separation Any *building element* able to prevent the passage of smoke between two spaces. *Smoke separations* shall:

a) Be a smoke barrier complying with BS EN 12101 Part 1, or

b) Consist of rigid *building elements* capable of resisting without collapse:

i) a pressure of 0.1 kPa applied from either side, and

ii) self weight plus the intended vertically applied live loads, and

c) Form an imperforate barrier to the spread of smoke, and

Amend 4 Jul 2014

d) Be of *non-combustible construction*, or achieve a *FRR* of 10/10/-, except that non-*fire resisting glazing* may be used if it is toughened or laminated *safety glass*.

Comment:
The pressure requirement is to ensure rigidity and is not a smoke leakage requirement.

Walls and floors, whether *constructed* of sheet linings fixed to studs or joists, or of concrete, glazing, metal or fired clay, need only be inspected by someone experienced in *building construction* to judge whether the *construction* is tight enough to inhibit the passage of smoke.

Item d) is intended to ensure that the *smoke separation* will continue to perform as an effective barrier when exposed to *fire* or smoke for a short period during *fire* development.

Amend 4 Jul 2014 There is no requirement for *smoke control doors* or other closures in *smoke separations* to meet the provisions of item d).

Specific extinction area of smoke
Extinction area of smoke produced by a test specimen in a given time period, divided by the mass lost from the test specimen in the same time period.

Structural adequacy In the context of the *standard test* for *fire* resistance, is the time in minutes for which a prototype specimen has continued to carry its applied load within defined deflection limits.

Surface spread of flame Flame spread away from the source of ignition across the surface of a liquid or a solid.

Travel distance Distance that is necessary for a person to travel from any point within a built environment to the nearest exit, taking into account the layout of walls, partitions and fittings.

Visibility Maximum distance at which an object of defined size, brightness and contrast can be seen and recognised.

Yield Mass of a combustion product generated during combustion divided by the mass loss of the test specimen.

1 Introduction and scope

CONTENTS

1.1 Purpose

This is a Verification Method for the specific design of *buildings* to demonstrate compliance with NZBC C1 to C6 Protection from Fire. It is suitable for use by professional fire engineers who are proficient in the use of fire engineering modelling methods.

1.2 Scope

1.2.1 This Verification Method is for *fire* designs for all *buildings* except those *buildings* that:

a) Do not have simultaneous evacuation schemes that evacuate immediately to the outside, or

b) Require a managed evacuation, or

c) Contain *fire hazards* that are not defined by Part 2 of this Verification Method "The rules and parameters for the Design Scenarios".

Comment:

Errata 1 Amend 4

1. This Verification Method is an analysis tool for *buildings* with simultaneous evacuation schemes that evacuate immediately to the outside, and with typical *fire growth* rates.
2. Additional *fire* safety precautions to those determined by this Verification Method may be necessary to facilitate approval of the intended evacuation procedures to meet the Fire Safety and Evacuation of Buildings Regulations 2006.
3. Examples of *buildings* outside of the scope include hospitals, care homes, stadia, principal transport terminals, large shopping malls (greater than 10,000 m^2 and contain mezzanine floors), tall *buildings* (greater than 60 metres or 20 storeys in height) or tunnels.
4. *Fire* safety design for *buildings* that are outside of the scope can be performed using the Fire Engineering Brief (FEB) process and the appropriate parts of this Verification Method, which can be considered by the *building consent authority* as an *alternative solution.*

Amend 5 Nov 2017

1.2.2 This Verification Method does not provide *fire* design where there is use, storage or processing of *hazardous substances*.

Comment:
Compliance with NZBC F3 and the Hazardous Substances and New Organisms (HSNO) Act 1996 should be considered where applicable in addition to the requirements of this Verification Method.

Amend 5
Nov 2017

1.3 How to use this Verification Method

This Verification Method sets out 10 *design scenarios* that must each be considered and designed for, where appropriate, in order to achieve compliance with NZBC C: Protection from Fire.

The concept *fire* design shall be trialled using *building* specific *fire* design requirements ascertained via the Fire Engineering Brief (FEB) process as described in internationally recognised *fire* engineering process documents.

Comment:
There are a number of internationally recognised process documents including the International Fire Engineering Guidelines and others published by British Standards and the Society for Fire Protection Engineers.

Amend 4
July 2014

Follow the process schematically illustrated in Figure 1.1 as appropriate, analysing or testing the *fire* design against the *design scenarios* as applicable and modelling the *design scenario*: CF Challenging Fire (see Paragraph 4.9) a number of times with the *design fire* positioned in the most challenging locations.

Comment:
ASET/RSET and other computational modelling is only required for a few of the *design scenarios*. Many can be satisfied by inspection or by providing certain features (eg, *fire separations* or smoke detection systems).

In many cases the location that is the most challenging (that which will provide the shortest *ASET/RSET*) will be easily determined.

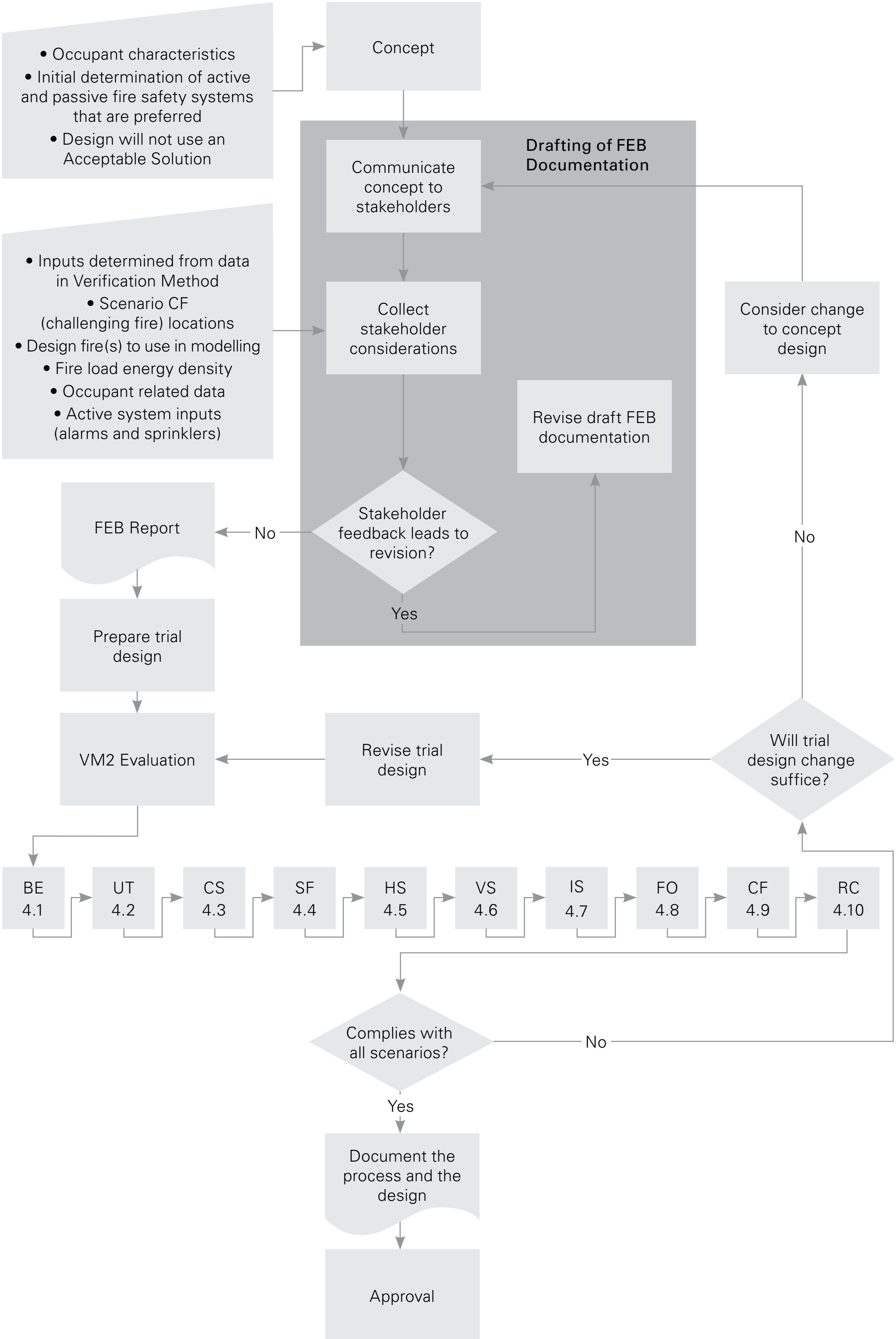
In Figure 1.1, the numbered references are to paragraph numbers in this Verification Method.

Figure 1.1 is guidance information illustrating how the use of this Verification Method – in particular the *design scenarios* – fits into the general iterative *fire* design process. The flowchart assumes design starts at concept design stage. The sequence of assessing each of the *design scenarios* may vary from that idealised in Figure 1.1. The design process outlined in the flowchart will vary when using this Verification Method for assessing Code compliance of existing *buildings*. The overall process described in Figure 1.1 is not itself a normative part of C/VM2.

The communication process relating to FEB development will vary for each project and may include both written and verbal communication to collect stakeholder considerations and test options when preparing trial designs. Similarly, the form of FEB documentation will vary depending on the complexity and scale of the project and the design issues. The key features of both the FEB communication and documentation are that it is unambiguous, complete (i.e. provided with appropriate context) and recorded in some form for later reference.

Amends
3 and 4

Figure 1.1: The design process overview for C/VM2



Amend 4
Jul 2014

1.4 Design scenarios: Building Code objectives and performance criteria

The *design scenarios* specified in Part 4 are summarised in Table 1.1 (with paragraph numbers given in brackets for ease of reference). Each scenario must be considered separately to achieve the *Building Code* objectives and to satisfy the performance criteria of the *Building Code* clauses shown.

1.5 Construction

Detailing during *construction* shall meet the requirements of the design as developed using this Verification Method.

Comment:
For example:

1. *Fire* rated closures including doors have to be tested in accordance with an internationally recognised standard to confirm the *FRR.*
2. *Fire* and smoke separations should be *fire stopped* with appropriate proprietary products for the orientation and be specific for use in that *separating element.*

Amend 4
Jul 2014

Table 1.1 **Key features of design scenarios**

Design scenario		*Building Code* objectives	*Building Code* criteria	Expected method
Keeping people safe				
BE	*Fire* blocks exit (4.1)	C1(a)	C4.5	Solved by inspection
UT	*Fire* in a normally unoccupied room threatening occupants of other rooms (4.2)	C1(a)	C4.3, C4.4	*ASET/RSET* analysis or provide *separating elements*/suppression complying with a recognised Standard
CS	*Fire* starts in a *concealed space* (4.3)	C1(a)	C4.3	Provide *separating elements*/suppression or automatic detection complying with a recognised Standard
SF	Smouldering *fire* (4.4)	C1(a)	C4.3	Provide automatic detection and alarm system complying with a recognised Standard
IS	Rapid *fire* spread involving internal surface linings (4.7)	C1(b)	C3.4	Suitable materials used (proven by testing)
CF	Challenging *fire* (4.9)	C1(a)	C4.3, C4.4	*ASET/RSET* analysis
RC	Robustness check (4.10)	C1(a), C1(b), C1(c)	C3.9, C4.5, C5.8, C6.2(d)	Modified *ASET/RSET* analysis
Protecting other property				
HS	Horizontal *fire* spread (4.5)	C1(b), C1(a)	C3.6, C3.7, C4.2	Calculate radiation from *unprotected areas* as specified
VS	External vertical *fire* spread (4.6)	C1(a), C1(b)	C3.5	Suitable materials used (proven by testing) and *construction* features specified (eg, aprons/ spandrels/sprinklers) as required to limit vertical *fire* spread
Firefighting operations				
FO	Firefighting operations (4.8)	C1(b), C1(c)	C3.8, C5.3, C5.4, C5.5, C5.6, C5.7, C5.8, C6.3	Demonstrate firefighter safety

Amend 4
Jul 2014

Part 2: Rules and parameters for the design scenarios

CONTENTS

Amend 6 Nov 2020

2.1 Applying the design scenarios

This Verification Method sets out 10 *design scenarios* that must each be considered and designed for, where appropriate, in order to achieve compliance with NZBC C1-C6: Protection from Fire.

This section sets out the *fire* modelling rules, *design fire* characteristics and other parameters to be used in calculations required by the *design scenarios*. Occupancy criteria and calculations for the movement of people are provided in Part 3.

2.2 Fire modelling rules

The *fire* modelling rules in Paragraphs 2.2.1 and 2.2.2 shall be applied to the *design scenarios* as appropriate.

2.2.1 Fire modelling rules for life safety design

The model to be used, and the spaces or volumes to be modelled, shall be established at FEB.

The trial design shall identify the type of separations (eg *fire separation*, smoke separation or unrated *construction*) and closures (eg *fire* or *smoke control doors* etc) proposed, and which of these are relevant for inclusion in the analysis. These modelling rules detail the assumptions to be made regarding the different types of separation or closure. These modelling rules are not intended to imply that it is necessary to include all separations and closures in the analysis. Only those separations and closures forming the volumes required to demonstrate the safe evacuation of occupants need be considered in an *ASET* analysis. Amend 4 Jul 2014

Fire modelling rules for life safety design shall be as follows:

a) Warning systems in accordance with Paragraph 3.4 shall be installed.

b) *Fire* and *smoke control doors* with self-closers complying with a recognised national or international Standard are assumed closed unless being used by occupants. During egress, when *occupant load* is low, doors are assumed to be open for three seconds per occupant. However, when the *occupant load* is high and queuing is expected, the door is considered to be open for the duration of queuing.

c) *Smoke control doors* serving bedrooms in sleeping areas where care is provided (these do not have self closers) shall be considered to be closed from the time that evacuation from the bedroom is completed in accordance with Paragraph 3.2 and Table 3.3. Amend 4 Jul 2014

d) External doors and other closures such as roller shutters shall be modelled as closed unless explicitly designed to open in the event of *fire.* Amend 3 Dec 2013

Amend 3 Dec 2013

e) All doors not described in Paragraph 2.2.1 b), c) and d) shall be considered to be open during the analysis unless:

Amend 4 Jul 2014

i) there is a high likelihood that the door will be closed for security or other functional reasons throughout the time period of analysis; and

Amend 6 Nov 2020

ii) the substantiated functional reason is established at FEB.

Amend 3 Dec 2013

f) Doors being used for egress, when in the open position, are assumed to be half-width for smoke flow calculations.

Amend 3 Dec 2013

Errata 2 Feb 2013

g) Leakage area through non *fire*-rated walls shall be calculated according to Paragraph 2.2.1 i). The leakage may be modelled either as a tall narrow slot from floor to ceiling with the width determined by the calculated area, or as two vents, one at floor level and one at ceiling level, to fit within the computational grid (in the case of *CFD* modelling). Where the leakage is from a room to the outside, it may also be modelled as a single vent at floor level. Where there is a permanent opening between two spaces, the leakage between those spaces may be ignored if the area of the permanent opening is at least five times the leakage area.

Errata 2 Feb 2013

Amend 3 Dec 2013

h) Where *CFD* modelling is used, leakage areas shall be calculated according to Paragraph 2.2.1 i) and modelled as described in Paragraph 2.2.1 g). In cases where the required leakage vent area is smaller than a single grid cell, the leakage may be increased to fit within the computational grid. However, the combined area of the modelled leakage vents shall not exceed 5 times that of the calculated leakage area.

Amend 4 Jul 2014

Amend 3 Dec 2013

i) Leakage areas assumed for modelling shall be as follows:

Amend 4 Jul 2014

i) *smoke control doors* that comply with a recognised national or international Standard (including doors that have both *fire* and smoke control capability complying with a recognised national or international Standard) and *smoke separations* are assumed to have zero leakage area, except for a 10 mm gap under doors

Amend 4 Jul 2014

ii) *fire* doors that are not *smoke control doors* are assumed to have a 10 mm gap over the height of the door

iii) *construction* having a *fire resistance rating* (excluding doors) is considered to have no leakage, and

iv) non *fire*-rated internal and *external walls* are assumed to have leakage areas that are proportional to the surface area of the walls. Leakage area is equal to the wall area multiplied by 0.001 m^2/m^2 (ie, 0.1%) for lined internal and *external walls* and 0.005 m^2/m^2 for unlined *external walls*.

j) The volume of storage racking, furniture and other contents need not be subtracted from the gross volume.

Amends 3 and 4

Errata 1 Amend 3

k) *Smoke separations* including glazing that comply with recognised national or international Standards for use as a smoke barrier are assumed to remain in place up to the rated temperature or the time at which *flashover* occurs, whichever is sooner.

Amend 3 Dec 2013

l) *Smoke separations* that are not tested (eg, non *fire* rated but imperforate *construction*) are assumed to remain in place until the average upper layer temperature reaches 200°C.

Amend 4 Jul 2014

Errata 1 Amend 3

m) Exterior windows that are not *fire resisting glazing* are assumed to break (ie, glass falls out to become completely open) at the sooner of either average upper layer temperature reaching 500°C or when the *fire* becomes limited by ventilation. Windows that are *fire resisting glazing* may be assumed to remain in place up to the rated time.

Amend 3 Dec 2013

n) The *fire* shall be located away from walls and corners to maximise entrainment of air into the fire plume. The base of the *fire* shall be located at a height of no more than 0.5 m above floor level.

Amend 3 Dec 2013

o) *Fractional Effective Dose (FED)* for CO and thermal effects shall be calculated using the procedures described in ISO 13571. FED_{CO} shall include contributions from CO, CO_2 and O_2 gases. $FED_{thermal}$ shall include radiative and convective effects.

Amend 4 Jul 2014

p) For *design scenario* FO only, if *CFD* modelling is used the layer height shall be defined from the visibility results arranged over a number of points throughout the space. The number and location of the points where the layer height is monitored and the criteria for defining the average layer height are described in Appendix C of the commentary.

Amend 3 Dec 2013

Also refer to Paragraph 2.3.3 for guidance on modelling post-*flashover fires* when evaluating life safety on *escape routes* that are not in the room of *fire* origin.

2.2.2 Fire modelling rules for resistance of fire separations and structural design

a) *Fire* modelling rules shall be as specified in Paragraphs 2.3.2 and 2.3.3 for *fires* reaching full *burnout*, for structural design and for assessing *fire* resistance required of *separating elements*.

b) The *design fire* severity for car parking areas incorporating a vehicle stacking system shall use the *FLED* specified in Table 2.2.

c) The *design fire* severity for car parking areas with overlapping interconnected floors shall be based on the worst case (floor area and effective openings available for ventilation) for one of the overlapping floors or for the worst combination of two adjacent (overlapping) floors.

d) For car parking areas, the area of vertical opening ventilation available to the *fire* shall be the area available via permanent openings to the outside environment in the perimeter walls and access ramps to a car parking level above. Access ramp area shall be taken as the projection on the vertical plane at the point where the ramp meets the floor of the car park at the level under consideration.

e) For effective openings:

i) Only those areas of openings in *external walls* and roofs which can dependably provide airflow to the *fire* shall be used in calculating the *fire* severity. Such opening areas include windows containing non-*fire resisting glazing* and horizontal parts of a roof which are specifically designed to open or to melt rapidly in the event of exposure to *fully developed fire*.

ii) An allowance can be made for air leakage through the *external wall* of the *building* envelope. The allowance for inclusion in the vertical openings area shall be no greater than 0.1% of the *external wall* area where the wall is lined internally and 0.5% where the *external wall* is unlined.

iii) For single storey *buildings* or the top floor of multi-storey *buildings* where the structural system supporting the roof is exposed to view and has no dependable *fire* resistance (eg, less than 10 minutes), the ratio of A_h/A_f can be taken as 0.2.

2.3 Design fire characteristics

Analysis for a number of the *design scenarios* is based on the use of '*design fires*'. These are defined by one or more of the following parameters:

a) *Fire* growth rate

b) Peak *heat release rate*

c) *Fire load energy density*

d) Species production (CO, CO_2, water, soot)

e) Heat flux, and

f) Time.

Parameters and modelling instructions are given below for:

a) Pre-*flashover design fires*

b) Post-*flashover design fires*, and

c) Full *burnout design fires*.

The individual *design scenarios* in Part 4 specify where these *design fires* are to be used.

2.3.1 Pre-flashover design fires

The characteristics of the pre-*flashover design fire* are given in Table 2.1. In most cases (ie, for all *buildings*, including storage *buildings*, that are capable of storage to a height of less than 3.0 m) the *fire* is assumed to grow as a fast t^2 *fire* up to *flashover* or until the *HRR* reaches the peak given in Table 2.1 or becomes ventilation limited.

Table 2.1 Pre-flashover design fire characteristics

Building use	*Fire* growth rate (kW)	Species	Radiative fraction	Peak *HRR*/ *HRR*/m^2
All *buildings* including storage with a stack height of less than 3.0 m	$0.0469\ t^2$	Y_{soot}= 0.07 kg/kg Y_{CO}= 0.04 kg/kg ΔH_C= 20 MJ/kg Y_{CO_2}= 1.5 kg/kg$^{(1)}$ Y_{H_2O}= 0.82 kg/kg$^{(1)}$	0.35	20 MW 500 – 1000 kW/m$^{2(2)}$ 250 kW/m$^{2(3)}$
Carparks (no stacking)	$0.0117\ t^2$		0.35	
Capable of storage to a stack height of between 3.0 m and 5.0 m above the floor	$0.188\ t^2$		0.35	50 MW
Capable of storage to a stack height of more than 5.0 m above the floor and car parks with stacking systems	$0.00068\ t^3\ H$		0.35	1000–2500 kW/m$^{2(2)}$ 250 kW/m$^{2(3)}$

NOTE:
t = time in seconds
H = height to which storage is capable of in metres
Y = *yield* kg/kg
ΔH_C = heat of combustion
(1) As an an alternative to CO_2 + H_2O *yields* use generic fuel as $CH_2O_{0.5}$ and calculate *yields*.
(2) In a CFD model the *fire* is intended to be modelled as a plan area where the size is determined from the peak *HRR*/m^2. A range is provided for *HRR*/m^2 to accommodate different *HRR* and mesh sizes.
(3) Use in a zone model.

Amend 4 Jul 2014
Amend 4 Jul 2014
Amend 4 Jul 2014
Amend 4 Jul 2014
Amend 3 Dec 2013

For life safety analysis in sprinklered *buildings*, the *fire* is assumed to be controlled (ie, with a constant *HRR*) after the sprinkler activates based on *RTI*, C-factor and activation temperature as specified in Table 3.2.

2.3.2 Post-flashover design fires

Flashover is assumed to occur when the average upper layer temperature first reaches 500°C.

For uncontrolled *fires*, the burning rate is assumed to be governed by the ventilation limit or the peak *HRR*, whichever is less.

2.3.3 Modelling post-flashover fires

For life safety calculations (ie, *ASET*), modelling the *fire* into the post-*flashover* phase is unlikely to be required for sprinklered *buildings*. The *fire* is expected to be controlled (ie, with a constant *HRR*) after the sprinkler activates based on *RTI*, C-factor and activation temperature, and therefore *flashover* is not expected to occur. Sprinkler response calculations would be expected to confirm that this is the case.

However, note that for the full *burnout design fire* (see Paragraph 2.4), calculations of *fire* resistance shall be based on *burnout* without sprinkler or other intervention, except that the design *FLED* may be modified as described in Paragraph 2.4.1 where sprinklers are installed.

The following parameters shall apply:

a) Post-*flashover* species *yield* for soot is Y_{soot} = 0.14 kg/kg$_{fuel}$

b) Post-*flashover* species *yield* for CO is Y_{CO} = 0.40 kg/kg$_{fuel}$, and

c) Design *FLEDs* shall be as specified in Table 2.2 for activities within *buildings*.

The three steps for modelling the *fire* shall be as follows:

Step 1: Determine initial pre-*flashover fire growth* rate from Table 2.1; typically $q=0.0469t^2$.

Step 2: Run the *fire* model and determine which of the following five cases apply. If necessary adjust the input *HRR* to the model as described below and rerun the model.

Case 1 *Fire growth* reaches the peak *HRR* from Table 2.1 before $T_{UL}=500°C$

Fast *fire growth* to the peak *HRR* from Table 2.1

Species as given for pre-*flashover*

Case 2 Sprinklers activate before *fire growth* reaches the peak *HRR* from Table 2.1

Fast *fire growth* to sprinkler activation

Species as given for pre-*flashover*

Case 3 $T_{UL}=500°C$ before *HRR* reaches the peak from Table 2.1 and *fire* is not ventilation limited

Fast *fire growth* to $T_{UL}=500°C$

Species as given for pre-*flashover*

At $T_{UL}=500°C$ ramp up the *HRR* to the peak *HRR* from Table 2.1 over a period of 15s

Species as given for post-*flashover*

Case 4 $T_{UL}=500°C$ before *HRR* reaches the peak from Table 2.1 and *fire* is ventilation limited

Fire growth to $T_{UL}=500°C$

Species as given for pre-*flashover*

At $T_{UL}=500°C$ (or ventilation limit, whichever occurs first) ramp up the *HRR* to 1.5 times the ventilation limit over a period of 15s

Species as given for post-*flashover*

Case 5 $T_{UL}<500°C$ and *fire* is ventilation limited

Fast *fire growth* to ventilation limit

Species as given for pre-*flashover*

At ventilation limit ramp up the *HRR* to 1.5 times the ventilation limit over a period of 15s

Species as given for post-*flashover*.

For modelling purposes, the ventilation limit shall be taken as the *HRR* at the time when the predicted energy release first diverges from the *design fire* (given in Table 2.1) due to the lack of sufficient oxygen for complete combustion.

Comment:
Ventilation limit is determined by *fire* modelling. See the commentary document for this Verification Method for a calculation example.

T_{UL} is the average temperature of the upper layer.

Step 3: Allow the *fire* to burn until all the fuel is exhausted, based on the design *FLED*. Use the design *FLEDs* provided in Table 2.2.

Table 2.2 **Design FLEDs for use in modelling fires in C/VM2**

Design *FLED* (MJ/m^2)	Activities in the space or room	Examples
400	1. Display or other large open spaces; or other spaces of low *fire hazard* where the occupants are awake but may be unfamiliar with the *building*.	1. Art galleries, auditoriums, bowling alleys, churches, clubs, community halls, court rooms, day care centres, gymnasiums, indoor swimming pools
	2. Seating areas without upholstered furniture	2. School classrooms, lecture halls, museums, eating places without cooking facilities
	3. All spaces where occupants sleep	3. *Household units*, motels, hotels, hospitals, residential care institutions
	4. Working spaces and where low *fire hazard* materials are stored	4. Wineries, meat processing plants, manufacturing plants
	5. Support activities of low *fire hazard*	5. Car parks, locker rooms, toilets and amenities, service rooms, plant rooms with plant not using flammable or *combustible* fuels
800	1. Spaces for business	1. Banks, personal or professional services, police stations (without detention), offices
	2. Seating areas with upholstered furniture, or spaces of moderate *fire hazard* where the occupants are awake but may be unfamiliar with the *building*	2. Nightclubs, restaurants and eating places, *early childhood centres*, cinemas, *theatres*, libraries
	3. Spaces for display of goods for sale (retail, non-bulk)	3. Exhibition halls, shops and other retail (non bulk)
1200	1. Spaces for working or storage with moderate *fire hazard*	1. Manufacturing and processing moderate *fire load* 2. Storage up to 3.0 m high other than *foamed plastics*
	2. Workshops and support activities of moderate *fire hazard*	3. Maintenance workshops, plant and boiler rooms other than those described elsewhere
400/tier of car storage	Spaces for multi-level car storage	Car stacking systems. The design floor area over which the design *FLED* applies is the total actual car parking area
800/m height, with a minimum of 2400	1. Spaces for working or storage with high *fire hazard*	1. Chemical manufacturing and processing, feed mills, flour mills 2. Storage over 3.0 m high of *combustible* materials, including temperature controlled storage
	2. Spaces for display and sale of goods (bulk retail)	3. Bulk retail (over 3.0 m high)

Amends 3 and 4

Amend 3 Dec 2013

Amend 3 Dec 2013

Amend 4 Jul 2014

2.4 Full burnout design fires

Comment:
Design fire characteristics include parameters for *FLED, fire growth* rate and heat of combustion. This means a post-*flashover* 'full *burnout design fire*' can be defined.

The 'full *burnout design fire*' for structural design and for assessing *fire* resistance of *separating elements* shall be based on complete *burnout* of the *firecell* with no intervention. However, the maximum *fire resistance rating* for an unsprinklered *firecell* need not exceed 240/240/240 and 180/180/180 for a sprinklered *firecell*, determined using AS 1530.4.

Amend 4 Jul 2014

There are three choices for modelling the full *burnout design fire*:

a) Use a time-equivalent formula to calculate the equivalent *fire* severity and specify *building elements* with a *fire resistance rating* not less than the calculated *fire* severity. In this case, an equivalent *fire* severity of 20 minutes shall be used, if the calculated value is less.

b) Use a parametric time versus gas temperature formula to calculate the thermal boundary conditions (time/temperature) for input to a structural response model, or

c) Construct an *HRR* versus time structural *design fire*. Then, taking into account the ventilation conditions, use a *fire* model or energy conservation equations to determine suitable thermal boundary conditions (time/temperature/flux) for input to a structural response model.

Amend 4 Jul 2014

Comment:
1. A common approach to use with this Verification Method is the 'equivalent fire severity' method described in Eurocode 1 Actions on structures, Part 2-2. This allows the equivalent time of exposure to the *standard test* for *fire* resistance to be estimated based on the compartment properties, *FLED* and available ventilation given complete *burnout* of the *firecell* with no intervention.
2. In c) the designer has to establish and justify at FEB the peak *HRR*.

Amend 4 Jul 2014

2.4.1 Modifications to the design FLED

For assessing the *fire* resistance of structural and non-structural elements, the design *FLED* from Table 2.2 used for the *design fire* shall be modified by multiplying the *FLED* by the applicable F_m factor from Table 2.3.

For assessing *fire* duration for life safety calculations the design *FLED* from Table 2.2 shall be modified by multiplying the *FLED* by the applicable F_m factor from Table 2.3.

Table 2.3 **F_m factors to be applied to FLED**

	Sprinklered *firecell*	Unsprinklered *firecell*
For calcuations of *fire* duration[1] and for *fire* resistance of all non-structural elements[2] Fire resistance of structural elements not covered by the description in the row below	0.50	1.00
Fire resistance of structural elements in a structural system which is unable to develop dependable deformation capacity under post-*flashover fire* conditions [3]	1.00	1.25

Errata 1 Apr 2012

Notes

1. Life safety calculations of the duration of the *fire* (total duration of burning) may use the *FLED* as modified by the F_m factor in the table.
2. This table does not prescribe that all non-structural elements require fire resistance based on fire duration. However, where calculation of *fire* resistance of non-structural elements is based on *fire* duration, this table gives the F_m value to be applied to the *FLED*.
3. This factor accounts for impact of non-uniform *fire load* and/or ventilation and hence local increase in actual structural *fire* severity on a structural system which has less resilience to accommodate variations from the calculated *fire* severity. For this purpose the structural system comprises the individual members and the connections between these members.

Amend 3 Dec 2013

2.4.2 Openings for full burnout fires

For the purposes of calculating A_v (the total area (m^2) of vertical windows and doors) in full *burnout design fire* calculations it shall be assumed that doors in *external walls* are closed. Wall areas clad in sheet metal shall not be included in the area A_v.

Comment:
Also refer to the *fire* modelling rules for full *burnout fires* in Paragraph 2.2.2 for effective openings.

2.4.3 Structural fire severity for interconnected floors

Where a space contains interconnected floors, separate calculations shall be made to determine the structural *fire* severity, first by considering the total floor area of the space and then by considering the interconnected floor at each level. The greatest magnitude of structural *fire* severity shall be applied to all levels, unless the structural system supporting floors is designed to dependably prevent collapse during the *fire*.

2.4.4 Time equivalence formula

The time equivalence formula shall be taken from Annex E of Eurocode DD ENV 1991-2-2.

Comment:
Further discussion can be found in the Fire Engineering Design Guide.

The required *fire resistance rating* must be greater than the time equivalence (t_e) value calculated using the equations 2.1 and 2.2:

$$t_e = e_f\, k_b\, k_m\, w_f \qquad \text{Equation 2.1}$$

where:

e_f = *FLED* given in Table 2.2 and as modified by Table 2.3.

k_b = conversion factor to account for the thermal properties of the material, as specified in Table 2.4

k_m = modification factor for the structural material.

and

w_f = ventilation factor.

$$w_f = \left(\frac{6.0}{H}\right)^{0.3}\left[0.62 + \frac{90(0.4-\alpha_v)^4}{1 + b_v\alpha_h}\right] \geq 0.5$$

Equation 2.2

where

$\alpha_v = A_v / A_f \qquad 0.025 \leq \alpha_v \leq 0.25$

$b_v = 12.5\left(1 + 10\alpha_v - \alpha_v^2\right) \geq 10.0$

$\alpha_h = A_h / A_f$ Amend 4 Jul 2014

A_f = floor area of the *space*

A_v = area of vertical window and door openings (m^2)

A_h = area of horizontal openings in the roof (m^2), and

H = average height of the space (m). Amend 4 Jul 2014

If $A_v < 0.025A_f$ then $A_v = 0.025A_f$ shall be used for the purpose of this calculation.

If $A_v > 0.25A_f$ then $A_v = 0.25A_f$ shall be used for the purpose of this calculation.

When $W_f < 0.5$ then use $W_f = 0.5$

When there are multiple vertical openings, the weighted average height (h_{eq}) of all of the openings is used.

For pitched roofs use the average value for H. Amend 4 Jul 2014

k_m = 1.0 for reinforced concrete, protected steel, timber, and a mix of unprotected and protected steel. For unprotected steel:

$$k_m = 13.7\, A_v\sqrt{h_{eq}} / A_t \geq 1.0$$

applicable over the range:

$$0.02 \leq A_v\sqrt{h_{eq}} / A_t \leq 0.20$$

A_t = total internal surface area of the enclosure (walls, floor and ceiling including the openings) (m^2) Amend 4 Jul 2014

2.5 Equivalent time of exposure

When elements of construction are required to resist fully developed *fires* for a specified period of time, their minimum *fire resistance rating* may be determined from one of the following (but not less than 20 minutes):

1. Specifying a fire resistance rating equal to three times the time period for which the construction is required to perform, or
2. The equivalent time of exposure in a standard *fire* resistance test assuming full *burnout* as described in 2.4.4; or
3. The equivalent time of exposure in a standard *fire* resistance test having the same destructive potential for the element of construction as for the compartment *fire*.

Comment:
Further guidance on the applicability of this approach and a suggested procedure is given in the commentary.

Alternatively, other approaches described in Paragraph 2.4 using thermal/structural response calculations may be used when applicable for the particular material or structural element. Amend 4 Jul 2014

Errata 2
Amend 4

Table 2.4	Conversion factor k_b for various lining materials	
Typical values for $\sqrt{kpc}$ $J/m^2s^{0.5}K$	*Construction* materials	k_b
400	Very light highly insulating materials	0.10
700	Plasterboard ceilings and walls	0.09
1100	Light weight concrete ceilings	0.08
1700	Normal weight concrete ceilings	0.065
>2500	Thin sheet steel roof and any wall systems	0.04

Amend 4
Jul 2014

NOTE:

(i) k=thermal conductivity (W/m K)
ρ=density (kg/m^3)
c=specific heat (J/kg K)

(ii) To account for different thermal properties of the walls, ceiling and floor it is permissible to calculate an effective thermal property and determine the k_b factor by interpolation from Table 2.4.
An effective thermal property $\sqrt{kpc} = (\Sigma(b_jA_j))/(A_t - A_v)$ where:
A_j = area of the enclosed surface j, openings not included
b_j = thermal property ($\sqrt{kpc}$) of enclosure surface j
Where a surface comprises multi-layers with different materials, it is only the first few centimetres on the fire exposed side that are relevant for the purposes of this calculation.

Amend 4
Jul 2014

Part 3: Movement of people

CONTENTS

3.1 Occupant numbers

The occupancy of any space in a *building* shall be calculated using the occupant densities provided in Table 3.1.

If, in a particular situation, the *occupant load* derived from Table 3.1 is clearly more than that which will occur, the basis of any proposal for a lesser *occupant load* must be substantiated to the *building consent authority*. However, note that designing a building for a reduced *occupant load* can severely restrict future occupancy options and may involve significant expense in meeting the *means of escape from fire* provisions for increased numbers.

If the maximum *occupant load* is greater than that calculated from Table 3.1, the higher number shall be used as the basis for the *fire* safety design and will need to be justified to the *building consent authority*.

Amend 4 Jul 2014

Table 3.1	Occupant densities
Activity	Occupant density (m²/person)
Aircraft hangars	50
Airports – Baggage handling area – Waiting/check-in – Terminal spaces	2 1.4 10
Area without seating or aisles	1.0
Art galleries, museums	4
Bar sitting areas	1.0
Bar standing areas	0.5
Bleachers, pews or bench type seating	0.45 linear m per person
Bedrooms	As number of bed spaces and staff when appropriate
Bunkrooms	
Dormitories, hostels	
Halls and *wharenui*	
Wards in hospitals, operating theatres and similar	
Detention quarters	
Boiler rooms, plant rooms	30
Bulk storage including racks and shelves (warehouses etc)	100
Call centres	7
Classrooms	2
Commercial kitchens	10
Commercial laboratories, laundries	10
Computer server rooms	25
Consulting rooms (doctors, dentists, beauty therapy)	5
Dance floors	0.6
Day care centres	4
Dining, restaurant and cafeteria spaces	1.25
Early childhood centres	Based on Education (Early Childhood Services) Regulations 2008 plus the number of staff
Exhibition areas, trade fairs	1.4
Fitness centres	5
Gaming and casino areas	1
Heavy industry	30
Indoor games areas, bowling alleys	10
Interview rooms	5
Libraries – stack areas	10
Libraries other areas	7
Lobbies and foyers	1

Amend 3 Dec 2013

Amend 3 Dec 2013

Amend 4 Jul 2014

Table 3.1	Occupant densities (continued)
Activity	Occupant density (m²/person)
Mall areas used for assembly uses	1
Manufacturing and process areas	10
Meeting rooms	2.5
Offices	10
Parking *buildings*, garages	50
Personal service facilities	5
Reading or writing rooms and lounges	2
Reception areas	10
Retail and trading (with storage >3.0 m high) (eg trading stores and supermarkets)	5
Retail spaces and pedestrian circulation areas including malls and arcades	3.5
Retail spaces for furniture, floor coverings, large appliances, building supplies and Manchester	10
Showrooms	5
Spaces with fixed seating	As number of seats
Spaces with loose seating	0.8
Spaces with loose seating and tables	1.1
Sports halls	3
Stadiums and grandstands (standing areas)	0.6
Staffrooms and lunch rooms	5
Stages for theatrical performances	0.8
Standing spaces	0.4
Swimming pools: water surface area	5
Swimming pools: surrounds and seating	3
Teaching laboratories	5
Technology class rooms in schools (eg wood work, metal work)	10
Workrooms, workshops	5

Amend 3 Dec 2013

Amend 3 Dec 2013

Amend 4 Jul 2014

3.2 Required safe egress time (RSET)

The *required safe egress time* (*RSET*), is the calculated time available between ignition of the *design fire* and the time when all the occupants in the specified room/location have left that room/location.

The *RSET* in a simple hydraulic model for evacuation (see Comment below) is:

$$RSET = (t_d + t_n + t_{pre}) + (t_{trav} \text{ or } t_{flow})$$

Equation 3.1

where:

t_d = detection time determined from deterministic modelling

t_n = time from detection to notification of the occupants

t_{pre} = time from notification until evacuation begins

t_{trav} = time spent moving toward a *place of safety*, and

t_{flow} = time spent in congestion controlled by flow characteristics.

The requirements for establishing each of these times are set out in Paragraphs 3.2.1 to 3.2.5.

When calculating the flow from the room of origin, the occupants are assumed to be evenly distributed in the space. Therefore, the egress time is determined by the greater of the queuing time and the travel time to the exit.

Comment:
This Verification Method defines the minimum analysis required to demonstrate that the *fire* engineer's design meets the required performance criteria.
For more information on how to calculate *RSET*, refer to the SFPE Handbook of Fire Protection Engineering, Section 3 Chapter 13.

3.2.1 Detection time

The *fire* engineer shall establish the detection time from deterministic modelling or as described in Paragraph 3.4 for a manually activated warning system. It is expected that the model used to calculate the detection time for an automatic warning system will use an appropriate algorithm that includes at least a ceiling jet correlation or a *CFD* model code that solves for the velocity and temperature (and smoke/soot concentration) directly.

Regardless of the actual make/model and installation parameters of the detection device specified to be installed in the *building*, the values given in Table 3.2 for the detector shall be used in this analysis.

Table 3.2 Detector criteria

Heat detectors RTI = 30 $m^{1/2}s^{1/2}$ T_{act} = 57°C Radial distance = 4.2 m Distance below ceiling not less than 25 mm	**Extended coverage (sprinkler)** RTI = 50 $m^{1/2}s^{1/2}$ C = 0.65 $m^{1/2}s^{1/2}$ T_{act} = 68°C Radial distance = 4.3 m (maximum) Distance below ceiling not less than 25 mm
Standard response (sprinkler) RTI = 135 $m^{1/2}s^{1/2}$ C = 0.85 $m^{1/2}s^{1/2}$ T_{act} = 68°C Radial distance = 3.25 m Distance below ceiling not less than 25 mm	**Quick response (sprinkler)** RTI = 50 $m^{1/2}s^{1/2}$ C = 0.65 $m^{1/2}s^{1/2}$ T_{act} = 68°C Radial distance = 3.25 m Distance below ceiling not less than 25 mm
Amend 4 Jul 2014 **Smoke detectors** Optical density at alarm = 0.097 m^{-1} Radial distance = 7 m Distance below ceiling not less than 25 mm	**Projected beam smoke detectors** Optical density at alarm to be determined based on beam path length and the design setting for the total obscuration for alarm[1]

NOTE:

1. The commentary document for this Verification Method provides a method for calculating the optical density for projected beam smoke detectors.
2. When a space is smaller than the radial distance quoted above it is permitted to use the maximum spacing distance appropriate to the dimensions of the space in compliance with the appropriate standard.
3. If a higher activation temparature is required by the chosen sprinker standard this shall be used as T_{act}.

Amend 4 Jul 2014

3.2.1.1 Smoke detection optical density criteria for spot detectors

The optical density at alarm criteria in Table 3.2 shall apply to spot detectors (ionisation and photoelectric).

3.2.1.2 Criteria for very high sensitivity air sampling smoke detectors

This type of detector requires specialised design, and the response depends on a range of factors including air flow rates, sampling tube length and alarm threshold levels. The response criteria in Table 3.2 shall be used in the analysis.

3.2.2 Notification time

For standard evacuation strategies, take the notification time as 30 seconds.

For non-standard evacuation strategies (for example, management investigating sole activation), take account of the extended notification time.

3.2.3 Pre-travel activity time

Use the values in Table 3.3 for *pre-travel activity times*.

Comment:
The incipient phase of the *fire growth* has not been considered in the *design fire*. This provides an implicit safety factor for the *pre-travel activity time*.

Errata 1 Apr 2012

Amend 3 Dec 2013

Amend 4 Jul 2014

Amends 3 and 4

Table 3.3 Pre-travel activity times

Description of *building* use	*Pre-travel activity time(s)*
Buildings where the occupants are considered awake, alert and **familiar** with the *building* (eg, offices, warehouses **not** open to the public)	
Enclosure of origin	30
Remote from the enclosure of origin	60
Buildings where the occupants are considered awake, alert and **unfamiliar** with the *building* (eg, retail shops, exhibition spaces, restaurants)	
Enclosure of origin (standard alarm signal)	60
Remote from the enclosure of origin (standard alarm signal)	120
Enclosure of origin (voice alarm signal)	30
Remote from the enclosure of origin (voice alarm signal)	60
Buildings where the occupants are considered sleeping and **familiar** with the *building* (eg, apartments)	
Enclosure of origin (standard alarm signal)	60
Remote from the enclosure of origin (standard alarm signal)	300
Buildings where the occupants are considered sleeping and **unfamiliar** with the *building* (eg, hotels and motels)	
Enclosure of origin	60
Remote from the enclosure of origin (standard alarm signal)	600
Remote from the enclosure of origin (voice alarm signal)	300
Buildings where the occupants are considered awake and under the care of trained staff (eg, day care, dental office, clinic)	
Enclosure of origin (independent of alarm signal)	60
Remote from the enclosure of origin (independent of alarm signal)	120
Spaces within *buildings* used for early childhood care	
Enclosure of origin (assume staff will respond to room of origin first)	60 s for staff to respond to alarm then 60 s per child per staff to an adjacent *place of safety* (on the same floor)[1]
Remote from the enclosure of origin (independent of alarm signal)	120
Buildings where the occupants are considered sleeping and under the care of trained staff (eg, hospitals and rest homes)	
Enclosure of origin (assume staff will respond to room of origin first)	60 s for staff to respond to alarm then 120 s (per patient per 2 staff)[2]
Remote from the enclosure of origin (independent of alarm signal)	1800
Remote from the enclosure of origin (independent of alarm signal) where occupants are unable to be moved due to the procedure or other factor	1800 or as per specific requirements, whichever is the greater
Buildings where the occupants are considered sleeping and detained under the care of trained staff (eg, prisons etc)	
To be established at FEB, see Commentary to this Verification Method	
Spaces within *buildings* which have only focused activities (eg, cinemas, *theatres* and stadiums)	
Space of origin (occupants assumed to start evacuation travel immediately after detection and notification time or when *fire* in their space reaches 500 kW, whichever occurs first)	0

NOTE:

1. This allows 60 s to move each child from their location to the *place of safety* and then to return to evacuate another child.
2. This allows 120 s to move each patient from their room to the next adjacent *firecell*. This includes time for staff to prepare the patient and transport them to the adjacent *firecell*, and then to return to evacuate another patient. It is expected that three (3) teams each of 2 staff members is a realistic maximum limit that can shuttle patients from their ward/bedroom to a *place of safety*. The commentary document for this Verification Method gives details of staff to patient ratios.

3.2.4 Travel time

Travel time within a space is governed by:

a) The time taken to travel to the doorway (t_{trav}), or

b) The flow time (ie, the time taken for all the occupants to flow through a restriction, typically a doorway, when queueing is necessary).

The greater of these two times is the evacuation time from the space.

For **horizontal travel**, the travel time shall be calculated based on the estimated walking speed. Horizontal travel speed shall be calculated using equation 3.2. If the calculated travel speed exceeds 1.2 m/s then the travel speed shall be taken as 1.2 m/s.

Errata 2
Amend 4

Comment:
If the travel speed is calculated as less than 1.2 m/s, then the calculated value is to be used.

Amend 4
Jul 2014

$S = k - akD$ Equation 3.2

where:

S= horizontal travel speed (m/s)

D= occupant density of the space (persons/m^2)

k = 1.4 for horizontal travel, and

a =0.266.

Travel time (t_{trav}) is calculated by using equation 3.3:

$t_{trav} = L_{trav}/ S$ Equation 3.3

where:

t_{trav} = travel time (s), and

L_{trav} = travel distance (m).

The maximum horizontal travel distance (L_{trav}) shall be determined as follows:

a) Adding together the length of orthogonal travel distance to the nearest exit, or

b) If the actual distance measured around fixed obstructions is known, use this.

Amends
3 and 4

For **vertical travel**, equation 3.2 applies but the values used for k are a function of the stair riser and tread size as given in Table 3.4.

Table 3.4 Maximum flow rates for use in equation 3.2 for horizontal and vertical travel speeds

Exit route elements		k	Speed m/s
Corridor, aisle, ramp, doorway		1.40	1.2
Stair riser (mm)	Stair tread (mm)		
191	254	1.00	0.85
178	279	1.08	0.95
165	305	1.16	1.00
165	330	1.23	1.05

Amend 4
Jul 2014

3.2.5 Time if flow governs

Comment:
This Verification Method does not provide a comprehensive guide to egress analysis, but highlights the level of rigour expected in the egress calculations. Refer to the SFPE Handbook of Fire Protection Engineering, Section 3 Chapter 13, for further details regarding egress calculation procedures, including flow transitions.

The egress analysis should be undertaken for the entire length of the *escape route* ensuring that the flow of occupants is not restricted at some point closer to the *final exit*.

Amend 4
Jul 2014

Flow rate shall be calculated using equation 3.4:

$$F_c = (1 - aD)kDW_e \qquad \text{Equation 3.4}$$

where:

F_c = calculated flow (persons/sec), and

D = occupant density near flow constriction (ie, for doors, use 1.9 persons/m²)

W_e = effective width of component being traversed in metres.

The effective width is equal to the measured width minus the boundary layer, where the thickness of the boundary layer is given in Table 3.5.

Comment:
Equation 3.4 is most commonly used for doorway flows to estimate the queuing times. However, it is useful in many situations, as shown by the variety of exit route elements listed in Table 3.5.

Table 3.5 Boundary layer width for calculating the effective width of an exit component

Exit route element	Boundary layer on each side (m)
Stairway – walls or side tread	0.15
Railing or *handrail*	0.09
Theatre chairs, stadium bench	0.00
Corridor wall and ramp wall	0.20
Obstacle	0.10
Wide concourse, passageway	0.46
Door, archway	0.15

For doorway flows, the maximum flow rate is limited to 50 people per minute for each standard door leaf that has a self-closing device fitted. If there is no self-closing device, equation 3.4 shall be used with no upper limit on the flow rate.

3.2.6 Direction of opening

Doors on *escape routes* shall be hung to open in the direction of escape and, where escape may be in either direction, doors shall swing both ways. These requirements need not apply where the number of occupants of spaces with egress using the door is no greater than 50. Manual sliding doors are permitted where the relevant number of occupants is no more than 20.

Comment:
This requirement applies to standard, manual, self-closing side-hinged doors and not to automatic sliding doors. In the case of automatic sliding doors, the effective width of the opening may be used in equation 3.4 from the time when the doors are opened and remain open. The same applies to manual sliding doors. They may be assumed to remain fully open once the first occupant has passed through the door.

The maximum flow rate corresponds to a door of 0.95 m wide with a boundary layer each side of 0.15 m and a total effective width of 0.65 m.

Amend 4
Jul 2014

3.2.7 Exit doors

Where a primary entrance can be identified the primary entrance shall be designed to egress 50% of the total *occupant load* of the space and the remaining occupants are evenly distributed in proportion to the number of exits.

Where there is no primary entrance the *occupant load* shall be distributed to the available exits with no more than 50% to one exit.

Errata 2
Feb 2013

3.3 Requirements for delayed evacuation strategies

Buildings and parts of *buildings* that have occupants that are required to stay in place or where evacuation is to a *place of safety* inside the *building* (eg, where occupants may either be detained or undergoing treatment such as in an operating theatre, hyperbaric chamber or dialysis unit) must comply with the definition of '*place of safety*'.

Amend 4 Jul 2014

Comment:
As these spaces usually have a climate controlled environment, special care should be taken with the design of smoke detection and air handling system smoke control.

Amend 4 Jul 2014

3.4 Alerting people with alarm systems

There must be automatic detection and alarm systems installed to NZS 4512 or automatic sprinkler systems installed to an appropriate standard to alert the occupants to a *fire*.

Manual activation of an alarm system shall only be permitted in spaces where the average ceiling height is ≥5 m, the occupants of the *building* are awake and familiar with their surroundings, and where the occupant density calculation results in an *occupant load* of fewer than 50 persons. In all other situations automatic detection is required.

Amend 3 Dec 2013

Where only manual systems are installed occupants are assumed to be aware of the *fire* when the ceiling jet flow has traversed the entire length of the space from a *fire* at the opposite end of the space. No additional pre-evacuation time need be included. The time required for the ceiling jet to completely traverse the ceiling can either be determined using *CFD* modelling or by the following relationship if zone modelling is used:

For storage height ≤ 5.0 m (ultrafast fire growth):

$t_d = 10 + 2.4\,L$ when $L \le 1.4\,w$, and

$t_d = 10 + w + 1.7\,L$ when $1.4\,w < L \le 4\,w$,

and

For storage height >5 m (rack growth):

$t_d = 25 + 1.7\,L$ when $L \le 1.4\,w$, and

$t_d = 25 + w + L$ when $1.4\,w < L \le 4\,w$,

where:

w = width of the space in metres (shortest dimension)

L = length of the space in metres (longest dimension).

3.4.1 Small ancillary spaces

If the space with a high ceiling has *intermediate floor(s),* the manual activation will be permitted to apply if the *intermediate floors* are open and the occupants will be fully aware of a fire located in the warehouse.

Amend 4 Jul 2014

If there are *occupied spaces* that are separated from the space with a high ceiling such as offices in warehouses, the methodology may be used and the following criteria apply to the small occupied area:

a) *Pre-travel activity time* of 60 s for the occupants of the small *occupied space* after manual activation

Amend 4 Jul 2014

b) Maximum area of the space 500 m^2

c) The area must be located on the ground floor of the space with a high ceiling

d) There must be an *escape route* directly from the *occupied space* to the outside without the need to enter the space with a high ceiling.

If these criteria are not met, the *RSET* calculations for the adjacent office areas will need to be carried out as per C/VM2 Paragraph 3.2 and include a notification and detection time. C/VM2 requires automatic detection to be installed within the adjacent office.

Amend 4 Jul 2014

The exception to the above requirements is a very small isolated area within the space with a high ceiling such as washrooms or offices each being no larger than 30 m^2 located on the ground floor. The maximum aggregate *occupant load* of these spaces is 10 persons. The *pre-travel activity time* of 60 s shall be applied for egress from these spaces.

Amend 3 Dec 2013

3.5 Fire modelling to determine ASET

For the *design scenario*: CF Challenging fire (see Paragraph 4.9), the designer must demonstrate that the occupants have sufficient time to evacuate the *building* before being overcome by the effects of *fire*.

In *fire* engineering terms, the *available safe egress time* (*ASET*) shall be greater than the *required safe egress time* (*RSET*).

ASET is defined as the time between ignition of the *design fire* and the time when the first tenability criterion is exceeded in a specified room within the *building*. The tenability parameters measured at a height of 2.0 m above floor level, as specified in NZBC C4.3, are:

a) Visibility

b) $FED_{(thermal)}$, and

c) $FED_{(CO)}$.

Exceptions can be applied, as outlined in NZBC C4.4 (a *building* with an automatic sprinkler system and more than 1000 people cannot be exposed to conditions exceeding the *visibility* limits or $FED_{thermal}$ limits).

Comment:
Visibility will generally be the first tenability criterion exceeded in the calculations unless any exception is applied.

Calculate the *ASET* by choosing a *fire* model and using the *design fire* as specified in Part 2.

In most cases there will be a number of locations for the *fire* that could produce the lowest *ASET* for a given *escape route*. Check a number of rooms to determine the limiting case.

3.6 Exposure to radiation along egress routes

3.6.1 General

When occupants located within an *exitway* or on an external *escape route* must egress past a window opening or glazed panel, they must not be exposed to a radiation level which will cause pain while evacuating. Therefore, the time to onset of pain (t_p) must be longer than the exposure time (t_{exp}).

The limitations for the analysis are as follows:

a) The analysis requires that all occupants must have evacuated past the window opening or glazed panel within 10 minutes after ignition unless *fire resisting glazing* tested to a recognised national or international Standard is used.

b) The maximum allowable radiation level that an occupant can be exposed to is 10 kW/m².

c) The analysis described here is only applicable for a single window. Multiple windows require more detailed analysis on the time to pain calculations where the time-dependent cumulative effect of the radiation can be accounted for (such procedures can be found in the SFPE Engineering Guide – Predicting 1st and 2nd Degree Skin Burns from Thermal Radiation).

d) Analysis is not appropriate where occupants are likely to be mobility-impaired.

e) Radiation through uninsulated *fire resisting glazing* can be reduced by 50% (see k=0.5 in equation 3.6 below).

f) Analysis is not required where an alternative *escape route* is available.

g) Analysis is not required where insulated glazing with *fire* resistance of not less than -/30/30 is used.

h) Analysis is not required for sprinklered *buildings* with window wetting sprinklers located on the same side of the window as the *fire* and designed and installed for that specific purpose.

Comment:
Wall wetting sprinkler heads listed and approved by a qualified agency for this purpose are considered to provide protection equivalent to a fire separation provided they are installed to the specific requirements of the listing.

Amend 4 Jul 2014

i) Analysis is not required during the period prior to *ASET* for the room of fire origin.

j) Any part of the window or glazed panel that is openable must be fitted with a self-closer or other device that automatically closes the opening on detecting smoke or heat.

3.6.2 Time to onset of pain

The time to onset of pain shall be determined using equation 3.5.

$$t_p = \left(\frac{35}{\dot{q}''_r}\right)^{1.33} \qquad \text{Equation 3.5}$$

where:

t_p = time required for pain (s), and

$\dot{q}''_r$ = maximum incident thermal radiation (kW/m^2)

3.6.3 Radiation from a window to an egressing occupant

The maximum incident thermal radiation occurs opposite the centre of the window or glazing, at a height of 2.0 m or mid-height of the glazing whichever is the lower height, and can be calculated using equation 3.6:

$$\dot{q}''_r = F_W\, \varepsilon k \dot{q}''_w \qquad \text{Equation 3.6}$$

where:

$\dot{q}''_w$ = design emitted heat flux from the window. This shall be taken as:

a) 83 kW/m^2 for *FLED* (from Table 2.3) 400 MJ/m^2

b) 103 kW/m^2 for *FLED* (from Table 2.3) between 400 and 800 MJ/m^2, and

c) 144 kW/m^2 for *FLED* (from Table 2.3) greater than 800 MJ/m^2.

and

ε = emissivity of the *fire* gases (shall be taken as 1.0)

k = glazing factor (=0.5 for *fire resisting glazing*; =1.0 for all other glazing)

F_W = view factor from a window or glazing to a point opposite the centre of the window or glazing, at a height of 2.0 m or mid-height of the glazing whichever is the lower height, and at a distance corresponding to the nearest part of the required *escape route*.

For sprinklered *buildings* the maximum incident thermal radiation may instead be determined from Paragraph 3.6.5 and equation 3.8 assuming the *fire* point source is located mid-width of the window or glazing at a height of 2.0 m, and at a horizontal distance of 2.0 m from the window or glazing. Amend 4 Jul 2014

The sprinkler controlled *heat release rate* may be used in equation 3.8. Amend 4 Jul 2014

3.6.4 Exposure time

The exposure time (t_{exp}) is determined by calculating the distance (D) the occupant must travel while exposed to radiation from the window or glazed panel and assuming a travel speed of 1.0 m/s. The occupant is assumed to be exposed as long as their exposure to the incident thermal radiation is greater than 2.5 kW/m^2. The exposure time for the occupant is the *travel distance* required to pass the window, divided by the walking speed as shown in equation 3.7, below:

$$t_{exp} = \frac{D}{V} \qquad \text{Equation 3.7}$$

where:

t_{exp} = the time an occupant is exposed to the radiation (s)

V = travel speed (=1 m/s), and

D = the distance the occupant must travel while exposed to incident thermal radiation of at least 2.5 kW/m^2 from the window or glazing (m).

3.6.5 Radiation from a burning object to an egressing occupant

Amend 4 Jul 2014

Radiation calculations from a burning object can be approximated using the point source model with fixed radiation fraction as given in equation 3.8:

$$\dot{q}''_r = \frac{0.45\,\dot{q}_{Fire}}{4\pi r^2} \qquad \text{Equation 3.8}$$

where:

$\dot{q}''_r$ = radiation flux at a distance r from the fire occupant (kW/m^2)

$\dot{q}_{Fire}$ = total *heat release rate* from the fire (kw)

and

r = radial distance from the *fire* to the egressing occupant (m).

Limitation:

Average upper layer temperature within the *fire* compartment must not have exceeded 150˚C.

Part 4: Design scenarios

CONTENTS

Comment:
References in the *design scenarios* to C1(a), C4.5 etc are to clauses within NZBC C1 to C6: Protection from Fire. The relevant *Building Code* clauses are included in full in *italic* at the start of each scenario for ease of reference.

4.1 Design scenario (BE): Fire blocks exit

Scenario in brief	A *fire* starts in an *escape route* and can potentially block an exit.
Code objective	***C1(a)*** *Safeguard people from an unacceptable risk of injury or illness caused by fire.*
What you must satisfy	C4.5 by providing a viable *escape route* or routes for *building* occupants in the event of *fire*. ***C4.5*** *Means of escape to a place of safety in buildings must be designed and constructed with regard to the likelihood and consequence of failure of any fire safety systems.*
Outcome required	Demonstrate that a viable *escape route* (or multiple routes where necessary) has been provided for *building* occupants.

Scenario description

This scenario addresses the concern that an *escape route* may be blocked due to proximity of the *fire source*. In this event, the number of exits and total exit width must be sufficient for occupants to escape before *ASET* is reached.

This scenario applies to *escape routes:*

a) serving more than 50 people, or

b) with a single direction of travel. Amend 4 Jul 2014

Exception: this scenario does not apply to vertical stair enclosures serving not more than 150 people *fire separated* from all other parts of a *building* or, if the *building* is sprinkler protected, serving not more than 250 people.

Single *escape routes* are permitted to serve up to 50 people.

For each room/space within the *building* (accommodating more than 50 people), assume that the *fire source* is located near the primary *escape route* or exit and that it prevents occupants from leaving the *building* by that route. *Fire* in *escape routes* can be the result of a deliberately lit *fire* or accidental. *Fire* originating within an *escape route* will be considered to be a severe *fire* applicable to the particular *building* use as described in the *design scenario*: CF Challenging fire (see Paragraph 4.9).

In order to be regarded as alternative *escape routes*, the routes shall be separated from each other and shall remain separated until reaching a *final exit*. Separation shall be achieved by diverging (from the point where two *escape routes* are required) at an angle of no less than 90° until separated by:

a) a distance between closest parts of the openings of at least 8.0 m when:

   i) up to 250 occupants are required to use the *escape routes,* or

   ii) more than 250 occupants are requiring escape through more than two *escape routes*

   and at least 20 m when more than 250 occupants are required to escape through only two *escape routes*, or Amend 4 Jul 2014

b) *Smoke separations* and *smoke control doors.*

Active and passive *fire safety systems* in the *building* shall be assumed to perform as intended by the design.

Comment:
The engineer needs to consider *fire source* locations that prevent the use of exits in *escape routes*.

Fire characteristics (eg, *HRR*) and analysis need not be considered in this scenario, as the *fire* is assumed to physically block the exit. It may be assumed that occupant tenability criteria cannot be met where *fire* plumes and flame block an exit.

Method

If *escape routes* serve more than 50 people, demonstrate by analysis whether or not a second exit is required.

If there is an escape route with a single direction of travel, the maximum length of that single direction shall be not greater than:

a) 50 m if occupants are familiar

b) 40 m if occupants are not familiar with the *building*. Amend 4 Jul 2014

4.2 Design scenario (UT): Fire in normally unoccupied room threatening occupants of other rooms

Scenario in brief	A *fire* starts in a normally unoccupied room and can potentially endanger a large number of occupants in another room.
Code objective	***C1(a)*** *Safeguard people from an unacceptable risk of injury or illness caused by fire.*
What you must satisfy	The performance criteria of C4.3 and C4.4 for any *buildings* with rooms or spaces that can hold more than 50 people. This may require analysis. ***C4.3*** *The evacuation time must allow occupants of a building to move to a place of safety in the event of fire so that occupants are not exposed to any of the following:* *a) a fractional effective dose of carbon monoxide greater than 0.3;* *b) a fractional effective dose of thermal effects greater than 0.3;* *c) conditions where, due to smoke obstruction, visibility is less than 10 m except in rooms of less than 100 m^2 where visibility may fall to 5.0 m.* ***C4.4*** *Clause C4.3 (b) and (c) do not apply where it is not possible to expose more than 1,000 occupants in a firecell protected with an automatic fire sprinkler system.*
Required outcome	Demonstrate *ASET>RSET* for any rooms or spaces that can hold more than 50 people given a *fire* occurs in the normally unoccupied space. Solutions might include the use of *separating elements* or *fire* suppression to confine the *fire* to the room of origin.

Scenario description

This *design scenario* only applies to *buildings* with rooms or spaces that can hold more than:

a) 50 occupants with only a manual alarm system, or

b) 150 occupants with automatic detection and alarm

Amend 4 Jul 2014

that could be threatened by a *fire* occurring in another normally unoccupied space. It does not need to be satisfied for any other rooms or spaces in the *building*.

A *fire* starting in an unoccupied space can grow to a significant size undetected and then spread to other areas where large numbers of people may be present. This scenario is intended to address the concern regarding a *fire* starting in a normally unoccupied room and then migrating into the space(s) that can potentially hold large numbers of occupants in the *building*.

The analysis shall assume that the target space containing the people is filled to capacity under normal use. For analysis, select a *design fire* as described in Part 2 for the applicable occupancy.

Active and passive *fire safety systems* in the *building* shall be assumed to perform as intended by the design.

Method

Either:

a) Carry out *ASET/RSET* analysis to show that the occupants within target spaces are not exposed to untenable conditions, or

b) Include *separating elements* or *fire* suppression to confine the *fire* to the room of origin. If *separating elements* are used the *FRR* shall be based on the following design criteria.

Comment:
Fire suppression includes any automatic system that controls or extinguishes the *fire*. This may include: automatic sprinkler, gas flooding or oxygen depletion systems (that are designed and installed in accordance with internationally recognised standards.

Amend 4 Jul 2014

i) If no automatic *fire* detection is installed in the space of *fire* origin, separating elements shall have *fire* resistance to withstand a full *burnout fire* (see Paragraph 2.4).

ii) If automatic *fire* detection is installed in the space of *fire* origin, *separating elements* shall either:

A) Have a *fire resistance rating* of not less than 60 minutes (-/60/60), or

B) Demonstrate the *separating elements* will be effective for the period from ignition to the time when the *occupied space* (target space) is evacuated.

4.3 Design scenario (CS): Fire starts in a concealed space

Scenario in brief	A *fire* starts in a *concealed space* that can potentially endanger a large number of people in another room.
Code objective	***C1(a)*** *Safeguard people from an unacceptable risk of injury or illness caused by fire.*
What you must satisfy	For any *buildings* with rooms holding more than 50 people and with *concealed spaces*, ensure that *fire* spread via *concealed spaces* will not endanger the *building* occupants. This will not require analysis.
Required outcome	Demonstrate that *fire* spread via *concealed spaces* will not endanger occupants located in rooms/spaces holding more than 50 people. This scenario is deemed to be satisfied by the use of *separating elements*, automatic detection or suppression.

Scenario description

This *design scenario* only applies to *buildings* with rooms holding more than 50 occupants and with *concealed spaces*. It does not apply if the *concealed space* has no *combustibles* (other than timber framing) and no more than two dimensions (length, width or depth) greater than 0.8 m.

A *fire* starting in a *concealed space* can develop undetected and spread to endanger a large number of occupants in another room. This scenario addresses a concern regarding a *fire*, originating in a non-separated *concealed space* without either a detection system or suppression system, and spreading into any room within the *building* that can, potentially, hold a large number of occupants.

Assume that active and passive *fire safety systems* in the *building* perform as intended by the design.

Comment:
Fire spreading in *concealed spaces* may also compromise the ability of firefighters to assess the threat to themselves whilst undertaking rescue and firefighting operations.

Method

Due to the difficulty in modelling *fire* spread within *concealed spaces*, it is expected that traditional solutions will apply here (ie, containment, detection or suppression.)

The expected methodology is to either:

a) Use *separating elements* (*cavity barriers*) or suppression to confine *fire* to the *concealed space*, or

b) Include automatic detection of heat or smoke to provide early warning of *fire* within a *concealed space*.

Separating elements (*cavity barriers*) in *concealed spaces* without a means of automatic *fire* detection shall have a *fire resistance rating* of not less than 30 minutes (-/30/30) and the *concealed space* shall not have an area greater than 500 m^2.

4.4 Design scenario (SF): Smouldering fire

Scenario in brief	A fire is smouldering in close proximity to a sleeping area.
Code objective	*C1(a) Safeguard people from an unacceptable risk of injury or illness caused by fire.*
What you must satisfy	For *buildings* with a sleeping use, ensure that there are automatic means of smoke detection and alarm complying with a recognised national or international Standard for occupants who may be sleeping.
Required outcome	Provide an automatic smoke detection and alarm system throughout the *building* that has been designed and installed to a recognised national or international Standard.

Scenario description

This scenario addresses the concern regarding a slow, smouldering *fire* that causes a threat to sleeping occupants. Assume that active and passive *fire safety systems* in the *building* perform as intended by the design.

Method

Amend 3 Dec 2013

Provide an automatic detection and alarm system throughout the *building* including smoke detection in sleeping areas, designed and installed to a recognised national or international Standard. No further analysis is expected.

4.5 Design scenario (HS): Horizontal fire spread

Scenario in brief	A fully developed *fire* in a *building* exposes the *external walls* of a neighbouring *building* or *firecell.*
Code objectives	***C1(b)*** *Protect other property from damage caused by fire.*
What you must satisfy	The performance criteria in C3.6 and C3.7. This will require calculation. C4.2 is to be considered in relation to horizontal *fire* spread across a *notional boundary* to sleeping occupancies and *exitways* in *buildings* under the same *ownership.* ***C3.6*** *Buildings must be designed and constructed so that in the event of fire in the building the received radiation at the relevant boundary of the property does not exceed 30 kW/m² and at a distance of 1 m beyond the relevant boundary of the property does not exceed 16 kW/m².* ***C3.7*** *External walls of buildings that are located closer than 1 m to the relevant boundary of the property on which the building stands must either:* *a) be constructed from materials which are not combustible building materials, or* *b) for buildings in Importance levels 3 and 4 be constructed from materials that, when subjected to a radiant flux of 30 kW/m², do not ignite for 30 minutes, or* *c) for buildings in Importance levels 1 and 2, be constructed from materials that, when subjected to a radiant flux of 30 kW/m², do not ignite for 15 minutes.* ***C4.2*** *Buildings must be provided with means of escape to ensure that there is a low probability of occupants of those buildings being unreasonably delayed or impeded from moving to a place of safety and that those occupants will not suffer injury or illness as a result.*
Required outcome	Demonstrate that the criteria in C3.6 and C3.7 are not exceeded by calculating the radiation from *unprotected areas* in the *external wall* to the closest point on an adjacent *boundary* and at 1.0 m beyond an adjacent *boundary*, and specifying exterior cladding materials with adequate resistance to ignition Control horizontal *fire* spread across a *notional boundary* to sleeping occupancies and *exitways* in *buildings* under the same *ownership.*

Amend 4 Jul 2014

Amend 6 Nov 2020

Scenario description

A fully developed *fire* in a *building* exposes the *external walls* of a neighbouring *building* (*other property*) or *firecell* (sleeping occupancy, *exitway* or *other property*).

Amend 4 Jul 2014

This scenario addresses a *fire* in a *building* that leads to high levels of radiation heat exposure across a *relevant boundary*, potentially:

1) Igniting the *external walls* of a neighbouring *building*, or

2) Leading to *fire* spread to *other property*, sleeping occupancies and *exitways*.

Amend 4 Jul 2014

The performance requirements of C3.6 are also to be applied to limit the radiation at the *notional boundary* to sleeping occupancies and *exitways* in *buildings* under the same ownership.

Amend 6 Nov 2020

An exception to 2) above is if a sprinklered unit-titled *building* is subdivided, the protection between any title and areas in common need not be *fire* rated for the protection of *other property* unless required for separation of *escape routes*, to separate sleeping occupancies, or by the FO scenario.

Amend 4 Jul 2014

Amend 6 Nov 2020

Unprotected area shall include both unrated *external wall construction* as well as any unrated window/door assemblies and other openings. Areas of the *external wall* that are not designated as *unprotected area* shall have a *fire resistance rating* meeting the *integrity* criteria sufficient to resist the full *burnout design fire* described in Paragraph 2.4 and with *insulation* sufficient to meet NZBC C3.7.

Furthermore, the structural system supporting those parts of the *external wall* that are not permitted to be unprotected must also provide *structural adequacy* sufficient to keep the *external wall* in place for the full duration of the *fire*.

Unprotected area is not permitted within 1.0 m of a *relevant boundary*, except for a combination of small *unprotected area* and/or *fire resisting glazing* as described in Acceptable Solution C/AS2 Paragraph 5.4 or in Appendix C for this Verification Method.

There are no restrictions on the amount of *unprotected area* and the performances specified in NZBC C3.6 are deemed to be achieved if:

a) the *external wall* is more than 1.0 m of the *relevant boundary;* and

b) the *firecell* does not contain a storage occupancy with a capability to store to more than 3.0 m; and

c) the *building* is provided with a sprinkler system complying with either:

i) NZS 4541 with a Class A or Class B2 water supply, or

ii) NZS 4541, as amended by Appendix B of C/AS2, with a Class A or Class B2 water supply.

Amend 6 Nov 2020

Amend 4 Jul 2014

Design fire

The *design fire* for this scenario comprises an assumed emitted radiation flux from *unprotected areas* in *external walls* of the *fire source building* (assuming no intervention). This shall be taken as:

Amend 6 Nov 2020

a) for unsprinklered *firecells:*

i) 83 kW/m² for *FLED* ≤ 400 MJ/m²,

ii) 103 kW/m² for *FLED* > 400 to ≤ 800 MJ/m², and

iii) 144 kW/m² for *FLED* > 800 MJ/m²; and

b) for sprinklered *firecells*:

i) 58 kW/m² for *FLED* ≤ 400 MJ/m²,

ii) 72 kW/m² for *FLED* > 400 to ≤ 800 MJ/m², and

iii) 101 kW/m² for *FLED* > 800 MJ/m².

Amend 4 Jul 2014

Emissivity of *fire* gases shall be taken as 1.0.

Method A Calculation

Amend 6 Nov 2020

Calculate radiation from *unprotected areas* in the *external wall* to the closest point on an adjacent boundary and at 1.0 m beyond an adjacent boundary. The calculations must take into account:

a) The distance to the boundary, and

b) The size/shape of the *unprotected area* in the *external walls*, assuming the emitted radiant heat flux specified above for the applicable *FLED* range.

In a *firecell* not containing a storage occupancy or a storage occupancy with a capability to store to more than 3.0 m, and which is protected with an automatic sprinkler system, the calculation for maximum permitted *unprotected area* may use:

Amend 4 Jul 2014

a) the emitted radiation flux for sprinklered *firecells* for the appropriate *FLED*

Amends 4 and 6

b) the height of the enclosing rectangle as the vertical distance between the floor and the ceiling level beneath which the sprinklers are installed in the area adjacent to the *external wall* facing the *relevant boundary*, and

c) the width of the enclosing rectangle as the least of the square root of the design maximum area of sprinkler operation or the actual width of the enclosing rectangle or 20 metres.

The *unprotected area* calculated using the emitted radiation flux for sprinklered *firecells* is not permitted to be doubled.

The fire engineer only needs to consider one *fire separated* space at a time as a potential source of thermal radiation.

For unsprinklered *buildings*, the width of the enclosing rectangle need be no greater than 20 m for *FLED* up to and including 800 MJ/m², or no greater than 30 m for *FLED* greater than 800 MJ/m². The actual width of the enclosing rectangle shall be used if it is less than 20 m.

Method B Tabulated values

Amend 4 Jul 2014

Use the tabulated values of the maximum percentage of permitted *unprotected area* directly from Acceptable Solution C/AS2 as appropriate for the *firecell*, or the tables as provided in Appendix C of this Verification Method.

Amend 6 Nov 2020

Amend 6 Nov 2020

The tables in Appendix C have been produced in accordance with this Verification Method. These tables can be used directly for unsprinklered *firecells* as long as *external walls* are parallel to, or angled at no more than, 10º to the *relevant boundary* and are no closer than 1.0 m to the *relevant boundary*.

For *external walls* at greater angles to the *relevant boundary*, appropriate calculations shall be undertaken to demonstrate that the performance criteria are achieved and minimum dimensions shall be specified for return and/or wing walls as necessary or use tables as provided in Appendix C.

Amend 6 Nov 2020

Amend 4 Jul 2014

In all *firecells* protected with an automatic sprinkler system, the maximum permitted *unprotected area* obtained from tabulated values in Appendix C for an unsprinklered space can be doubled.

Amend 6 Nov 2020

Horizontal fire spread from roofs

In addition for unsprinklered *buildings* where the average *fire load* exceeds 1200 MJ/m² and the *building* is located within 1.0 m of a *relevant boundary,* horizontal *fire* spread via a non-rated roof shall be resisted. This requirement can be satisfied by undertaking one of the following:

a) *Fire* rating (for *fire* exposure from below) that part of the roof within 1.0 m of a *relevant boundary*. The *FRR* shall be based on the *burnout fire* determined in Paragraph 2.4. The determined *FRR* needs to meet with *structural adequacy* and *integrity* criteria as a minimum, or

b) Extending the wall, being a *fire separation* along or adjacent to the *relevant boundary*, no less than 450 mm above the roof to form a *parapet*, or

c) Undertaking specific calculation to demonstrate that the resultant incident radiation 1.0 m beyond the *relevant boundary* due to *fire* breaking through a non-rated roof does not exceed 16 kW/m².

Amend 4 Jul 2014

Canopies

Amend 4 Jul 2014

The potential for any space to expose *other property* shall be evaluated. However, the area beneath a canopy roof does not need to be assessed as a source of external *fire* spread if all the following conditions apply:

a) The nearest distance between any part of the canopy and the *relevant boundary* is not less than 1.0 m, and

b) The average *FLED* applying to the area beneath the canopy is not greater than 800 MJ/ m², and

c) The canopy has at least 50% of the perimeter area open to the outside.

External wall cladding materials

Amend 4 Jul 2014

To demonstrate that NZBC C3.7 is achieved, where *external walls* are located less than 1.0 m from a *relevant boundary*, cladding materials shall be:

a) *Non-combustible* or *limited combustible* materials; or

Amend 3 Dec 2013

b) Tested in accordance with the relevant *standard test* in Table 4.1 and achieve a Type A classification.

For *buildings* containing *sleeping care* or *sleeping detention* uses, where *external walls* are located more than 1.0 m from a *relevant boundary*, cladding materials shall be:

a) *Non-combustible* or *limited combustible* materials; or

b) Tested in accordance with the relevant *standard test* in Table 4.1 and achieve a Type A or Type B classification.

Amend 6 Nov 2020

Table 4.1	Classification of cladding materials	
Cladding material type[1,2,3,4]	Peak heat release rate (kW/m^2)	Total heat released (MJ/m^2)
Type A	≤ 100	≤ 25
Type B	≤ 150	≤ 50

Notes:

1. Cladding materials shall be classified as Type A or Type B based on the peak heat release rate and total heat released when tested in accordance with:

a) ISO 5660 Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 1: Heat release rate (cone calorimeter method), or

b) AS/NZS 3837 Method of test for heat and smoke release rates for materials and properties using an oxygen consumption calorimeter.

2. In addition to meeting the general requirements of ISO 5660 Part 1 or AS/NZS 3837, testing shall be in accordance with the following specific requirements:

a) an applied external heat flux of 50 kW/m^2, and

a) a test duration of 15 minutes, and

b) the total heat release measured from start of the test, and

c) sample orientation horizontal, and

d) ignition initiated by the external spark igniter.

3. Timber claddings which have a *fire retardant* treatment incorporated in or applied to them shall be subjected to the regime of accelerated weathering described in ASTM D 2898 Method B with the water flow rate from Method A before testing in accordance with the requirements in Note 1.

4. Cladding materials incorporating a metal facing with a melting point of less than 750°C covering a *combustible* core or insulant shall be tested as described in Note 2 without the metal facing present.

Amend 6
Nov 2020

Amend 4 Jul 2014

4.6 Design scenario (VS): External vertical fire spread

Scenario in brief	A *fire source* exposes the *external wall* and leads to significant vertical *fire* spread.
Code objectives	***C1(a)*** *Safeguard people from an unacceptable risk of injury or illness caused by fire.* ***C1(b)*** *Protect other property from damage caused by fire.*
What you must satisfy	The performance criteria of C3.5 (ie, if *buildings* are taller than 10 m or have upper floors that are *other property* or contain people sleeping, *fire* shall be prevented from spreading more than 3.5 m vertically) so that: • tenable conditions are maintained on *escape routes* until the occupants have evacuated, and • vertical *fire* spread does not compromise the safety of firefighters working in or around the *building*. ***C3.5*** *Buildings must be designed and constructed so that fire does not spread more than 3.5 m vertically from the fire source over the external cladding of multi-level buildings.*
Required outcome	Demonstrate that the *building's* external claddings do not contribute to excessive vertical *fire* spread using one of the methods described.

Scenario description

This *design scenario* applies to:

Amend 4 Jul 2014

a) All multi-level *buildings* with a *building height* of more than 10 m, and

b) Any other multi-level *buildings* with upper floors

  i) where people sleep, or

  ii) are defined as *other property*, or

  iii) that have external *exitways* with an *external wall*, and

Amend 4 Jul 2014

c) Where there is a lower roof exposure to a higher *external wall* within the same or an adjacent *building*, where *firecells* behind the higher *external wall* house sleeping occupancies, *exitways* or *other property*.

Comment:

Amend 4 Jul 2014

1. This scenario is not concerned with horizontal *building*-to-*building fire* spread across a *relevant boundary*, as this is addressed in the *design scenario*: HS (see Paragraph 4.5).
2. Multi-level *buildings* include:
   a) *Buildings* with more than one full floor
   b) *Buildings* that have more than one *intermediate floor* and the *escape height* of the uppermost *intermediate floor* is greater than 10 m, e.g. a multi-storey office with an atrium.

Amend 4 Jul 2014

There are three considerations in this scenario:

Part A: External vertical *fire* spread over the cladding materials and within the *external wall* cladding system, and

Amend 6 Nov 2020

Part B: *Fire* plumes spreading *fire* vertically up the *external wall* via openings and *unprotected areas*, and

Part C: *Fire* plumes spreading *fire* from a lower *firecell* through an unprotected lower roof to an adjacent higher *external wall* via *unprotected areas*.

Amend 4 Jul 2014

Comment:
Part A addresses concerns regarding the contribution of the *external wall* cladding system to vertical *fire* spread. Parts B and C look at the use of aprons, spandrels, *fire* rated lower roofs, *fire* rated external walls, or sprinklers to prevent external *fire* spread between openings at different levels in the *building*. In the case of Part C, vertical *fire* spread via an unprotected lower roof to an adjacent *building* also needs to be considered.

Amend 6 Nov 2020

Part A: External vertical fire spread over facade materials

This part applies to all multi-level *buildings* with a *building height* of more than 10 m.

Amend 6 Nov 2020

The *design fire* for this scenario shall be a *fire source* that is either:

a) In close contact with the façade (eg, in a rubbish container/skip) that could ignite and spread *fire* vertically to higher levels in the *building*, or

b) Adjacent to an *external wall*, such as a *fire* plume emerging from a window opening or from an *unprotected area* of the wall burning.

The *design fire* exposure is:

Amend 4 Jul 2014

a) Radiant flux of 50 kW/m^2 impinging on the façade for 15 minutes for *buildings* in *importance levels* 2 and 3, or

b) Radiant flux of 90 kW/m² impinging on the façade for 15 minutes for *buildings* in *importance level* 4.

The intention is to prevent façade cladding materials from contributing to significant flame spread propagation beyond the area initially exposed. Some damage to the area initially exposed is expected.

This can be achieved by limiting the extent of the vertical flame spread distance of the *external wall* cladding system above the *fire* source.

Amend 6
Nov 2020

Method

For all *buildings* where this scenario applies, the entire *external wall* cladding system shall be:

a) Comprised of *non-combustible* or *limited combustible* materials; or

b) Classified in accordance with AS 5113 and achieve a EW classification; or

Amend 3
Dec 2013

c) Tested in accordance with BS 8414-1 and satisfy the acceptance criteria in BR 135; or

d) Tested in accordance with BS 8414-2 and satisfy the acceptance criteria in BR 135; or

Amend 4
Jul 2014

e) Tested in accordance with NFPA 285 and pass, and have all substantive components in the *external wall* cladding system:

i) comprised of *non-combustible* or *limited combustible* materials; or

Amend 4
Jul 2014

ii) achieve a Type A classification from Table 4.1.

The spread of fire through cavities in an external wall shall be avoided by providing cavity barriers at each floor level. Cavity barriers shall comply with the requirements in Paragraphs 4.15.3 to 4.15.5 of Acceptable Solution C/AS2.

The requirements given in Acceptable Solution C/AS2 Paragraphs 5.8.3 to 5.8.5 are an acceptable means of demonstrating compliance with Part A above for *buildings* with an *importance level* not higher than 3.

Amend 6
Nov 2020

Part B: External vertical fire spread via openings and unprotected areas

Amend 4
Jul 2014

This part applies to multi-level *buildings* with a *building* height greater than 10 m where people sleep, have external *exitways* or *exitways* with an *external wall,* or that are defined as *other property.*

Amend 6
Nov 2020

The *design fire* exposure is a *fire* plume projecting from openings or *unprotected areas* in the *external wall*, with characteristics determined from the *design fire* as described in Part 2 of this Verification Method for the applicable occupancy.

Amend 6
Nov 2020

The intention is to prevent *fire* spread in unsprinklered *buildings* from projecting *fire* plumes to *unprotected areas* on upper floors where they are within 1.5 m vertically of a projecting plume *fire source*.

This can be achieved by either:

a) Limiting external vertical *fire* spread with the introduction of *fire* rated construction on certain areas of the *external wall* to prevent a *fire* plume extending from a lower opening or *unprotected area*, and then re-entering the *building* via an opening or *unprotected area* at a higher level, or

b) Installing an automatic sprinkler system in accordance with an approved standard.

Method

For Part B, either:

a) Follow the requirements of Acceptable Solution C/AS2 and provide *construction* features such as aprons and/or spandrels, or

Amend 6
Nov 2020

b) Install an automatic sprinkler system in accordance with an approved standard, or

c) Calculate the effect of the radiation from *fire* plumes projected from openings. *Fire* plume characteristics and geometry shall be derived from the design fires as described in Part 2 of this Verification Method for the applicable geometry.

Amend 6
Nov 2020

Part C: Lower Roof Exposure

This part applies if there is a lower roof exposure to external *exitways* or a higher *external wall* within the same or an *adjacent building*, where spaces behind the higher *external wall* are sleeping occupancies or *other property*.

Amend 6 Nov 2020

The design *fire* exposure is a *fire* plume spreading through a lower non *fire* rated roof to an adjacent higher *external wall* and spreading vertically via openings and *unprotected areas* in the same or *adjacent building*.

Amend 6 Nov 2020

The intention is to prevent *fire* from spreading from unsprinklered *buildings* due to a *fire* that has initiated below a non-*fire* rated lower roof that could spread to *unprotected areas* or openings that are located in a higher *external wall*.

The lower roof exposure risk is to be addressed where compartments behind the higher *external wall* contain sleeping or *other property*, for the same *building* or an *adjacent building* on the same site. The exposure risk needs also to be assessed for *buildings* on *other property* that have an *external wall* that is higher than the lower roof exposure.

Amend 6 Nov 2020

Amend 6 Nov 2020

This can be achieved by:

a) *Fire* rating the underside of the lower roof where it represents an exposure risk to the higher *external wall* in order to prevent a *fire* plume extending through the lower roof, or

b) *Fire* rating parts of the higher *external wall* to prevent the *fire* plume that has passed through the unrated lower roof spreading into the higher levels , or

c) Installing sprinklers in the compartment below the unprotected lower roof.

Amend 4 Jul 2014

Method

For Part C follow the requirements of Part 5: Control of external fire spread of Acceptable Solution C/AS2 and use:

Amend 6 Nov 2020

a) Construction features that will provide a *fire* rating to the underside of any part of the lower roof that is within 5.0 metres of the higher *external wall*. The *fire resistance rating* to be applied over the rated area of the lower roof shall be based on the *burnout fire* determined in Paragraph 2.4 for the space below the roof or,

b) Construction features that will enable a fire rating to be provided to all parts of the *external wall* that are within 9.0 metres vertically, of any area of unprotected lower roof that is within 5 metres horizontally of the higher *external wall*. The *fire resistance rating* to be provided over the required area of the *external wall* shall be based on the *burnout fire* determined in Paragraph 2.4 for the space below the roof,

c) The installation of sprinklers to an approved standard throughout the space below the roof.

Amend 4 Jul 2014

Amend 4
Jul 2014

Amend 3
Dec 2013

Amend 6
Nov 2020

4.7 Design scenario (IS): Rapid fire spread involving internal surface linings

Scenario in brief	Interior surfaces are exposed to a growing *fire* that potentially endangers occupants.
Code objective	*C1(a) Safeguard people from an unacceptable risk of injury or illness caused by fire.*
What you must satisfy	The performance criteria of C3.4 for materials used as internal surface linings in the relevant *building* areas, as also specified in C3.4. Where *foamed plastics* or combustible insulating materials form part of an element requiring a *Group Number* in accordance with NZBC Clause C3.4(a), the completed assembly shall achieve a *Group Number* as specified in C3.4(a) and the *foamed plastics* shall comply with the flame propagation criteria as specified in AS 1366 for the type of material being used. Comment: The completed system may or may not include a surface lining product enclosing any insulation material from any adjacent *occupied space*. If a surface lining is not included then the *foamed plastics* or combustible *insulating materials* when tested alone shall achieve a *Group Number* of 3. Otherwise a surface lining is also required such that the completed system achieves a *Group Number* of 3.

Amend 3 Dec 2013

Walls and ceiling linings and ducts	*Limits on application*	
C3.4(a) Materials used as internal surface linings in the following areas of buildings must meet the performance criteria specified below:	*Clause C3.4 does not apply to detached dwellings, within household units in multi-unit dwellings, or outbuildings and ancillary buildings.*	
Area of building	*Performance determined under the conditions described in ISO 9705: 1993*	
	Buildings not protected with an automatic fire sprinkler system	*Buildings protected with an automatic fire sprinkler system*
Wall/ceiling materials in sleeping areas where care or detention is provided *Wall/ceiling materials in exitways* *Wall/ceiling materials in all occupied spaces in importance level 4 buildings* *Internal surfaces of ducts for HVAC systems*	*Material Group Number 1-S*	*Material Group Number 1 or 2*
Ceiling materials in crowd and sleeping uses but not household units or where care or detention is provided	*Material Group Number 1-S or 2-S.*	*Material Group Number 1 or 2*
Wall materials in crowd and sleeping uses except household units or where care or detention is provided	*Material Group Number 1-S or 2-S*	*Material Group Number 1, 2 or 3*
Wall/ceiling materials in occupied spaces in all other locations in buildings, including household units *External surfaces of ducts for HVAC systems* *Acoustic treatment and pipe insulation within air-handling plenums in sleeping uses*	*Material Group Number 1, 2 or 3*	*Material Group Number 1, 2 or 3*

	Floor surfaces suspended flexible fabrics and membrane structures		
	C3.4(b) *Floor surface materials in the following areas of buildings must meet the performance criteria specified below:*		
	Area of building	*Minimum critical radiant flux when tested to ISO 9239-1: 2010*	
		Buildings not protected with an automatic fire sprinkler system	*Buildings protected with an automatic fire sprinkler system*
	Sleeping areas and exitways in buildings where care or detention is provided	*4.5 kW/m²*	*2.2 kW/m²*
	Exitways in all other buildings	*2.2 kW/m²*	*2.2 kW/m²*
	Firecells accommodating more than 50 persons	*2.2 kW/m²*	*1.2 kW/m²*
	All other occupied spaces except household units	*1.2 kW/m²*	*1.2 kW/m²*
	C3.4(c) is to be satisfied by ensuring that: a) suspended flexible fabrics used as underlay to exterior cladding or roofing, when exposed to view in all *occupied spaces* excluding *household units*, shall have a *flammability index* of no greater than 5 when tested to AS 1530 Part 2 b) Suspended flexible fabrics and membrane structures shall have a *flammability index* of no greater than 12 when tested to AS 1530 Part 2 in the following locations: i) *exitways* from spaces where people sleep, and ii) all *occupied spaces* within crowd uses.		
Required outcome	Demonstrate that *surface finishes* comply with these performance requirements.		

Scenario description

The performance criteria required for lining materials will depend on their location within a *building*, the use of the *building* and its *importance level*.

The criteria in NZBC C3.4 shall be applied to lining materials, except in the following cases:

a) Small areas of non-conforming product within a space with a total aggregate surface area not more than 5.0 m²

b) Electrical switches, outlets, cover plates and similar small discontinuous areas

c) Pipes and cables used to distribute power or services

d) *Handrails* and general decorative trim of any material such as architraves, skirtings and window components, including reveals, that do not exceed 5% of the area of the surface to which it is attached

Amend 3 Dec 2013

e) *Damp-proof courses*, seals, caulking, flashings, thermal breaks and ground moisture barriers

f) Timber joinery and structural timber *building elements* constructed from solid wood, glulam or laminated veneer lumber. This includes heavy timber columns, beams, portals and shear walls not more than 3.0 m wide, but does not include exposed timber panels or permanent formwork on the underside of floor/
ceiling systems

g) Uniformly distributed roof lights where:

i) the total area does not exceed 15% of the ceiling area (in plan), and

ii) the minimum floor to ceiling height is not less than 6.0 m, and

iii) the roof lights achieve a *Group Number* not greater than 3

h) Individual *doorsets*, and

Amend 3 Dec 2013

i) Continuous areas of permanently installed openable wall partitions not more than 3.0 m high and having a surface area of not more than 25% of the divided room floor area or 5.0 m², whichever is less.

The smoke production rate criteria do not need to apply for sprinklered *buildings*.

Material *Group Numbers* apply to the exposed surface of the interior wall or ceiling lining. They are determined by the *fire* testing laboratory using the procedure described in Appendix A. This is either to:

a) ISO 9705, which is a full-scale room corner test, or

b) ISO 5660, which is a bench-scale fire test on a small sample of the material.

A correlation is used that allows the ISO 9705 result to be predicted using data obtained in the ISO 5660 test.

If an 'S' is appended to the material *Group Number*, the material also is required to meet smoke production criteria. The limit for maximum smoke production is:

a) 5.0 m^2/s if the ISO 9705 test is used, or

b) 250 m^2/kg if the ISO 5660 test is used.

Materials that are classified *non-combustible* when tested to AS 1530.1 or ISO 1182 can be assigned a material *Group Number* of 1 or 1–S without further evaluation using Appendix A.

When testing to ISO 1182 the following criteria are required to be classified as non-combustible:

$\Delta T \leq 30°C$

$\Delta m \leq 50\%$

$t_f = 0s$

Where:

ΔT= The rise in temperature of the furnace

Δm = The mass loss of the specimen

Amend 4 Jul 2014

t_f = The time of sustained flaming

Rigid or flexible ductwork meeting the *fire* hazard properties set out in AS 4524 can be assigned a material *Group Number* of 1 or 1-s without further evaluation using Appendix A.

Amend 3 Dec 2013

The minimum critical flux for a floor surface material or covering is determined by *fire* testing to ISO 9239 Part 1 (radiant panel test).

A critical radiant heat flux may be assigned to some flooring materials, without further evaluation, using Appendix B.

Method

The following tests shall be applied to lining materials to achieve compliance with NZBC C3.4, unless otherwise permitted in this Verification Method.

Amend 4 Jul 2014

For wall/ceiling lining materials, external surface of ducts and pipe insulation:

a) Small scale testing to ISO 5660 (cone calorimeter test) provided it is appropriate for the type of material, or

b) Full scale testing to ISO 9705 (room corner test), or

c) Small scale testing to meet *fire* hazard properties set out in AS 4254 for rigid and flexible ductwork.

For floor surface materials:

a) *Fire* testing to ISO 9239 Part 1 (radiant panel test).

For suspended flexible fabrics and membrane structures:

a) *Fire* testing to AS 1530 Part 2 (flammability test).

4.8 Design scenario (FO): Firefighting operations

Scenario in brief	This scenario provides for the safe operation of firefighters in a *building*.
Code objectives	***C1 b)*** *Protect other property from damage caused by fire, and* ***C1(c)*** *Facilitate firefighting and rescue operations.*
What you must satisfy	The performance criteria in C3.8, C5.3, C5.4, C5.5, C5.6, C5.7, C5.8 and C6.3. ***C3.8*** *Firecells located within 15 m of a relevant boundary that are not protected by an automatic fire sprinkler system, and that contain a fire load greater than 20 TJ or that have a floor area greater than 5000 m^2 must be designed and constructed so that at the time that firefighters first apply water to the fire, the maximum radiation flux at 1.5 m above the floor is no greater than 4.5 kW/m^2; and the smoke layer is no less than 2 m above the floor.*
	C5.3 *Buildings must be provided with access for fire service vehicles to a hard-standing from which there is an unobstructed path to the building within 20 m of:* *(a) the firefighter access into the building, and* *(b) the inlets to automatic fire sprinkler systems or fire hydrant systems, where these are installed.*
	C5.4 *Access for fire service vehicles in accordance with Clause C5.3 shall be provided to more than 1 side of firecells greater than 5 000 m^2 in floor area that are not protected by an automatic fire sprinkler system.*
	C5.5 *Buildings must be provided with the means to deliver water for firefighting to all parts of the building.*
	C5.6 *Buildings must be designed and constructed in a manner that will allow firefighters, taking into account the firefighters' personal protective equipment and standard training, to:* *a) reach the floor of fire origin,* *b) search the general area of fire origin, and* *c) protect their means of egress.*
	C5.7 *Buildings must be provided with means of giving clear information to enable firefighters to:* *a) establish the general location of the fire,* *b) identify the fire safety systems available in the building, and* *c) establish the presence of hazardous substances or process in the building.*
	C5.8 *Means to provide access for and safety of firefighters in buildings must be designed and constructed with regard to the likelihood and consequence of failure of any fire safety systems.*
	C6.3 *Structural systems in buildings that are necessary to provide firefighters with safe access to floors for the purpose of conducting firefighting and rescue operations must be designed and constructed so that they remain stable during and after fire.*
Required outcome	Show that the performance requirements are satisfied.

Scenario description

This scenario has been designed to test the safe operation of firefighters in the event of a *fire* in the *building*.

For the purposes of NZBC Clause C3.8, when measuring the distance between a *firecell* and a *relevant boundary* and when determining the *fire load*, the area beneath a canopy roof may be ignored if all the following conditions apply:

a) The nearest distance (in plan) between any part of the canopy and the *relevant boundary* is greater than 1.0 m, and

Amend 3 Dec 2013

b) The average *FLED* applying to the area beneath the canopy is not greater than 800 MJ/m^2, and

c) The canopy has at least 50% of the perimeter area open to the outside.

Amend 3 Dec 2013

For the purposes of NZBC C3.8, take the time that the Fire Service first applies water to the *fire* as either:

a) 1200 seconds, or

b) 1000 seconds if there is an automatic alarm and direct connection to the Fire Service, or

c) Some other time as determined and supported by the application of a *fire* brigade intervention model.

Use the *design fire* as described in Paragraph 2.3 for the applicable occupancy. This can be modified to account for ventilation conditions.

Where *fire separations* are specified to create *firecells* of area not more than 5000 m^2, the full *burnout design fire* defined in Paragraph 2.4 shall be used to determine the required *fire* resistance of the *fire separation*.

For the purposes of NZBC C5.5, water shall be provided from either:

a) A pumping appliance parked close to the *building* such that any point within the *building* may be reached within 75 m (~3 hose lengths) of the pumping appliance, or

b) An internal hydrant designed and installed to NZS 4510 or as approved by the National Commander of the New Zealand Fire Service.

In relation to NZBC C6.3, firefighters are provided with the means of conducting search and rescue operations by giving them safe access to the *fire* floor with *building construction* that will not collapse during the *fire*. Derive the *fire* resistance of the structure or separating *construction* needed to achieve this by reference to the full *burnout design fire* defined in Pararaph 2.4 and by meeting the requirements below.

A. For buildings with an escape height >10 m:

a) Provide firefighters with access to all floors within the *building* that are not directly *accessible* from street level by having *stairway(s)* designed as *exitways*, *fire separated* from all other parts of the *building*, that are designed to resist *fire* spread until *burnout*, and

Amend 4
Jul 2014

Comment:
In the case of *intermediate floors*, access to the *intermediate floor* can be taken as being achieved if:

a) The distance between the most remote point on the *intermediate floor* and a hydrant located within a *safe path* is no more than 40 m. This corresponds to ~2 hose lengths with some allowance for a non-direct path, or

b) The furthest point on the *intermediate floor* is able to be reached within 3 hose lengths to satisfy the requirement of NZBC C5.5 to provide water to all points of the *building*.

b) Protect firefighters and others at ground level and within the *building* by designing the load-carrying structure and floor systems (excluding *intermediate floors*) to resist collapse and prevent *fire* spread between floor levels until *burnout*, and

c) Design *intermediate floors* and supporting structure to resist collapse until *burnout*. This is unless the *intermediate floor* has an *occupant load* ≤100 people and an *escape height* ≤4.0 m and the area below the floor is open to the *firecell*; in which case the *intermediate floor* may be designed to resist collapse for not less than 30 minutes. Such collapse shall not cause consequent collapse of any other part of the structural system that is required to resist *burnout* in accordance with a) or b) above.

Errata 2
Feb 2013

Verification Method C/VM2

B. For buildings with an escape height ≤10 m:

a) Provide firefighters with *stairways fire separated* from all other parts of the *building* allowing them access to all floors within the *building* that are not directly accessible from street level either for a period of 60 minutes (from ignition) or to resist collapse until *burnout*, and

Amend 4 Jul 2014

b) Protect firefighters and others at ground level and within the *building* by designing the floor systems (excluding *intermediate floors*) and supporting structure to resist collapse and prevent *fire* spread between floor levels for a period of at least 30 minutes, and

Errata 2 Amend 4

Comment:
In the case of *intermediate floors*, access to the *intermediate floor* can be taken as being achieved if:

a) The distance between the most remote point on the *intermediate floor* and a hydrant located within a *safe path* is no more than 40 m. This corresponds to ~2 hose lengths with some allowance for a non-direct path, or

b) The furthest point on the *intermediate floor* is able to be reached within 3 hose lengths to satisfy the requirement of NZBC C5.5 to provide water to all points of the *building*.

Amend 4 Jul 2014

c) Design *intermediate floors* and supporting structure to resist collapse for a period of at least 30 minutes.

Errata 2 Amend 4

Comment:
These requirements permit search and rescue operations, and attempt to avoid unexpected or sudden collapse that would endanger Fire Service personnel within the *building*. See commentary C2.5 for guidance on design to resist collapse and prevent *fire* spread for a given period of time. An *FRR* of 30/30/- may be used to comply with b) and c) above.

Intermediate floors – additional requirements:

If the total floor area of *intermediate floors* exceeds 40% of the floor area of the *firecell*, the *intermediate floors* shall be rated for *integrity, insulation* and *structural adequacy* to resist collapse to comply with the requirements of a), b), or c).

Amend 3 Dec 2013

Amend 4 Jul 2014

Catwalks used intermittently in industrial plants, platforms for retractable seating, flytowers over stages, and similar structures do not need to be *fire* rated.

Amends 3 and 4

4.9 Design scenario (CF): Challenging fire

Scenario in brief	A *fire* starts in a normally *occupied space* and presents a challenge to the *building's fire safety systems*, threatening the safety of its occupants.
Code objective	***C1(a)*** *Safeguard people from an unacceptable risk of injury or illness caused by fire.*
What you must satisfy	The performance criteria of C4.3 and C4.4. This will require analysis. ***C4.3*** *The evacuation time must allow occupants of a building to move to a place of safety in the event of a fire so that occupants are not exposed to any of the following:* *(a) a fractional effective dose of carbon monoxide greater than 0.3;* *(b) a fractional effective dose of thermal effects greater than 0.3;* *(c) conditions where, due to smoke obscuration, visibility is less than 10 m except in rooms of less than 100 m² where the visibility may fall to 5 m.* ***C4.4*** *Clause C4.3 (b) and (c) do not apply where it is not possible to expose more than 1000 people in a firecell protected with an automatic fire sprinkler system.*
Required outcome	Demonstrate *ASET>RSET* for *design fires* in various locations within the *building.*

Scenario description

The challenging *fires* are intended to represent credible worst case scenarios in normally occupied spaces that will challenge the *fire* protection features of the *building*.

This scenario requires the use of *design fires* in various locations within the *building*. *ASET* need not be determined for occupants of the space of *fire* origin for the following *fire* locations:

Amend 3 Dec 2013 Errata 1 Apr 2012

a) Any room with a floor area less than 2.0 m², or

b) Sanitary facilities adjoining an *exitway*, or

c) Any room or space of *fire* origin other than *early childhood centres* on an upper level and sleeping areas where care or detention is provided, which has all of the following:

Errata 1 Amend 3

i) a total floor area, including *intermediate floors*, of less than 500 m², and

ii) more than one direction of travel or a single direction of travel that is less than 25 m, and

iii) an *occupant load* of less than 150 people for the room or less than 100 people for any *intermediate floor*, or

d) Any room where care is provided which has no more than 4 occupants undergoing treatment.

Comment:
Rooms specified in d) may include areas providing direct support functions such as security desks or kiosks, nurse stations, tea bays and sanitary facilities essential to the operation of the treatment room.

Amend 3 Dec 2013

For c), the *fire* engineer does not have to demonstrate that tenability is maintained for occupants within the enclosure of *fire* origin; however, they must demonstrate that the challenging *fire* in this space does not threaten occupants in the rest of the *building*. This includes demonstrating that the *structural adequacy, integrity* and *insulation* of floors, stairs and walkways forming *escape routes* and the smoke and *fire separations* protecting these *escape routes* is maintained sufficiently to protect the occupants in the rest of the *building* for the duration of their *RSET*. Where occupants in the rest of the *building* use *escape routes* protected from the effects of *fire* (such as *exitways*), the effect of sprinklers to control the *fire* (with constant *HRR*) shall be ignored for assessing the performance required of the *construction* protecting the *escape routes*. The *design fires* shall be characterised with a power law *HRR*, peak *HRR* and *FLED* as specified in Part 2. Design values for *yields* are specified for CO, CO_2 and soot/smoke. Hydrogen cyanide production need not be considered.

Amends 2 and 3

Amend 4 Jul 2014

The *design fires* are intended to represent 'free-burning' *fires*. However, they shall be modified during an analysis (depending on the methodology used) to account for *building* ventilation and the effects of automatic *fire* suppression systems (if any) on the *fire*. The *design scenario*: RC (see Paragraph 4.10) will require the overall robustness of the design to be examined separately.

Comment:
Refer to Commentary to Paragraph 3.2.7 when there is an identifiable primary exit via a reception or lobby area and determining *RSET* in such a situation

Amend 4 Jul 2014

Verification Method C/VM2

The *fire* engineer shall:

a) For each location of the challenging *fire*, use a single *fire source* to evaluate the *building's* protection measures

b) Consider the impact on occupants who may be using *escape routes* external to the *building* as well as internal routes (see Paragraph 3.6.1), and

Errata 1 Feb 2013

c) Assume that active and passive *fire safety systems* in the *building* will perform as intended by the design.

Method

This scenario requires the *ASET/RSET* analysis of the impact on all *building* occupants of *design fires* located in various locations within the *building*, except for those rooms or spaces excluded in the scenario description above.

The *fire* engineer is expected to calculate the *fire* environment in the *escape routes* over the period of time the occupants require to escape. Assess the *fire* environment based on the *fractional effective dose* and *visibility* at the location of the occupants.

The *fire* engineer will typically select a *fire* calculation model appropriate to the complexity and size of the *building*/space that allows the *fractional effective dose* and *visibility* to be determined.

4.10 Design scenario (RC): Robustness check

Scenario in brief	The *fire* design will be checked to ensure that the failure of a critical part of the *fire safety system* will not result in the design not meeting the objectives of the *Building Code*.
Code objectives	*C1(a) Safeguard people from an unacceptable risk of injury or illness caused by fire.* *C1(b) Protect other property from damage caused by fire.* *C1(c) Facilitate firefighting and rescue operations.*
What you must satisfy	This scenario contributes to testing the performance criteria of C3.9, C4.5, C5.8 and C6.2d). Where tenability criteria are evaluated, these criteria only need to be assessed based on *FED* (CO). *C3.9 Buildings must be designed and constructed with regard to the likelihood and consequence of failure of any fire safety system intended to control fire spread.* *C4.5 Means of escape to a place of safety in buildings must be designed and constructed with regard to the likelihood and consequence of failure of any fire safety systems.* *C5.8 Means to provide access for and safety of firefighters in buildings must be designed and constructed with regard to the likelihood and consequence of failure of any fire safety systems.* *C6.2 Structural systems in buildings that are necessary for structural stability in fire must be designed and constructed so that they remain stable during fire and after fire when required to protect other property taking into account:* *(a) …* *(b) …* *(c) …* *(d) the likelihood and consequence of failure of any fire safety systems that affect the fire severity and its impact on structural stability.*
Required outcome	Demonstrate that if a single *fire safety system* fails, where that failure is statistically probable, the *building* as designed will allow people to escape and *fire* spread to *other property* will be limited.

Scenario description

This scenario applies where failure of a key *fire safety system* could potentially expose to untenable conditions:

a) More than 150 people, or

Amend 4 Jul 2014

b) More than 50 people in a sleeping occupancy where the occupants are neither detained or undergoing some treatment or care, or

c) More than 20 people detained, or undergoing treatment or care, or children in *early childhood centres*.

Comment:
Undergoing treatment or care is not restricted to people in operating theatres or procedure rooms, but also those in recovery and recuperative wards and rooms.

Amend 3 Dec 2013

For this scenario, key *fire safety systems* include:

a) Smoke management systems (other than permanent natural/passive ventilation features that do not rely on the activation of any mechanical or electronic component)

b) *Fire* and/or *smoke control doors* or similar *fire* closures, and

c) Any other feature or system required as part of the *fire* safety design that relies on a mechanical or electronic component to be activated during the *fire*, except that:

i) *fire* sprinkler systems and automatic *fire* alarms installed to a recognised national or international Standard, can be considered to be sufficiently reliable that they are exempt from this robustness scenario, and

ii) in sprinklered *buildings*, *fire* and *smoke control doors* fitted with automatic *hold-open devices* that are designed and installed to BS 7273.4 or another recognised national or international Standard and are activated by the operation of the *fire* alarm system can be considered to be sufficiently reliable that they are exempt from this robustness scenario.

This particular scenario focuses on the *ASET/RSET* life safety calculations performed as part of the *design scenario*: CF Challenging fire (see Paragraph 4.9). The robustness of the design shall be tested by considering the *design fire* with each key *fire safety system* rendered ineffective in turn.

For this scenario, where tenability criteria are evaluated, the engineer needs to assess these based on *FED* (CO).

Comment:
Ideally, a comprehensive quantitative probabilistic risk assessment would be used to assess the safety of a design. However, the risk assessment tools and supporting data are currently not suitable for inclusion within this Verification Method. Therefore, the framework currently requires a deterministic *ASET/RSET* approach with additional checks and balances to meet *Building Code* objectives.

As a general rule, when calculating *ASET* times, *fire safety systems* may be assumed to operate as designed, provided they are manufactured and installed in accordance with recognised national or international Standards. However, in the situations defined above, additional *fire safety systems* are required to provide redundancy and robustness to the *fire* safety design.

Method

In the circumstances described in the scenario, assume the failure of each key *fire safety system* in turn. If *ASET* cannot be shown to be greater than *RSET* when each key system fails, then the design must be altered until the requirements of this scenario can be satisfied.

If a design does not require a key *fire safety system* for *ASET*>*RSET*, there is no system to fail and the further robustness test is not required.

Robustness check of vertical escape routes

In addition to the above, a robustness check applies to sprinklered sleeping occupancies as follows:

For a *building* served by a single vertical *escape route*, visibility in the vertical *escape route* shall not be less than 5.0 m for the period of the *RSET*.

Errata 2
Feb 2013

For a *building* where the vertical *escape routes* serve more than 250 people in a sleeping occupancy, visibility shall not be less than 5.0 m in more than one vertical *escape route* for the period of the *RSET*.

This check assumes that all *fire safety systems* are operating as designed.

Errata 2
Feb 2013

Appendix A (normative): Establishing Group Numbers for lining materials

A1.1 Tests for material Group Numbers

Materials shall be assigned a material *Group Number* when tested to either:

a) ISO 9705 Fire tests – full scale room test for surface products, or

b) ISO 5660 Reaction to fire tests (Heat release, smoke production and mass loss rate) Part 1: Heat release rate (cone calorimeter method); and ISO 5660 Reaction to fire tests (Heat release, smoke production and mass loss rate) Part 2: Smoke production rate (dynamic measurement).

This is except in the following cases:

a) Metal-skin panel assemblies with *combustible* core materials, which shall only be assessed using either the ISO 9705 or ISO 13784 Part 1 test method, or

b) Foil-faced *combustible* materials, which shall only be assessed using the ISO 9705 test method, but if forming part of rigid and flexible ductwork may instead satisfy the requirements of A1.4 a), or

Amend 3 Dec 2013

c) Other products that an accredited test laboratory believes are not appropriate to be evaluated using the ISO 5660 test method due to the configuration or other characteristics of the product. Such products shall be assessed using either the ISO 9705 test or another large scale test if deemed to be appropriate.

Comment:
ISO 5660 is unsuitable in cases where the *fire* performance of the assembly is dominated by the *construction* details rather than the flammability characteristics of the surface material or in cases where, due to the configuration of the material in the test, significant mechanical damage occurs at full scale which does not occur with small, horizontal samples.

A1. 2 Determining a material's Group Number when tested to ISO 9705

For a material tested to ISO 9705, the material's *Group Number* shall be determined as follows:

Group Number 1 material has total heat release not greater than 1 MW following exposure to 100 kW for 10 minutes then 300 kW for 10 minutes

Group Number 1–S material has total heat release not greater than 1 MW following exposure to 100 kW for 10 minutes then 300 kW for 10 minutes and the average smoke production rate over the period 0–20 min is not greater than 5.0 m^2/s

Group Number 2 material has total heat release not greater than 1 MW following exposure to 100 kW for 10 minutes

Group Number 2–S material has total heat release not greater than 1 MW following exposure to 100 kW for 10 minutes and the average smoke production rate over the period 0–10 min is not greater than 5.0 m^2/s

Group Number 3 material has total heat release not greater than 1 MW following exposure to 100 kW for 2 minutes, and

Group Number 4 material has total heat release greater than 1 MW following exposure to 100 kW for 2 minutes.

The rate of total heat release determined in ISO 9705 includes contribution from both the internal lining and the exposure source (100 kW or 300 kW).

The *Group Number* of a material predicted in accordance with Paragraph A1.3 using data obtained by testing the material at 50 kW/m^2 irradiance in the horizontal orientation with edge frame in accordance with ISO 5660 is given by:

Group Number 1 material: as predicted in accordance with Paragraph A1.3

Group Number 1-S material: as predicted in accordance with Paragraph A1.3 and an average *specific extinction area* less than 250 m^2/kg

Group Number 2 material: as predicted in accordance with Paragraph A1.3

Group Number 2-S material: as predicted in accordance with Paragraph A1.3 and an average *specific extinction area* less than 250 m^2/kg

Group Number 3 material: as predicted in accordance with Paragraph A1.3, and

Group Number 4 material: as predicted in accordance with Paragraph A1.3.

A1. 3 Determining a material's Group Number when tested to ISO 5660

For a material tested to ISO 5660, the material's *Group Number* must be determined in accordance with the following:

a) Data must be in the form of time and *HRR* pairs for the duration of the test. The time interval between pairs should not be more than 5 seconds. The end of the test (t_f) is determined as defined in ISO 5660, and

b) At least three replicate specimens must be tested.

The following five steps must be applied separately to each specimen:

Step 1: Determine time to ignition (t_{ig}). This is defined as the time (in seconds) when the *HRR* reaches or first exceeds a value of 50 kW/m^2.

Step 2: Calculate the Ignitability Index (I_{ig}) expressed in reciprocal minutes.

$$I_{ig} = \frac{60}{t_{ig}}$$

Step 3: Calculate the following two *HRR* indices:

$$IQ_1 = \int_{t_{ig}}^{t_f} \left[\frac{q''(t)}{(t - t_{ig})^{0.34}} \right] dt$$

$$IQ_2 = \int_{t_{ig}}^{t_f} \left[\frac{q''(t)}{(t - t_{ig})^{0.93}} \right] dt$$

Amend 3
Dec 2013

Comment:
These definite integral expressions represent the area under a curve from the ignition time until the end of the test, where the parameter is plotted on the vertical axis and time (t) is plotted on the horizontal axis.

Step 4: Calculate the following three integral limits:

$$IQ_{,10\text{min}} = 6800 - 540 I_{ig}$$

$$IQ_{,2\text{min}} = 2475 - 165 I_{ig}$$

$$IQ_{,12\text{min}} = 1650 - 165 I_{ig}$$

Step 5: Classify the material in accordance with the following:

i) If $IQ_1 > IQ_{10}$ min and $IQ_2 > IQ_2$ min, the material is a *Group Number* 4 material

ii) If $IQ_1 > IQ_{10}$ min and $IQ_2 \leq IQ_2$ min, the material is a *Group Number* 3 material

iii) If $IQ_1 \leq IQ_{10}$ min and $IQ_2 > IQ_{12}$ min, the material is a *Group Number* 2 material

iv) If $IQ_1 \leq IQ_{10}$ min and $IQ_2 \leq IQ_{12}$ min, the material is a *Group Number* 1 material, or

v) If the ignition criterion in Step 1 above is not reached, the material is a *Group Number* 1 material.

Repeat steps 1 to 5 above for each replicate specimen tested. If a different classification group is obtained for different specimens tested, then the highest (worst) classification for any specimen must be taken as the final classification for that material.

Comment:
It is expected that the *fire* testing laboratory will determine the material *Group Number* as described in this section when reporting the *fire* test results.

A1.4 Determining a Group Number for surfaces of ducts for HVAC systems

Surfaces of rigid and flexible ductwork for *HVAC* systems shall be assigned either:

a) A material *Group Number* of 1-s when the ductwork complies with the fire hazard properties set out in AS 4254, or

b) A material *Group Number* as determined by A1.2 or A1.3.

Amend 3
Dec 2013

A1.5 Determining a Group Number for some surface finishes

For the purposes of compliance with the *surface finish* requirements, the specified combinations of substrate and coating in Table A1 can be taken as having the performance indicated without the need for further evaluation using A1.2 or A1.3.

Table A1 Specified performances for some substrate and coating combinations

Coating (coating in good condition and well adhered to substrate)	Substrate	Performance (with or without coating)
Waterborne or solvent borne paint coatings $\leq$ 0.4 mm thick Polymeric films $\leq$ 0.2 mm thick	Concrete and masonry $\geq$ 15 mm thick Sheet metal $\geq$ 0.4 mm thick, or Fibre-cement board $\geq$ 6.0 mm thick Glass	G1-S
Waterborne or solvent borne paint coatings $\leq$ 0.4 mm thick	Gypsum plasterboard with or without paper facing $\geq$ 9.5 mm thick $\geq$ 400 kg/m^3 core density < 5% wt organic contribution to board	G2-S
Waterborne or solvent borne paint coatings, varnish or stain $\leq$ 0.4 mm thick $\leq$ 100 g/m^2	Solid wood or wood product $\geq$ 9.0 mm thick $\geq$ 600 kg/m^3 for particle boards, or $\geq$ 400 kg/m^3 for all other wood and wood products	G3
Note: The requirements of this table do not apply to metal faced panels with polymeric substrate.		

Amend 3 Dec 2013

A1.6 Selecting a substrate for testing materials or coatings usually applied to a substrate

Materials or coatings that are usually applied to a particular substrate shall be applied to the appropriate substrate. Where the material may be applied to a variety of substrates, the substrate selected for testing shall be one which most closely represents the end use condition. The choice shall be based on Table A2. A test result for a material or coating tested on any one of the specified substrates may be also be used when the material or coating is applied to any other substrate of the same type or a less reactive type and of equal or greater density.

However, Table A2 only applies where the substrate is not modified by the application of a surface coating or treatment.

Amend 4 Jul 2014

Where the substrate is modified by a surface coating or treatment, through significant absorption of material into it, the coating and substrate should be specifically tested. Notwithstanding the above, a surface coating on any nominated substrate may be tested and a *Group Number* assigned as described in A1.2 or A1.3.

Table A2 Selection of substrate

Substrate type	Substrate material
1 (most reactive)	Timber, Standard grade plywood, hardboard, fibre/particleboard (where the substrate is less than 12 mm thick)
2	Timber, Standard grade plywood, hardboard, fibre/particleboard (where the substrate is 12 mm thick or greater)
3	Paper faced gypsum board products
4 (least reactive)	Concrete/masonry, fibre-reinforced cement board, non-paper faced gypsum boards

Amend 4 Jul 2014

A1.7 Wall and ceiling elements that include foamed plastics or combustible insulating materials

Elements are parts of the *buildings* such as ceilings and walls. An assembly is a collection of materials and components that make up the element to form a system.

Samples submitted for testing to ISO 5660 are limited to a maximum thickness of 50 mm, and therefore only those parts within 50 mm of the exposed surface of an assembly which comprises composite layers need be included in the test specimen. When conducting a test to ISO 5660 or ISO 9705, the test laboratory may decide if a lesser thickness is appropriate or if the *foamed plastics* or *combustible* insulation may be omitted from the test specimen entirely (ie. when the surface lining is sufficiently robust and well-fixed such that substrate materials are unlikely to influence the outcome of the *Group Number* classification).

Foamed plastics or combustible insulating materials that form part of an element requiring a group number can be assumed not to influence the group number classification and need not be included in the test specimen in the following examples.

a) The surface lining material is a rigid sheet product of gypsum plasterboard, plywood, solid wood, wood composite, fibre-reinforced cement, concrete or masonry and is not less than 9 mm thick, and

b) It is securely fastened with steel fasteners to a conventional lightweight timber or steel frame or a concrete/masonry wall, according to manufacturers' literature, and

c) All sheet joins are supported and sealed and/or stopped with a non-flaming material.

Amend 4 Jul 2014

In all other situations, or when there is doubt whether the examples above apply to a particular assembly, an accredited testing laboratory shall be consulted.

Notwithstanding the above, foamed plastics must still meet the flame propagation criteria of AS 1366 and metal-skin panel assemblies with combustible core materials and foil-faced combustible insulating materials require ISO 9705 or ISO 13784.1 testing as described in Paragraph A1.1.

Appendix B (normative): Critical Radiant Flux values for some flooring materials

B1.0 For the purposes of compliance with Clause C3.4(b) of the Building Code the following critical radiant flux values may be assigned as shown in Table B1 for the given flooring material without further evidence of testing to ISO 9239-1:2010.

Table B1 **Specified performances for some flooring materials**

Flooring material	Critical Radiant Flux (CRF)
Concrete[2], brick, ceramic or porcelain tile	4.5 kW/M^2
Wood Products, Plywood or Solid Timber [1,2] ≥ 12 mm thick; and ≥ 400 kg/m^3	2.2 kW/M^2

Note

1. Some timber species and thicknesses and with/without applied coatings when tested may achieve a higher CRF. When a greater CRF is required to meet Clause C3.4 (b) than given in this table, supporting test data to ISO 9239-1:2010 for the product is required.
2. May include waterborne or solvent borne applied surface coatings not more than 0.4 mm thick and not more than 100 g/m^2.

Amend 4
Jul 2014

Appendix C (normative): Methodology for design scenario HS: Horizontal fire spread (Tabular Data)

C1.1 Horizontal fire spread from external walls

C1.1.1 This Appendix contains tabular data that can be used to satisfy Method B of *design scenario* HS: Horizontal fire spread. The requirements in this Appendix depend on the intersection angle of the *external wall* and the *relevant boundary*.

Intersection Angle

C1.1.2 The intersection angle is the angle produced between two horizontal lines, one being the line projected along the exterior face of a space bounded by *separating elements*, and the other being the *relevant boundary* (see Figure C1). Where *external walls* are parallel to one another, or to a *relevant boundary*, the intersection angle is zero degrees.

C1.1.3 The following methods shall be applied depending on the intersection angle.

a) For angles ≤ 10°, apply Methods 1 or 2.

b) For angles > 10° to < 80° or for *buildings* of irregular shape, apply Method 3.

c) For angles ≥ 80° to < 135°, apply Method 4.

For angles of 135° or greater there are no requirements and an *unprotected area* of 100% is permitted for the *external wall.*

Notional boundary firecells on the same property

C1.1.4 For *buildings* on the same property, the words *relevant boundary* shall be interpreted as *notional boundary* for the application of this Appendix.

Amend 6 Nov 2020

C2.1 Method 1 – Small openings and fire resisting glazing

C2.1.1 The provisions for *external wall construction* are satisfied if:

a) Small *unprotected areas* with a maximum area of 0.1 m^2 (Type A areas) and areas of *fire resisting glazing* (Type B areas) are located to comply with Figure C2, and

b) The remainder of the *wall* is *fire* rated equally for exposure to *fire* on both sides.

C2.1.2 The *fire resisting glazing* shall be rated for *integrity* and the *FRR* of both the glazing and *external wall* shall be derived from the full *burnout design fire* as described in Paragraph 2.4 of this Verification Method.

Size and spacing of Type A and Type B areas

C2.1.3 Type A areas shall be no greater than 0.1 m^2. Type B areas shall be no greater than permitted by Table C1 according to the distance from the *relevant boundary*.

C2.1.4 There is no limitation on the spacing between adjacent Type A and Type B areas which occur in different spaces bounded by *separating elements*. Within a space bounded by *separating elements* the following requirements shall apply:

a) Type A areas shall be no closer, both vertically and horizontally, than 1.5 m to another Type A or to a Type B area.

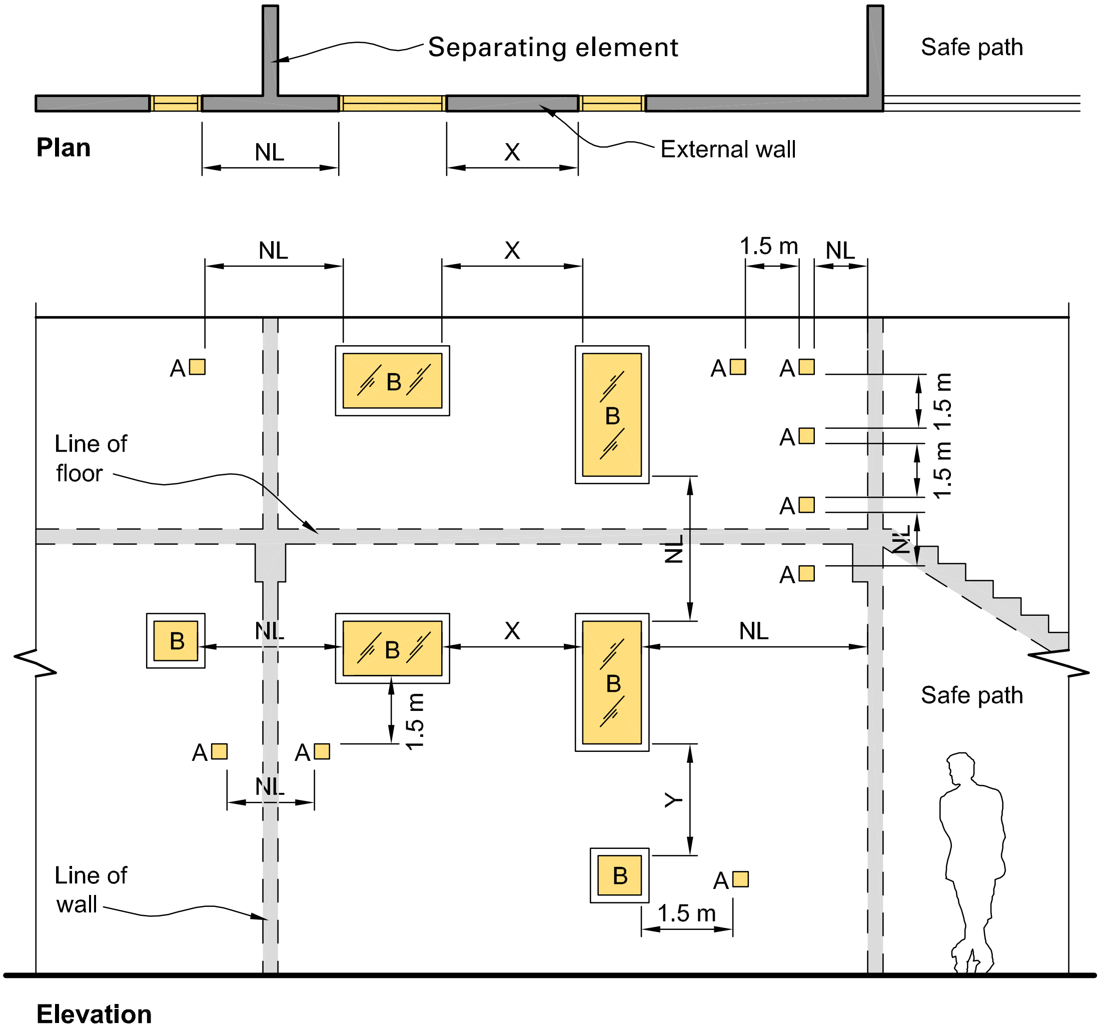
b) Type B areas shall be no closer to one another, vertically or horizontally, than the dimensions X or Y shown on Figure C2.

Comment:
To determine dimensions X and Y, measure the width and height of both the adjacent Type B areas. The minimum value for X is the greater of the two widths, and for Y the greater of the two heights

Amend 6 Nov 2020

c) Where Type B areas are staggered, rather than being aligned vertically or horizontally, the shortest distance, in any direction, between adjacent areas shall be no less than the greater of the X and Y measurements.

Figure C2 **Method 1 – Permitted small unprotected areas and fire resisting glazing**
Paragraph C2.1.4



Dimensions shown are minimum distances between Type A unprotected areas and of Type B fire resisting glazing

Legend

A☐ Type A *unprotected areas* of 0.1 m^2 maximum

B Type B areas of *fire resisting glazing* complying with Table C1

NL No limitation on spacing

X Spacing to be no less than the greater of the widths of the two Type B areas being considered

Y Spacing to be no less than the greater of the heights of the two Type B areas being considered

Amend 6
Nov 2020

Table C1 **Maximum permitted areas of fire resisting glazing (m^2)**
Paragraph C2.1.3

Minimum distance to relevant boundary (m)	FLED				
	≤ 400 MJ/m^2	> 400 to ≤ 800 MJ/m^2		> 800 MJ/m^2	
	Unsprinklered[1]	Unsprinklered	Sprinklered	Unsprinklered	Sprinklered
0.0	1.0	1.0	5.0	1.0	1.0
0.1	1.0	1.0	6.5	1.0	1.0
0.2	1.0	1.0	7.5	1.0	1.0
0.3	1.0	1.0	9.0	1.0	1.0
0.4	1.0	1.0	10.0	1.0	1.5
0.5	1.5	1.0	11.0	1.0	2.5
0.6	2.0	1.0	13.0	1.0	3.5
0.7	3.0	1.5	14.0	1.0	5.0
0.8	3.5	2.0	15.0[3]	1.0	6.5
0.9	5.0	3.0		1.5	7.5
1.0	6.0	3.5		1.5	8.5
1.1	7.5	4.5		2.0	9.5
1.2	8.5	5.5		2.5	10.0
1.3	10.0	7.0		3.0	11.0
1.4	12.0	8.0		3.5	12.0
1.5	13.0	8.5		4.0	13.0
1.6	14.0	9.5		5.0	14.0
1.7	15.0[2]	10.0		5.5	15.0[3]
1.8		10.0		6.0	
1.9		11.0		6.5	
2.0		12.0		7.0	
2.1		13.0		7.5	
2.2		14.0		8.0	
2.3		15.0[3]		8.5	
2.4				9.0	
2.5				9.5	
2.6				10.0	
2.7				11.0	
2.8				11.0	
2.9				12.0	
3.0				12.0	
3.1				13.0	
3.2				14.0	
3.4				15.0[3]	

Notes:

1. For *sprinklered firecells* with a *FLED* ≤ 400 MJ/m^2, the area of *fire resisting glazing* is unlimited and may be any distance from the *relevant boundary.*
2. For *firecells* with a *FLED* ≤ 400 MJ/m^2, there is no limit on the permitted area of *fire resisting glazing* at distances greater than 1.7 m from the *relevant boundary.*
3. For *firecells* with a *FLED* > 400 MJ/m^2, the maximum permitted area of *fire resisting glazing* is 15 m^2.

Amend 6
Nov 2020

C2.2 Method 2 – enclosing rectangles – parallel boundary

Application

C2.2.1 This method shall be applied to *external walls* of *buildings* that are parallel to or angled at no more than 10° to the *relevant boundary*.

C2.2.2 This method is used to calculate the maximum percentage of *unprotected area* in the *external wall* of each space bounded by *separating elements*. This is based on the dimensions of *unprotected areas*, *FLED,* and the distance from the *external wall* to the *relevant boundary.*

Enclosing rectangle dimensions

C2.2.3 The dimensions of the *unprotected areas* in the *external wall* of each space shall be determined by drawing a rectangle enclosing all *unprotected areas* and the protected areas between them (see Figure C3) and measuring the height and width of the enclosing rectangle.

Amend 6
Nov 2020

Figure C3 **Method 2 – Enclosing rectangles (unprotected areas)**
Paragraph C2.2.4

Rectangle construction

Diagram A, B and C demonstrate how, for a given *external wall* of a single *firecell*, dimensions of the enclosing rectangle (indicated by the rectangle diagonals) vary according to the extent and location of *fire rated construction*. The essential requirement is for the rectangle to enclose all *unprotected areas.* This means that such things as an isolated window or door or other non-*fire rated* part of the wall can significantly alter the rectangle dimensions and may include part of the *fire rated* wall.

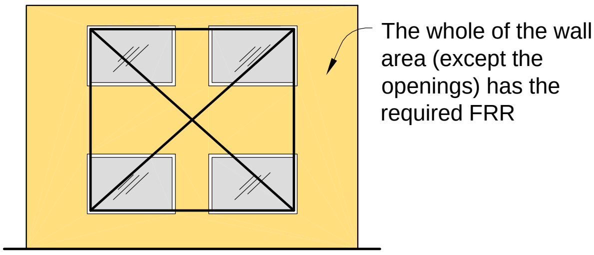


Diagram A

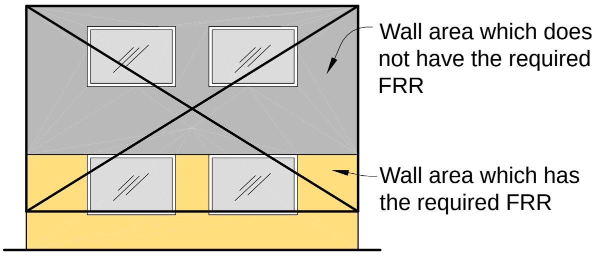


Diagram B

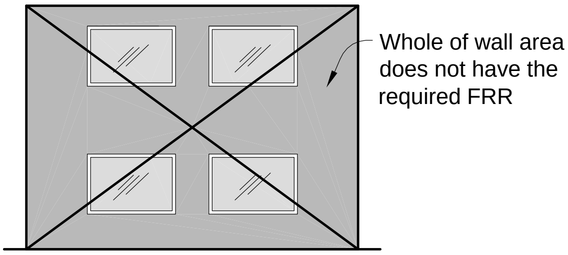
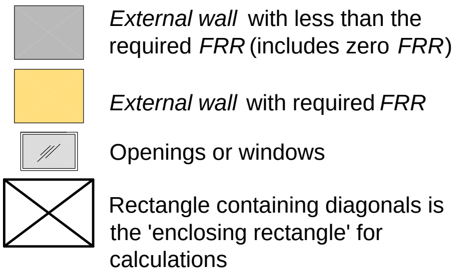


Diagram C

Legend



Amend 6
Nov 2020

Maximum percentage of unprotected area allowed

C2.2.4 The maximum *unprotected area* for the *external walls* shall be specified in:

a) Table C2a for an enclosing rectangle height of 1.0 m

b) Table C2b for an enclosing rectangle height of 2.0 m

c) Table C2c for an enclosing rectangle height of 3.0 m

d) Table C2d for an enclosing rectangle height of 4.0 m

e) Table C2e for an enclosing rectangle height of 6.0 m

f) Table C2f for an enclosing rectangle height of 8.0 m

For enclosing rectangle heights greater than 8.0 m, radiation from *unprotected areas* in the *external wall* shall be determined using Method A Calculations in accordance with Paragraph 4.5 of the Verification Method.

Tables C2a to C2f are split into three parts according to the *FLED* range. The design *FLED* is provided in Table 2.2. The maximum enclosing rectangle width shall be 20 m for *FLED* ≤ 800 MJ/m^2 and 30 m for *FLED* > 800 MJ/m^2.

C2.2.5 If Tables C2a to C2f do not contain the exact measurements for the enclosure being considered, use the next highest value for rectangle height or rectangle width or next lowest value for distance to the *relevant boundary*.

Amend 6 Nov 2020

C2.2.6 Where the enclosure is sprinklered, increases are permitted in accordance with Paragraph 4.5 of this Verification Method.

Required distance from the relevant boundary

C2.2.7 Tables C2a to C2f can also be used to determine the required distance from the *relevant boundary* where the percentage of *unprotected area* has previously been determined. Select the permitted percentage of *unprotected areas* (under the column "Width of enclosing rectangle (metres)") and read the minimum permitted distance to the *relevant boundary* from the left hand column of the table.

Additional check of large unprotected openings

C2.2.8 The enclosing rectangle method assumes that *unprotected areas* are uniformly distributed openings over the total *external wall* of the *firecell*. In most cases, radiant heat flux is more intense from a single large opening than from several small openings with the same total area. As an additional safety check, identify the largest single *unprotected area* and use the height and width of this opening as an enclosing rectangle on its own with 100% *unprotected area*. The minimum permitted distance from the largest single *unprotected area* to the *relevant boundary* shall be no greater than the distance between the *external wall* and the *relevant boundary* used in Paragraphs C2.2.4 to C2.2.7.

Amend 6
Nov 2020

Table C2a **Height of enclosing rectangle 1.0 metres**
Paragraph C2.2.4

Minimum distance to *relevant boundary* (metres)	Maximum percentage of unprotected area in the external wall allowed																								
	FLED ≤ 400 MJ/m²								FLED > 400 to ≤ 800 MJ/m²								FLED > 800 MJ/m²								
	Width of the enclosing rectangle (metres)								Width of the enclosing rectangle (metres)								Width of the enclosing rectangle (metres)								
	2	3	4	6	8	10	15	20	2	3	4	6	8	10	15	20	2	3	4	6	8	10	15	20	30
1.0	100	89	85	82	81	81	80	80	81	71	68	66	66	65	65	64	58	51	49	47	47	47	46	46	46
1.1		98	92	89	87	85	84	84	91	79	75	72	70	69	68	67	65	56	53	51	50	49	48	48	48
1.2		100	100	96	92	90	88	87	100	87	81	78	74	72	71	70	73	62	58	56	53	52	51	50	50
1.3				100	96	94	92	91		95	88	82	78	76	74	73	81	68	63	59	56	54	53	53	52
1.4					100	98	96	95		100	96	87	81	79	77	77	90	74	68	62	58	57	55	55	55
1.5						100	100	99			100	91	85	83	80	80	100	81	74	65	61	59	57	57	57
1.6								100				96	89	86	84	83		88	80	69	64	62	60	59	59
1.7												100	93	90	87	86		96	86	72	67	64	62	61	61
1.8													97	93	90	89		100	91	75	70	67	64	64	63
1.9													100	97	93	92			96	79	72	69	67	66	66
2.0														100	97	95			100	83	76	72	69	68	68
2.1															100	99				87	79	75	72	71	70
2.2																100				90	82	78	74	73	72
2.3																				94	85	81	76	75	74
2.4																				99	88	83	79	78	77
2.5																				100	92	86	81	80	79
2.6																					95	89	84	82	81
2.7																					99	92	86	85	83
2.8																					100	95	89	87	86
2.9																						99	91	89	88
3.0																						100	94	92	90
3.1																							97	94	93
3.3																							100	99	97
3.5																								100	100

Note: For enclosing rectangle widths greater than given in the table, an enclosing rectangle width of 20 m for FLED ≤ 800 MJ/m² and 30 m for FLED > 800 MJ/m² may be used

Amend 6
Nov 2020

Table C2b **Height of enclosing rectangle 2.0 metres**
Paragraph C2.2.4

Minimum distance to *relevant boundary* (metres)	Maximum percentage of unprotected area in the external wall allowed																								
	FLED ≤ 400 MJ/m²								FLED > 400 to ≤ 800 MJ/m²								FLED > 800 MJ/m²								
	Width of the enclosing rectangle (metres)								Width of the enclosing rectangle (metres)								Width of the enclosing rectangle (metres)								
	2	3	4	6	8	10	15	20	2	3	4	6	8	10	15	20	2	3	4	6	8	10	15	20	30
1.0	65	57	53	47	45	44	43	43	53	46	43	38	36	36	35	35	38	33	31	27	26	25	25	25	25
1.1	71	61	57	50	47	46	45	45	57	49	46	40	38	37	36	36	41	35	33	29	27	27	26	26	26
1.2	78	66	60	52	49	48	47	47	63	53	48	42	40	39	38	38	45	38	35	30	28	28	27	27	27
1.3	85	71	64	55	51	50	49	49	69	57	51	44	41	40	39	39	49	41	37	32	30	29	28	28	28
1.4	93	76	67	57	54	52	51	50	75	61	54	46	43	42	41	41	53	44	39	33	31	30	29	29	29
1.5	100	82	71	60	56	54	53	52	81	66	57	48	45	44	42	42	58	47	41	35	32	31	30	30	30
1.6		88	75	63	58	56	55	54	89	71	60	51	47	45	44	44	63	50	43	36	34	32	31	31	31
1.7		94	79	66	61	59	57	56	96	76	64	53	49	47	46	45	69	54	46	38	35	34	33	32	32
1.8		100	83	69	63	61	58	58	100	81	67	55	51	49	47	47	75	58	48	40	36	35	34	33	33
1.9			88	72	66	63	60	60		86	71	58	53	51	49	48	81	61	51	41	38	36	35	34	34
2.0			92	75	68	65	62	62		90	74	60	55	53	50	50	87	65	53	43	39	38	36	36	35
2.1			97	78	71	68	64	64		95	78	63	57	54	52	51	94	68	56	45	41	39	37	37	36
2.2			100	82	74	70	66	65		100	82	66	59	56	54	53	100	72	59	47	42	40	38	38	37
2.3				85	76	72	69	67			86	69	62	58	55	54		76	61	49	44	42	40	39	38
2.4				89	79	75	71	69			90	71	64	60	57	56		80	64	51	46	43	41	40	40
2.5				92	82	77	73	71			94	74	66	62	59	57		84	67	53	47	45	42	41	41
2.6				96	85	80	75	73			99	77	69	64	60	59		88	71	55	49	46	43	42	42
2.7				100	88	82	77	75			100	80	71	66	62	61		92	74	57	51	48	44	43	43
2.8					91	85	79	77				84	73	69	64	62		96	77	60	53	49	46	45	44
2.9					94	88	81	79				87	76	71	66	64		100	80	62	54	51	47	46	45
3.0					98	90	84	81				90	79	73	67	66			84	64	56	52	48	47	46
4.0					100	100	100	100				100	100	97	86	83			100	91	77	69	62	59	57
5.0														100	100	100				100	100	90	77	72	69
6.0																						100	94	86	81
7.0																							100	100	94
7.5																									100

Note: For enclosing rectangle widths greater than given in the table, an enclosing rectangle width of 20 m for FLED ≤ 800 MJ/m² and 30 m for FLED > 800 MJ/m² may be used

Amend 6
Nov 2020

Table C2c **Height of enclosing rectangle 3.0 metres**
Paragraph C2.2.4

Minimum distance to *relevant boundary* (metres)	Maximum percentage of unprotected area in the external wall allowed																								
	FLED ≤ 400 MJ/m²								FLED > 400 to ≤ 800 MJ/m²								FLED > 800 MJ/m²								
	Width of the enclosing rectangle (metres)								Width of the enclosing rectangle (metres)								Width of the enclosing rectangle (metres)								
	2	3	4	6	8	10	15	20	2	3	4	6	8	10	15	20	2	3	4	6	8	10	15	20	30
1.0	57	47	40	35	34	33	32	32	46	38	33	29	27	27	26	26	33	27	23	20	19	19	19	19	19
1.1	61	49	43	37	35	34	34	33	49	40	34	30	28	28	27	27	35	29	24	21	20	20	19	19	19
1.2	66	52	45	39	36	35	35	34	53	42	36	31	29	29	28	28	38	30	26	22	21	20	20	20	20
1.3	71	55	47	40	38	37	36	35	57	45	38	32	30	30	29	29	41	32	27	23	22	21	21	20	20
1.4	76	59	49	42	39	38	37	37	61	47	40	34	32	31	30	29	44	34	28	24	23	22	21	21	21
1.5	82	62	52	44	41	39	38	38	66	50	42	35	33	32	31	30	47	36	30	25	23	23	22	22	22
1.6	88	65	55	46	42	41	39	39	71	53	44	37	34	33	32	31	50	38	31	26	24	23	23	22	22
1.7	94	69	57	47	44	42	40	40	76	56	46	38	35	34	33	32	54	40	33	27	25	24	23	23	23
1.8	100	73	60	49	45	43	42	41	81	59	48	40	36	35	34	33	58	42	35	28	26	25	24	24	24
1.9		77	63	51	47	45	43	42	86	62	51	41	38	36	35	34	61	44	36	30	27	26	25	24	24
2.0		81	66	53	49	46	44	44	90	65	53	43	39	37	36	35	65	46	38	31	28	27	25	25	25
2.1		85	69	56	50	48	45	45	95	68	56	45	41	39	37	36	68	49	40	32	29	28	26	26	26
2.2		89	72	58	52	49	47	46	100	72	58	47	42	40	38	37	72	51	42	33	30	28	27	27	26
2.3		93	76	60	54	51	48	47		75	61	48	43	41	39	38	76	54	44	35	31	29	28	27	27
2.4		98	79	62	56	52	49	49		79	64	50	45	42	40	39	80	56	46	36	32	30	28	28	28
2.5		100	82	65	58	54	51	50		83	66	52	46	44	41	40	84	59	48	37	33	31	29	29	28
2.6			86	67	59	56	52	51		86	69	54	48	45	42	41	88	62	50	39	34	32	30	29	29
2.7			90	70	61	57	54	52		90	72	56	50	46	43	42	92	65	52	40	35	33	31	30	30
2.8			94	72	63	59	55	54		94	75	58	51	48	44	43	96	68	54	42	37	34	32	31	30
2.9			97	75	66	61	56	55		99	79	60	53	49	45	44	100	71	56	43	38	35	32	32	31
3.0			100	78	68	63	58	56		100	82	63	55	51	47	45		74	58	45	39	36	33	32	32
4.0				100	91	82	73	70			100	87	74	66	59	56		100	85	62	53	48	42	40	39
5.0					100	100	90	85				100	96	85	73	68			100	84	69	61	52	49	47
6.0							100	100					100	100	89	82				100	88	77	63	58	55
7.0															100	96					100	94	76	69	63
8.0																100						100	90	80	72
9.0																							100	92	82
10.0																								100	91
10.8																									100

Note: For enclosing rectangle widths greater than given in the table, an enclosing rectangle width of 20 m for FLED ≤ 800 MJ/m² and 30 m for FLED > 800 MJ/m² may be used

Amend 6
Nov 2020

Table C2d	Height of enclosing rectangle 4.0 m Paragraph C2.2.4																								
Minimum distance to *relevant boundary* (metres)	Maximum percentage of unprotected area in the external wall allowed																								
	FLED ≤ 400 MJ/m²								FLED > 400 to ≤ 800 MJ/m²								FLED > 800 MJ/m²								
	Width of the enclosing rectangle (metres)								Width of the enclosing rectangle (metres)								Width of the enclosing rectangle (metres)								
	2	3	4	6	8	10	15	20	2	3	4	6	8	10	15	20	2	3	4	6	8	10	15	20	30
1.0	53	40	35	30	29	28	28	27	43	33	28	24	23	23	22	22	31	23	20	17	17	16	16	16	16
1.1	57	43	36	31	30	29	28	28	46	34	29	25	24	23	23	23	33	24	21	18	17	17	16	16	16
1.2	60	45	38	33	31	30	29	29	48	36	31	26	25	24	23	23	35	26	22	19	18	17	17	17	17
1.3	64	47	40	34	32	31	30	30	51	38	32	27	25	25	24	24	37	27	23	19	18	18	17	17	17
1.4	67	49	42	35	33	32	31	30	54	40	33	28	26	25	25	24	39	28	24	20	19	18	18	17	17
1.5	71	52	43	36	34	32	31	31	57	42	35	29	27	26	25	25	41	30	25	21	19	19	18	18	18
1.6	75	55	45	38	35	33	32	32	60	44	37	30	28	27	26	26	43	31	26	22	20	19	19	18	18
1.7	79	57	47	39	36	34	33	33	64	46	38	31	29	28	27	26	46	33	27	22	21	20	19	19	19
1.8	83	60	49	40	37	35	34	34	67	48	40	33	30	29	27	27	48	35	29	23	21	20	20	19	19
1.9	88	63	52	42	38	36	35	34	71	51	42	34	31	29	28	28	51	36	30	24	22	21	20	20	20
2.0	92	66	54	43	39	37	36	35	74	53	43	35	32	30	29	28	53	38	31	25	23	22	21	20	20
2.1	97	69	56	45	41	39	37	36	78	56	45	36	33	31	30	29	56	40	32	26	23	22	21	21	21
2.2	100	72	59	47	42	40	38	37	82	58	47	38	34	32	30	30	59	42	34	27	24	23	22	21	21
2.3		76	61	48	43	41	38	38	86	61	49	39	35	33	31	30	61	44	35	28	25	24	22	22	22
2.4		79	64	50	45	42	39	39	90	64	51	40	36	34	32	31	64	46	37	29	26	24	23	22	22
2.5		82	66	52	46	43	40	40	94	66	53	42	37	35	33	32	67	48	38	30	27	25	23	23	23
2.6		86	69	54	47	44	41	40	99	69	56	43	38	36	33	33	71	50	40	31	27	26	24	23	23
2.7		90	72	56	49	46	42	41	100	72	58	45	39	37	34	33	74	52	41	32	28	26	24	24	24
2.8		94	75	57	50	47	43	42		75	60	46	41	38	35	34	77	54	43	33	29	27	25	24	24
2.9		97	78	59	52	48	44	43		79	62	48	42	39	36	35	80	56	45	34	30	28	26	25	25
3.0		100	81	61	53	49	45	44		82	65	50	43	40	37	36	84	58	46	35	31	28	26	25	25
4.0			100	84	71	64	57	54		100	92	68	57	52	46	44	100	85	66	49	41	37	33	31	30
5.0				100	92	81	70	65			100	90	74	66	56	53		100	90	65	53	47	40	38	36
6.0					100	100	84	77				100	94	82	68	62			100	84	67	59	48	45	42
7.0							100	90					100	100	81	73				100	84	72	58	52	48
8.0								100							95	84					100	87	68	60	55
9.0															100	97						100	79	69	62
10.0																100							92	79	69
11.0																							100	90	77
12.0																								100	85
13.0																									94
13.7																									100

Note: For enclosing rectangle widths greater than given in the table, an enclosing rectangle width of 20 m for FLED ≤ 800 MJ/m² and 30 m for FLED > 800 MJ/m² may be used

Amend 6
Nov 2020

Table C2e **Height of enclosing rectangle 6.0 metres**
Paragraph C2.2.4

Minimum distance to *relevant boundary* (metres)	Maximum percentage of unprotected area in the external wall allowed																								
	FLED ≤ 400 MJ/m²								FLED > 400 to ≤ 800 MJ/m²								FLED > 800 MJ/m²								
	Width of the enclosing rectangle (metres)								Width of the enclosing rectangle (metres)								Width of the enclosing rectangle (metres)								
	2	**3**	**4**	**6**	**8**	**10**	**15**	**20**	**2**	**3**	**4**	**6**	**8**	**10**	**15**	**20**	**2**	**3**	**4**	**6**	**8**	**10**	**15**	**20**	**30**
1.0	47	35	30	26	25	24	23	23	38	29	24	21	20	19	19	19	27	20	17	15	14	14	14	13	13
1.1	50	37	31	27	25	25	24	24	40	30	25	22	20	20	19	19	29	21	18	16	15	14	14	14	14
1.2	52	39	33	28	26	25	24	24	42	31	26	22	21	20	20	19	30	22	19	16	15	14	14	14	14
1.3	55	40	34	28	26	26	25	24	44	32	27	23	21	21	20	20	32	23	19	16	15	15	14	14	14
1.4	57	42	35	29	27	26	25	25	46	34	28	24	22	21	20	20	33	24	20	17	16	15	15	14	14
1.5	60	44	36	30	28	27	26	25	48	35	29	24	22	21	21	20	35	25	21	17	16	15	15	15	15
1.6	63	46	38	31	28	27	26	26	51	37	30	25	23	22	21	21	36	26	22	18	16	16	15	15	15
1.7	66	47	39	32	29	28	27	26	53	38	31	26	23	22	21	21	38	27	22	18	17	16	15	15	15
1.8	69	49	40	33	30	28	27	27	55	40	33	26	24	23	22	22	40	28	23	19	17	16	16	15	15
1.9	72	51	42	34	31	29	28	27	58	41	34	27	25	23	22	22	41	30	24	19	18	17	16	16	16
2.0	75	53	43	35	31	30	28	28	60	43	35	28	25	24	23	22	43	31	25	20	18	17	16	16	16
2.1	78	56	45	36	32	30	29	28	63	45	36	29	26	24	23	23	45	32	26	21	19	17	17	16	16
2.2	82	58	47	37	33	31	29	29	66	47	38	30	27	25	24	23	47	33	27	21	19	18	17	17	16
2.3	85	60	48	38	34	32	30	29	69	48	39	31	27	26	24	24	49	35	28	22	19	18	17	17	17
2.4	89	62	50	39	35	32	30	30	71	50	40	32	28	26	24	24	51	36	29	23	20	19	17	17	17
2.5	92	65	52	40	36	33	31	30	74	52	42	32	29	27	25	24	53	37	30	23	20	19	18	17	17
2.7	100	70	56	43	37	35	32	31	80	56	45	34	30	28	26	25	57	40	32	25	22	20	19	18	18
3.0		78	61	47	40	37	34	33	90	63	50	38	33	30	27	27	64	45	35	27	23	21	20	19	19
4.0		100	84	62	52	47	41	39	100	87	68	50	42	38	33	32	91	62	49	36	30	27	24	23	22
5.0			100	81	66	58	49	46		100	90	65	53	47	40	37	100	84	65	46	38	33	28	27	25
6.0				100	82	71	59	54			100	83	66	58	47	44		100	84	59	48	41	34	31	29
7.0					100	87	70	63				100	82	70	56	51			100	74	58	50	40	36	33
8.0						100	81	72					99	84	66	58				90	71	60	47	42	38
9.0							95	82					100	99	76	66				100	85	71	54	48	42
10.0							100	94						100	88	75					100	83	63	54	47
11.0								100							100	85						97	72	61	52
12.0																96						100	82	68	58
13.0																100							92	77	63
14.0																							100	85	59
16.0																								100	83
18.4																									100

Note: For enclosing rectangle widths greater than given in the table, an enclosing rectangle width of 20 m for FLED ≤ 800 MJ/m² and 30 m for FLED > 800 MJ/m² may be used

Amend 6
Nov 2020

Table C2f **Height of enclosing rectangle 8.0 metres**
Paragraph C2.2.4

Minimum distance to *relevant boundary* (metres)	Maximum percentage of unprotected area in the external wall allowed																								
	FLED > 400 to ≤ 800 MJ/m²								FLED > 800 MJ/m²								FLED > 800 MJ/m²								
	Width of the enclosing rectangle (metres)								Width of the enclosing rectangle (metres)								Width of the enclosing rectangle (m)								
	2	**3**	**4**	**6**	**8**	**10**	**15**	**20**	**2**	**3**	**4**	**6**	**8**	**10**	**15**	**20**	**2**	**3**	**4**	**6**	**8**	**10**	**15**	**20**	**30**
1.0	45	34	29	25	23	23	22	22	36	27	23	20	19	18	18	17	26	19	17	14	13	13	13	13	12
1.1	47	35	30	25	24	23	22	22	38	28	24	20	19	18	18	18	27	20	17	15	14	13	13	13	13
1.2	49	36	31	26	24	23	22	22	40	29	25	21	19	19	18	18	28	21	18	15	14	13	13	13	13
1.3	51	38	32	26	24	24	23	22	41	30	25	21	20	19	18	18	30	22	18	15	14	14	13	13	13
1.4	54	39	33	27	25	24	23	23	43	32	26	22	20	19	19	19	31	23	19	16	14	14	13	13	13
1.5	56	41	34	28	25	24	23	23	45	33	27	22	20	20	19	19	32	23	19	16	15	14	13	13	13
2.0	68	49	39	31	28	26	25	24	55	39	32	25	23	21	20	20	39	28	23	18	16	15	14	14	14
2.5	82	58	46	36	31	29	27	26	66	46	37	29	25	23	22	21	47	33	27	20	18	17	15	15	15
3.0	98	68	53	40	35	32	29	28	79	55	43	33	28	26	23	23	56	39	31	23	20	18	17	16	16
4.0	100	91	71	52	43	39	34	32	100	74	57	42	35	31	27	26	77	53	41	30	25	22	20	19	18
5.0		100	92	66	54	47	40	37		96	74	53	43	38	32	30	100	69	53	38	31	27	23	22	21
6.0			100	82	66	57	47	43		100	94	66	53	46	38	35		88	67	48	38	33	27	25	23
7.0				100	81	69	55	49			100	82	65	55	44	40		100	84	58	46	40	32	28	26
8.0					97	82	64	56				99	78	66	51	45			100	71	56	47	37	33	29
9.0					100	96	74	64				100	92	77	59	52				85	66	55	42	37	33
10.0						100	84	72					100	90	68	58				100	78	65	49	42	36
11.0							96	81						100	77	66					90	75	55	47	40
12.0							100	91							88	73					100	86	63	53	44
14.0								100							100	91						100	79	65	53
17.0																100							100	87	68
20.0																								100	86
22.2																									100

Note: For enclosing rectangle widths greater than given in the table, an enclosing rectangle width of 20 m for FLED ≤ 800 MJ/m² and 30 m for FLED > 800 MJ/m² may be used

C2.3 Method 3 – enclosing rectangles – irregular buildings and non-parallel boundaries

C2.3.1 This method applies where the *building* is of irregular shape or the intersection angle between the *external wall* and *relevant boundary* is between 10° and 80° (see Figure C4). The method is a variation of Method 2 and evaluates the enclosing rectangle on an assumed reference plane.

Comment:
Greatest advantage is obtained by locating the reference plane to achieve the maximum separation distance over the part of the wall having the largest *unprotected area*. In general, the most convenient location of the reference plane will be parallel to the *relevant boundary*.

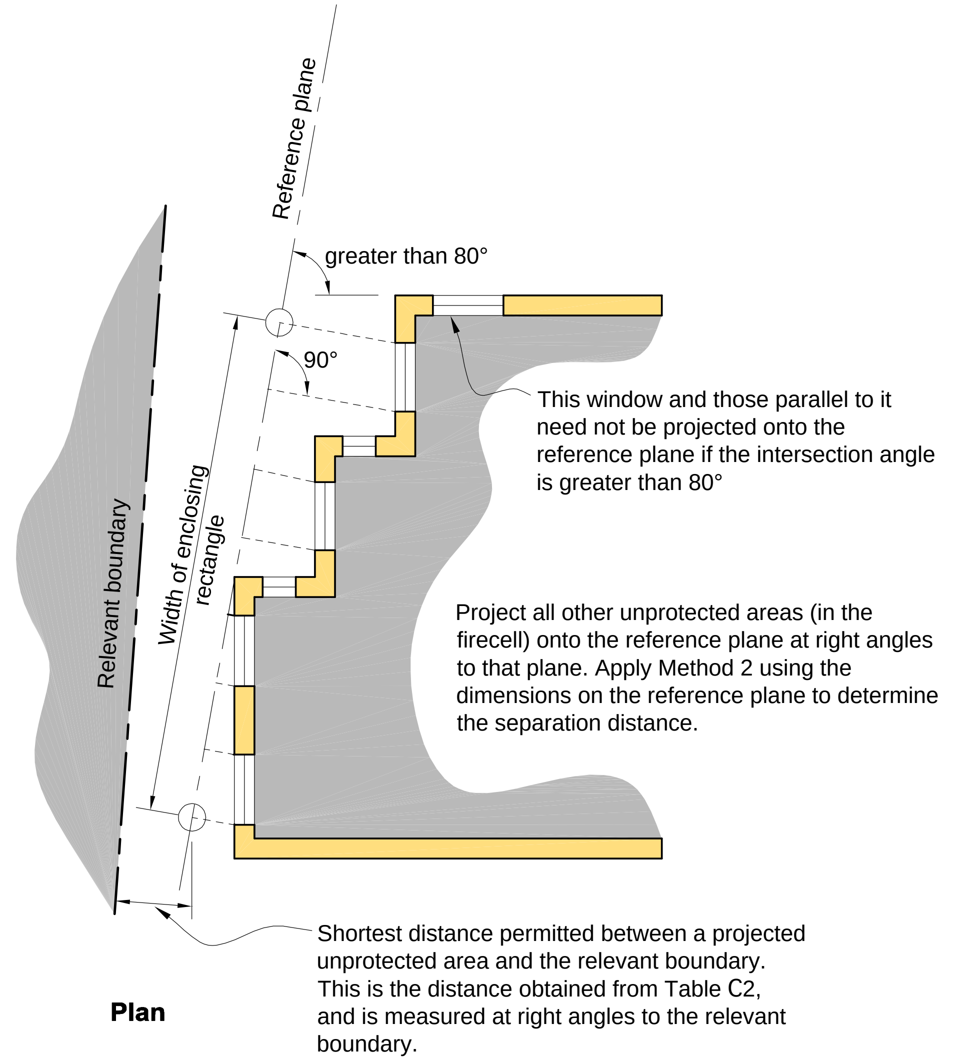
C2.3.2 The reference plane shall be vertical, touch at least one point on the *external wall*, and not cross the *relevant boundary* within the length of the enclosure. The plane shall not pass through the enclosure, but may pass through projections such as balconies or copings.

C2.3.3 The enclosing rectangle is determined by projecting the *unprotected areas* onto the reference plane at right angles to the plane, and the distance to the *relevant boundary* used in the calculations shall be the shortest distance between that *relevant boundary* and the closest projected *unprotected area* on the reference plane. *Unprotected areas* which are more than 80° to the reference plane are not included.

Once the enclosing rectangle is determined, comply with Paragraphs C2.2.4 to C.2.2.8 as required.

Amend 6 Nov 2020

Figure C4 Method 3 – Enclosing rectangles (irregular shaped buildings and non-parallel boundaries)
Paragraph C2.3.1



Amend 6
Nov 2020

C2.4 Method 4 – Return walls and wing walls

Application

C2.4.1 This method shall be applied to *external walls* of *buildings* where the intersection angle is 80° or greater and less than 135°. It may be used for all values of *FLED*.

C2.4.2 This method is used to determine the length of wing walls and return walls. Protection is achieved by providing either return walls or wing walls in accordance with Paragraphs C2.4.3 to C2.4.8 depending on the *construction* method proposed. Where the *firecell* is sprinklered, wing walls and return walls are not required.

Comment:
It is more economical to use a return wall in the *firecell* of *fire* origin than to use a wing wall as a shield between that *firecell* and the property being protected.

C2.4.3 For this method, there are two tables. Table C.3 is used for the separation from the *relevant boundary* with *other property*. Table C.4 is used for separation on the same property where one or both *firecells* being considered contains a sleeping use or is a *safe path*. When using Table C3, separation distances are measured between *unprotected areas* in the *firecells* being considered, and the *notional boundary* coinciding with the *external wall* of the other *firecell*.

Enclosing rectangle dimensions

C2.4.4 The dimensions of the *unprotected areas* in the *external wall* of each space shall be determined by drawing a rectangle enclosing all *unprotected areas* and the protected areas between them within a maximum distance of 20 m measured at right angles to the *relevant boundary*. The dimensions of the rectangle are:

a) A_o (the equivalent opening area) found by summing individual *unprotected areas* within the enclosing rectangle; and

b) h_{eq} (the equivalent opening height) based on the height of the enclosing rectangle; and

c) W_{eq} (equivalent opening width) found by dividing A_o by h_{eq}.

Amend 6
Nov 2020

Comments:
It is assumed that *unprotected areas* more than 20 m from the *relevant boundary* do not pose a radiation threat.

Return wall and wing wall lengths for intersection angles ≥ 80° to < 90°

C2.4.5 The length of return walls or wing walls shall be determined from equations C.1 and C.2.

$L_r = D_B - D_S$	Equation C.1
$L_w = \dfrac{L_B \times L_r}{D_B}$	Equation C.2

L_r is the return wall length (metres); and

L_W is the wing wall length (metres); and

D_B is the minimum permitted distance between *unprotected areas* in the *external wall* being considered and the *relevant boundary* (metres). D_B is determined from Tables C3 and C4 based on h_{eq} and W_{eq} from Paragraph C2.4.4; and

D_S is the shortest distance between the *external wall* of the space bounded by *separating elements* being considered and the *relevant boundary* (metres) (see Figure C5); and

L_B is the wing wall length if that wall is located on the *relevant boundary* (metres). L_B is determined from from Tables C3 and C4 based on h_{eq} and W_{eq} from Paragraph C2.4.4.

C2.4.6 L_r, D_B and D_S are measured at right angles to the *relevant boundary* (see Figure C5).

C2.4.7 On the *relevant boundary*, $D_S = 0$ and therefore for a return wall $L_r = D_B$ and for a wing wall $L_W = L_B$. If D_B is equal to or greater than D_S, the formula produces a zero or negative result and there is no requirement for a return wall or wing wall.

Comments:
1. Table C3 and Table C4 are based on the assumption that the equivalent opening area is located at the end of the wall nearest the *relevant boundary*. This is a conservative, but safe, simplification for determining the most severe thermal radiation likely to be emitted from a *fire* within the space bounded by *separating elements*.

Return wall and wing wall lengths for intersection angles ≥ 90° to < 135°

C2.4.8 For angles of 90° or greater, the return wall length and wing wall length can be reduced linearly to give shorter return walls or wing walls by applying Equations C.3 and C.4.

$$L_f = \left(\frac{135 - \theta}{45}\right) \times (D_B - D_S)$$ Equation C.3

$$L_w = \left(\frac{135 - \theta}{45}\right) \times \frac{L_B \times L_r}{D_B}$$ Equation C.4

L_r is the return wall length (metres); and

L_w is the wing wall length (metres); and

θ is the intersection angle (°); and

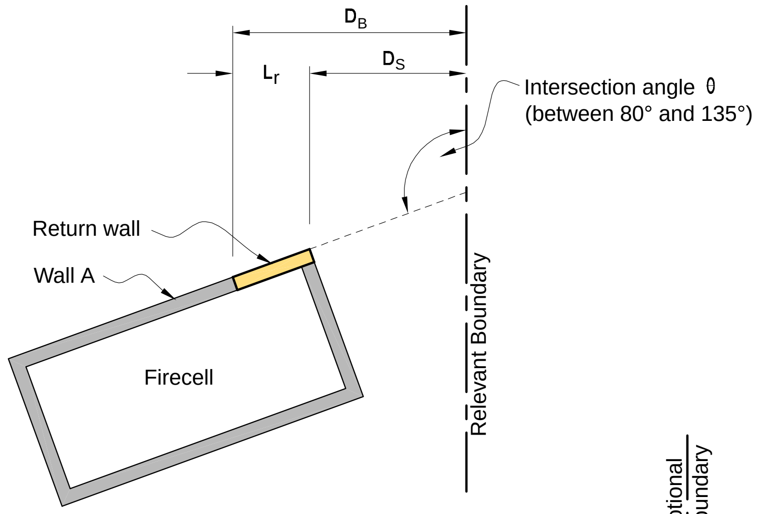
D_B is the minimum permitted distance between *unprotected areas* in the *external wall* being considered and the *relevant boundary* (metres). D_B is determined from Tables C3 and C4 based on h_{eq} and W_{eq} from Paragraph C2.4.4; and

D_S is the shortest distance between *external wall* of the space bounded by *separating elements* being considered and the *relevant boundary* (metres) (see Figure C5); and

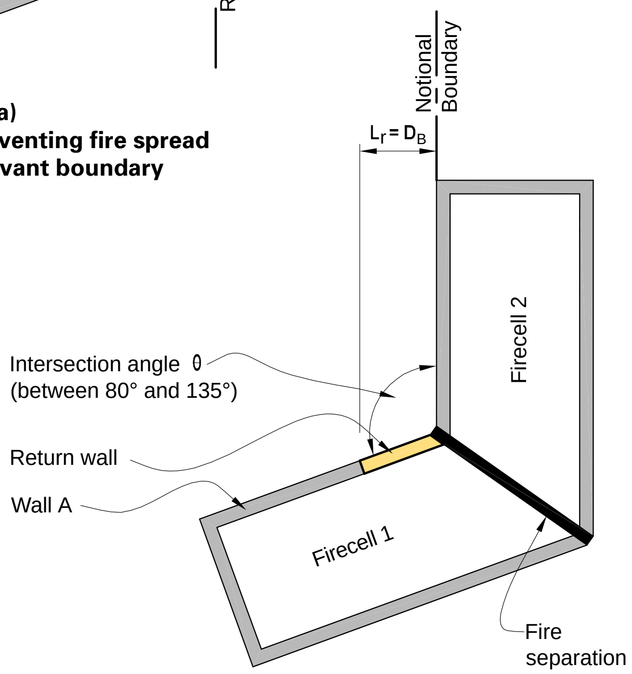
L_B is the wing wall length if that wall is located on the *relevant boundary* (metres). L_B is determined from from Tables C3 and C4 based on h_{eq} and W_{eq} from Paragraph C2.4.4.

Amend 6 Nov 2020

Figure C5	Method 4 – Return walls on external walls having an intersection angle of between 80° and 135° with the relevant boundary or notional boundary



Plan (a)
Return wall length for preventing fire spread from wall A to the relevant boundary



Plan (b)
Return wall for preventing fire spread from the external wall of firecell 1 to firecell 2 in the same or adjoining building

Key

D_S = The shortest distance between the *external wall* being considered and the *relevant boundary.*

D_B = Minimum permitted distance between *unprotected areas* in wall A and the *relevant boundary* as determined from Table C3 for plan (a), or the *notional boundary* as determined from Table C4 for plan (b).

L_r = The required return wall length measured at right angles to the *relevant boundary* or *notional boundary* as applicable.

Amend 6
Nov 2020

Table C3 Method 4 – Return walls and wing walls for unsprinklered firecells: protection of other property

Equivalent opening height h_{eq} (metres)	Return walls: Minimum separation distance between unprotected areas and notional boundary D_B (metres)								Equivalent opening height h_{eq} (metres)	Wing walls: Minimum length of wing wall if located on the relevant boundary L_B (metres)							
	Equivalent opening width W_{eq} (metres)									Equivalent opening width W_{eq} (metres)							
	1	2	3	4	6	8	10	20		1	2	3	4	6	8	10	20
1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7
2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	2	0.6	0.9	1.1	1.2	1.2	1.3	1.3	1.3
3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	3	0.7	1.1	1.4	1.6	1.7	1.8	1.9	1.9
4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	4	0.7	1.2	1.6	1.8	2.1	2.3	2.4	2.5
6	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	6	0.7	1.3	1.9	2.2	2.7	3.1	3.3	4.4
8	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.7	8	0.7	1.4	2	2.5	3.2	3.6	5.2	6.3
10	0.4	0.4	0.4	0.4	0.5	0.6	0.7	0.9	10	0.7	1.4	2.1	2.6	3.4	4.1	6.1	7.9

Table C4 Method 4 – Return walls and wing walls for unsprinklered firecells: protection of sleeping occupancies or safe paths on the same property

Equivalent opening height h_{eq} (metres)	Return walls: Minimum separation distance between unprotected areas and notional boundary D_B (metres)								Equivalent opening height h_{eq} (metres)	Wing walls: Minimum length of wing wall if located on the relevant boundary L_B (metres)							
	Equivalent opening width W_{eq} (metres)									Equivalent opening width W_{eq} (metres)							
	1	2	3	4	6	8	10	20		1	2	3	4	6	8	10	20
1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1	0.8	1.1	1.2	1.3	1.3	1.4	1.4	1.4
2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	2	1	1.5	1.9	2.1	2.3	2.5	2.6	2.7
3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6	3	1.1	1.8	2.3	2.6	3.1	3.4	3.6	3.9
4	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.9	4	1.2	2	2.6	3.1	3.7	4.2	4.4	5.1
6	0.4	0.5	0.7	0.8	1	1.1	1.1	1.2	6	1.2	2.2	3	3.6	4.6	5.2	5.8	7.2
8	0.4	0.5	0.7	0.9	1.1	1.3	1.4	1.5	8	1.2	2.3	3.2	4	5.2	6.2	6.8	8.8
10	0.4	0.5	0.8	1	1.3	1.4	1.5	1.9	10	1.2	2.4	3.4	4.2	5.6	6.7	7.6	10.5

Amend 6
Nov 2020

Index

References are to the relevent paragraphs, figures or tables in **C/VM2** unless otherwise stated. References to Appendices are prefixed by the Appendix letter.

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 6), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 1 January 2017 and supersedes all previous versions of this document.

The previous version of this document (Amendment 5) will cease to have effect on 30 May 2017.

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.building.govt.nz

D1: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	December 1993	p. 12, Table 5 p. 15, 4.4.2, 4.5.2	p. 30, 12.0, 12.1
Amendment 2	19 August 1994	pp. i and ii, Document History p. vii, Contents p. viii, References pp. ix and x, Definitions p. 1, 1.0, 1.0.1, 1.0.2 p. 3, 1.2.1 p. 4, Figure 2 p. 6, 1.7.1 p. 6A, 2.1.1, 2.1.2, 2.1.3, 2.1.4 pp. 6B, 6C, 6D, Table 1A p. 6D, 2.2.1	p. 7, 3.1.4 p. 10, Figure 11 p. 11, 4.1.3 p. 12, Table 5, 4.1.4, 4.1.8 p. 13, 4.4, 4.4.1 p. 14, Figure 17 p. 15, 4.4.3 deleted, Figure 18, 4.5, 4.5.1, 4.5.2, 4.6, 4.6.1, 4.6.2 p. 10, Table 1A pp. 33 to 35, Index
Amendment 3	1 December 1995	p. ii, Document History p. viii, References	p. 15, 5.1.1
Second edition	28 February 1998	Document revised – second edition issued	
Amendment 4	1 July 2001	p. 2, Document History, Status p. 11, References p. 13, Definitions	p. 25, Figure 8 p. 30, 4.2.1 Comment p. 41, 6.0.7 Comment p. 46, 12.0.1
Amendment 5	10 October 2011 until 30 May 2017	p. 2, Document History, Status pp. 3–4, Code Clause D1 p. 9, Contents p. 11, References	p. 13, Definitions p. 41, D1/AS1 6.0.7 p. 46, D1/AS1 11.0 pp. 47–49, Index
Amendment 6	Effective 1 January 2017	p. 9 Contents p. 11 References p. 13 Definitions p. 15 D1/VM1 p. 17 D1/AS1 1.1.5, 1.2.2 p. 21 D1/AS1 2.0, 2.1.1, 2.1.2, 2.1.3, 2.1.4 pp. D1/AS1 22-24 2.1.5, 2.1.16, Table 2 p. 25-26 D1/AS1 2.1.6, 3.1.3, 3.1.4 p. 27 D1/AS1 4.1.1 p. 29 D1/AS1 Figure 12	p. 30 D1/AS1 4.1.8, 4.2.1 p. 34 D1/AS1 5.1.1 p. 35 D1/AS1 Figure 19 p. 39 D1/AS1 6.0.1 p. 40 D1/AS1 Figure 25 p. 41 D1/AS1 6.0.6, 6.0.10 p. 42 D1/AS1 Figure 26 p. 43 D1/AS1 7.0.5 p. 45 D1/AS1 9.2.1, Table 9 p. 46 D1/AS1 10.0, 11.0, 12.0 pp. 47, 49 Index
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

New Zealand Building Code Clause D1 Access Routes

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE—*continued*

Clause D1—ACCESS ROUTES

Provisions	Limits on application
OBJECTIVE	
D1.1 The objective of this provision is:	
(a) Safeguard people from injury during movement into, within and out of *buildings*,	
(b) Safeguard people from injury resulting from the movement of vehicles into, within and out of *buildings*, and	
(c) Ensure that *people with disabilities* are able to enter and carry out normal activities and functions within *buildings*.	Objective D1.1(c) shall apply only to those *buildings* to which section 47A of the Act applies.
FUNCTIONAL REQUIREMENT	
D1.2.1 *Buildings* shall be provided with reasonable and adequate access to enable safe and easy movement of people.	Requirement D1.2.1 shall not apply to *Ancillary buildings* or *Outbuildings*.
D1.2.2 Where a *building* is provided with loading or parking spaces, they shall be constructed to permit safe and easy unloading and movement of vehicles, and to avoid conflict between vehicles and pedestrians.	
PERFORMANCE	
D1.3.1 *Access routes* shall enable people to:	
(a) Safely and easily approach the main entrance of *buildings* from the apron or *construction* edge of a *building*,	
(b) Enter *buildings*,	
(c) Move into spaces within *buildings* by such means as corridors, doors, stairs, ramps and lifts,	
(d) Manoeuvre and park cars, and	
(e) Manoeuvre and park delivery vehicles required to use the loading space.	

Note: Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

Effective from 29 December 2000

1992/150 *Building Regulations 1992* 29

FIRST SCHEDULE—*continued*

Provisions	Limits on application
D1.3.2 At least one *access route* shall have features to enable *people with disabilities* to:	Performance D1.3.2 shall not apply to *Housing, Outbuildings, backcountry huts, Ancillary buildings*, and to *Industrial buildings* where no more than 10 people are employed.
(a) Approach the *building* from the street boundary or, where required to be provided, the *building* car park,	
(b) Have access to the internal space served by the principal access, and	
(c) Have access to and within those spaces where they may be expected to work or visit, or which contain facilities for personal hygiene as required by Clause G1 "Personal Hygiene".	
D1.3.3 Access routes shall:	
(a) Have *adequate* activity space,	
(b) Be free from dangerous obstructions and from any projections likely to cause an obstruction,	
(c) Have a safe cross fall, and safe slope in the direction of travel,	
(d) Have *adequate* slip-resistant walking surfaces under all conditions of normal use,	
(e) Include stairs to allow access to upper floors irrespective of whether an escalator or lift has been provided,	
(f) Have stair treads, and ladder treads or rungs which: (i) provide *adequate* footing, and (ii) have uniform rise within each flight and for consecutive flights,	
(g) Have stair treads with a leading edge that can be easily seen,	

Effective from 31 October 2008

FIRST SCHEDULE—*continued*

Provisions	Limits on application
(h) Have stair treads which prevent children falling through or becoming held fast between treads, where open risers are used.	Performance D1.3.3 (h) shall not apply within *Industrial buildings*, *Outbuildings* and *Ancillary buildings*
(i) Not contain isolated steps.	Performance D1.3.3 (i) shall not apply with *Detached Dwellings* or within *household units* of *Multi-unit Dwellings*, or to *Outbuildings* and *Ancillary buildings*
(j) Have smooth, reachable and graspable *handrails* to provide support and to assist with movement along a stair or ladder,	Performance D1.3.3 (j) shall not apply to isolated steps.
(k) Have *handrails* of *adequate* strength and rigidity as required by Clause B1 "Structure",	
(l) Have landings of appropriate dimensions and at appropriate intervals along a stair or ramp to prevent undue fatigue,	
(m) Have landings of appropriate dimensions where a door opens from or onto a stair, ramp or ladder so that the door does not create a hazard, and	
(n) Have any automatically controlled doors *constructed* to avoid the risk of people becoming caught or being struck by moving parts.	
D1.3.4 An *accessible route*, in addition to the requirement of Clause D1.3.3, shall:	
(a) Be easy to find, as required by Clause F8 "Signs",	
(b) Have *adequate* activity space to enable a person in a wheelchair to negotiate the route while permitting an ambulant person to pass.	

FIRST SCHEDULE—*continued*

Provisions	Limits on application
(c) Include a lift complying with Clause D2 "Mechanical Installations for Access" to upper floors where: (i) *buildings* are four or more storeys high, (ii) *buildings* are three storeys high and have a total design occupancy of 50 or more persons on the two upper floors, (iii) *buildings* are two storeys high and have a total design occupancy of 40 or more persons on the upper floor, or (iv) an upper floor, irrespective of design occupancy, is to be used for the purposes of public reception areas of banks, central, regional and local government offices and facilities, hospitals, medical and dental surgeries, and medical, paramedical and other primary health care centres,	
(d) Contain no thresholds or upstands forming a barrier to an unaided wheelchair user,	
(e) Have means to prevent the wheel of a wheelchair dropping over the side of the *accessible route*,	
(f) Have doors and related hardware which are easily used,	
(g) Not include spiral stairs, or stairs having open risers,	
(h) Have stair treads with leading edge which is rounded, and	

FIRST SCHEDULE—*continued*

Provisions	Limits on application
(f) Have *handrails* on both sides of the *accessible route* when the slope of the route exceeds 1 in 20. The *handrails* shall be continuous along both sides of the stair, ramp and landing except where the *handrail* is interrupted by a doorway.	
D1.3.5 Vehicle spaces and circulation routes shall have:	
(a) Dimensions appropriate to the *intended use*,	
(b) Appropriate crossfall, and slope in the direction of travel,	
(c) *Adequate* queuing and circulation space, and	
(d) *Adequate* sight distances.	
D1.3.6 Vehicle spaces for use by *people with disabilities*, shall, in addition to the requirements of Clause D1.3.5, be:	
(a) Provided in sufficient numbers,	
(b) Located to avoid conflict between vehicles and people using or moving to or from the space, and	
(c) Easy to find as required by Clause F8 Signs.	

Contents

Amend 6 Jan 2017

Amend 6 Jan 2017

Amend 5 Oct 2011

References

Amend 4 Jul 2001

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in these Acceptable Solutions and Verification Methods (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 Acceptable Solutions and Verification Methods must be used. Amend 6 Jan 2017

Amend 5 Oct 2011

Amend 6 Jan 2017

		Where quoted
Standards New Zealand		
AS/NZS 2890:-	Parking facilities	
Part 1: 2004	Off street parking	AS1 10.1
Part 2: 2002	Off street commercial facilities *Amend: 1*	AS1 11.0.2
NZS 3114: 1987	Specification for concrete surface finishes *Amend: 1*	AS1 Table 2
NZS 3116: 2002	Concrete segmental and flagstone paving *Amend: 1*	AS1 Table 2
NZS 4121: 2001	Design for access and mobility – Buildings and associated facilities	AS1 10.1.1, 12.0.2
Standards Australia		
AS 1657: 2013	Fixed platforms, walkways, stairways and ladders – Design, construction and installation	AS1 11.0.1
AS 4586: 2013:-	Slip resistance classification of new pedestrian surface materials	AS1 2.1.1, 2.1.2, 2.1.3, 2.1.4 3.1.4 Table 2
SA HB 198: 2014	Guide to the specification and testing of slip resistance of pedestrian surfaces	AS1 2.1.4
British Standards Institution		
BS 585:-	Wood stairs.	
Part 1: 1989	Specification for stairs with closed risers for domestic use, including straight and winder flights and quarter or half landings	AS1 4.5.3
BS 5395:-	Stairs, ladders and walkways	
Part 2: 1984	Code of practice for the design of helical and spiral stairs	AS1 4.4.1
BS EN 14975: 2006	Loft ladders – Requirements, marking and testing *Amend: 1*	AS1 5.1.1

Amend 6 Oct 2016; Amend 6 Jan 2017; Amend 5 Oct 2011; Amend 5 Oct 2011; Amend 4 Jul 2001; Amend 6 Jan 2017; Amend 6 Jan 2017; Amend 6 Jan 2017; Amend 6 Jan 2017; Amend 6 Jan 2017

Definitions

Amends 5 and 6

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

Access route A continuous route that permits people and goods to move between the apron or construction edge of the *building* to spaces within a *building*, and between spaces within a *building*.

Accessible Having features to permit use by *people with disabilities.*

Accessible route An *access route* usable by *people with disabilities.* It shall be a continuous route that can be negotiated unaided by a wheelchair user. The route shall extend from street boundary or car parking area to those spaces within the *building* required to be *accessible* to enable *people with disabilities* to carry out normal activities and processes within the *building*.

Accessible stairway A *stairway* having features for use by *people with disabilities*. *Buildings* required to be *accessible* shall have at least one *accessible stairway* leading off an *accessible route* whether or not a lift is provided.

Adequate ***Adequate*** to achieve the objectives of the *building code*.

Amend 5 Oct 2011

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

Common ramp A ramp which is used, or intended to be used by the public whether as of right or not, and is not a *service ramp* or *accessible* ramp.

Common stairway A *stairway* which is used, or intended to be used, by the public whether as of right or not, and is not a *private stairway*, *service stairway* or *accessible stairway*.

Handrail A rail to provide support to, or assist with the movement of a person.

Household unit

(a) means a *building* or group of *buildings*, or part of a *building* or group of *buildings*, that is—

(i) used, or intended to be used, only or mainly for residential purposes; and

(ii) occupied, or intended to be occupied, exclusively as the home or residence of not more than 1 household; but

(b) does not include a hostel, boarding house, or other specialised accommodation.

Amend 5 Oct 2011

Kerb ramp means a short ramp either cutting through a kerb or built up to the kerb.

Main private stairway A *private stairway* intended to provide access to and between frequently used spaces such as living areas, kitchens and garages, and includes all exterior *private stairways*.

Minor private stairway A *private stairway* not on a main thoroughfare, and intended to provide infrequent access to a single room which is not a living area or kitchen.

Nosing The rounded projecting edge of a stair tread.

Person with a disability means a *person* who has an impairment or a combination of impairments that limits the extent to which the *person* can engage in the activities, pursuits, and processes of everyday life, including, without limitation, any of the following:

Amend 4 Jul 2001

(a) a physical, sensory, neurological, or intellectual impairment:

(b) a mental illness.

Amend 5 Oct 2011

Pitch line The line joining the leading edge or *nosings* (if any) of successive stair treads within a single flight of a *stairway*.

Private stairway A *stairway* used, or intended to be used, by the occupants of a single *household unit*.

Secondary private stairway A *private stairway* other than a *main* or *minor private stairway*, intended to provide access to another floor containing only bedrooms, bathroom or similar accommodation

Service ramp means a ramp that is used, or intended to be used, infrequently by service personnel to gain access to spaces for the purposes of maintenance and the movement of goods.

Service stairway means a *stairway* that is used, or intended to be used, infrequently by service personnel to gain access to spaces for the purposes of maintenance and the movement of goods.

Stairway A series of steps or stairs with or without landings, including all necessary *handrails* and giving access between two different levels.

Threshold A sill to an external door, or the floor under an internal door.

Verification Method D1/VM1

No specific test methods have been adopted for verifying compliance with the Performance of NZBC D1.

Amend 6
Jan 2017

Figure 4: **Safe Minor Projections**
Paragraphs 1.5.1 and 1.5.2

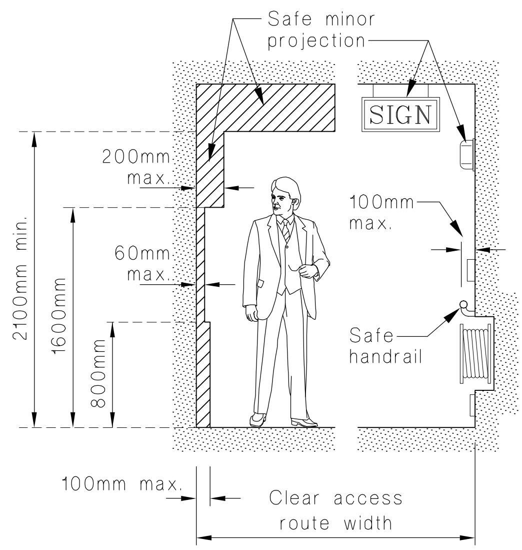
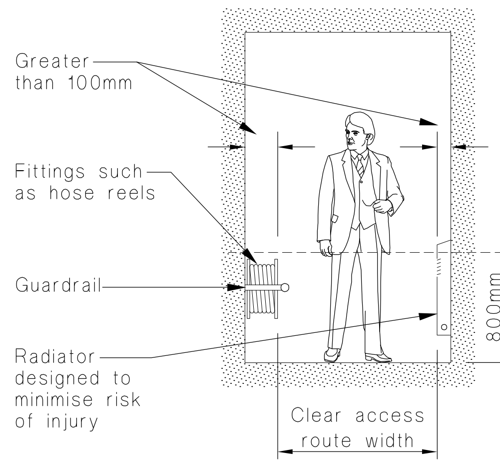


Figure 5: **Protection from Major Projections**
Paragraph 1.5.3



1.5.2 Handrails may be considered a minor projection if they project no more than:

a) 100 mm into the *access route* (see Figure 4), or

b) In the case of a centre *handrail*, 300 mm into a landing (see Figure 25).

1.5.3 Major projections (see Figure 5) are permitted if:

a) The clear width of the *access route* is provided between the faces of the projections, and

b) The transition between the face of the wall and the face of the projection is designed to minimise the risk of injury by impact.

1.5.4 Dangerous projections – Windows, fittings or other dangerous obstructions may project into the space adjacent to an *access route* (see Figure 6) if users are protected from the projection by:

a) A kerb provided at floor level which defines the extent of the projection, or

b) A *handrail*, guard-rail, or other protection at sill level.

COMMENT:

1. Many *people with disabilities* require better lighting than is normally provided to highlight obstructions. This applies particularly with respect to the elderly and those with impaired sight.
2. Illumination should also highlight doors, signs, counters and other areas.
3. Lighting designers should avoid glare and sudden sharp changes in lighting levels. Diffused types of lighting are preferred.

1.7 Barriers

1.7.1 Barriers to prevent falling from the *access route* shall comply with NZBC F4.

COMMENT:
Barriers and *handrails*, having different functions, are considered separately in the *building code*. A barrier (or balustrade on a stair) is required to prevent people falling where there is a sudden change in level. A *handrail* is a graspable rail designed to guide and support people using a *stairway* or ramp. A *handrail* may be attached to or form the top of a barrier where the height is appropriate.

1.8 Lighting

1.8.1 Artificial lighting complying with NZBC G8 shall be provided along the *access route*.

2.0 Access Routes

2.1 Slip resistance

2.1.1 Scope: This section provides means of complying with Performance D1.3.3(d): 'Access routes shall have adequate slip-resistant walking surfaces under all conditions of normal use.'

2.1.2 For level *access routes* (including level *accessible routes*) expected to become wet with water in normal use, walking surfaces shall either:

a) Have an SRV classification of not less than 39 from the wet pendulum test method of AS 4586 Appendix A using the Slider 96 rubber, or

b) Use the materials listed in Table 2 as 'acceptable wet slip'.

COMMENT:
The most common area of buildings that becomes wet under normal use is at entrances where water can be tracked from the footpath.

The exceptions are:

a) situations where safety matting is provided as described in 2.1.5

b) for *housing* this requirement applies only to the access route on the approach to the main entrance and not inside that entrance and not on the approach to other entrances. The internal access routes of housing, including kitchens and bathrooms, shall be assumed to be dry in normal use.

Amend 1 Jan 2017

COMMENT:
Bathroom floors in housing can become partially wet but safety is best managed using movable mats because most flooring materials with high slip resistance are not appropriate in this location.

Amend 1 Jan 2017

c) in areas that are primarily used barefoot, such as around swimming pools and adjacent to communal showers, Classification 'B' from the ramp method of AS 4586 Appendix C gives an acceptable slip resistance for walking surfaces.

Note 1: See 2.1.5 for stairs, steps and sloping *access routes* in buildings including *housing*.

Note 2: A slip resistance value of 0.4 when tested under AS/NZS 3661.1 may be assumed as equivalent to a SRV of 39.

COMMENT:

a) The cleaning regime established by the building owner or manager should be such that it maintains the effectiveness of slip resistant walking surfaces. Unsuitable cleaning methods can reduce the slip resistance significantly. People may still slip even on slip resistant walking surfaces because other factors such as footwear and walking gait can affect their stability.

b) Imported materials are often tested by a ramp test equivalent to Appendix D of NZS 4586. While this is an oil wet test using an industrial work shoe, an R11 result will often be equivalent to an SRV of 39 for water wet conditions. Additionally, the ramp test is suitable for heavily profiled surfaces for which Appendix A is not applicable.

2.1.3 For level *access routes* expected to remain dry under normal use, a co-efficient of friction not less than 0.40 for walking surface materials from the friction test method of AS 4586 Appendix B is acceptable. Alternatively, the materials specified in Table 2 as 'acceptable dry slip' may be used without testing.

2.1.4 For industrial and commercial situations, AS 4586 Appendix D is an acceptable method of determining the slip resistance of walking surfaces that may be contaminated by oils and similar slip-inducing materials in use.

COMMENT:
HB 198 in Table 3B lists suggested *R-values* for a range of commercial situations.

Some processing activities will require floors with a profiled or displacement surface. The evaluation method given by Appendix E of NZS 4586 can be used to measure displacement area.

Amend 6
Jan 2017

Table 2: Slip Resistance for Walking Surfaces

Walking surface[12]	Level surface[1]		Sloping surface[2] or stairs[3]	
	Acceptable dry slip resistance	Acceptable wet slip resistance	Acceptable dry slip resistance	Acceptable wet slip resistance
Timber				
Uncoated smooth	Yes	No	No	No
Uncoated profiled[4]				
– across profile	Yes	Yes	Yes	Test
– along profile	Yes	No	No	No
Coated (paint, polyurethane, etc)	Yes	No	No	No
Coated and sand/grit impregnated[5]	Yes	Yes	Yes	Yes
Portland cement concrete				
Smooth trowelled finish (Class U3)[6]	Yes	No	Yes	No
Broomed (Class 5 or 6)[6] or wood float finish (Class U2)	Yes	Yes	Yes	Yes
Coated (paint, polyurethane, etc)	Yes	No	No	No
Coated and sand/grit impregnated[5]	Yes	Yes	Yes	Yes
Exposed aggregate finish				
– rounded aggregate	Yes	Test	Yes	Test
– crushed aggregate	Yes	Yes	Yes	Yes
Asphaltic concrete	Yes	Yes	Yes	Yes
Marble and granite				
Polished surface[7]	Yes	No	No	No
Honed finish[8]	Yes	Test	Yes	Test
Flamed finish	Yes	Yes	Yes	Yes
Fully sandblasted surface[8]	Yes	Test	Yes	Test
Patterned sandblasted surface	Yes	Test[9]	Yes	Test[9]
Split slate	Yes	Test	Yes	Test
Terrazzo				
Polished	Yes	Test	No	No
Honed	Yes	Test	Yes	Test
Sandstone	Yes	Yes	Yes	Test
Ceramic tiles				
Unglazed				
– smooth finish	Yes	Test	Yes	Test
– profiled	Yes	Test[9]	Yes	Test[9]
– grit finish	Yes	Test[10]	Yes	Test[10]
Glazed				
– smooth or polished finish[7]	Yes	No	No	No
– profiled	Yes	Test[9]	Yes	Test[9]
– grit finish	Yes	Test[10]	Yes	Test[10]
Clay pavers				
Wire cut	Yes	Yes	Yes	Test
Smooth texture	Yes	Test	Yes	Test

Amend 6
Jan 2017

Amend 6 Jan 2017

Table 2: Slip Resistance for Walking Surfaces (cont'd)

Walking surface[12]	Level surface[1]		Sloping surface[2] or stairs[3]	
	Acceptable dry slip resistance	**Acceptable wet slip resistance**	**Acceptable dry slip resistance**	**Acceptable wet slip resistance**
Concrete pavers				
Dry press concrete	Yes	Yes	Yes	Test
Interlocking concrete block paving[11]	Yes	Yes	Yes	Test
Moulded surface (e.g. simulated slate or concrete cobbles)	Yes	Test	Yes	Test
Compressed fibre-cement sheet				
Uncoated	Yes	Yes	Yes	Test
Coated (paint, polyurethane, etc)	Yes	No	No	No
Coated and sand impregnated[5]	Yes	Yes	Yes	Yes
Rubber tiles/sheeting				
Smooth	Yes	Test	Yes	Test
Profiled	Yes	Test[9]	Yes	Test[9]
Vinyl and linoleum				
Smooth or with imprinted pattern	Yes	Test	Yes	No
Profiled (studs or ribs)	Yes	Test[9]	Yes	Test[9]
Grit/flaked finish	Yes	Test	Yes	Test
Carpet				
Tufted or loop pile[13]	Yes	Yes	Yes	Yes
Artificial turf[13]	Yes	Yes	Yes	Yes
Timber composites (chipboard, cork tiles, etc)				
Uncoated	Yes	No	Yes	No
Coated (paint, polyurethane, etc)	Yes	No	No	No
Coated and sand/grit impregnated[5]	Yes	Yes	Yes	Yes
Anti-slip tapes[14]	Yes	Yes	Yes	Test

Amend 6 Jan 2017

See page 24 for notes to Table 2.

Amend 6 Jan 2017

Table 2: Slip Resistance for Walking Surfaces (cont'd)

Notes:

1. Level surfaces including surfaces with slopes no steeper than 1:50.
2. Sloping surfaces with slopes greater than 1:50 but less than 1:10 for wet conditions, or less than 1:8 for dry conditions.
3. Acceptability as shown is based on stair treads without slip resistant *nosings*. When testing stair treads without *nosings* acceptability for slip resistance should be on a slope of 1:10. With slip resistant *nosings* at least 50 mm wide, acceptability criteria for stair treads is based on the requirements for level surfaces. (Amend 6 Jan 2017)
4. Profile at right angles to direction of pedestrian traffic. Algal growth on uncoated timber walkways significantly reduces slip resistance when wet and requires regular removal, e.g. by high pressure waterblasting.
5. The sand/grit, which is sprinkled over the complete surface of the final paint coating, should be a hard angular material such as silica sand or calcined bauxite. The particle size should not be less than 0.2 mm so that it is not submerged by the coating and not greater than about 2 – 3 mm so that it remains tightly bound to the surface. If overpainted, testing is required to establish acceptability of slip resistance.
6. Concrete surface finishes complying with NZS 3114.
7. Glazed or polished surfaces are unsuitable in either wet or dry conditions for sloping surfaces or for stairs because of the effect of foot placement, even though test measurements may indicate adequacy. (Amend 6 Jan 2017)
8. The coefficient of friction can vary significantly with the extent of surface preparation.
9. It is noted in AS 4586 that the pendulum slip resistance tests prescribed in that Standard may not be suitable for heavily profiled (or patterned) surfaces. (Amend 6 Jan 2017)
10. When the grit finish has a "feel" rougher than 80 grit sandpaper, the surface may be deemed to have acceptable wet slip resistance, for either level or sloping surfaces or for stair treads, without testing.
11. Interlocking concrete block paving to NZS 3116.
12. To meet durability requirements of NZBC B2, the surface should have at least a five year life under normal maintenance.
13. Validity of the listed typical values for coefficient of friction is uncertain as the test methods may not be applicable to carpets.
14. Anti-slip tapes will normally require regular replacement to remain effective. To ensure foot contact, tapes should be placed at right angles to the line of travel and be spaced at no more than 150 mm centres.

Amend 6 Jan 2017

2.1.5 For sloping *access routes* including stairs AS 4586 Appendix F shall be used to derive the appropriate slip classification for walking surfaces at various slopes. Alternatively, Table 2 lists surfaces that are acceptable for stairs as well as sloping surfaces within a limited range of slopes (see Note 2). A P4 rating from the wet pendulum test is also acceptable for stairs and for ramps not steeper than 1:12

COMMENT:

a) Most commonly-used walking surface materials have acceptable dry slip resistance on level surfaces, but some may not be acceptable on sloping surfaces or stairs even when dry, as indicated by Table 2.

b) Paragraphs 3.1.4 and 4.1.4 require ramp and stair surfaces to comply with Table 2 but testing to AS 4586 Appendix A or B is another option. Note 3 to Table 2 provides for stair materials to be tested to AS 4586 on the basis of a 1:10 slope.

2.1.6 Except in *housing*, the transition zone between any part of the *access route* which is intended to remain dry under normal usage and that part of the *access route* which may become wet during normal usage shall be provided with:

a) Water absorbent matting across the width of the effective walkway with a sufficient dimension in the direction of the pedestrian traffic to remove water which may be tracked by footwear, or

b) An extension of the wet slip resistant walking surface for sufficient distance from the point at which water can be tracked indoors (normally from the entrance portal) to allow water to be shed from footwear, or

c) A combination of a) and b) above.

COMMENT:

1. The dimension of the transition zone in the direction of pedestrian traffic is dependent upon the usage, however either:

a) The absorbent matting should be of sufficient size to allow for at least one (preferably two) contacts between each foot with normally spaced footfalls. (As a guide, the minimum dimension is 1.8 m, but this could be reduced if the design of the entranceway restricts the spacing of the footfalls, e.g. an entranceway incorporating a revolving door), or

b) The wet slip resistant walking surface should extend typically 6 m to 10 m from the entrance portal.

Amend 6 Jan 2017

2. The absorbent matting should be either fixed in place (e.g. by a mat well) or should adequately grip the underlying flooring and should be of a design (e.g. with a heavy rubber backing) which will not curl up at the edges.
3. A cleaning/replacement regime should be established by the building operator to ensure the ongoing effectiveness of the matting.

Amend 6 Jan 2017

2.2 Width

2.2.1 The clear width of an *accessible route* shall be no less than 1200 mm.

COMMENT:
Handrails and other minor obstructions complying with Paragraphs 1.5.1 and 1.5.2 are permitted to intrude into this width.

2.3 Protection from falling

2.3.1 Where the surface of an *accessible route* is more than 25 mm above the adjacent ground, protection is to be provided by either a 75 mm upstand (kerb) or a low barrier rail.

3.0 Ramps

3.1 Slope

3.1.1 The maximum acceptable slopes for ramps are given in Table 3. The choice of slope must take account of the type of use and risk of slipping.

3.1.2 *Service ramps* steeper than 1 in 8 shall have footholds complying with Figure 8 and Table 4.

Table 3: Acceptable Ramp Slopes
Paragraph 3.1.1

Type of ramp	Maximum slope
Accessible ramp	1:12
Common ramp subject to wetting	1:10
Common ramp normally dry	1:8
Service ramps	1:3

Table 4: Foothold Spacing for Service Ramps
Paragraph 3.1.2

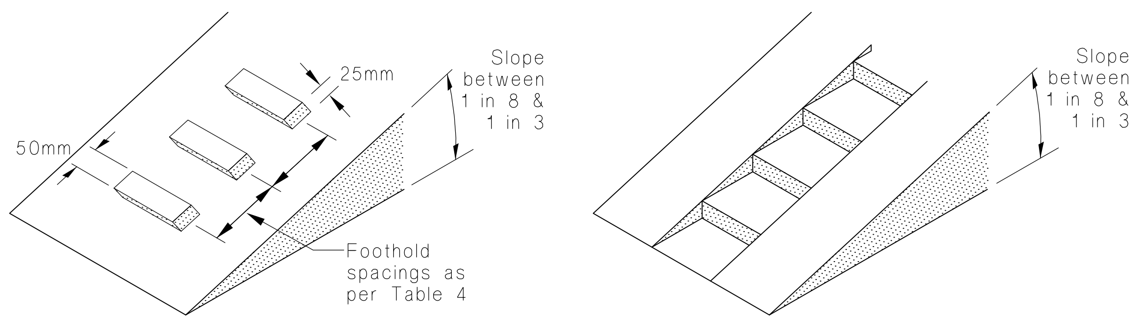
Ramp slope	Spacing (mm)	
	Goods carried	No goods carried
1:6	360	460
1:5	330	430
1:4	300	400
1:3	280	380

3.1.3 *Accessible ramps* shall have an upstand no less than 75 mm in height on any drop-off side of a ramp (see Figure 9).

COMMENT:
Handrails are not required on *accessible routes* with slopes flatter than 1 in 20, but the requirements of Paragraph 2.3.1 apply.

Amend 6 Jan 2017

Figure 8: Service Ramps Footholds
Paragraph 3.1.2



(a) Cleats (b) Steps

Amend 4 Jul 2001

Table 5: Landings
Paragraphs 3.3.1 and 3.3.3

Ramp type	Maximum rise between landings (mm)	Length of landing (mm)
Accessible	750[1]	1200
Other	1500	Ramp width but need not be greater than 900

Note:

1. 750 mm is the reasonable maximum level difference for a person to negotiate in a wheelchair.

3.3.2 Landing width shall be no less than the minimum width of the ramp it serves.

3.3.3 Landing length shall comply with Table 5 and Figure 9.

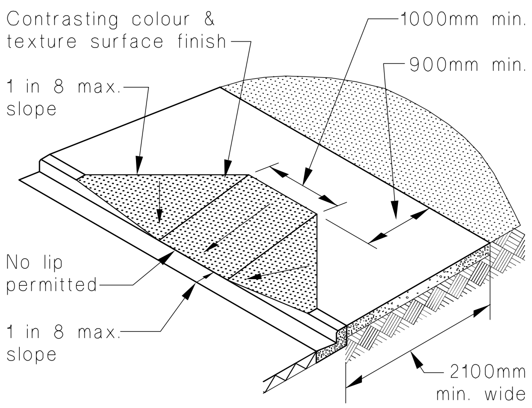
3.4 Kerb ramps

3.4.1 *Kerb ramps* (see Figure 10) shall have:

a) A slope of no greater than 1 in 8, and

b) Colour and texture contrast with the adjacent footpath.

Figure 10: Minimum Dimensions for Kerb Ramps
Paragraph 3.4.1



COMMENT:
Kerb ramps allow the safe and easy movement of wheeled trolleys and prams, as well as wheelchairs.

4.0 Stairways

4.1 Pitch, risers and treads

4.1.1 Acceptable *stairway pitch line* slopes, and step riser heights are given in Table 6 and Figure 11.

COMMENT:

1. Figure 11 and Table 6 refer to several types of stair. Descriptions for all these types of stair and where they are to be used are given in the Definitions section.
2. Stairs having a *pitch line* slope of less than 23° do not permit a person to use the stair with an acceptable gait. Dangerous falls occur where the rhythm of movement is broken.

Amend 6 Jan 2017

4.1.2 The method of measuring risers and treads is shown in Figure 12. If a landing on an outside *stairway* is formed by ground sloping across the width of the flight, the rise is measured at mid-width.

4.1.3 Uniformity – Riser height and tread depth for all steps in one flight, shall be uniform within the tolerance of ± 5 mm measured at the centreline on straight flights and at the *pitch line* on curved and spiral flights.

COMMENT:
The foot is normally only lifted a few mm above the treads during ascent. A minor variation in riser height can cause someone to stumble.

Table 6: Design Limits for Stairs
Paragraphs 4.1.1, 4.1.4 a), 4.4.2, 4.5.1 a) and Figure 17

Stair	Maximum pitch	Maximum riser height (mm)	Minimum tread (mm)
Service, minor private	47°	220	220
Secondary private	41°	200	250
Common and main private	37°	190	280
Accessible	32°	180	310

4.1.4 Stair treads – Acceptable stair treads (see Figure 11) have:

a) A tread depth of no less than that specified in Table 6,

b) A level surface,

c) Slip resistant surfaces complying with Table 2.

COMMENT:

1. Adequate tread depth is essential for *stairway* safety. Analysis of *stairway* related accidents shows that overstepping of treads is a common cause of accidents.
2. Glazed or polished surfaces are normally unsuitable for stair treads unless the stairs are fitted with slip resistant *nosings*. (See Table 2, Notes 3 and 7.)

4.1.5 Service stairs having treads less than 250 mm in depth shall have open risers.

4.1.6 Tread projection – Figure 12 illustrates acceptable projections for the leading edge of successive stair treads. Limiting dimensions are:

a) For open risers – 15 mm minimum and 25 mm maximum,

b) For closed risers – nil projection minimum, and 25 mm maximum.

4.1.7 Leading edges of treads or *nosings* (if any) on *accessible stairways* shall:

a) Be rounded to avoid a sharp edge (see Figure 13), and

b) Be colour contrasted with the rest of the tread.

COMMENT:

Visibility of the stair tread is essential for stair safety. The difference between two dark colours does not necessarily provide sufficient tonal contrast to allow the edge of the tread to be seen by a *person* with impaired vision. The lighting levels required by Paragraph 4.5 are essential for *stairway* safety.

4.1.8 Open risers

a) To prevent children falling or becoming held fast, the space between treads shall not permit the passage of a 100 mm sphere in areas frequented by children under 6 years of age.

Amend 6 Jan 2017

b) Open risers are not to be used within *accessible stairways*, and may be used on *common stairways* only if both the following criteria are satisfied:

i) there is an *accessible stairway* available as an alternative, and

ii) leading edges of the *nosings* are colour contrasted with the rest of the tread.

COMMENT:

1. Paragraph 4.1.8 a) does not apply to stairs within *Industrial Buildings, Outbuildings* or *Ancillary buildings*, or other *stairways* in areas not frequented by children under 6 years of age.
2. Open risers are hazardous to ambulant *people with disabilities*. People who wear leg braces or prosthetic devices need a solid riser to guide the foot up over the riser to the next step and to maintain balance.

4.2 Width

4.2.1 The width between *handrails* on an *accessible stairway* or between *handrail* and wall on a *common stairway* shall be no less than 900 mm.

Amend 6 Jan 2017

COMMENT:

While no minimum width is given for *stairways* within *household units* it should be noted that C/AS2 Paragraph 3.3.2 for risk group SM (multi-unit dwellings) requires a minimum stair width of 850 mm. This is also a practical minimum requirement for any *private stairway.*

Amends 4 and 6

Narrow *private stairways* can make the movement of furniture difficult, if not impossible.

Figure 14: Landings Not Required at Door Locations
Paragraph 4.3.1

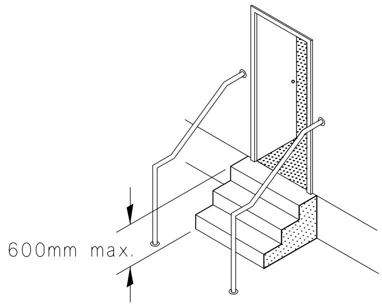


Table 7: Rise Between Landings
Paragraph 4.3.2

Stairway type	Maximum rise between landings (m)
Private	4.0
Service	4.0
Common	2.5
Accessible	2.5

4.3 Landings

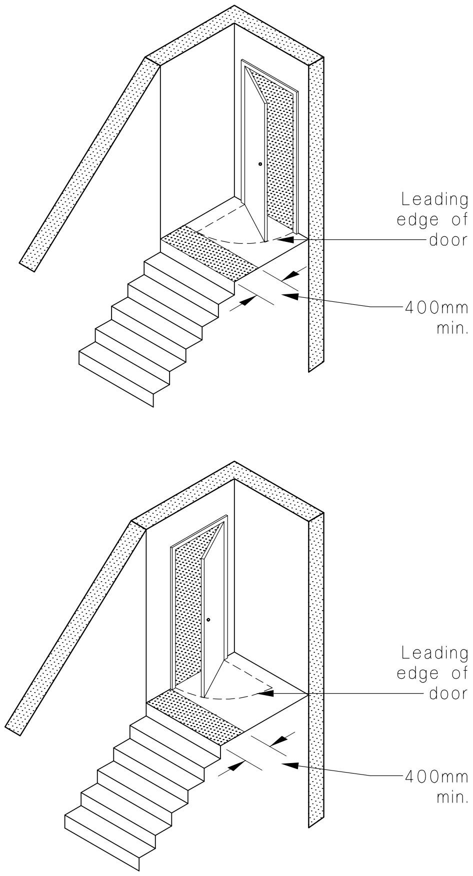
4.3.1 Landings required – Landings shall be provided at the top and bottom of every flight of stairs, ramp or ladder, or where a door opens into the *stairway*. A landing need not be provided between a flight and a door where the rise of the flight is no more than 600 mm and the door slides or opens away from the steps (see Figure 14).

4.3.2 The maximum rise between successive landings shall comply with Table 7. (See also Figure 25.)

4.3.3 Landing width shall be no less than the minimum width of the *access route* it serves.

4.3.4 Landing length shall be no less than 900 mm.

Figure 15: Clearances at Door Locations
Paragraph 4.3.5



4.3.5 Obstructions – Landings shall be clear of any permanent obstruction. A clear space of at least 400 mm across the full width of the landing shall be available beyond the outer arc formed by any opening door (see Figure 15).

4.3.6 Arresting a falling user – The line of sight between landings more than 8.0 m apart vertically shall be broken by one or more of the following methods:

a) Off-setting the alignment of adjacent flights.

b) Changing the direction of at least one flight by a minimum angle of 30° (see Figure 16).

c) Providing a landing of no less than 1800 mm in length.

4.4 Curved and spiral stairways

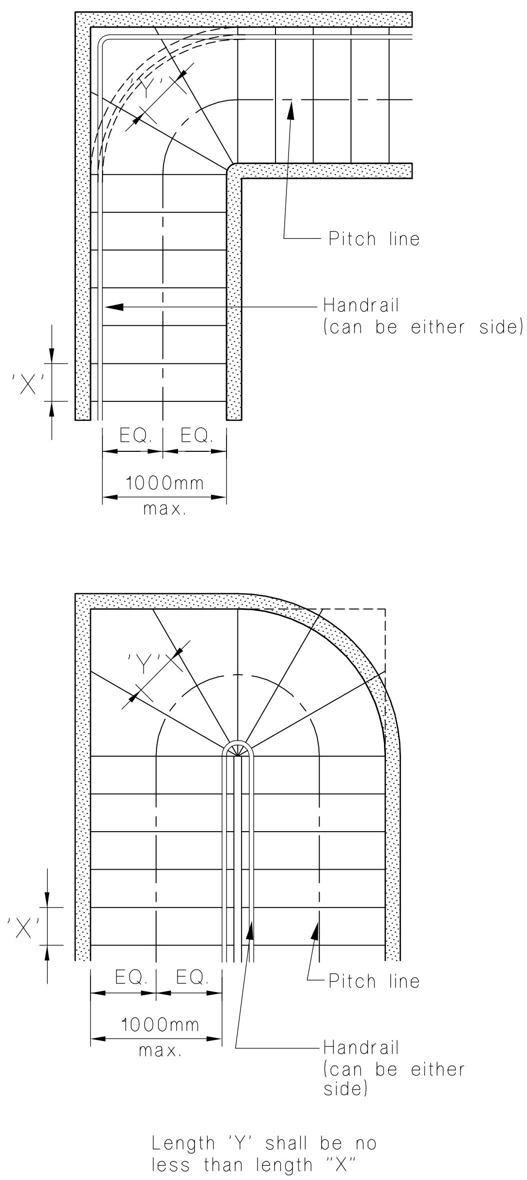
4.4.1 Curved and spiral stairways with tapered treads shall have their *pitch line* located:

a) For a spiral stairway of width less than 1000 mm – as shown in Figure 17 (a)), and

b) For a curved stairway of width 1000 mm or greater – as shown in Figure 17 (b)).

BS 5395: Part 2 is an acceptable solution for spiral *stairways* having a diameter of no less than 1500 mm.

Figure 18: Stair Winders
Paragraphs 4.5.1 and 4.5.2



COMMENT:

1. The dimensions of Figure 17 are based on the assumption that people walk up and down only on the outside of a narrow *stairway*, but both the inside and outside of wider *stairways*.
2. Spiral *stairways* complying with BS 5395.2 and being less than 1500 mm in diameter (measured to the inside of *handrail*), may be acceptable as an additional means of access to spaces adequately served by alternative *access routes*.

4.4.2 Consecutive tapered treads shall have uniform taper angles. *Pitch line* slope, riser height and tread depth along both *pitch lines* shall comply with Table 6 and Figure 11.

4.5 Stair winders

4.5.1 Winders are acceptable on *private stairways* and *service stairways* provided that all the following conditions are satisfied:

a) Riser heights and tread depths on the *pitch line* comply with Table 6 and Figure 11.

b) Riser height is uniform and the same as that on the adjoining straight flights of stairs.

c) Tread depth on the *pitch line* is no less than that on adjoining straight flights of stairs.

d) Winders have a uniform taper angle.

e) Consecutive winders do not turn through an angle of more than 180º.

4.5.2 For a *stairway* width of less than 1000 mm the *pitch line* shall be located as shown in Figure 18. For widths of 1000 mm or more, the *pitch line* shall be located as shown in Figure 17 (b)).

4.5.3 BS 585: Part 1 is an acceptable solution for winders on *stairways* having a width of between 770 and 1200 mm.

4.6 Visibility of stair treads

4.6.1 To ensure that the leading edge of stair treads can be easily seen, the lighting levels given in Table 8 shall be provided.

4.6.2 Except for external *private stairways*, switches for *stairway* lighting shall be able to be activated at:

a) The top of the *stairway*,

b) The bottom of the *stairway*, and

c) Any intermediate landings having access to or from any floor.

5.0 Fixed Ladders

5.1 General

5.1.1 Types of fixed ladders

a) Step-type ladders (see Figure 19),

b) Rung-type ladders (see Figure 20),

c) Individual rung-type ladders (see Figure 24).

Rung-type ladders shall not be used where frequent access and the carriage of tools, equipment or materials are required.

COMMENT:

1. Where ladders are proposed, due consideration needs to be given to all relevant factors affecting the user's safety including:
   - the reason for access (e.g. plant servicing or inspection of passive *building elements* such as roofs)
   - the intended frequency of use
   - the need to carry tools or materials by hand.

   Rung-type ladders are not considered suitable for any part of an *access route* to a lift machine room or similar mechanical plant room where service access is required at least monthly and tools or materials need to be carried. Rung-type ladders are however considered appropriate to areas such as roofs, pits, silos, towers, chimneys and tanks where access is required infrequently and tools and materials are only occasionally carried.
2. Ladders are acceptable in *Housing* for access to infrequently used spaces such as attics and lofts.

BS EN 14975 is an acceptable solution for retractable ladders to lofts and attics in *housing* and for maintenance access in other *buildings*. Amend 6 Jan 2017

5.1.2 Ladder enclosures – People shall be protected from falling from all fixed ladders which rise more than 6.0 m above the ground level or rise from a landing or platform. An acceptable solution for safety hoops and longitudinal straps (see Figure 21) shall have:

a) Hoops and straps fabricated from 50 mm x 8 mm grade 250 steel,

b) Hoops dimensioned as shown in Figure 21, and spaced at no more than 1000 mm intervals,

c) The highest hoop level with the top of the barrier on the platform being accessed, and

d) The lowest hoop 2.5 m above the ground or platform.

Table 8: Lighting for Stairways
Paragraph 4.6.1

Luminaire type	Lighting output Watts/m^2	
	Private and service stairways	**Accessible and common stairways**
Incandescent (plastic shade)	20	30
Incandescent (general diffusing enclosure)	25	35
Flourescent 36/58 W cool white (enclosed diffusing fitting)	7	10
Flourescent compact single ended 16-38 W (enclosed diffusing fitting)	10	15
Discharge 50/80 W mercury or high pressure sodium (enclosed diffusing fitting)	7	10

Notes:
The values given are based on:
– 150 lux at tread level for *accessible* and *common stairways.*
– 100 lux at tread level for *private* and *service stairways.*
– A stair lobby 7 m by 4 m including two landings and a single flight of stairs.
– Light coloured walls and ceilings and medium coloured floors.

5.2 Step-type ladders

5.2.1 Step-type ladders (see Figure 19) shall have:

a) **A slope** of between 60° and 70° from the horizontal,

b) **Treads** no less than 100 mm wide and spaced evenly at between 200 mm and 250 mm centres,

c) **A width** between stiles of no less than 450 mm,

d) **A height** between landings of no more than 6.0 m,

e) **Clearances** of at least:

i) 50 mm for hand movement along the *handrail*,

ii) 50 mm between the treads and any solid objects behind the ladder,

f) **Horizontal openings at landings** of not less than 1150 mm (see Figure 19), and

g) **Handrails** which:

i) are fitted on both sides of the ladder,

ii) are spaced between 550 mm and 750 mm apart,

iii) are located at a vertical distance above the stile of no more than 450 mm,

iv) commence no less than 900 mm above floor level,

v) extend above the upper landing by no less than 900 mm to connect with a barrier (if any), and

vi) are constructed to comply with Paragraphs 6.0.1 to 6.0.6.

Figure 22: Step Through Access to Landings from Rung-type Ladders
Paragraphs 5.3.1 and 5.3.2

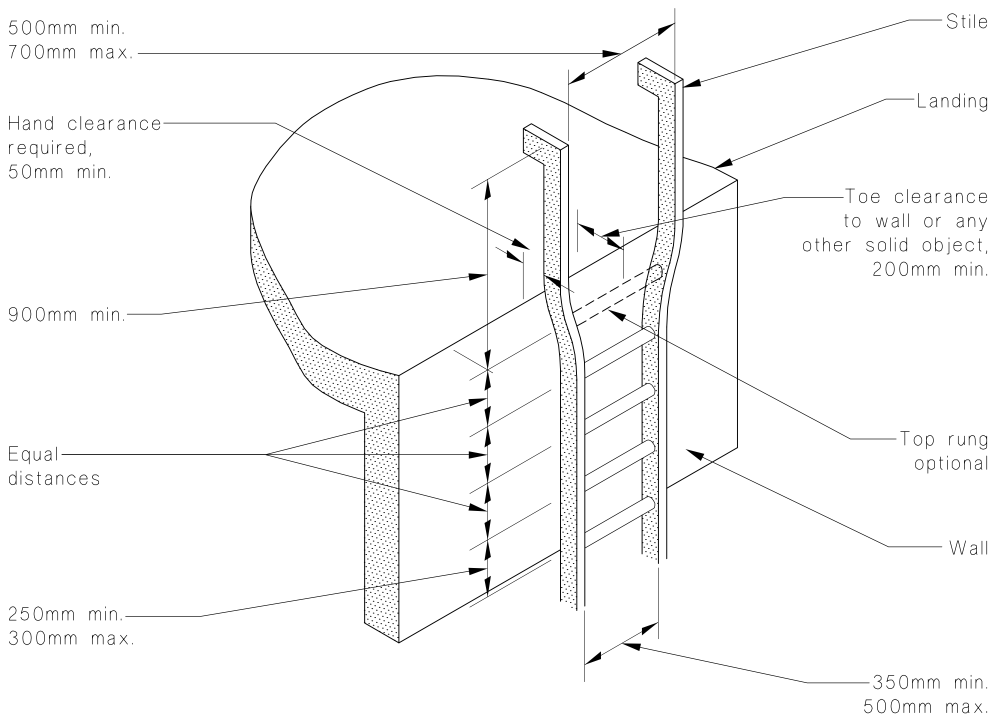
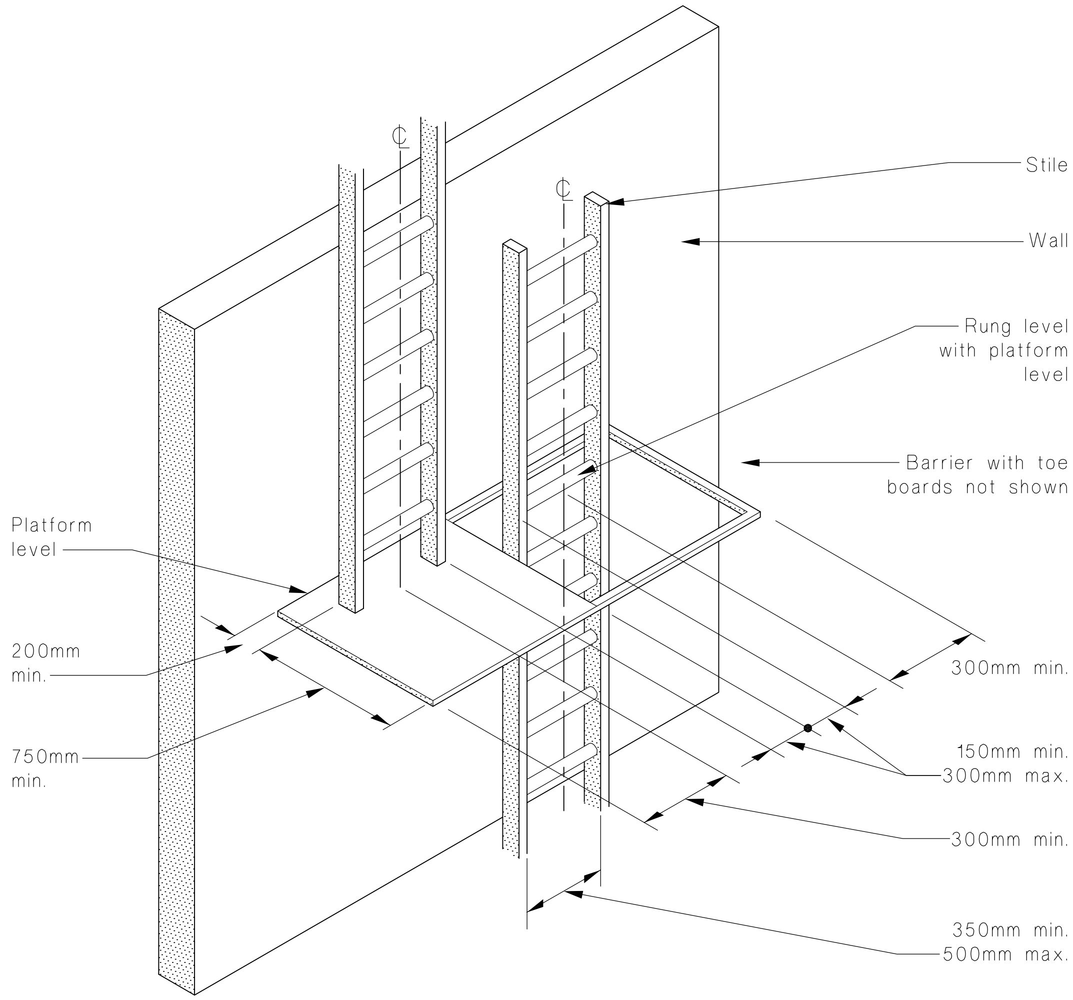


Figure 23: Side Access to Landings from Rung-type Ladders
Paragraphs 5.3.1 and 5.3.2



5.3 Rung-type ladders

5.3.1 Rung-type ladders (see Figures 20, 22 and 23) shall have:

a) **A pitch line slope** of between 70° and 90° from the horizontal,

b) **Rungs** of no less than 20 mm diameter and spaced evenly at between 250 mm and 300 mm centres,

c) **A width** between stiles of no less than 350 mm or more than 500 mm,

d) **A height** between landings of no more than 9 m, and

e) **Clearances** of at least:

i) 750 mm between the rungs and any obstruction behind the climber,

ii) 300 mm from the ladder centre line to each side,

iii) 50 mm for hand movement along the stiles where the stiles extend above a landing, and

iv) 200 mm between the rungs and any solid objects behind the ladder.

5.3.2 Access to landings (see Figures 22 and 23).

a) Ladder stiles shall extend to the height of the barrier, but no less than 900 mm above the landing.

b) Toeboards shall not extend across ladder openings.

c) For step-through access, stile spacing above the landing shall be between 500 mm and 700 mm, and the top rung either level with, or one full rise below, the landing.

d) For side access to landings, the spacing from the nearest stile to the landing shall be between 150 mm and 300 mm, and the top rung must be level with the landing.

5.4 Individual rung-type ladders

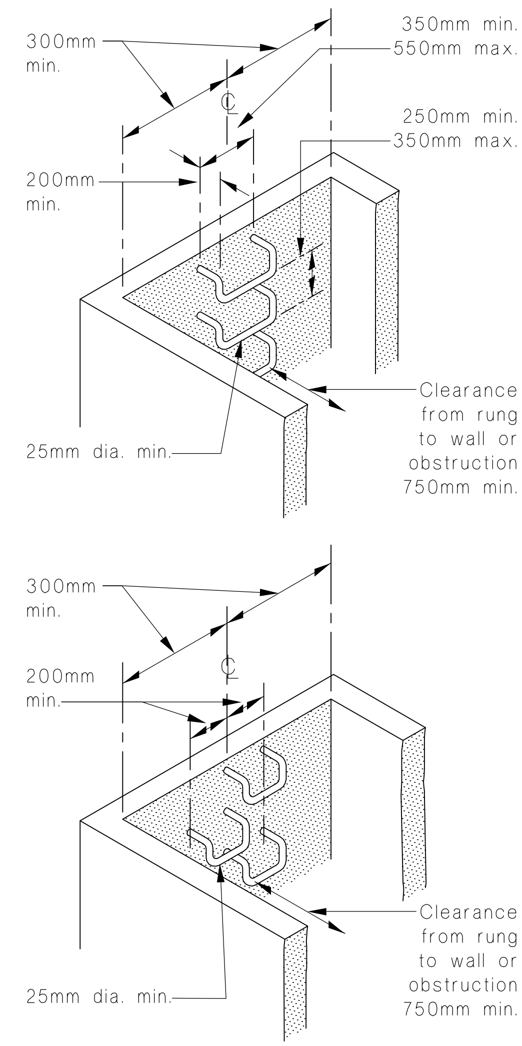
5.4.1 Individual rung-type ladders (see Figure 24) shall have:

a) **Rungs** of no less than 25 mm diameter, shaped to prevent the foot slipping off sideways, and spaced evenly at between 250 mm and 350 mm centres,

b) **A tread width** on each rung of between 300 mm and 550 mm, except that for staggered rungs this may be reduced to 200 mm, and

c) **Height and clearance** limitations as for rung-type ladders (see Paragraphs 5.3.1 d) and e)).

Figure 24: Individual Rung-type Ladders
Paragraphs 5.1.1 c) and 5.4.1



6.0 Handrails

6.0.1 All *accessible stairways* shall have *handrails* on both sides (see Paragraph 6.0.3). All other *stairways* with a width of 2.0 m or less and having two or more risers, shall have *handrails* on at least one side. *Handrails* may be omitted on *stairways* of two or three risers within or giving access to a *household unit*. Amend 6 Jan 2017

COMMENT:

1. Wherever possible, *handrails* should be continuous on all *access routes*. On *private stairways* a *handrail* may be considered continuous if the continuity is interrupted by newel posts.
2. A single riser is an isolated step which by NZBC D1.3.3 i) is permitted only within *Detached dwellings* or within *household units* of *Multi-unit dwellings,* and in *Outbuildings* and *Ancillary buildings*.

6.0.2 Any *stairway* which exceeds 2.0 m in width shall:

a) Have *handrails* on both sides and, where the width exceeds 4.0 m, shall also have an intermediate *handrail* provided at the centre of the *stairway*, or

b) If the *stairway* is essentially an outdoor architectural feature and not required to be an *accessible stairway*, have at least one *handrail*. Examples of such *stairways* are those leading to civic areas, or to decks on *Housing*.

COMMENT:
A central rail gives all users a rail to use for safety purposes. On *stairways* in public *buildings*, such as sports stadia, intermediate rails are also effective for crowd control. The 2.0 m width is a comfortable width for three people, two of whom can grasp a rail if anyone trips.

6.0.3 Accessible stairways and accessible ramps – *Handrails* shall be provided on both sides of *accessible stairways* and on both sides of *accessible* ramps where the ramp slope is steeper than 1 in 20. The *handrails* shall be continuous except where doors are located on landings (see Figures 9 and 25).

6.0.4 Slope of handrails – *Handrails* shall have the same slope as the *pitch line*, begin no further than the second riser from the lower end of the *stairway*, and extend the full length of the *stairway* they serve. Except that, where the *handrail* serves an *accessible stairway* or *accessible* ramp, a 300 mm (minimum) horizontal extension shall be provided at each end of the *handrail*, as shown in Figures 9 and 25.

6.0.5 The first riser shall be located a sufficient distance back from the corner where the two walls meet, to accommodate the extended *handrail*, as shown in Figure 25.

6.0.6 Height of handrails – *Handrails* shall be positioned between 900 mm and 1 m above the *pitchline* (see Figure 25) measured to the top of the *handrail*.

COMMENT:
Where a *handrail* is located on top of the barrier of a stairway flight it may transition to a height of 1100 mm on an intermediate landing..

Amend 6
Jan 2017

6.0.7 Handrail profiles – *Handrails* shall have a profile which can be readily grasped by an adult hand and shall be installed in a way that avoids the likelihood of personal injury. An acceptable *handrail* shall be shaped and located to ensure that, under normal usage, a person's hand will not contact adjacent walls, supporting brackets or fixings, or any other obstruction.

COMMENT:
It is important that in the event of stumbling on a *stairway* or ramp an adult, even with a small hand, can firmly grasp the *handrail* to prevent a fall.

Amends
4 and 5

6.0.8 A graspable *handrail* profile shall have:

a) A flat or convex upper surface,

b) Arrised or radiused edges,

c) A minimum cross section width of 20 mm, and

d) A "relevant width" (as illustrated in Figure 26 (a)) across the top surface of no greater than 80 mm. Figure 26 (a) and (b) indicates some acceptable profiles but others may also be acceptable.

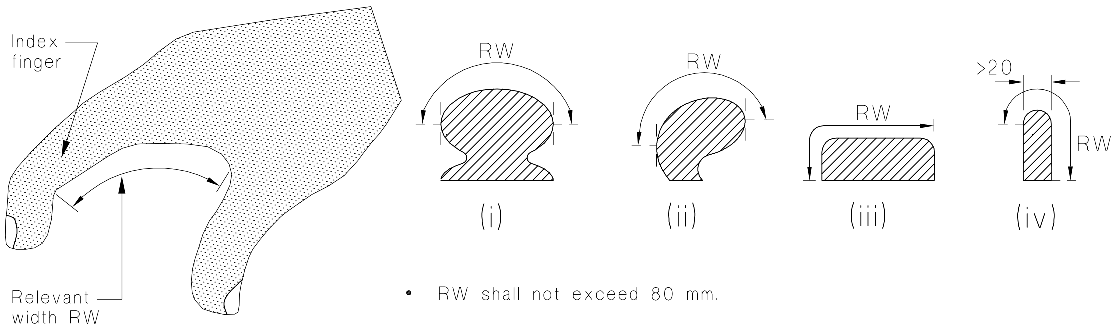
6.0.9 Acceptable *handrail* profiles for *accessible stairways* and *accessible* ramps are shown in Figure 26 (b).

COMMENT:
In most circumstances a *handrail* is used with a light grip to steady the user of a *stairway* or ramp. Ambulant *people with disabilities* use *handrails* for both leverage and support, and wheelchair users often need to firmly grip the rails to pull themselves along, particularly on ramps. In those circumstances a profile offering an adequate grip is important.

6.0.10 *Handrails* are not required on the steps between tiers of seating rows such as in cinemas and stadiums where the steps take the form of two risers with a tread between leading onto a landing alongside a row of seats. However, a *handrail* shall be provided alongside the steps that give access to the end of a row of seats. Steps shall have a *common stairway* or *accessible stairway* dimensions (see Figure 11).

Amend 6
Jan 2017

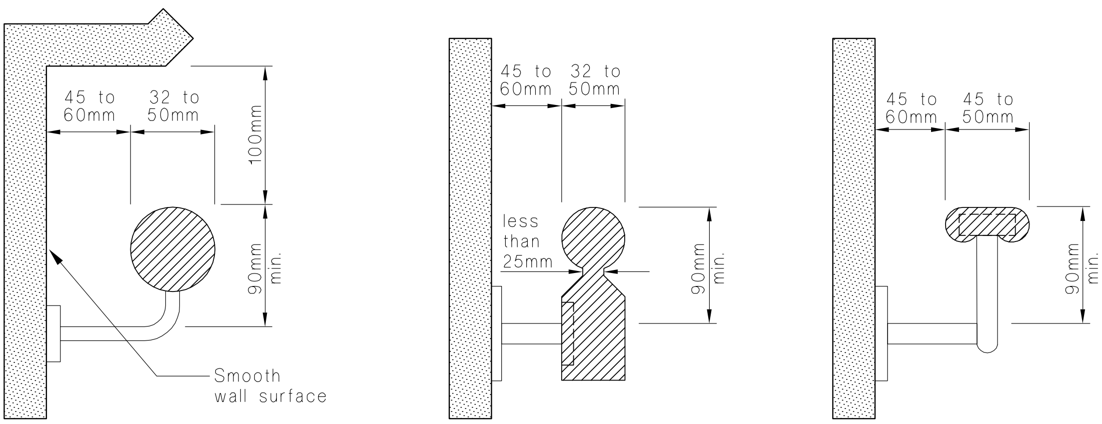
Figure 26: **Handrail Profiles and Clearances**
Paragraphs 6.0.8 and 6.0.9



Amend 6
Jan 2017

- RW shall not exceed 80 mm.
- RW (relevant width) is measured around the upper surface perimeter of the handrail section between the vertical tangents on either side.
- Variations in shape are acceptable provided the effective grip is not reduced. For example, the side faces shown as vertical in details (iii) and (iv) are still acceptable even if slightly curved or sloped up to 5° from vertical.
- See fig. 26 (b) for wall clearances.

(a) Determination of relevant width for private and common stairways



The profiles shown comply with the provisions for accessible handrails.

The clearances apply to all handrails and the maximum dimension must be used for rough textured wall surfaces.

(b) Acceptable profiles and clearances for accessible stairways

7.0 Doors and Openings

7.0.1 Lobby doors – Where doors open into a lobby, the clear space between open doors shall comply with Figure 27. Where doors, including those providing access to sanitary facilities, are used within an *accessible route* and a *person* must open the door towards the wheelchair, an unobstructed wall space of not less than 300 mm shall be provided at the side of the door adjacent the handle (see Figure 27 (b)).

COMMENT:

1. *People with disabilities* generally find sliding doors more convenient than hinged doors.
2. Sliding doors may be installed in places where a hinged door would otherwise hinder circulation or manoeuvrability, but may only be installed in accordance with any requirements for *escape routes*.

7.0.2 Other doors where located on *accessible routes* shall comply with Figure 9.

7.0.3 Width – *Accessible* doors shall have at least 760 mm clear opening.

7.0.4 Visibility – Doors which swing in both directions shall incorporate glazing to provide adequate visibility for a *person* using the door. Acceptable glazing is shown in Figure 28. *Accessible* doors shall be of a colour that contrasts with their surroundings.

COMMENT:

1. Glass doors set in a largely glazed wall and wooden panel doors set in a similarly panelled wall are difficult to locate by those with visual impairment.
2. Door handles should contrast with the door.

7.0.5 Door handles – *Accessible* doors shall be openable with one hand and have a lever action operation for handles, locks and latches. Amend 1 Jan 2017 The end of handles shall be returned towards the door. Handles shall be between 900 mm and 1200 mm above floor level. Pull handles or push plates are acceptable only where doors are not latched.

COMMENT:

1. People who use wheelchairs must have one hand free to propel the chair through the open door.
2. Door knobs with a twist or turn action do not provide an adequate grip for people with hand impairments.

7.0.6 Revolving doors and turnstiles – Where revolving doors or turnstiles are used within an *accessible route*, an alternative hinged or sliding door shall be provided (see Figure 29).

7.0.7 Frameless glass doors shall comply with NZBC F2.

8.0 Places of Assembly

8.1 Spaces for wheelchairs

8.1.1 The number of spaces in rooms and areas used for public meetings, entertainment, and assembly, shall be provided on the scale of 2 for up to 250 seats provided, plus 1 for every additional 250 seats.

8.1.2 Spaces for wheelchairs shall be located immediately adjacent to other seating, as shown in Figure 30.

8.2 Access to performance areas

8.2.1 An *accessible route* shall be provided to a podium or stage area.

9.0 Accessible Accommodation Units of Communal Residential Buildings

9.1 Number of units to be provided

9.1.1 The number of *accessible* accommodation units to be provided in hotels, motels and other *Communal Residential buildings* providing accommodation for the public shall be no less than that given in Table 9.

10.0 Movement of Vehicles

10.1 Car parking areas

10.1.1 AS/NZS 2890 Part 1 is an Acceptable Solution for car parking areas and circulation routes.

COMMENT:
NZS 4121 in section 5 covers the provision of *accessible* car parking and the number of *accessible parks* to be provided.

11.0 Other Acceptable Solutions

Amend 5 Oct 2011

11.0.1 AS 1657 is an Acceptable Solution for stairs, ladders, platforms and walkways for service and maintenance personnel.

COMMENT:
Barriers (guard railings) are covered by Clause F4 'Safety from Falling'. Note that Paragraph 1.2.2 of F4/AS1 refers to barriers in maintenance access situations. If a proposed barrier height is 1000 mm then it needs to be treated as an alternative solution from Table 1 of F4/AS1 for the particular situation

11.0.2 AS 2980 Part 2 is an acceptable solution for loading spaces and circulation routes for commercial vehicles.

Amend 6 Jan 2017

12.0 Lifts

12.0.1 For the purposes of determining whether a lift must be provided for *people with disabilities* to access upper floors, the design occupancy of a floor shall be calculated using Paragraph 1.4 of C/AS2 through to C/AS6 as appropriate or Paragraph 3.1 of C/VM2.

Amend 4 Jul 2001

Amend 4 Jul 2001

Amend 6 Jan 2017

12.0.2 *Building* size may also be used to determine the need for a lift for *people with disabilities*. NZS 4121 is an acceptable solution based on gross floor area.

COMMENT:
Gross floor area is a defined term in NZS 4121.

Amend 6 Jan 2017

Index D1/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Amend 6
Jan 2017

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 7), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 1 January 2017 and supersedes all previous versions of this document.

The previous version of this document (Amendment 6) will cease to have effect on 06 August 2017.

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.building.govt.nz

D2: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	September 1993	p. vii, NZS 3109 p. 5, Rule 17.5	p. 7, Rules, 25.7.1, 28.3.4 26.1.21
Amendment 2	19 August 1994	pp. i and ii, Document History p. vii, Contents p. viii, References p. 3, 1.0.1, 1.0.3, Rule 2.2 p. 5, Rule 14.5 p. 6, 24.18	p. 7, Rules 25.5, 25.6.1, 25.6.2 b) c), 25.7 25.7.1, 25.7.2 a) b) c) d) g) p. 8, Rule 34.2.3.3 a) p. 8A, 3.0.1 Rule 71.5.4, Figure 1
Reprinted incorporating Amendments 1 and 2	October 1994		
Amendment 3	1 December 1995	p. ii, Document History p. vii, Contents	p. 3, 1.0.1, 1.0.2, 1.0.3 deleted, 2.0 completely revised pp. 4 to 8A deleted
Reprinted incorporating Amendments 1, 2 and 3	April 1996		
Amendment 4	28 February 1998	p. vii, References	p. 3, 1.0.1 revised, 1.0.2 and 2.0 deleted
Second Edition (Amendment 5)	Effective from 6 January 2002 until 14 August 2014		
Amendment 6	Effective from 14 February 2014 until 6 August 2017	p. 2A, Document History, Status p. 3, Code Clause D2 p. 7, Contents p. 9, References	p. 11, Definitions p. 21, D2/VM2 p. 23, D2/AS2 p. 27, D2/AS3
Amendment 7	Effective 1 January 2017	p. 7 Contents p. 9 References	pp. 15–20 D2/AS1 1.0, 2.0, 2.1
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

New Zealand Building Code Clause D2 Mechanical Installations for Access

The mandatory provisions for building work are contained in the New Zealand Building Code (NZBC), which comprises the First Schedule to the Building Regulations 1992. The relevant NZBC clause for Mechanical Installations for Access is D2.

FIRST SCHEDULE–*continued*

Clause D2–MECHANICAL INSTALLATIONS FOR ACCESS

Provisions	Limits on application
OBJECTIVE **D2.1** The objective of this provision is to: (a) Safeguard people from injury and loss of amenity while using mechanical installations for movement into, within and out of *buildings*, (b) Safeguard maintenance personnel from injury while servicing mechanical installations for access, and	
(c) Ensure that *people with disabilities* are able to carry out normal activities and processes within *buildings*.	Objective D2.1(c) shall apply only to those *buildings* to which section 47A of the Act applies.
FUNCTIONAL REQUIREMENT **D2.2** Mechanical installations for access into, within and out of *buildings* shall provide for the safe and easy movement of people, and for the safety of maintenance personnel.	
PERFORMANCE **D2.3.1** Mechanical installations for access shall: (a) Move people safely, and stop and hold as required for the normal use of the installation, for all loads up to and including 25% in excess of the rated load, (b) Not produce excessive acceleration or deceleration, (c) Be constructed to avoid the likelihood of people falling, tripping, becoming caught, being able to touch or be struck by moving parts, sharp edges or projections, under both normal and reasonably foreseeable abnormal conditions of use,	

See Note

NOTE:

Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

FIRST SCHEDULE–*continued*

Provisions	Limits on application
(d) Be constructed to prevent collision between components, or between components and the *building*, (e) Have a control system that ensures safe abnormal operation in the event of overloading or failure of any single component, and (f) Be capable of being isolated for inspection, testing and maintenance. **D2.3.2** Mechanical installations for access shall be provided with: (a) *Adequate* control over normal use, to ensure people's safety throughout any operation involving starting, stopping or changing the direction of travel, (b) Notification of position, where people are fully enclosed and the installation serves more than two levels, (c) *Adequate* lighting and ventilation for both normal and emergency use, and (d) Signs as required by Clause F8 "Signs", **D2.3.3** Mechanical installations for access shall, for emergency purposes, be provided with a means of: (a) Calling outside help, (b) Releasing people safely, (c) Safeguarding people from exposure to *hazardous* situations, and	
(d) Allowing authorised personnel to override the normal running procedure and take exclusive control of the installation.	Performance D2.3.3(d) shall not apply to installations travelling less than 15 m vertically.
D2.3.4 Potentially dangerous equipment shall be located in spaces which:	

FIRST SCHEDULE–*continued*

Provisions	Limits on application
(a) Are secure from unauthorised entry and contain only equipment associated with the installation, (b) Are appropriately sized and suitably guarded to provide *adequate* safe working areas for maintenance personnel, (c) Are provided with *adequate* power and lighting for maintenance, and (d) Have an environment that ensures the safe operation of the equipment under all likely conditions of use. **D2.3.5** Mechanical installations on *accessible routes* shall: (a) Where the passenger conveyor is manually controlled, provide: (i) controls which are easily identifiable and easy to use, (ii) *adequate* notification that the passenger conveyor has registered a summoning call, and (iii) *adequate* notification that the passenger conveyor has arrived, and of its future direction of travel, (b) Where the passenger conveyor is fully enclosed and serves more than two levels, provide an *adequate* means of informing occupants of their location, (c) Where appropriate, have doors which: (i) are power operated, (ii) are readily distinguishable from their surroundings, and (iii) where automatic, remain open sufficiently long to enable *people with disabilities* to pass through, and (d) Have *handrails* within the passenger conveyor.	

Contents

Amend 7 Jan 2017

Amend 6 Feb 2014

Amend 6 Feb 2014

Amend 6 Feb 2014

References

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in these Verification Methods and Acceptable Solutions (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 these Verification Methods and Acceptable Solutions must be used.

Amend 6 Feb 2014

			Where quoted
	Standards New Zealand		
	NZS 4223:-	Glazing in buildings	
Amends 6 and 7	Part 3: 2016	Human impact safety requirements	AS3 1.0.1 g)
	NZS 4332: 1997	Non-domestic passenger and goods lifts	AS1 1.0.1
Amend 6 Feb 2014	NZS 4334: 2012	Platform lifts and low-speed lifts	AS2 1.0
Amend 6 Feb 2014			
	The European Committee for Standardisation, Brussels		
	EN 81-20: 2014	Safety rules for the construction and installation of lifts. Lifts for the transport of persons and goods. Passenger and goods passenger lifts	AS1 2.0
	EN 81-28: 2003	Safety rules for the construction and installation of lifts. Lifts for the transport of persons and goods. Remote alarm on passenger and goods passenger lifts	AS1 2.1
	EN 81-50: 2014	Safety rules for the construction and installation of lifts. Examinations and tests. Design rules, calculations, examinations and tests of lift components	AS1 2.1 Comment
Amend 7 Jan 2017	EN 81-77: 2013	Safety rules for the construction and installation of lifts. Particular applications for passenger and goods passenger lifts. Lifts subject to seismic conditions	AS1 2.1
	EN 115:-	Safety of escalators and moving walks	AS3 1.0.1
Amend 6 Feb 2014	Part 1: 2008	Construction and installation *Amend: A1*	

Definitions

Amend 6 Feb 2014

This is an abbreviated list of definitions for words or terms particularly relevent to these Verification Methods and Acceptable Solutions. The definitions for any other italicised words may be found in the New Zealand Building Code Handbook.

Accessible Having features to permit use by *people with disabilities.*

Accessible route An *access route* usable by *people with disabilities*. It shall be a continuous route that can be negotiated unaided by a wheelchair user. The route shall extend from street boundary or car parking area to those spaces within the *building* required to be *accessible* to enable *people with disabilities* to carry out normal activities and processes within the *building.*

Adequate *Adequate* to achieve the objectives of the *Building Code*.

Amenity An attribute of a *building* which contributes to the health, physical independence, and well being of the *building's* users but which is not associated with disease or a specific illness.

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

Amend 6 Feb 2014

Building consent authority (BCA) means a person whose name is enteredin the register referred to in section 273(1)(a) of the Building Act 2004.

Building element Any structural and non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.

Amend 6 Feb 2014

Compliance schedule means a compliance schedule required under section 100 of the Building Act 2004.

Handrail A rail to provide support to, or assist with the movement of a *person*.

Hazardous Creating an unreasonable risk to people of bodily injury or deterioration of health.

Amend 6 Feb 2014

Owner, in relation to land and any *buildings* on the land,—

(a) means the *person* who—

(i) is entitled to the rack rent from the land; or

(ii) would be so entitled if the land were let to a tenant at a rack rent; and

(b) includes—

(i) the *owner* of the fee simple of the land; and

(ii) any *person* who has agreed in writing, whether conditionally or unconditionally, to purchase the land or any leasehold estate or interest in the land or to take a lease of the land and who is bound by the agreement because the agreement is still in force.

Person includes—

(a) the Crown; and

(b) a corporation sole; and

(c) a body of persons (whether corporate or unincorporate)

Person with a disability means any *person* who has an impairment or combination of impairments that limits the extent to which the person can engage in the processes of everyday life, including, without limitation, any of the following:

a) a physical, sensory or neurological impairment:

b) a mental illness.

Verification Method D2/VM1 Passenger Carrying Lifts

No specific test methods have been adopted for verifying compliance with the Performance of NZBC D2.

Acceptable Solution D2/AS1 Passenger Carrying Lifts

1.0 Reference Document NZS 4332

1.0.1 NZS 4332 is an acceptable solution subject to the the following modifications:

a) Where this Standard has provisions that are in non-specific or unquantified terms (such as where provisions are required to be appropriate, adequate, suitable, equivalent, satisfactory, acceptable, applicable or the like), then these do not form part of the acceptable solution and must be treated as an alternative solution.

b) Where this Standard requires approval, verification or the like, then this must be to the satisfaction of the *building consent authority.*

Amend 7
Jan 2017

c) The structural design of the *building*, its elements and the fixings supporting the lift installation, shall comply with Clause B1 "Structure" and is outside the scope of this Standard as an acceptable solution. Structural design of parts of the lift installation where described in this Standard shall be undertaken by a suitably qualified designer and shall be to the approval of the *building consent authority.*

Amend 7
Jan 2017

2.0 Reference Document EN 81-20

2.1 EN 81-20 is an acceptable solution for electric and hydraulic passenger lifts subject to the following modifications.

COMMENT:
EN 81-20 makes extensive reference to EN 81-50.

Add a new Clause 1.5 to read:

Amend 7
Jan 2017

"**1.5** The Standard does not cover the following:

1.5.1 Structural Design (NZBC Clause B1)

The structural design of the lift installation including its various components and the building housing the installation are outside of the scope of this Standard. Designs need to be undertaken by a suitably qualified designer, using Verification Method B1/VM1 and EN 81-77 as considered appropriate, with proposals approved by the *building consent authority* as part of the *building consent* process.

Amend 7
Jan 2017

NOTE: Although this Standard provides some design criteria and information on the loads resulting from the operation and use of the lift installation, it does not fully account for all loadings that must be taken into consideration, e.g. earthquake. The overall structural design of the lift installation and of its components is therefore outside of the scope of this Standard.

Amend 7
Jan 2017

1.5.2 Durability (NZBC Clause B2)

The design of the lift installation with respect to durability is outside of the scope of this Standard.

NOTE This Standard does not specifically address the durability of all components of the lift installation. As part of the *building consent* process the *building consent authority* may require evidence that the various components of the lift installation will meet the *building code's* durability provisions.

Amend 7 Jan 2017

1.5.3 Protection from Fire (NZBC Clauses C1-C6)

The design of the lift installation with respect to protection from *fire* is outside of the scope of this Standard. Designs need to be undertaken by a suitably qualified designer with proposals approved by the *building consent authority* as part of the *building consent* process. The appropriateness of any information in this Standard that relates to *fire* safety needs to be considered as part of that design.

Amend 7 Jan 2017

NOTE 1 The Standard provides some limited information however any *fire* design cannot look at the lift installation in isolation and needs to consider the building as a whole before determining requirements.

Amend 7 Jan 2017

NOTE 2 This acceptable solution, by reference to Clause 25.6 of NZS 4332, aims to ensure lifts are not used during a firecall in the *building*. Lifts specifically designed to be used during a *fire* require special engineering consideration and are outside of the scope of this acceptable solution and NZS 4332.

Amend 7 Jan 2017

Add a new Clause 1.6 to read:

"1.6 Requirements from NZS 4332

The lift installation shall meet the requirements of the following clauses from NZS 4332. If there is conflict between these clauses and provisions in EN 81-20, these clauses shall take precedence:

Amend 7 Jan 2017

Clause 2.5 Maintenance and inspection

Clause 7.9 Hatches in machine rooms

Clause 7.15 Protection of machine rooms against weather

Clause 7.17 Ventilation of machine rooms

Clause 7.18 Machine room lifting beams

Clause 11.3 Pit maintenance

Amend 7 Jan 2017

Clause 11.5.3 Access from bottom landing doors

Clause 11.9 Dryness of pits

Clause 22.20.2 Internal lighting.
The Clause shall be modified by adding the words "Where batteries provide the emergency lighting source, the batteries shall be secured in such a manner that they cannot be displaced or the contents spilled by the operation of the safety gear or by earthquake."

Amend 7 Jan 2017

Clause 24.10 Lift circuit drawing in machine room

Clause 25.6 Operation of lifts under fire or other emergency conditions (excluding earthquakes)

Clause 25.7 Detection of fire in machine rooms (including sheave rooms and governor rooms containing electronic equipment) and liftwells

Clause 25.8 Operation of lifts under earthquake conditions
The Clause shall be modified by adding the words "The requirements of Clause 25.8 may be replaced with an earthquake detection system complying with Clauses 5.10.3 and 5.10.4 of EN 81-77".

Clause 28.2 Emergency communication and alarm
The Clause shall be modified by adding the words "The requirements of Clause 28.2 may be replaced with a telephone alarm system that complies with EN 81-28 provided it complies also with the requirements of Clause 70.4 of NZS 4332."

Amend 7 Jan 2017

Clause 70 Requirements for lifts on access routes for people with disabilities

NOTE NZS 4332 does not provide for the use of touch screens for calling or controlling lifts. Further, touch screens by themselves do not comply with *Building Code* Clause D2.3.5 as, among other things, they do not provide tactile

Amend 7 Jan 2017

interaction. Touch screens need to be supplemented with tactile activation linked to audible notifications to ensure ease of use by people with visual impairments (see Codewords 71 article 'Compliant lifts are easy to use for everyone')."

Amend 7 Jan 2017

Add a new Clause 1.7 to read:

"1.7 Interpretation

Where this Standard has provisions that are in non-specific or unquantified terms (such as where provisions are required to be suitable, special, adequate, appropriate, equivalent, 'within easy reach' or the like) then proposals to meet those provisions must be to the satisfaction of the *building consent authority*.

Amend 7 Jan 2017

Amend 7 Jan 2017

Where the Standard requires that manufacturer's advice be followed, the adequacy of that advice shall be to the satisfaction of the *building consent authority*.

Amend 7 Jan 2017

Where this Standard requires approval, verification or the like, this shall be to the satisfaction of the *building consent authority*.

Amend 7 Jan 2017

The word "shall" identifies a mandatory requirement for compliance with this Standard. The word "should" refers to practices which are advised or recommended.

The word "normative" identifies a mandatory requirement for compliance with this Standard.

The words "NOTE" and "informative" identify commentary material. Such material is given for the purposes of general information and explanation and does not form part of the mandatory requirements of this Standard."

Add the following to Clause 5.2.1.4.1

"d) at least 50 lux maintained vertical illumination at landing door headers."

NOTE: The required illumination may be provided by lighting mounted on the car roof.

Amend 7 Jan 2017

Maintained illumination is the minimum illumination during the life of the installation taking into account the drop in light output as the light sources age and the effect of dirt accumulating on optical surfaces etc.

Amend Clause 5.2.2.5 to read:

"**5.2.2.5** A safe access for persons to machinery spaces and pulley rooms shall be provided. Where level access from the nearest lift landing is not available access between levels shall be provided by stairs.

Delete 5.2.5.2.2.1c)

Add new clause 5.2.5.8.3 to read:

"5.2.5.8.3 Devices to hold car above the lowest floor

For direct-acting electrohydraulic lifts, suitable devices shall be provided to hold the car above the lowest floor. Such devices shall support the car as necessary during all testing and maintenance without impinging on the clearances required by this Standard.

If the device is not permanently fixed in place it shall remain on the site in an area exclusively for the use of the lift installation. If stored in the pit it shall not interfere with the lift installation nor with any clearance required by this Standard.

Proposals for the device, demonstrating compliance with the requirements of this Clause, shall be to the satisfaction of the *building consent authority*."

Amend Clause 5.4.3.3 to read:

"**5.4.3.3** Car walls with glass placed lower than 1.10 m from the floor shall have a support rail at a height between 0.95 m and 1.05 m. This support rail shall be fastened independently from the glass. "

Amend Clause 5.4.10.2 to read:

"**5.4.10.2** Lift cars shall have a minimum of two lights, one to be connected to the lift supply and one to be connected to some other part of the electrical installation of the building in which the lift is located or to some other source of supply."

Amend 7 Jan 2017

Amend Clause 5.4.10.4 to read:

"**5.4.10.4** There shall be an automatically rechargeable emergency supply, which is capable of ensuring at least a lighting intensity of 10 lux for 2 hours at the alarm initiation device and in the centre of the car one metre above the floor. This lighting shall come on automatically upon failure of the normal lighting supply. At least two lamps of approximately equal wattage shall be used. The recovery rate of the emergency supply after 2 hours continuous use shall be such that a further 2 hours illumination can be maintained after not more than 16 hours recharging. "

Amend Clause 5.9.3.2.5.1 to read:

"**5.9.3.2.5.1** Any hole bored in the ground to house a hydraulic jack shall be lined with a waterproof caisson. The inner diameter of the caisson shall be at least 100 mm greater than the outer diameter of the hydraulic jack. There shall be a minimum of 100 mm clearance between the caisson bottom and the bottom of the jack. The caisson shall extend at least 150 mm above the floor of the pit. The lift shall not impose any load on the caisson.

If the jack itself is weatherproof then subject to demonstration of adequate performance the caisson can be open-ended so as to act as a drain with its upper end finishing flush with the pit floor.

NOTE: The caisson performs the two functions of preventing collapse of the bored hole and protecting the jack from damage and deterioration caused by contact with water. An example of a jack that may be weatherproof could be a water hydraulic jack.

Amend 7
Jan 2017

Amend 7
Jan 2017

Verification Method D2/VM2 Platform Lifts and Low-speed Lifts

Amend 6
Feb 2014

No specific test methods have been adopted for verifying compliance with the Performance of NZBC D2.

Acceptable Solution D2/AS2 Platform Lifts and Low-speed Lifts

1.0 Reference Document NZS 4334

1.0.1 NZS 4334 is an Acceptable Solution for platform lifts and low-speed lifts.

Amend 6
Feb 2014

Amend 6
Feb 2014

Verification Method D2/VM3
Escalators and Moving Walks

No specific test methods have been adopted for verifying compliance with the Performance of NZBC D2.

Acceptable Solution D2/AS3 Escalators and Moving Walks

1.0 Reference Document EN 115

1.0.1 EN 115 is an Acceptable Solution subject to the following modifications:

a) Where the Standard uses the word 'shall' this refers to requirements that are essential for compliance with the Standard; while the word 'should' refers to practices that are advised or recommended. A 'Normative' appendix is an integral part of the Standard and contains requirements; an 'Informative' appendix contains recommendations only.

b) Where this Acceptable Solution does not nominate the specific details of what is required for an escalator or moving walk component or feature but instead describes the required performance or is otherwise non-specific (such as where provisions are required to be appropriate or suitable) the details of the component or feature, along with justification of its adequacy, shall be included on plans and specifications for consideration by the *building consent authority* as part of the normal *building consent* process.

c) Where escalators or moving walks are provided an alternative *Building Code* compliant non-mechanical means of access, such as stairs or ramps, shall also be provided. Escalators and moving walks shall not comprise part of an *escape route*.

d) Escalators shall not be used on *accessible routes*.

e) Moving walks on *accessible routes* shall meet the following requirements:

i) the maximum slope shall be 1 in 10 (5.7 degrees)

Comment

A maximum slope of 1 in 14 (4.1 degrees) is recommended.

ii) the width of the pallet or belt shall be no less than 900 mm and no greater than 1200 mm

Amend 6 Feb 2014

iii) the pallets or belt shall move horizontally for at least 1200 mm before entering the combs

iv) the *handrails* shall extend 300 mm beyond the combs

f) The structural adequacy of the escalator or moving walk, its supports and of the *building* supporting the escalator or moving walk, to withstand all likely loads including earthquake, shall be demonstrated by a suitably qualified structural designer. The person proposing to install the escalator or moving walk shall supply to the structural designer all necessary information to enable the design to be carried out, including weights of escalator or moving walk components and all working tolerances necessary for safe operation.

COMMENT

It is expected that evidence would be furnished to the *building consent authority (BCA)* with the *building consent* application showing that a competent structural designer, Chartered Professional Engineer (CPEng) or other, has designed or otherwise checked the proposed escalator or moving walk, and the *building* supporting it, and considers the proposals to be *adequate*. The evidence about the escalator or moving walk itself could, depending on circumstances, be either specific engineering calculation or it could be a consideration of a design carried out overseas by others. It is envisaged that most *BCAs* would accept the advice of a CPEng working within a known area of expertise.

g) All glazing associated with the escalator or moving walk installation shall be Grade A safety glass complying with NZS 4223.3.

h) The electrical requirements of the Standard are additional to the normal requirements for an electrical installation. All wiring shall comply with NZBC Clause G9 'Electricity'.

i) Signs complying with F8/AS1 may be used instead of those required by the Standard.

Where moving walks are intended for transporting trolleys, safety signs describing safe and correct use shall be provided. Amend 6 Feb 2014

j) For *building consent* purposes the *person* proposing to install the escalator or moving walk shall supply the following information:

i) drawings and specifications detailing the escalator or moving walk installation (including the circuit diagram) and its attachment to the *building*

ii) demonstration of structural adequacy – see f) above

iii) justification for components or features meeting performance or other unspecific requirements of the Standard – see b) above

iv) the specific data, test reports and certificates noted in Clause 6.2 of the Standard

v) details of inspections and tests to be performed on behalf of the *owner* during installation of the escalator or moving walk and on completion of the work

vi) requirements for inspection and routine maintenance for inclusion in the *building's compliance schedule*.

Comment

This information comprises 'plans and specifications' as defined in the Building Act. It is expected that the person proposing to install the escalator or moving walk will receive the above information from the escalator or moving walk manufacturer or supplier, the structural designer, and others.

Amend 6
Feb 2014

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 11), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 5 November 2020 and supersedes all previous versions of this document.

The previous version of this document (Amendment 10) will cease to have effect on 3 November 2021.

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.building.govt.nz

E1: Document History

	Date	Alterations	
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
Reprinted incorporating Amendments 1, 2 and 3 – July 1996			
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 until 30 May 2017	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

E1: Document History (continued)			
	Date	**Alterations**	
Amendment 10	Effective 1 January 2017 until 3 November 2021	pp. 7, 8 Re1erences p. 12 E1/VM1 Table 1	p. 31 E1/VM1 9.0.6
Amendment 11	Effective 5 November 2020	p. 5 Contents pp. 7–8 References p. 9 Definitions p. 13 E1/VM1 2.2.1 p. 34 E1/AS1 3.2.2, Table 1 p. 37 E1/AS1 3.6.1	p. 40 E1/AS1 Figure 13 p. 44 E1/AS1 5.1.5, Table 6 pp. 45– 51 E1/AS1 Appendix A pp. 52–55 New Acceptable Solution E1/AS2 included p. 57 Index
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

New Zealand Building Code Clause E1 Surface Water

Amend 6 Jan 2002

The mandatory provisions for building work are contained in the New Zealand Building Code (NZBC), which comprises the First Schedule to the Building Regulations 1992. The relevant NZBC Clause for Surface Water is E1.

FIRST SCHEDULE–*continued*

Clause E1–SURFACE WATER

Provisions	Limits on application
OBJECTIVE	
E1.1 The objective of this provision is to:	
(a) Safeguard people from injury or illness, and *other property* from damage, caused by *surface water*, and	
(b) Protect the *outfalls* of drainage systems.	
FUNCTIONAL REQUIREMENT	
E1.2 *Buildings* and *sitework* shall be constructed in a way that protects people and *other property* from the adverse effects of *surface water.*	
PERFORMANCE	
Amend 6 Jan 2002 — **E1.3.1** Except as otherwise required under the Resource Management Act 1991 for the protection of *other property*, *surface water*, resulting from an event having a 10% probability of occurring annually and which is collected or concentrated by *buildings* or *sitework*, shall be disposed of in a way that avoids the likelihood of damage or nuisance to *other property*.	
Amend 6 Jan 2002 — **E1.3.2** *Surface water*, resulting from an event having a 2% probability of occurring annually, shall not enter *buildings*.	Performance E1.3.2 shall apply only to *Housing*, *Communal Residential* and *Communal Non-residential buildings*.
E1.3.3 Drainage systems for the disposal of *surface water* shall be constructed to:	
(a) Convey *surface water* to an appropriate *outfall* using gravity flow where possible,	
(b) Avoid the likelihood of blockages,	
(c) Avoid the likelihood of leakage, penetration by roots, or the entry of ground water where pipes or lined channels are used,	

FIRST SCHEDULE–*continued*

Provisions	Limits on application
(d) Provide reasonable access for maintenance and clearing blockages, (e) Avoid the likelihood of damage to any *outfall*, in a manner acceptable to the *network utility operator*, and (f) Avoid the likelihood of damage from superimposed loads or normal ground movements.	

Contents

References

Amend 1 Sep 1993 · Amend 8 Oct 2011 · Amend 9 Feb 2014 · Amend 11 Nov 2020 · Amend 7 Sep 2010 · Amends 9 and 11

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in this Verification Method and Acceptable Solutions (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 Solutions must be used.

Standards New Zealand

		Where quoted
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*	AS1 Table 4, Table 6
AS/NZS 1254: 2010	PVC pipes and fittings for stormwater and surface water applications *Amend: 1, 2*	AS1 Table 1, Table 3
AS/NZS 1260: 2017	PVC-U Pipes and fittings for drain, waste and vent application	AS1 Table 1, Table 4
AS/NZS 1734: 1997	Aluminium and aluminium alloys – Flat sheets, coiled sheet and plate	AS1 Table 4, Table 6
AS/NZS 2032: 2006	Installation of PVC Pipe Systems *Amend: 1*	AS1 Table 3, 3.9.8
AS/NZS 2033: 2008	Installation of polyethylene pipe systems *Amend: 1, 2*	AS1 Table 3
AS/NZS 2280: 2014	Ductile iron pipes and fittings *Amend: 1, 2*	AS1 Table 1, Table 3
AS/NZS 2566:-	Buried Flexible pipelines	
Part 1: 1998	Structural Design	AS1 3.9.8
Part 2: 2002	Installation *Amend: 1, 2, 3*	AS1 3.9.8, Table 3
AS/NZS 3500:-	Plumbing and drainage	
Part 3: 2018	Stormwater drainage	AS2 1.0, 1.0.1, 1.0.4
NZS 3604: 2011	Timber framed buildings	AS1 3.9.7
AS/NZS 4058: 2007	Precast concrete pipes (pressure and non-pressure)	AS1 Table 1
AS/NZS 4130: 2018	Polyethylene (PE) pipes for pressure applications	AS1 Table 1

Margin amendment notes: Amend 1 Sep 1993 (NZS/BS 970); Amend 9 Feb 2014, Amend 10 Jan 2017 (AS/NZS 1254); Amends 9, 10, 11; Amend 11 Nov 2020 (AS/NZS 1260); Amend 8 Oct 2011 (AS/NZS 2032); Amend 8 Oct 2011 (AS/NZS 2033); Amends 9, 10, 11 (AS/NZS 2280); Amend 7 Sep 2010, Amends 10 and 11, Amend 8 Oct 2011 (AS/NZS 2566); Amend 11 Nov 2020 (AS/NZS 3500); Amends 1, 4, 7, 8, 9, Amend 5 July 2001 (NZS 3604); Amend 7 Sep 2010 (AS/NZS 4058); Amends 8, 9, 10, 11 (AS/NZS 4130)

		Where quoted
NZS 4229: 2013	Concrete masonry buildings not requiring specific design	AS1 3.9.7
NZS 4442: 1988	Welded steel pipes and fittings for water, sewage and medium pressure gas	AS1 Table 1, Table 3
AS/NZS 5065: 2005	Polyethylene and polypropylene pipe and fittings for drainage and sewerage applications *Amend: 1, 2*	AS1 Table 1

Amends 1, 4, 10

Amend 7 Sep 2010

Amend 8 Oct 2011

Amend 11 Nov 2020

British Standards Institution

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
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 7 Sep 2010

Amend 8 Oct 2011

Amend 7 Sep 2010

Standards Association of Australia

Amend 7 Sep 2010

AS 1273: 1991	Unplasticised PVC (UPVC) downpipes and fittings for rainwater	AS1 Table 4, Table 6
AS 1397: 2011	Continuous hot-dip metallic coated steel sheet and strip – Coatings of zinz and zinc alloyed with aluminium and magnesium *Amend: 1*	AS1 Table 4, Table 6
AS 1579: 2001	Arc welded steel pipes and fittings for water and waste water	AS1 Table 1
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
AS 3706:- Part 1: 2012	Geotextiles – Methods of test General requirements, sampling, conditioning, basic physical properties and statistical analysis	VM1 9.0.4

Amend 11 Nov 2020

Amend 7 Sep 2010

Amend 7 Sep 2010

Amends 7 and 11

Amend 4 Dec 2000

New Zealand Legislation

Resource Management Act 1991	VM1 2.1.2

Definitions

Amend 7 Sep 2010

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

Amends 9 and 11

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.

Annual Exceedance Probability (AEP) The probability that a given rainfall intensity will be exceeded in any one year, expressed as a percentage.

Amend 11 Nov 2020

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

Amend 7 Sep 2010

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

Amend 8 Oct 2011

(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.

Amend 7 Sep 2010

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.

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.

Verification Method E1/VM1

(Revised by Amendment 4)

1.0 Scope

1.0.1 This Verification Method shall be used only if the *territorial authority* does not have more accurate data available from sophisticated hydrological modelling of the catchment undertaken as part of its flood management plans.

1.0.2 The following approach provides a method for verifying that a proposed *building* will meet the requirements of NZBC E1.3.1 and E1.3.2 in the following circumstances:

a) The catchment area does not exceed 100 ha (but see Paragraph 1.0.6 for soak pits), and

b) The *surface water* results only from rainfall on the catchment and does not include water from other sources such as inundation from rivers, lakes or the sea.

1.0.3 The method describes how to determine:

a) The volume of *surface water* arriving at the *building* site from upper areas of the catchment (see Paragraph 2.0),

b) The size of *drains* necessary to remove *surface water* from the *building* site (see Paragraph 3.0), and

c) The nature and volume of secondary flows likely to reach the *building* 1 from overloaded culverts, *drains* or open channels in the upper catchment (see Paragraph 4.0).

1.0.4 The procedure described for sizing *drains* only applies where free flow occurs at the outlet. The outlet must not be restricted by hydraulic impediments such as control gates, a pump station, or submerged outlets in a river, a lake or the sea.

COMMENT:
The capacity of *drains* which do not have a free flowing outlet shall be calculated by specific design in a manner which incorporates the effect of the restriction.

1.0.5 A method is provided for determining appropriate *outfall* protection.

1.0.6 A procedure is provided for determining soak pit requirements for *surface water* disposal. Such disposal is subject to suitable ground conditions, as confirmed by site tests.

COMMENT:
1. Where soak pits are used the overall ground stability may need to be verified but this is outside of the scope of this Verification Method.
2. Soak pit *surface water* disposal may require a resource management consent.

1.0.7 The design procedures in this document must be performed by a *person* who, on the basis of experience or qualifications, is competent to apply them.

1.0.8 This document makes no allowance for blockages to the intakes of *drains* or culverts. The procedures of this document shall only be used where the designer demonstrates that this approach is justified for the particular *building* work under consideration.

COMMENT:
The likelihood of blockage and the resulting risks will vary from project to project and need to be considered by the designer before applying this document.

1.0.9 The "Comments" in this document provide comment, background or general information but do not form part of this Verification Method.

2.0 Estimation of Surface Water Run-Off

2.0.1 *Surface water* run-off for the catchment shall be calculated using the Rational Method. The formula to be used is:

$Q_c = CIA_c/360$

where

Q_c = catchment run-off (m^3/s).

C = run-off coefficient (see Table 1).

I = rainfall intensity (mm/hr).

A_c = area (hectares) of catchment above the point being considered.

Table 1: Run-off Coefficients
Paragraphs 2.0.1, 2.1.1, 2.1.3

Description of surface	C
Natural surface types	
Bare impermeable clay with no interception channels or run-off control	0.70
Bare uncultivated soil of medium soakage	0.60
Heavy clay soil types:	
– pasture and grass cover	0.40
– bush and scrub cover	0.35
– cultivated	0.30
Medium soakage soil types:	
Amend 10 Jan 2017 – pasture and grass cover	0.30
– bush and scrub cover	0.25
– cultivated	0.20
High soakage gravel, sandy and volcanic soil types:	
Amend 10 Jan 2017 – pasture and grass cover	0.20
– bush and scrub cover	0.15
– cultivated	0.10
Parks, playgrounds and reserves:	
– mainly grassed	0.30
– predominantly bush	0.25
Gardens, lawns, etc.	0.25
Developed surface types	
Fully roofed and/or sealed developments	0.90
Steel and non-absorbent roof surfaces	0.90
Asphalt and concrete paved surfaces	0.85
Near flat and slightly absorbent roof surfaces	0.80
Stone, brick and precast concrete paving panels	
– with sealed joints	0.80
– with open joints	0.60
Unsealed roads	0.50
Railway and unsealed yards and similar surfaces	0.35
Land use types	
Industrial, commercial, shopping areas and town house developments	0.65
Residential areas in which the impervious area is less than 36% of gross area	0.45
Residential areas in which impervious area is 36% to 50% of gross area	0.55

Note:
Where the impervious area exceeds 50% of gross area, use method of Paragraph 2.1.2.

2.1 Run-off Coefficient

2.1.1 Table 1 lists run-off coefficients appropriate to a variety of land uses and soil characteristics. For catchments having a mixture of different types, the run-off coefficient shall be determined by averaging the value for individual parts of the catchment by using the formula:

$$C = \frac{\Sigma C_i A_i}{A_c}$$

where

C = the run-off coefficient for the catchment.

C_i = the run-off coefficient for a particular land use.

A_i = the area of land to which C_i applies.

A_c = the catchment area.

COMMENT:

1. The run-off coefficient C is the variable in the rational formula least able to be precisely determined, and represents the integrated effects of such things as infiltration, storage, evaporation, natural retention and interception, all of which affect the time distribution and peak rate of run-off.
2. The run-off coefficients given in Table 1 assume saturated ground conditions from previous rain, and shall be used in the calculation of *surface water* run-off.

2.1.2 The chosen run-off coefficient shall be based on the conditions likely to exist after the full catchment development allowable by the operative plan under the Resource Management Act 1991.

2.1.3 Slope correction

The values of run-off coefficient given in Table 1 shall be adjusted for slope in accordance with Table 2.

COMMENT:
The values in Table 1 assume an average sloping terrain of 5-10% (i.e. gently rolling). However, if the terrain is flatter or steeper this will have the effect of slowing down or speeding up overland flow. The above adjustment allows for this.

2.2 Rainfall intensity

2.2.1 The rainfall intensity shall be that for a storm having a duration equal to the time of concentration as determined by Paragraph 2.3.1, and a probability of occurrence as given by NZBC E1.3.1 or E1.3.2 as appropriate. Either local rainfall intensity curves produced by the *territorial authority* or rainfall frequency duration information produced by NIWA shall be used to determine the rainfall intensity.

COMMENT:
Rainfall intensity curves are available for most areas. These have been developed from meteorological data. Rainfall frequency-duration tables for each official rain gauge throughout New Zealand are also available.

Rainfall intensity data is also available online in digital form from the National Institute for Water and Atmospheric Research (NIWA) High Intensity Rainfall Design System (HIRDS).

HIRDS provides rainfall intensity estimates for any location in New Zealand based on historical rain gauge data and also projections of future rainfall intensities for various climate change scenarios.

Amend 11 Nov 2020 Where differing design rainfall intensities are provided for a particular location, the most conservative rainfall intensity should be used for design calculations.

Table 2: Slope Correction for Run-off Coefficients
Paragraph 2.1.3

Ground slope	Adjust C by:	
0-5%	subtracting	0.05
5-10%	no adjustment	
10-20%	adding	0.05
20% or steeper	adding	0.10

2.3 Time of concentration

2.3.1 The time of concentration used to determine rainfall intensity is the time taken for *surface water* run-off from the furthest point (in time) of the catchment to reach the design point. Flow time calculations shall take account of catchment run-off coefficients and slopes.

Time of concentration for the catchment t_c (minutes) shall be calculated from the formula:

$t_c = t_e + t_f$

but shall be no less than 10 minutes.

Where

t_e = time of entry (minutes) which is the run-off time for overland travel (i.e. via ground, roofs, downpipes, carriageways or road channels) to the point of entry to a *drain* or open channel.

t_f = time (minutes) of network flow, (comprising flow in pipes and open channels), to the design point.

COMMENT:
In some catchments due to shape, *surface water* network and varying permeabilities within the catchment, part of the catchment under consideration may produce a higher peak flow than the whole of the catchment. Although the area for the part catchment is smaller, this may be more than offset by the higher intensity storm associated with a shorter time of concentration and storm duration. This situation will generally arise where the lower reaches of a catchment are densely developed.

2.3.2 Time of entry t_e

The time of entry t_e:

a) Where the catchment area has a well defined and regularly repeated pattern for directing the *surface water* to the *drain* or open channel, the time of entry may be taken as:

t_e = 5 minutes for commercial or industrial areas where greater than 50% of the surface of the catchment area feeding the *drain* or open channel consists of roofed, asphalt, concrete, paved or metalled surfaces.

t_e = 7 minutes for residential areas where the impervious area exceeds 50% of gross area.

t_e = 10 minutes for low density residential areas where the impervious area is 36% to 50% of gross area.

b) Where the catchment does not have a well defined and regularly repeated pattern or where the catchment is longer than 1.0 km, the time of entry t_e shall be the sum of the time of overland flow and, if applicable, the time of road channel flow as given in i) and ii) below:

i) the time of overland flow shall be determined by the formula:

$t = 100\ nL^{0.33}/s^{0.2}$

where

t = time (minutes).

L = length of overland flow (m).

s = slope (%).

n = Manning's 'n' (roughness coeffiecient).

The results from this formula, for normal surface types, are shown in Figure 1.

ii) The time of road channel flow, which is the time taken for water to flow from the point of entering the road channel, to the point of discharge to a *sump*, catchpit, *drain* or other outlet, shall be determined from Figure 2.

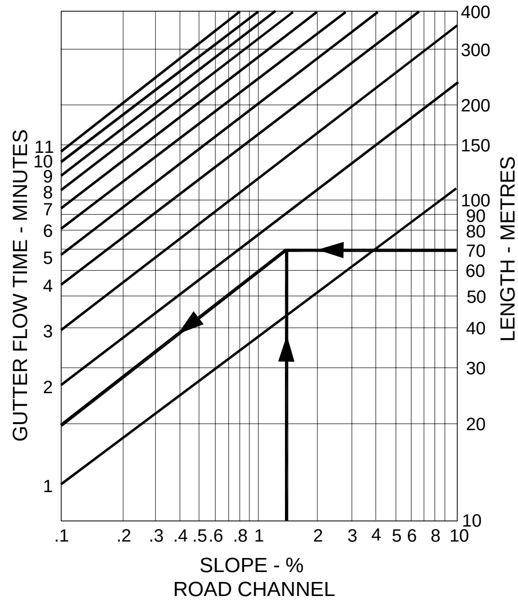
2.3.3 Time of network flow

The time of network flow t_f shall be determined from the sum of the travel times within pipes and open channels.

2.3.4 Time of pipe flow

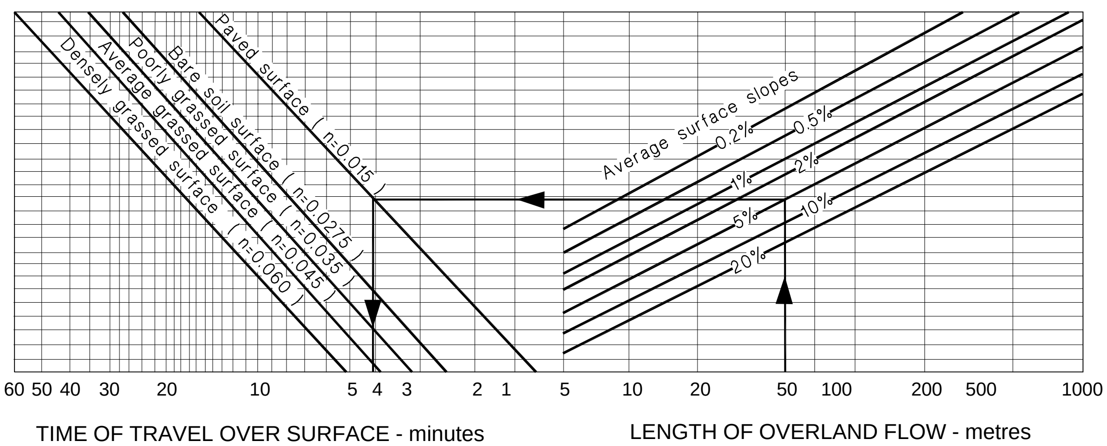
The time of pipe flow shall be calculated from the velocity as determined from Figure 3. Where the pipe changes in material, diameter or gradient the time taken in each section of the pipe shall be calculated and the component times summed. For pipes with Manning's 'n' other than 0.013 the velocity determined from Figure 3 shall be multiplied by the ratio of 0.013/n. Other values of Manning's 'n' for different pipe materials are given in Table 3.

Figure 2: Road Channel Flow Time
Paragraph 2.3.2 b) ii)



Example: For a slope of 1.4% and a road channel length of 70 metres the time of road channel flow is 1.7 minutes

Figure 1: Times for Overland Flow
Paragraph 2.3.2 b) i)



Example: For surface water flowing 50 m over a paved surface at a slope of 5 % the time of travel is 4.1 minutes

Table 3: Mannings 'n'
Paragraphs 2.3.4, 3.2.1, 4.1.6, 4.1.8, 4.1.11 and 4.2.1

Description	Value of 'n'
Circular pipes	
HDPE and uPVC	0.011
Ceramic and concrete	0.013
Culverts	
Cast-in-situ concrete	0.015
Corrugated metal	0.025
Open stream	
Straight uniform channel in earth and gravel in good condition	0.0225
Unlined channel in earth and gravel with some bends and in fair condition	0.025
Channel with rough stoney bed or with weeds on earth bank and natural streams with clean straight banks	0.03
Winding natural streams with generally clean bed but with some poolsand shoals	0.035
Winding natural stream with irregular cross-section and some obstruction with vegetation and debris	0.045
Irregular natural stream with obstruction from vegetation and debris	0.06
Very weedy irregular winding stream obstructed with significant overgrown vegetation and debris	0.1

2.3.5 Time of open channel flow

The time of flow in open channels (either watercourses or lined channels), shall be calculated by means of Manning's formula as given by Paragraph 3.0.

2.3.6 Alternative method to determine time of concentration

Where there are significant changes in gradient along the channel slope or where the open channel is in a rural area, the time of concentration t_c may be determined from:

t_c = $0.0195\,(L^3 / H)^{0.385}$

where

t_c = time of concentration (minutes).

L = length of catchment (m) measured along the flow path.

H = rise from bottom to top of catchment (m).

2.3.7 If the actual catchment slope varies significantly from the value H/L (e.g. with a sudden steepening in the upper reaches) the average slope and height h shall be determined from the equal areas method shown in Figure 4. Height h shall be substituted for H in the formula.

3.0 Sizing of Surface Water System

3.1 Minimum size of drains

3.1.1 To avoid blockages, *surface water drains* shall have an internal diameter of no less than 85 mm.

3.1.2 Except as allowed by Paragraph 5.0.2, the internal diameter of a *drain* shall not decrease in size in the direction of flow.

3.2 Hydraulic design

3.2.1 The cross-sectional area of the *drain* conveying surface water run-off Q_c to the *outfall* shall be determined by:

A_p = Q_c/v

where

A_p = cross-sectional area of *drain* (m^2).

Q_c = *surface water* run-off (m^3/s).

v = flow velocity (m/s).

The flow velocity v shall be determined from Manning's formula:

v = $R^{2/3}\, S^{1/2}\, n^{-1}$

where

R = hydraulic radius (m) = A_p/P.

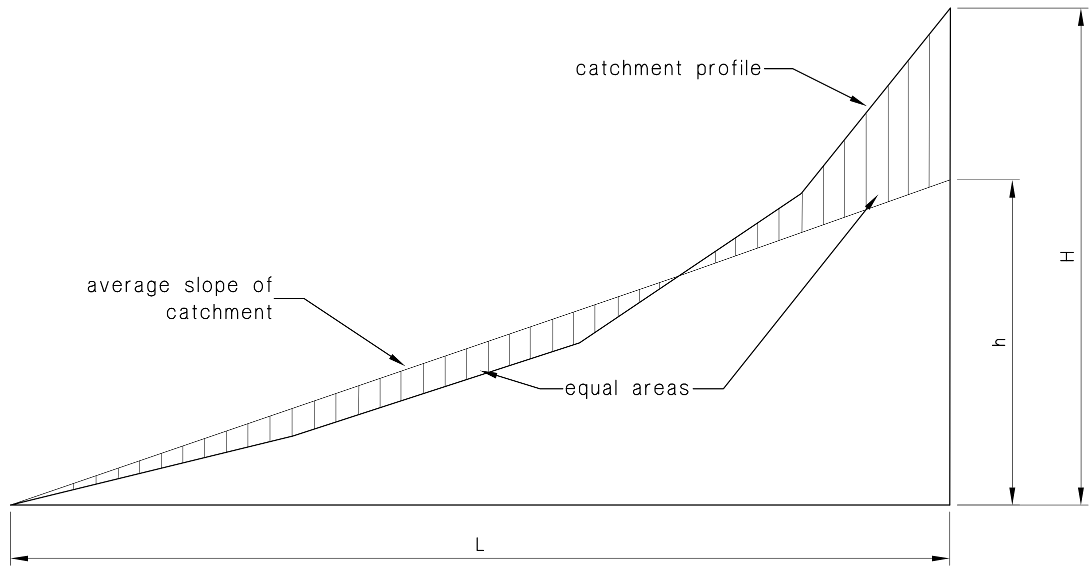
P = wetted perimeter of the cross-section of the flow (m).

S = slope = vertical rise/horizontal distance.

n = Manning's 'n' (roughness coefficient). See Table 3.

Where the *drain* is to be constructed using a piped section, Figure 3 may be used to determine pipe size instead of the above calculation procedure. Where the pipe material has a Manning's 'n' of 0.013, Figure 3 can be used directly. For other values of Manning's 'n', the flow in the pipe Q_p shall be modified

Figure 4: Equal Areas Method
Paragraph 2.3.7



by multiplying it by the ratio of n/0.013 before entering the Figure.

3.2.2 The designer shall estimate the headwater depth H_w (height of water level above inlet invert, refer to Figure 5 (a)) for the size of *drain* (determined from Paragraph 3.2.1), and confirm that there is sufficient ground depth available at the inlet to the *drain* to contain H_w without causing flooding to the *building* site or secondary flow from the inlet. If there is insufficient depth to contain the headwater the *drain* size shall be increased until H_w is less than the ground depth available at the *drain* inlet.

3.2.3 The headwater depth H_w (m) for the *drain* shall be determined from:

a) Figure 6 for a circular piped system, or

b) Figure 7 for a box culvert system.

3.2.4 Where a *drain* gradient exceeds 1 in 10 an allowance for the bulking of the flow due to air entrainment shall be made by multiplying the area of the pipe by:

$(1 + kv^2/gR)$

where

k = coefficient of entrainment

= 0.004 for smooth concrete pipes, or

= 0.008 for cast-in-situ concrete culverts.

v = flow velocity (m/s).

R = hydraulic radius (m).

g = acceleration due to gravity = 9.8 m/s^2.

3.3 Pipe materials

Pipe materials shall comply with Table 1 of Acceptable Solution E1/AS1.

4.0 Secondary Flow

4.0.1 Secondary flow occurs where *surface water* arrives at the site from an overflowing drainage system upstream in the catchment. Where there is a drainage system, being a pipe, culvert or open water course, upstream of the *building* site, the potential for a *secondary flow path* between the drainage system and the site shall be assessed. This shall involve determination of the capacity of the drainage system in conjunction with assessment of the ground levels in the general area.

COMMENT:
Secondary flow is not likely to cause flooding at the *building* site if the *surface water* run-off from the catchment above the site is less than 0.3 m^3/s unless the site is in a depression capable of ponding water.

4.1 Secondary flow from a piped surface water drainage system upstream of the site

4.1.1 This method applies to the assessment of secondary flow upstream of inlet controlled, and some outlet controlled, pipes and culverts (see Figure 5), provided that free flow occurs at the outlet (i.e. the outlet is not restricted by hydraulic obstructions such as control gates, a pump station or submerged outlets in a river or lake).

4.1.2 The method does not apply to outlet controlled pipes or culverts where the tailwater depth T_w (m) is less than the height D (m) of the pipe or culvert (see Figure 5 (f) i.e. outlet not flowing full), and where the estimated headwater depth H_w (m) is no greater than 0.75 D. Such situations shall be subject to specific design.

4.1.3 The headwater depth H_w shall be determined for both the inlet and outlet controlled flow conditions and the maximum value shall be used to assess secondary flow.

4.1.4 Assessment of H_w for inlet controlled pipe or culverts, see Figures 5 (a) and (b)

The headwater depth H_w for a system with inlet control shall be determined from:

a) Figure 6 for a circular piped system, or

b) Figure 7 for a box culvert system.

4.1.5 Assessment of H_w for outlet controlled pipes or culverts, see Figures 5 (c), (d) and (e)

The tailwater depth T_w shall be determined from Paragraphs 4.1.6 and 4.1.7, and the headwater depth H_w from Paragraph 4.1.8.

4.1.6 Tailwater depth T_w (m) shall be calculated by an iterative process from the formula:

$$Q_c = A_f S^{1/2} R^{2/3}/n$$

where

Q_c = catchment *surface water* run-off or that portion arriving at the pipe or culvert (m^3/s).

A_f = cross-sectional area of the flow immediately downstream of the pipe or culvert outlet (m^2).

S = slope of the stream (vertical fall/horizontal distance) immediately downstream of the outlet.

R = hydraulic radius of the stream (m) = A_f/P.

P = wetted perimeter (m) of the stream flow.

n = Manning's 'n' (roughness coefficient). See Table 3.

4.1.7 Firstly a tailwater depth T_w (m) is assumed and, from knowledge of the stream cross-section, the corresponding values of A_f, P and R are determined. These values are then used in the above formula to calculate Q_c which is compared to the actual value of Q_c known to arrive at the pipe. If the calculated value of Q_c is less than the actual value then the assumed tailwater depth shall be increased and the value of Q_c recalculated. The procedure shall be repeated until such time as the tailwater depth T_w used gives two values of Q_c that agree.

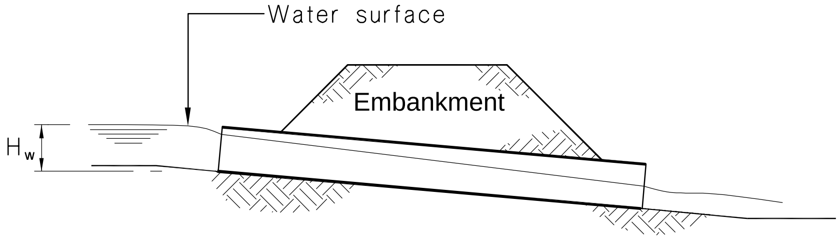
If $T_w < D$ then T_w shall be this value or $(d_c + D)/2$ whichever is the greater, where:

d_c = critical depth (m) and is determined by Figures 8 and 9.

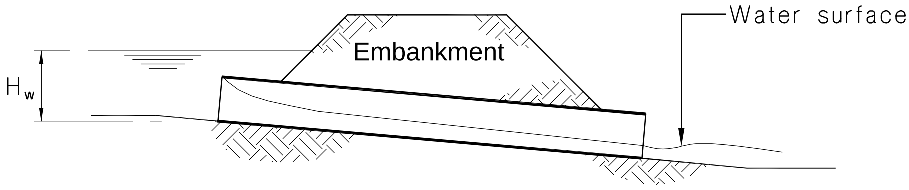
D = internal pipe diameter (m) for Figure 8.

B = culvert width (m) for Figure 9.

Figure 5: Pipe Flow Conditions for Inlet and Outlet Control
Paragraphs 3.2.2, 4.1.1, 4.1.2, 4.1.4 and 4.1.5

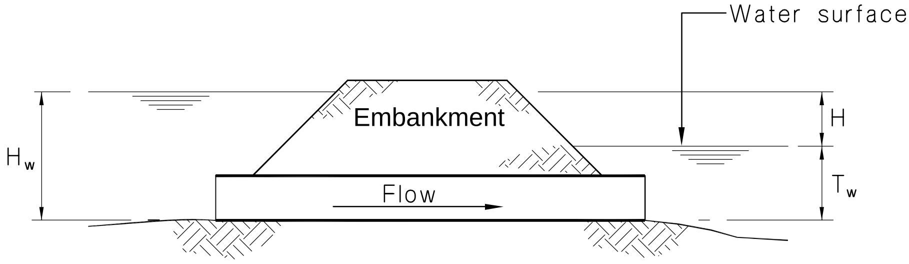


(a) Unsubmerged

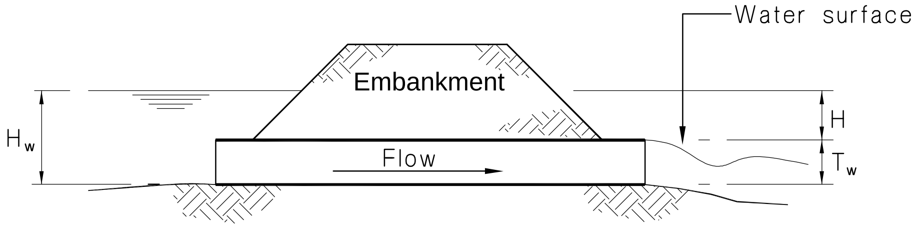


(b) Submerged

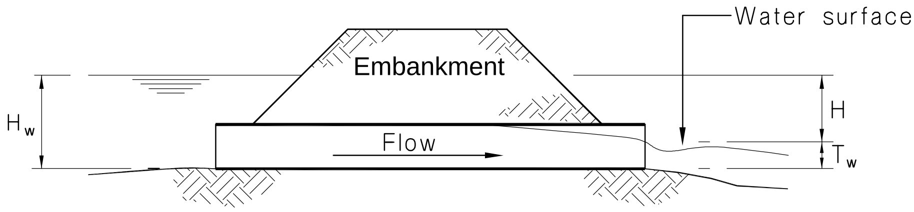
INLET CONTROL



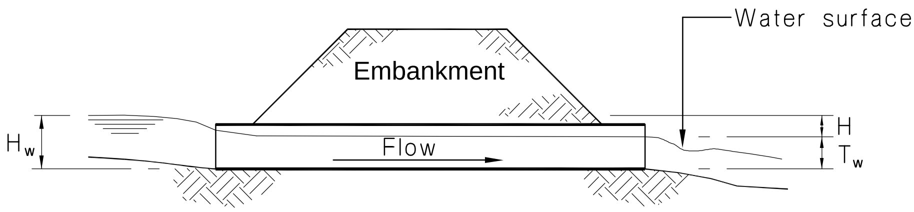
(c)



(d)



(e)



(f)

OUTLET CONTROL

Figure 6: Headwater Depth for Circular Pipes
Paragraphs 3.2.3 a) and 4.1.4 a)

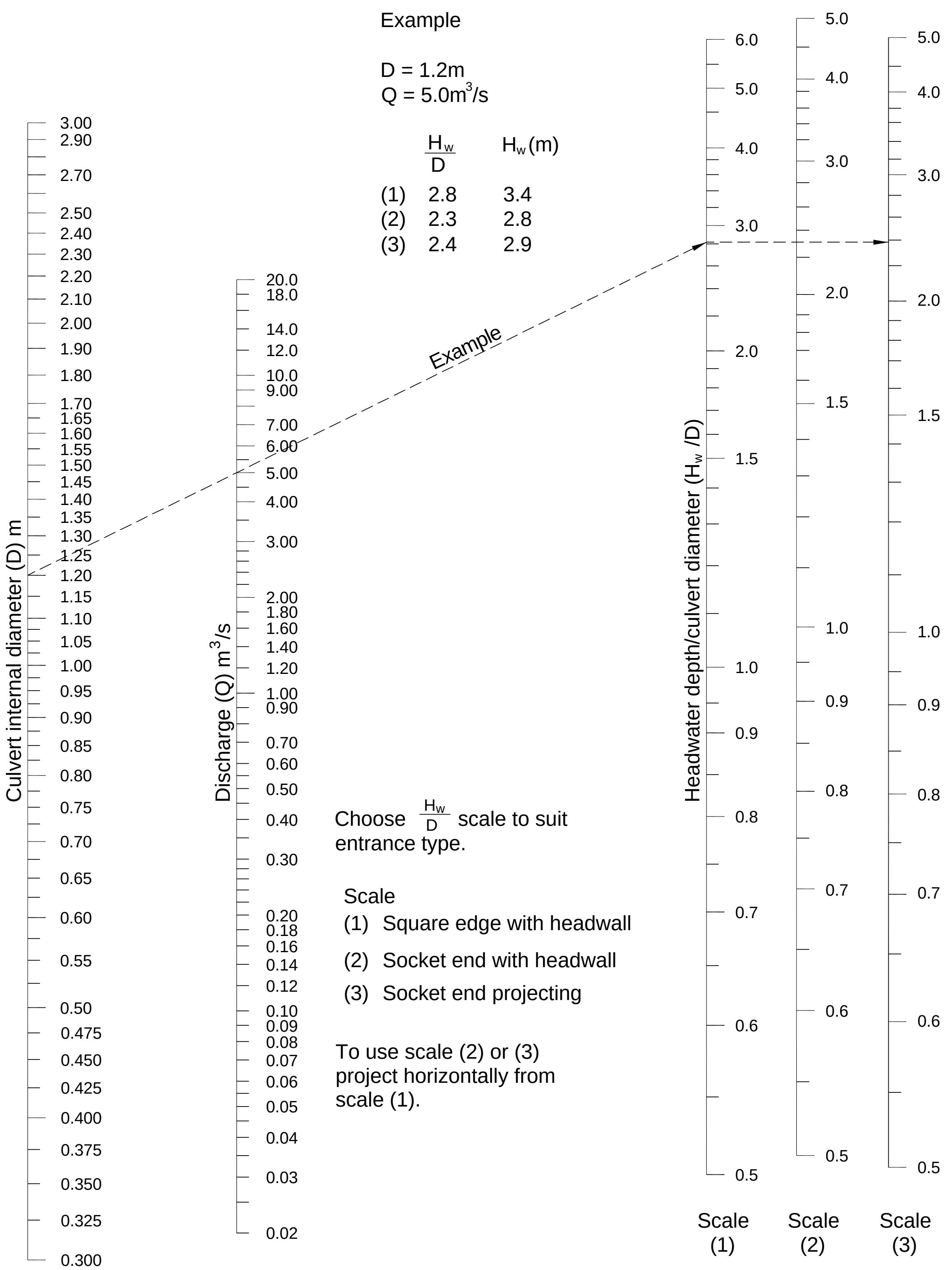


Figure 7: **Headwater Depth for Box Culverts**
Paragraphs 3.2.3 b) and 4.1.4 b)

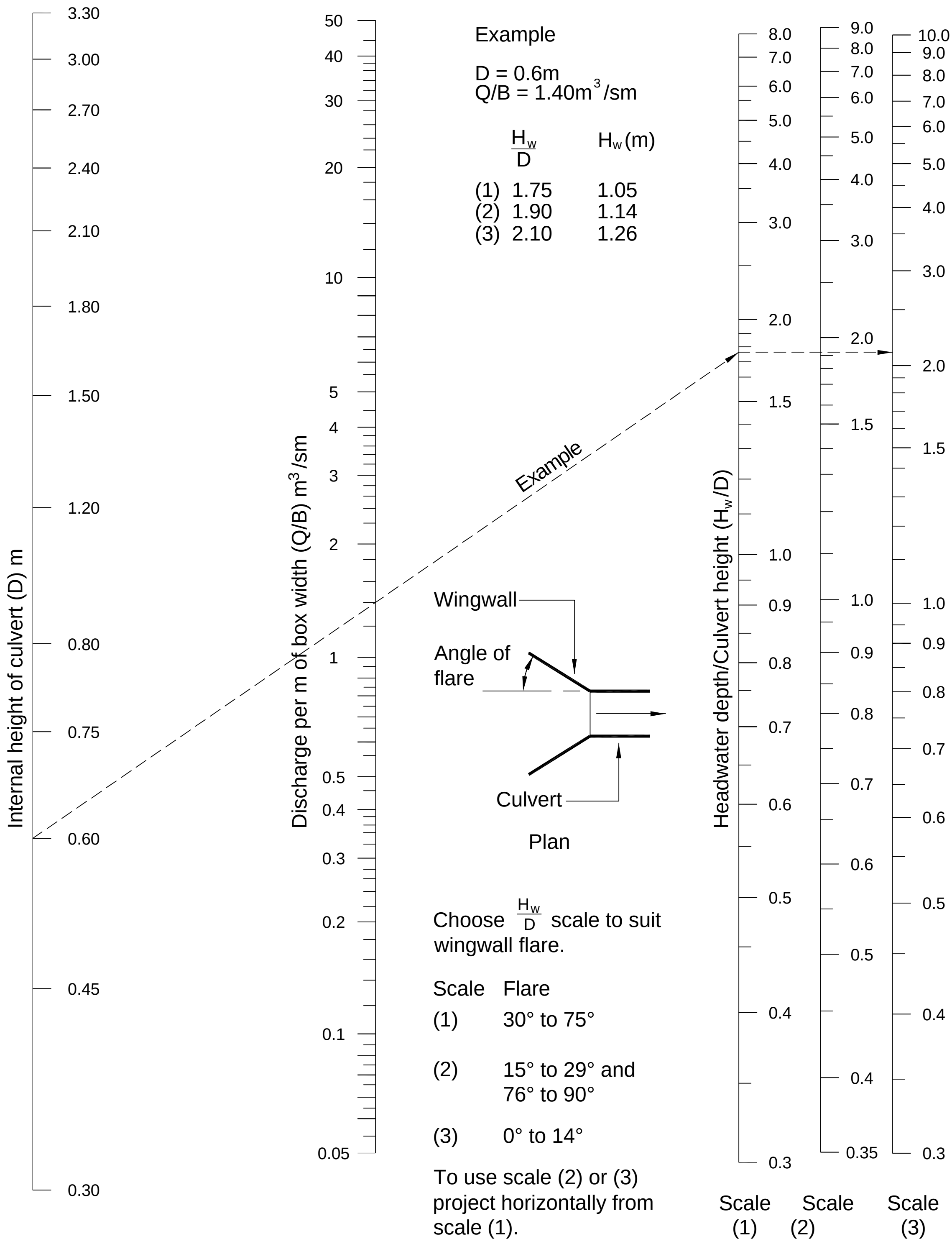
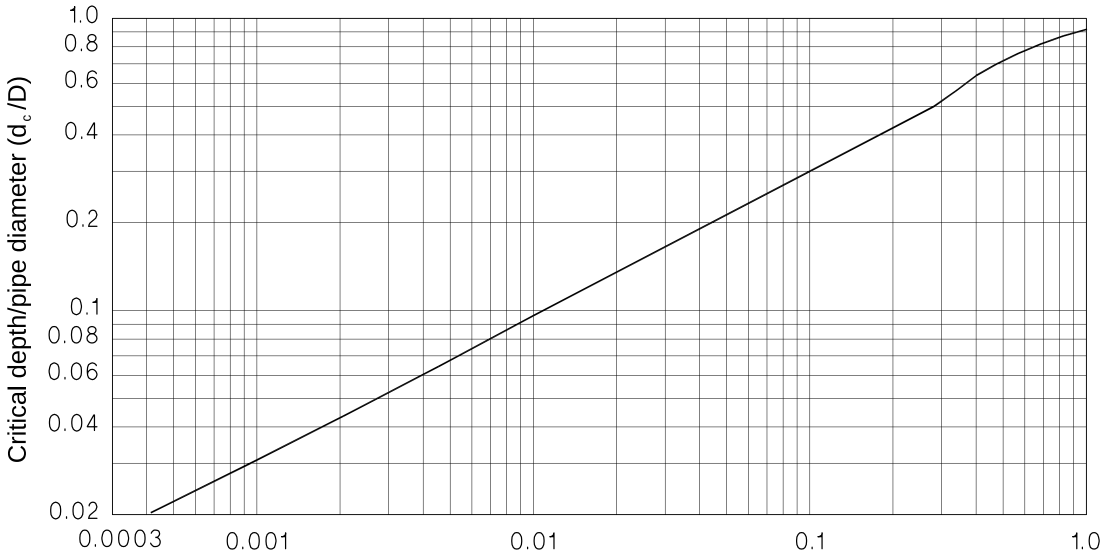


Figure 8: Critical Depth for Circular Pipes
Paragraph 4.1.7



Values of $Q/\sqrt{g}\,D^{2.5}$ where Q = pipe flow (m^3/s)
D = pipe diameter (m)
g = gravitational acceleration ($9.8 m/s^2$)

4.1.8 The headwater depth H_w (m) shall be calculated by:

H_w = $H + T_w - LS$, and

H = $v^2(1 + k_e)/2g + (Q_c n/R^{2/3} A_p)^2 L$

where

T_w = tailwater depth (m).

H = downstream head (m).

L = length of the pipe or culvert (m).

S = slope of the pipe or culvert (vertical fall/horizontal distance) with the vertical fall being measured between the intake and outlet invert levels. If gravels or sand are present in the pipe or culvert then the surface of the gravel or sand shall be taken as the invert level.

v = flow velocity in the pipe or culvert (m/s).

k_e = entrance loss coefficient as given by Table 4.

Q_c = catchment *surface water* run-off or that portion arriving at the pipe (m^3/s).

n = Manning's 'n' (roughness coefficient) as given in Table 3.

R = hydraulic radius (m).

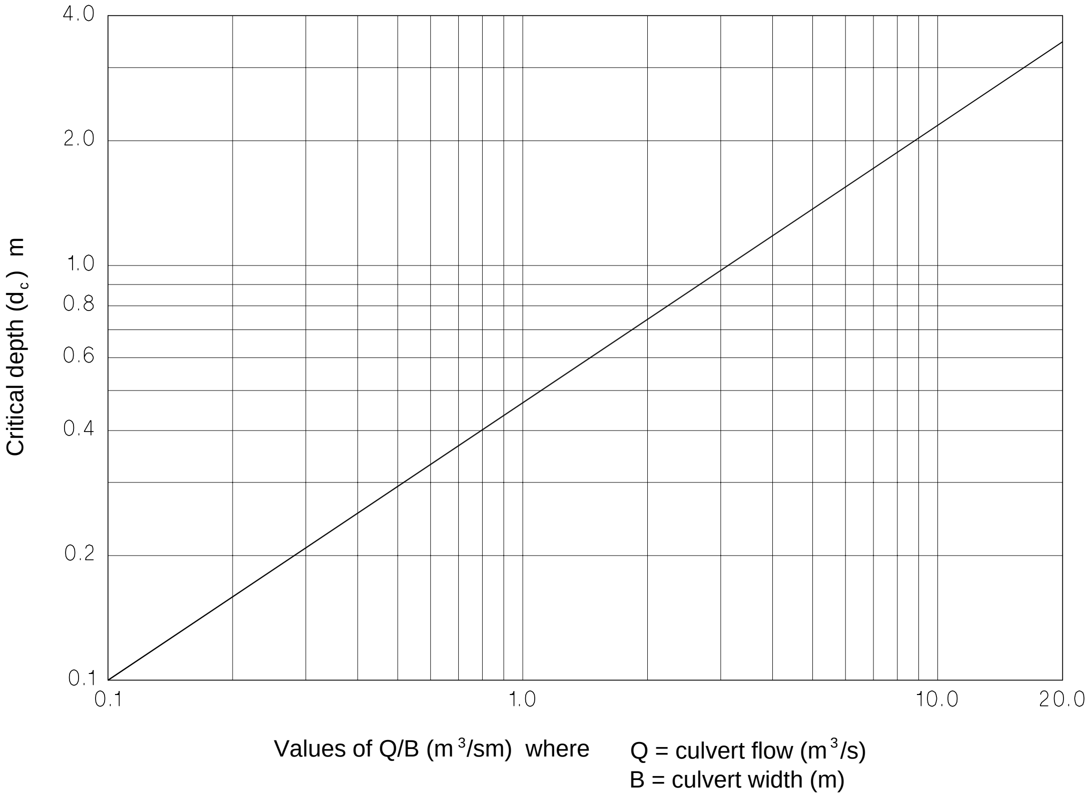
A_p = cross-sectional area of the pipe or culvert (m^2).

4.1.9 As an alternative to the formula given in Paragraph 4.1.8, Figures 10 and 11 may be used directly to determine downstream H applying the values of Manning's 'n' and k_e given in those Figures.

4.1.10 Determination of secondary flow quantity

The estimated water surface level, determined from H_w (m), is the actual water surface if all the *surface water* run-off Q_c (m^3/s) flows through the pipe or culvert. This level shall be compared to the ground levels upstream of the pipe intake to determine if a possible *secondary flow path* exists. If the ground level upstream of the intake is higher than the

Figure 9: Critical Depth for Box Culverts
Paragraph 4.1.7



water surface level (H_w) no secondary flow will occur. If the water surface is higher than the ground level upstream of the intake and the ground contours provide a *secondary flow path* between the possible overflow point and the *building* site, an estimate of the secondary flow volume likely to arrive at the site shall be made using the formula:

$Q_c = Q_p + Q_{sf}$

where Q_p and Q_{sf} (m^3/s) are determined from an iterative process where:

Q_p = flow in the pipe or culvert determined from Paragraphs 4.1.4 and 4.1.5 using an assumed headwater surface level H_w which allows for secondary flow, and

Q_{sf} = the secondary flow down the *secondary flow path* corresponding to the assumed headwater surface level H_w. Q_{sf} shall be determined from Paragraph 4.1.11 provided there is no restriction downstream of the secondary flow overflow point which could cause a backwater effect on either Q_p or Q_{sf} capable of ponding water to a height sufficient to reach the level of H_w. Specific design is required where such restrictions occur.

If the summation of Q_p and Q_{sf} is less than Q_c then a higher H_w shall be used to recalculate Q_p and Q_{sf}. If it is greater than Q_c then a lower H_w shall be used to recalculate Q_p and Q_{sf}. The designer shall refine the water surface level H_w until $Q_c = Q_p + Q_{sf}$.

Table 4: Entrance Loss Coefficients
Paragraph 4.1.8

Design of entrance	Entrance loss coefficients k_e
Pipe culverts	
Pipe projecting from fill:	
square cut end	0.5
socket end	0.2
Headwall with or without wing walls	
square end	0.5
socket end	0.2
Pipe mitred to conform with fill slope	
precast end	0.5
field cut end	0.7
Box culverts	
No wing walls, headwall parallel to embankment	
square edge on three edges	0.5
three edges rounded to 1/12 of barrel dimensions	0.2
Wing walls at 30° to 75° to barrel	
square edge at crown	0.4
crown rounded to 1/12 of culvert height	0.2
Wing walls at 10° to 30° to barrel	
square edge to crown	0.5
Wing walls parallel (extension of sides)	
square edge at crown	0.7

4.1.11 The secondary flow Q_{sf} shall be determined from a) or b) as appropriate.

a) Where the flow over the secondary flow point operates as a weir (such as a flow over a culvert headwall, kerb, footpath, crown in the road, driveway entrance, etc.) then Q_{sf} shall be determined by:

$Qsf = 1.6\ B\ H_{sf}^{3/2}$

where

Q_{sf} = secondary flow (m^3/s).

B = width (metres) of the *secondary flow path* at the point of overflow over the weir, from the channel to the *secondary flow path.*

H_{sf} = secondary flow water depth (metres), being the difference between the assumed headwater surface level H_w and the average ground level over width B, at the point of overflow into the *secondary flow path.*

b) Where the flow over the secondary flow point operates as a pipe or channel flow (such as directly down a side channel or pipe) then Q_{sf} shall be determined by:

$Q_{sf} = A_{sf}R_{sf}^{2/3}\ S_{sf}^{1/2}\ n_{sf}^{-1}$

where

Q_{sf} = secondary flow (m^3/s).

A_{sf} = cross-sectional area (m^2) of the flow down the secondary flow channel or pipe.

R_{sf} = hydraulic radius (m) = A_{sf} / P_{sf}

P_{sf} = wetted perimeter (m) of the cross-section of the secondary flow in the channel or pipe.

S_{sf} = slope of the ground (vertical fall/ horizontal distance) along the *secondary flow path* at the overflow point.

n_{sf} = Manning's 'n' (roughness coefficient). See Table 3.

4.2 Secondary flow from an open water course upstream of the site

4.2.1 Where the surface run-off from a catchment at a possible overflow point Q_c is flowing at subcritical flow, i.e. where:

$v_c \le (gH_c)^{0.5}$

where

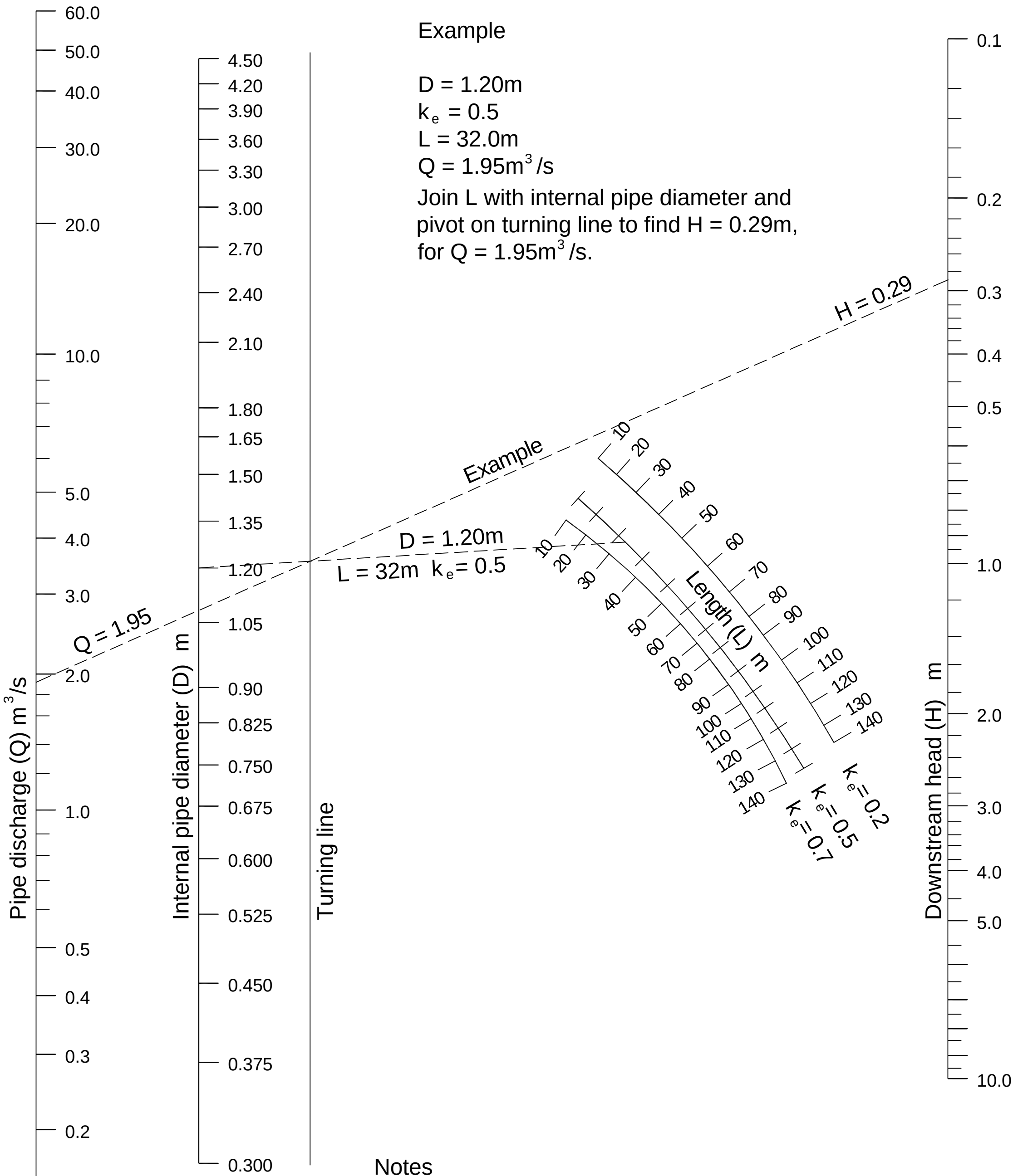
v_c = velocity (m/s) in the stream at the possible overflow point.

H_c = depth of flow (m) in the stream at the possible overflow.

then an assessment of secondary flow Q_{sf} shall be made by the procedure set out below. If the surface run-off from the catchment, at the possible overflow point Q_c is flowing at super critical flow (i.e. $v_c > (gH_c)^{0.5}$) then specific design shall be used to assess Q_{sf}.

Continued on page 27

Figure 10: Downstream Head for Circular Pipe Culverts
Paragraph 4.1.9

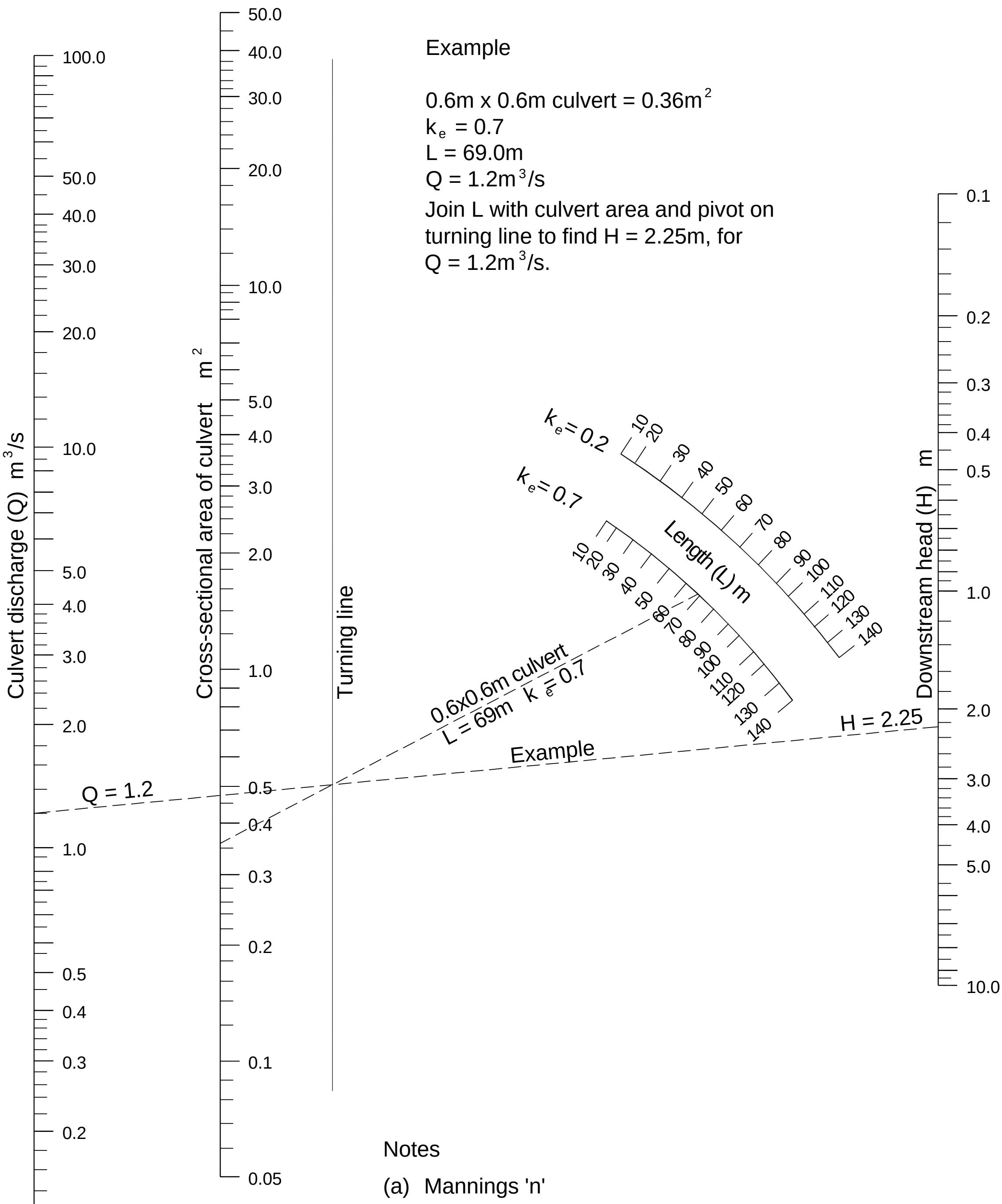


Notes

(a) Mannings 'n'
This figure uses n=0.013. For a different value of n use the length scale with an adjusted length $L_1=L(n_1/n)^2$.

(b) For values of k_e between 0.2 and 0.7, connect the given length on adjacent scales by a straight line and interpolate.

Figure 11: Downstream Head for Box Culverts
Paragraph 4.1.9



Notes

(a) Mannings 'n'
This figure uses n=0.013. For a different value of n use the length scale with an adjusted length $L_1 = L(n_1/n)^2$.

(b) For values of k_e between 0.2 and 0.7, connect the given length on adjacent scales by a straight line and interpolate.

Secondary flow from an open water course upstream of the site shall be determined by an iterative process similar to that described in Paragraph 4.1.10 for pipes and culverts but using the formula:

$Q_c = Q_{strm} + Q_{sf}$

where

Q_c = surface run-off from catchment upstream of possible overflow point (m^3/s),

Q_{strm} = that portion of surface water run-off (m^3/s) flow down the stream channel downstream of the possible overflow point, and

$Q_{strm} = R_{strm}^{2/3} S_{strm}^{1/2} n_{strm}^{-1} A_{strm}$

where R_{strm} and A_{strm} are determined from an assumed water surface and

R_{strm} = hydraulic radius of stream (m) downstream of the possible overflow point.

S_{strm} = slope of stream (vertical fall/horizontal distance) downstream of the possible overflow point.

n_{strm} = Manning's 'n' (roughness coefficient). See Table 3.

A_{strm} = cross-sectional area of the stream (m^2), and

$Q_{sf} = R_{sf}^{2/3} S_{sf}^{1/2} n_{sf}^{-1} A_{sf}$

where R_{sf} and A_{sf} are determined from the secondary flow depth being the difference between the assumed water surface and the ground level at the point of overflow into the *secondary flow path.*

The designer shall refine the level of water surface until $Q_c = Q_{strm} + Q_{sf}$.

4.3 Secondary flow from site to downstream drainage system

4.3.1 The secondary flow estimated to arrive on the site shall be directed into the *surface water* drainage system designed for the site. The height of the secondary flow shall be used as a basis for determining the *building* floor level necessary to comply with the requirements of NZBC E1.3.2.

The level of the floor shall be set at the height of the secondary flow plus an allowance for freeboard. The freeboard shall be:

– 500 mm where *surface water* has a depth of 100 mm or more and extends from the *building* directly to a road or car park, other than a car park for a single dwelling.

– 150 mm for all other cases.

COMMENT:

The 500 mm freeboard allows for waves generated by vehicles. Such waves will not be sustained unless there is at least 100 mm depth of water and an unobstructed path from the point where the wave is generated to the *building.*

5.0 Energy Losses Through Structures

5.0.1 Hydraulic design shall make allowance for energy losses at *access chamber* structures where a change in direction of the flow occurs. An additional fall shall be provided through the *access chamber* to allow for these losses. This fall H_L (m) is in addition to the fall produced by the gradient of the pipe line, and shall be calculated using the formula:

$H_L = Kv^2/2g$

where

K = energy loss coefficient for change in direction determined from Figure 12.

v = flow velocity (m/s).

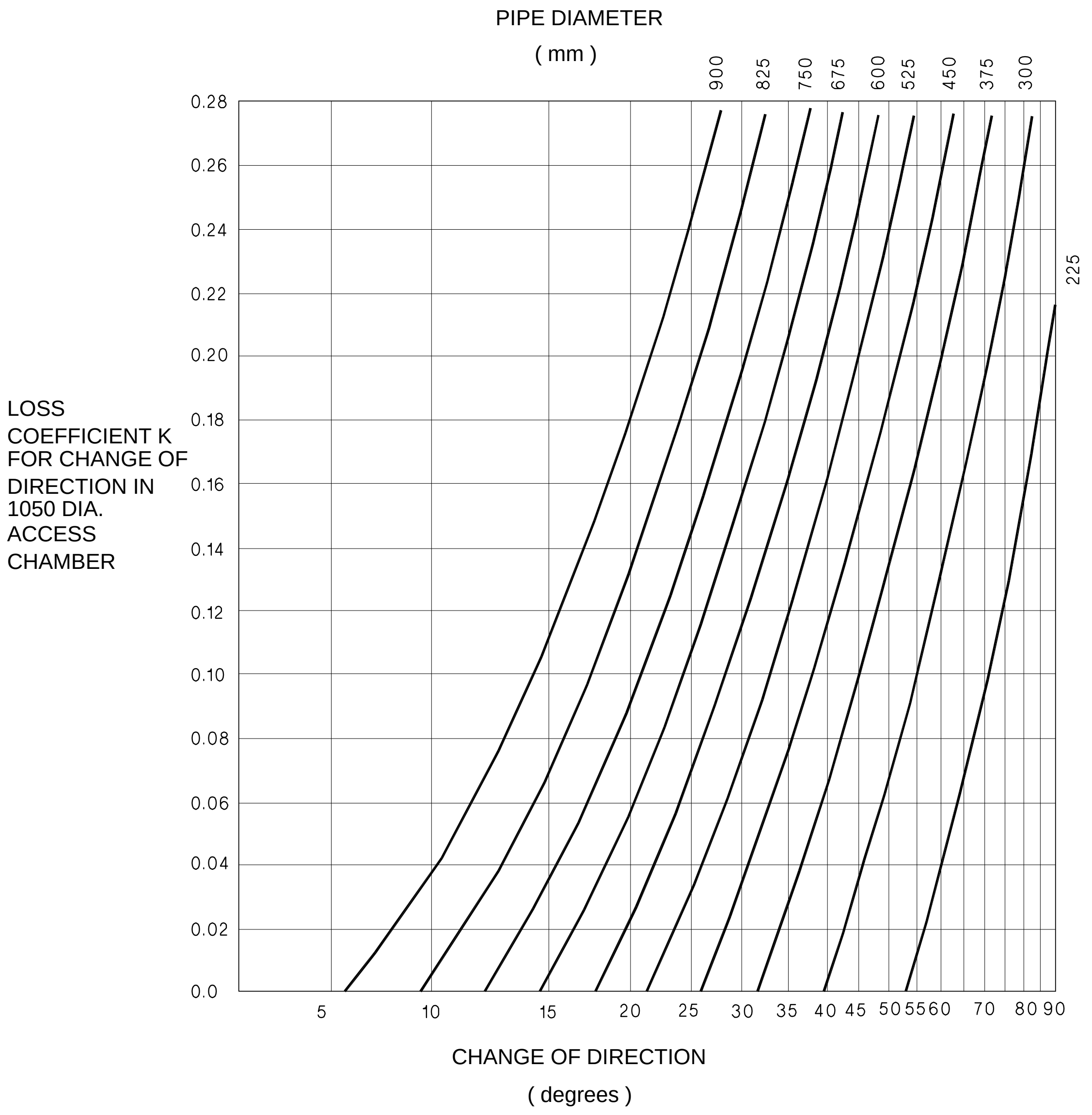
g = gravitational acceleration = 9.8 m/s^2.

5.0.2 In cases where a reduction in *drain* size is justified by a large increase in gradient, an additional head loss of $0.5\ v_e^2/2g$ shall be allowed for (v_e = exit velocity). Such reductions in size are only permissible where the exit pipe has an internal diameter of 300 mm or greater.

6.0 Minimum Velocity

6.0.1 A *drain*, shall have a minimum flow velocity of 0.6 m/s when *sumps* are incorporated and 0.9 m/s when no *sumps* are used.

Figure 12: Energy Loss Coefficient
Paragraph 5.0.1



7.0 Outfall Protection

7.0.1 Unless more stringent requirements are imposed by the *network utility operator* the following shall apply to the flow discharging from the site into the *outfall*:

a) The exiting velocity shall not exceed the values given in Table 5, and

b) Where the *outfall* is a pipe, culvert or stream the volume discharged shall not exceed 20% of the flow in the *outfall* immediately upstream of the discharge point.

COMMENT:

1. The *outfall*, be it a pipe, culvert, stream, lake or the sea, needs to be protected from erosion or scour to meet the requirements of Clause E1.3.3 (e).
2. If exit velocities exceed those given in Table 5 protective structures to dissipate the energy and reduce the velocities are required. These require specific design which is outside the scope of this document.
3. Discharge to some *outfalls* will require a resource management consent.

Table 5: Maximum Exit Velocities of Flow from Pipes and Culverts Discharging to Outfalls
Paragraph 7.0.1

Outfall material	Velocity m/s
Precast concrete pipes to NZS 3107	8.0
Precast concrete culverts	8.0
In-situ concrete and hard packed rock (300 mm minimum)	6.0
Beaching or boulders (250 mm minimum)	5.0
Stones (100-150 mm)	2.5 – 3.0
Grass covered surfaces	1.8
Stiff, sandy clay	1.3 – 1.5
Coarse gravel	1.3 – 1.8
Coarse sand	0.5 – 0.7
Fine sand	0.2 – 0.5

8.0 Drain Leakage Tests

8.0.1 The materials and workmanship used in *surface water drains* shall pass one of the following tests:

a) Water test.

b) Low pressure air test.

c) High pressure air test.

8.0.2 Regardless of test method the pipeline to be tested shall be sealed with suitably restrained plugs (at both ends and at all branch connections) and, where the pipe material is porous (such as ceramic or concrete), it shall be soaked for 24 hours prior to testing.

COMMENT:

Soaking is necessary as porous pipes can absorb water or transmit air through their walls.

8.1 Water test

a) Fill pipe with water, ensuring all air is expelled.

b) Top up water to test head level. The minimum head shall be 1.5 m above the top of the pipe or ground water level whichever is the higher. The maximum head at the lower end of the pipeline shall not exceed 6.0 m.

c) Leave for 30 minutes then measure water loss.

d) The pipeline is acceptable if water loss does not exceed 2 ml per hour, per mm of internal diameter, per m of pipeline length.

8.2 Low pressure air test

a) Introduce air to the pipeline till a pressure of 300 mm water gauge is reached. (This may be measured by a manometer such as a ‘U’ tube, connected to the system.)

b) Wait until the air temperature is uniform. (Indicated by the pressure remaining steady.)

c) Disconnect the air supply.

d) Measure pressure drop after 5 minutes.

e) The pipeline is acceptable if the pressure drop does not exceed 50 mm.

COMMENT:

1. The low pressure air test is highly susceptible to temperature fluctuations during the test period. A 1°C change during the 5 minute test period will cause a pressure change of 30 mm water gauge or 60% of the permitted change.
2. Failure to soak ceramic and concrete pipes can cause highly variable results.

8.3 High pressure air test

a) Pressurise pipeline to 25 kPa.

b) Wait at least 2 minutes to ensure temperature stabilisation.

c) Disconnect air supply.

d) Measure the time taken (minutes) for the pressure to drop to 17 kPa.

e) The pipeline is acceptable if the time taken exceeds that given for the appropriate pipe size in Table 6.

Table 6: Time For Pressure Drop Versus Internal Pipe Diameter
Paragraph 8.3 e)

Internal pipe diameter (mm)	Time for permissable pressure drop (minutes)
90	3
100	3
150	4
225	6

9.0 Disposal to Soak Pit

9.0.1 Where the collected *surface water* is to be discharged to a soak pit, the suitability of the natural ground to receive and dispose of the water without causing damage or nuisance to neighbouring property, shall be demonstrated to the satisfaction of the *territorial authority.*

COMMENT:
Means of demonstrating the suitability of the ground are outside of the scope of this Verification Method. Disposal of *surface water* to a soak pit may also require a resource management consent.

9.0.2 Field testing of soakage shall be carried out as follows:

a) Bore test holes of 100 mm to 150 mm diameter to the depth of the proposed soak pit. If groundwater is encountered in the bore test hole then this depth shall be taken as the depth of the soak pit.

b) Fill the hole with water and maintain full for at least 4 hours, (unless the soakage is so great that the hole completely *drains* in a short time).

c) Fill the hole with water to within 750 mm of ground level, and record the drop in water level against time, at intervals of no greater than 30 minutes, until the hole is almost empty, or over 4 hours, whichever is the shortest.

d) Plot the drop in water level against time on a graph, and the soakage rate in mm/hr is determined from the minimum slope of the curve. If there is a marked decrease in soakage rate as the hole becomes nearly empty, the lower rates may be discarded and the value closer to the average can be adopted.

9.0.3 The soak pit shall be designed utilising soakage and storage in accordance with 9.0.5 and 9.0.6 to ensure that *surface water* is discharged without overflowing. The rainfall intensity used in the design of the soak pit shall be that of an event having a duration of 1 hour and a 10% probability of occurring annually. Either local rainfall intensity curves produced by the *territorial authority* or rainfall frequency duration information produced by NIWA shall be used to determine the rainfall intensity.

COMMENT:
This Verification Method does not cover the design of soak pits with overflows discharging to *outfalls*. Such soak pits are often provided to retain water until peak flows in the *outfall* have passed and it is normally considered sufficient to design them for an event having a 10 minute duration and a 10% probability of occurring annually.

9.0.4 The soak pit shall comprise either a rock filled hole (see Figure 13 (a)) or a lined chamber (see Figure 13 (b)). Both of these options shall be enclosed in filter cloth complying with AS 3706.1. The filter cloth shall have a mass per unit area of 140 grams/m^2 and a minimum thickness of 0.45 mm.

9.0.5 The volume of storage required in the soak pit, V_{stor} (m^3), shall be calculated by:

$V_{stor} = R_c - V_{soak}$

where

R_c = run-off discharged from catchment to soak pit in 1 hour (m^3).

V_{soak} = volume disposed of by soakage in 1 hour (m^3).

and

R_c = 10CIA

where

C = run-off coefficient (see Table 1).

I = rainfall intensity (mm/hr) based on 1 hour duration of an event having a 10% probability of occurring annually.

Amend 5 Jul 2001

A = area (hectares) of the catchment discharging to the soak pit.

and

$V_{soak} = A_{sp}S_r/1000$

where

A_{sp} = area of the base of the soak pit (m^2).

S_r = soakage rate (mm/hr) determined from 9.0.2.

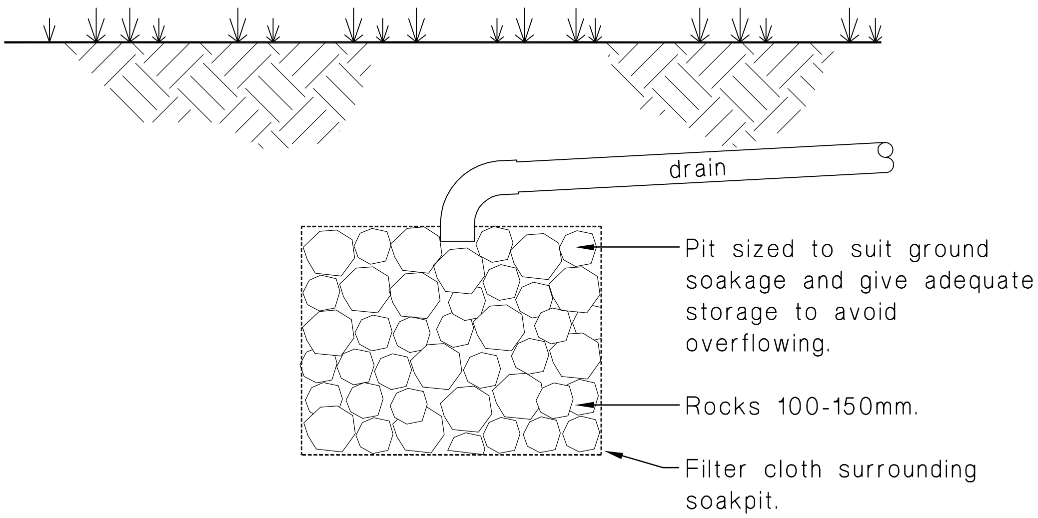
COMMENT:

Generally where the test results show a soakage rate of greater than 500 mm/hour, soakage rather than storage will be the main mechanism to remove the water. Where the soakage rate is significantly less than 500 mm/hour, storage will become the dominant factor. Intermediate soakage rates will require a design utilising both in the proportions necessary to ensure the water will dissipate before it overflows from the pit.

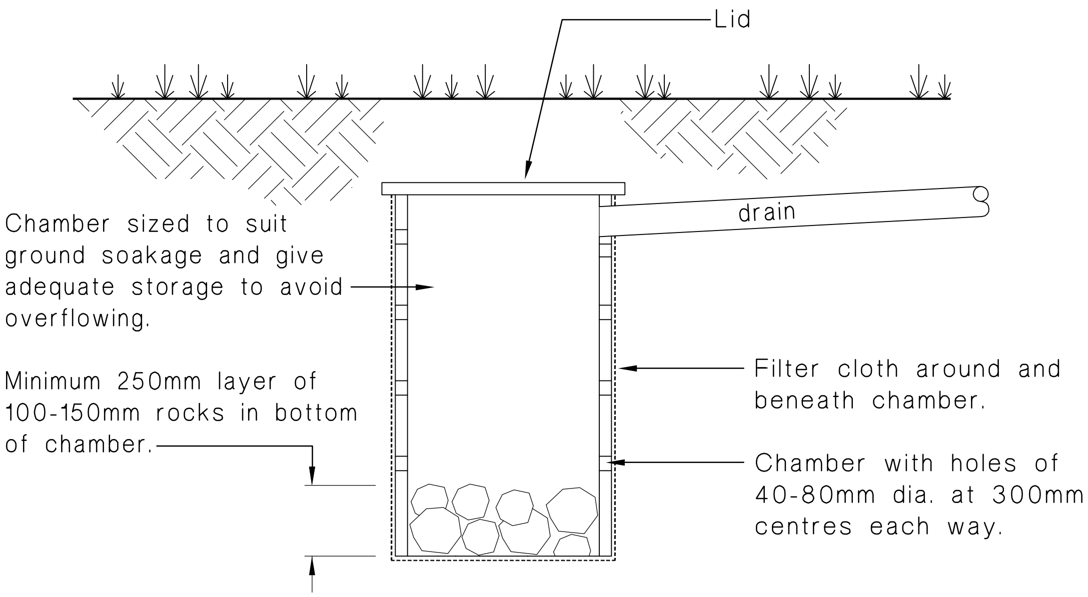
9.0.6 Where the soak pit comprises a rock filled hole (see Figure 13 (a)) then the volume of the hole shall be calculated as V_{stor} divided by 0.38.

Amend 10 Jan 2017

Figure 13: Soak Pit for Surface Water Disposal
Paragraph 9.0.4



(a) Rock soak pit



(b) Chamber soak pit

Acceptable Solution E1/AS1

1.0 Limitations of the Solution

1.0.1 This Acceptable Solution is limited to *buildings* and *sitework* having a catchment area of no more than 0.25 hectares and which are:

a) Free from a history of flooding,

b) Not adjacent to a watercourse,

c) Not located in low lying area, and

d) Not located in a *secondary flow path.*

COMMENT:
Boundary fences and other site development must not significantly hamper the flow of *surface water* from the site.

2.0 Minimum Acceptable Floor Level

2.0.1 Suspended floors and slabs on ground shall be at least 150 mm above the finished level of the surrounding ground immediately adjacent to the *building*, and:

a) For sites level with or above the road, no less than 150 mm above the road crown on at least one cross-section through the *building* and roadway (see Figure 1).

b) For sites below the road, no less than 150 mm above the lowest point on the site boundary (see Figure 2).

Figure 1: Minimum Floor Level for Site Above Road
Paragraph 2.0.1 a)

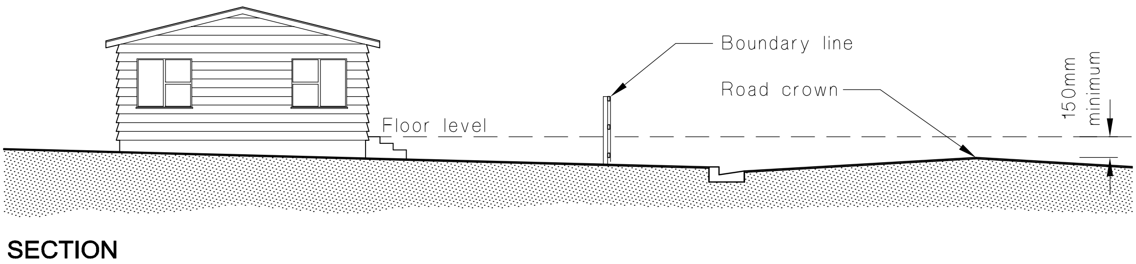
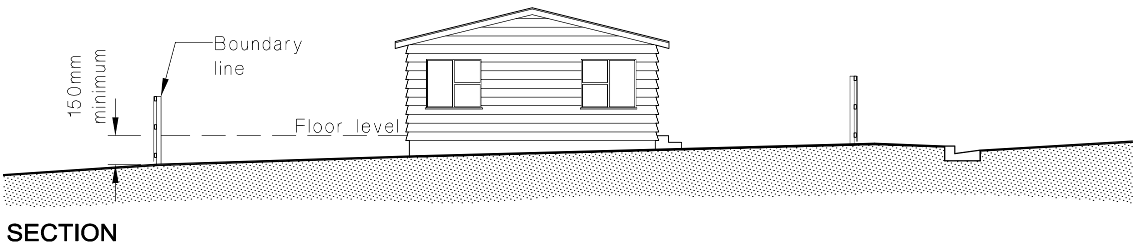


Figure 2: Minimum Floor Level for Site Below Road
Paragraph 2.0.1 b)



3.0 Drainage System Materials and Construction

3.1 Materials

3.1.1 Pipe materials shall comply with the standards given in Table 1.

Table 1: Acceptable Pipe Materials
Paragraphs 3.1.1 and 3.9.2

Concrete	AS/NZS 4058
Vitrified clay	AS 1741
Steel	NZS 4442 or AS 1579
Ductile iron	AS/NZS 2280
PVC-U	AS/NZS 1260 or AS/NZS 1254
Polyethylene	AS/NZS 4130 or AS/NZS 5065
Polypropylene	AS/NZS 5065

Amend 7 Sep 2010
Amends 8 and 11

3.2 Sizing of drains

3.2.1 *Drains* shall be of sufficient size and gradient to transport *surface water* from the site, and be capable of handling the rainfall calculated to fall on roof and paved areas of the site during a storm with a 10% probability of occurring annually. No *drain* shall have an internal diameter of less than 85 mm.

Amend 1 Sep 1993

3.2.2 Figure 3 provides a method for selecting the correct pipe size for a calculated modified catchment area, given as:

Modified catchment area = 0.01 AI,

where

A = area being drained comprising plan roof area (m^2) plus paved area (m^2). Paved area includes paving blocks, concrete, asphalt or metalled surfaces.

I = rainfall intensity for a storm with a 10% probability of occurring annually and a 10 minute duration (mm/hr).

The rainfall intensity (I) shall be obtained from the *territorial authority* or from the Table in Appendix A.

COMMENT:
Where there are differences between the design rainfall intensities obtained from the above sources for a particular location, the most conservative rainfall intensity should be used for design calculations.

Territorial Authorities may refer to any available Regional Council rainfall data to establish design rainfall intensities for their city or district.

Amend 11 Nov 2020

3.2.3 The modified catchment area method is only suitable for the combination of pipe sizes, gradients and areas indicated in Figure 3. For other combinations specific design is required.

3.3 Alignment and gradient of drains

3.3.1 *Drains* shall be laid on a uniform line and gradient between points of access (see Paragraph 3.7). The change in direction of a *drain* shall not exceed 90° at any point, and where practical should be kept to less than 45° as illustrated in Figure 4.

3.3.2 Where two *drains* intersect, the directions of flow as shown in Figure 5 shall be at an angle of 60° or less.

3.4 Minimum gradients

3.4.1 Minimum acceptable gradients for *surface water drains* are given in Table 2.

Table 2: Minimum Gradients
Paragraph 3.4.1

Drain internal diameter	Minimum gradient
85 mm	1 in 90
100 mm	1 in 120
150 mm	1 in 200
225 mm	1 in 350

Amend 1 Sep 1993

3.4.2 Restricted fall to outlet

Where the *surface water sewer*, road channel or other *outfall* is at too high a level to allow the gradient required by Table 2, the bubble-up chamber system shown in Figures 6 and 7 may be used provided that:

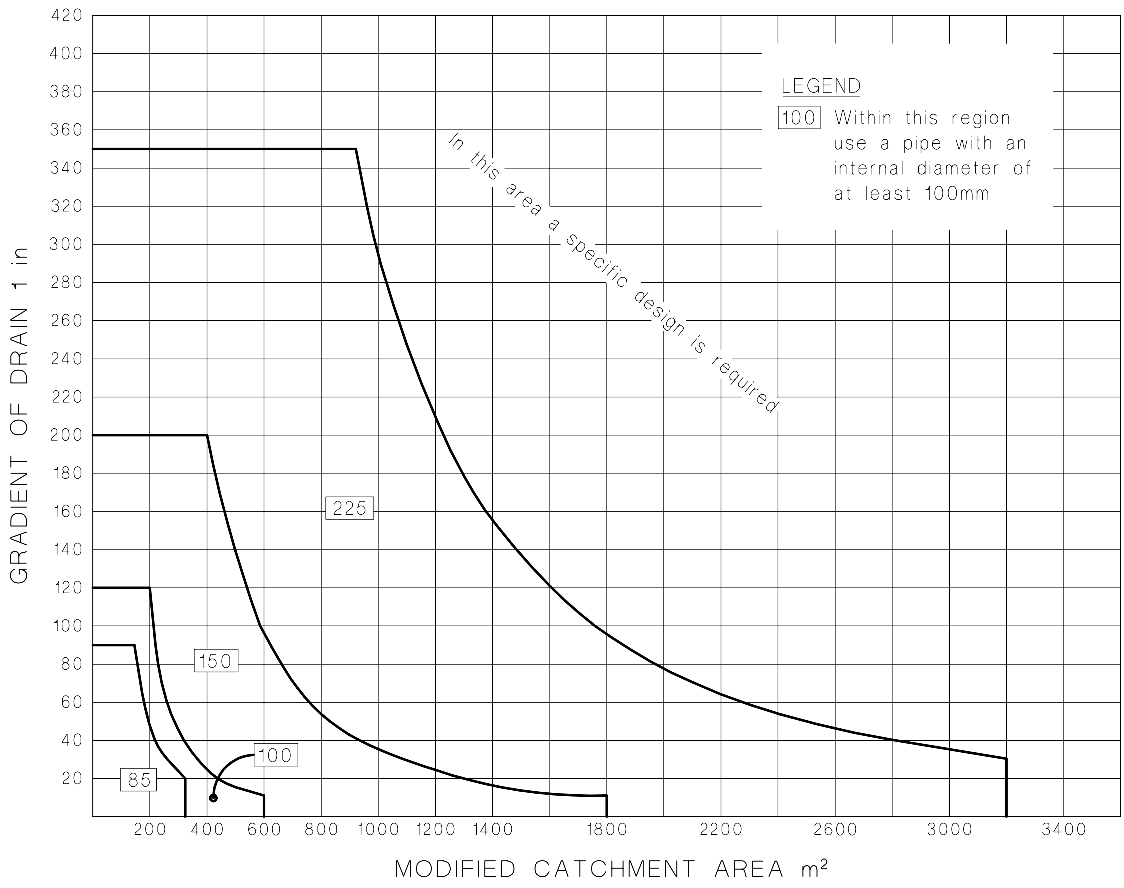
a) The ground level adjacent to any downpipe discharging to the bubble-up chamber is at least 150 mm higher than the level of the top of the chamber outlet.

b) The connections between the *drain* and downpipes are sealed.

Continued on page 36

Amend 11 Nov 2020

Figure 3: Sizing of Surface Water Drains
Paragraphs 3.2.2 and 3.2.3



Amend 1
Sep 1993

Figure 4: Changes of Direction
Paragraph 3.3.1

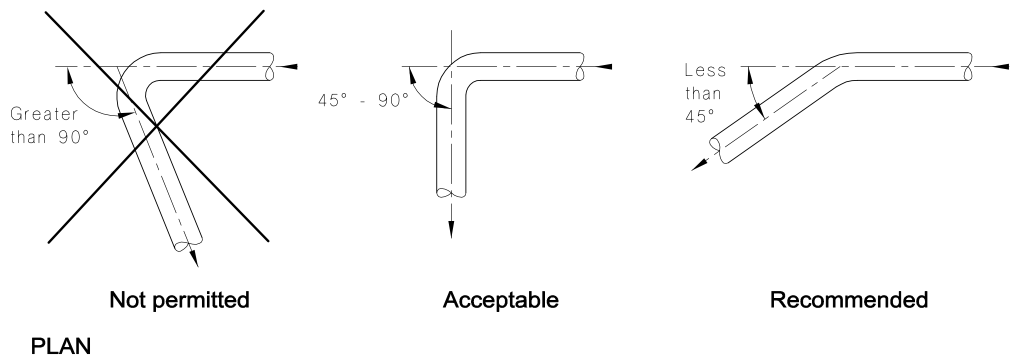


Figure 5: Junction of Drains
Paragraph 3.3.2

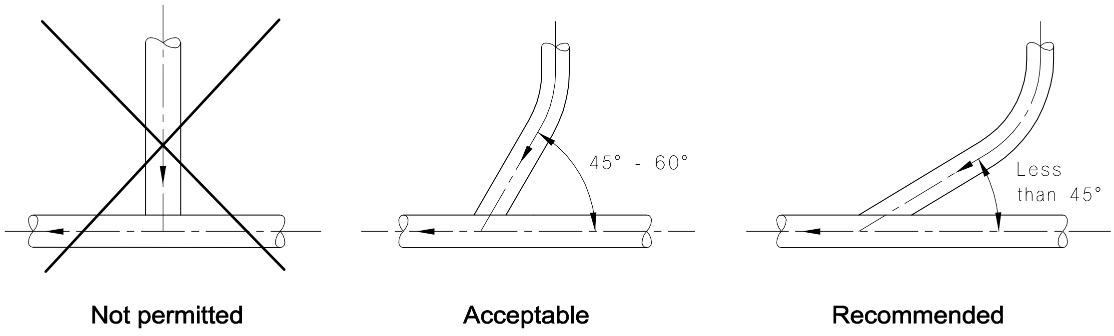
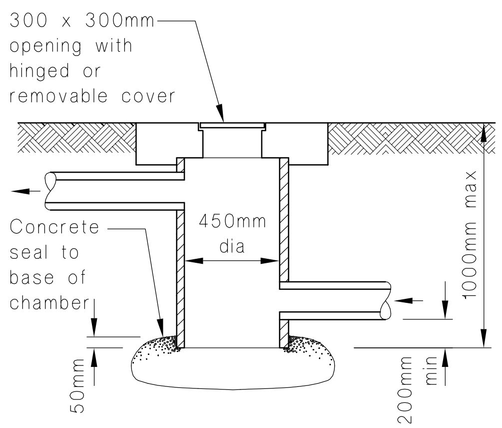


Figure 6: Bubble-up Chamber
Paragraph 3.4.2



c) The total chamber depth does not exceed 1.0 m.

COMMENT:

The bubble-up chamber allows the water to be discharged through pipes laid at the allowable minimum gradients, and for the convenient collection and removal of any silts or debris which might enter the system.

3.5 Jointing of drains

3.5.1 All joints in *drains* shall be watertight and prevent the infiltration of groundwater and the intrusion of tree roots.

3.5.2 Acceptable jointing methods and the relevant standards are given in Table 3. Jointing of *drains* shall be subject to the tests called for in Paragraph 3.8.

3.5.3 Where a *drain* consists of concrete, ceramic, vitrified clay or rubber ring jointed steel or uPVC, a flexible joint shall be installed within 225 mm of the outside wall of any *access chamber* or *inspection chamber*, but outside the line of the base (see Figures 11 and 12).

COMMENT:
This allows for differential settlement between the *access chamber,* or the *inspection chamber,* and the pipeline while minimizing damage to the pipeline.

3.6 Surface water inlets to drains

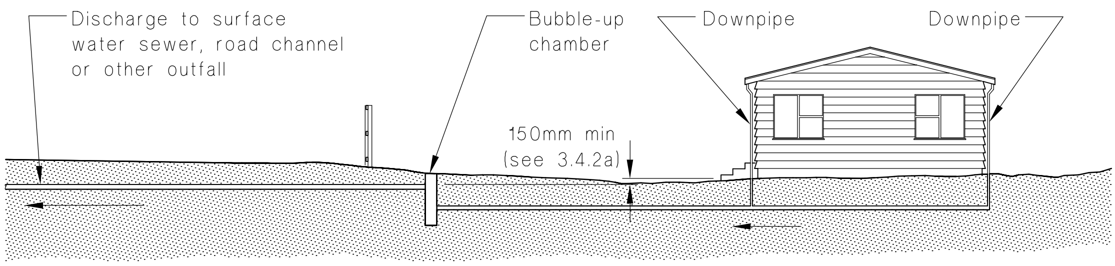
3.6.1 All *surface water*, except that collected directly from a roof, shall enter the *drain* via a *sump* which has:

a) A grating, hinged or removable for maintenance access. The grating shall comprise at least 35% openings. The smaller dimension of any individual opening shall not exceed 35 mm,

b) Capacity at the bottom for settlement of silt and debris, and

c) A submerged (or trapped) outlet which prevents floatable solids entering the *drain*.

Figure 7: Longitudinal Section of Bubble-up Chamber System
Paragraph 3.4.2



SECTION

Table 3: Acceptable Jointing Methods
Paragraph 3.5.2

Amend 7 Sep 2010

Amend 8 Oct 2011

Pipe material	Jointing method	Standard
Concrete	Elastomeric ring	AS 1646
Steel	Elastomeric ring, welded or flanged	NZS 4442, BS EN 1759.1
Ductile iron	Elastometric ring or flanged	AS/NZS 2280
PVC-U	Electromeric ring or solvent welded	AS 1646, AS/NZS 2032, AS/NZS 1254
Polyethylene	Heat welded or flanged	AS/NZS 2033
Polypropylene		AS/NZS 2566.2

Amend 11 Nov 2020

COMMENT:
For compliance with this Acceptable Solution, *surface water* collected directly from a roof should discharge directly to a *drain*, and should not enter the *drain* via a *sump.*

3.6.2 Two different *sumps* are shown in Figures 8 and 9. The *sump* shown in Figure 8 is suitable for an area of up to 4500/I m^2 and the *sump* illustrated by Figure 9 is suitable for an area up to 40,000/I m^2, where I is the rainfall intensity for a storm with a 10% probability of occurring annually. (See Paragraph 3.2.2.)

3.7 Access for maintenance

3.7.1 Access for maintenance shall be provided on all *drains*. Access is to be achieved via an *inspection point*, *rodding point*, *inspection chamber* or *access chamber*, complying as appropriate with Figures 10, 11 or 12.

COMMENT:
Rodding points rather than *inspection points* are preferred in landscaped or sealed areas.

3.7.2 Points of access shall be spaced at no further than:

a) 50 m where *rodding points* are used.

b) 100 m where *inspection points*, *inspection chambers* or *access chambers* are used.

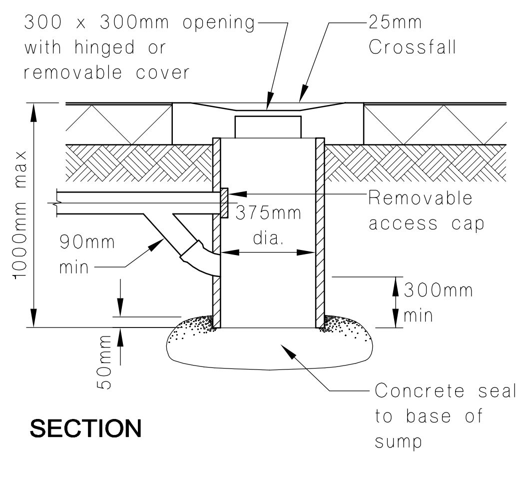
3.7.3 Points of access are required at:

a) Changes in direction of greater than 45°,

b) Changes in gradient of greater than 45°, and

c) Junctions of *drains* other than a *drain*, serving a single downpipe, that is less than 2.0 m long.

Figure 8: **Type-one Surface Water Sump**
Paragraph 3.6.2



3.7.4 *Inspection chambers* or *access chambers* (see Figures 11 and 12) shall be provided where changes in both gradient and direction occur and where either is greater than 22.5°. Amend 1 Sep 1993

3.7.5 Where the depth to the invert of the *drain* exceeds 1.0 m, an *inspection chamber* is not acceptable and an *access chamber* shall be used.

3.7.6 Drain under buildings

Any *drain* laid under a *building* shall be run in a straight line from one side to the other.

3.7.7 Access to a *drain* laid under a *building* shall be provided immediately outside the *building*. These points of access shall be located within 2.0 m of an exterior wall.

3.7.8 Under a *building* the only acceptable inlets to a *drain* are from sealed roof-water downpipes. Access shall be provided to the *drain* via a sealed access point in the downpipe immediately above ground floor level.

Figure 9: **Type-two Surface Water Sump**
Paragraph 3.6.2

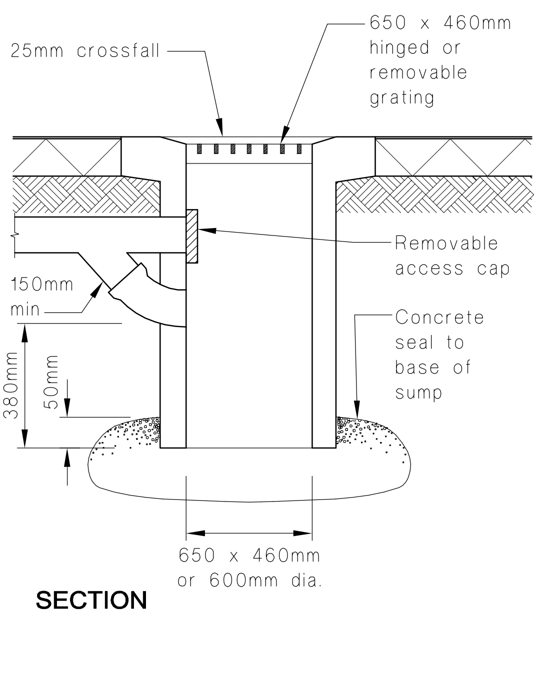


Figure 10: **Typical Rodding Point**
Paragraph 3.7.1

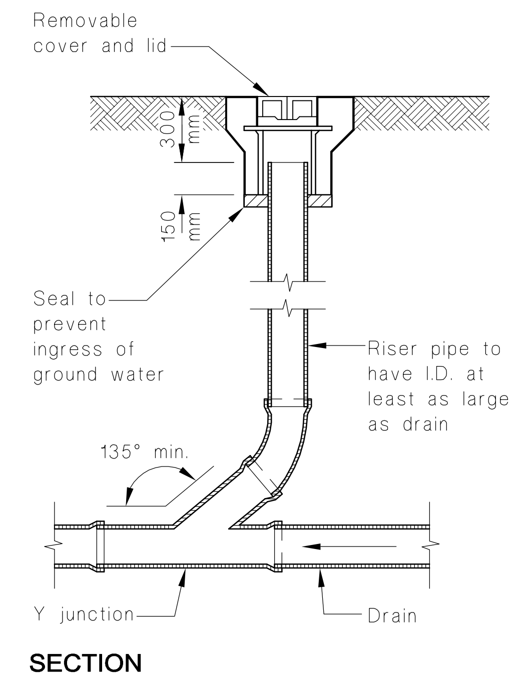
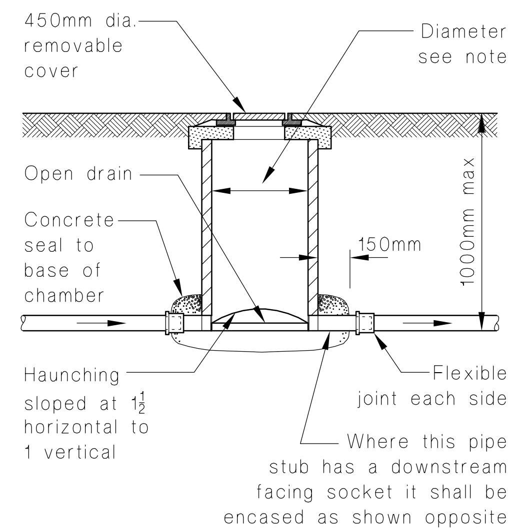
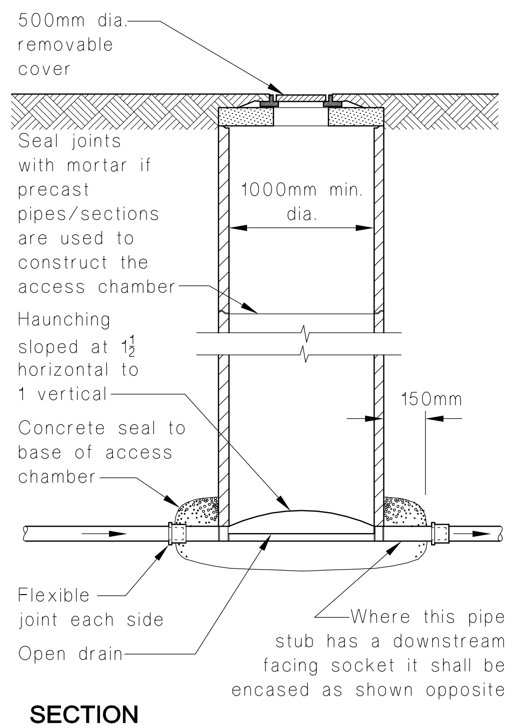


Figure 11: Typical Inspection Chamber
Paragraphs 3.5.3, 3.7.1 and 3.7.4



NOTE:
Inspection chamber diameter to be:
-450 mm for drains 100 mm dia or less.
-600 mm for drains greater than 100 mm dia.

Figure 12: Typical Access Chamber
Paragraphs 3.5.3, 3.7.1 and 3.7.4



3.8 Testing of drains

3.8.1 *Surface water drains* shall be capable of passing one of the tests described in E1/VM1 Paragraph 8.0. Amend 5 Jul 2001

3.9 Bedding and backfilling

3.9.1 General

NZBC B1 requires all *drains* be constructed to withstand the combination and frequency of loads likely to be placed upon them without collapse, undue damage, undue deflection or undue vibration. In addition, *adequate* support needs to be provided to prevent gradients becoming less than those required by Paragraph 3.4.1 as a result of:

a) Differential settlement, or

b) Deflection of an unsupported span.

3.9.2 Bedding and backfilling

Figure 13 gives acceptable solutions for the bedding and backfilling of the drainage pipes listed in Table 1 except where:

a) The trench is located within or above peat, or

b) Scouring of the trench is likely due to unstable soils, or

c) The horizontal separation between any *building* foundation and the underside of the pipe trench is less than that required by Paragraph 3.9.7, or

d) The cover H to the pipe is more than 2.5 m.

3.9.3 Trench slope

Where the slope of the trench is 1 in 8 or greater, anti-scour blocks shall be provided. These anti-scour blocks shall be:

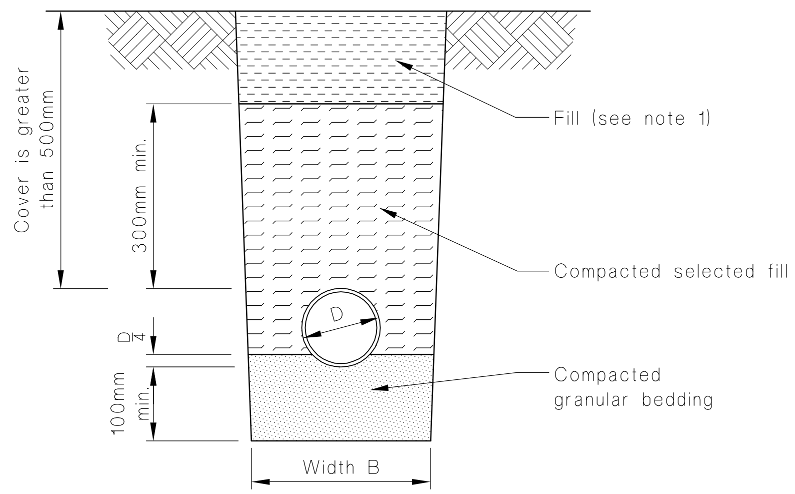
a) Constructed from 150 mm thick concrete (17 MPa),

b) Keyed into the sides and floor of the trench by 150 mm,

c) Extended to 300 mm above the *drain* or to ground level where the *drain* cover is less than 300 mm, and

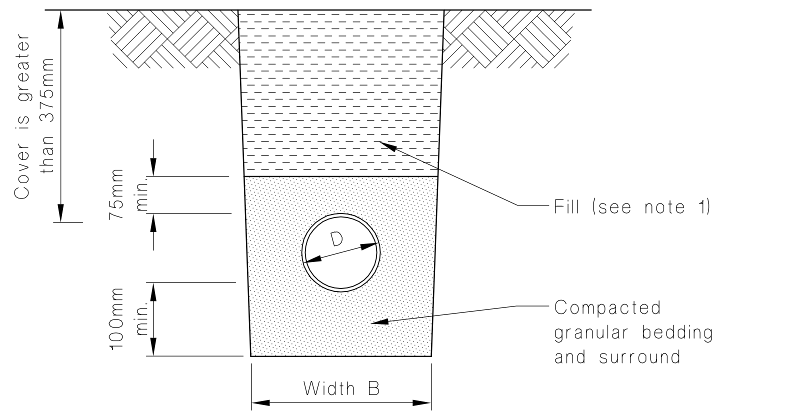
Continued on page 41

Figure 13: Bedding and backfilling
Paragraphs 3.9.2, 3.9.4 and 3.9.5



Amends 1 and 11

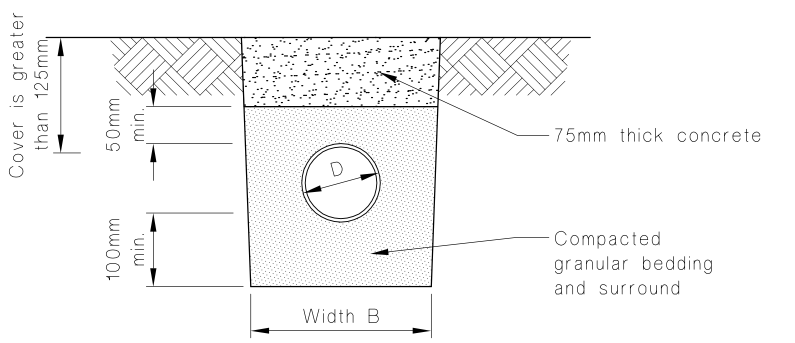
(a) Cover greater than 500mm



Amend 1 Sep 1993

Amends 1 and 11

(b) Cover greater than 375mm



Amend 1 Sep 1993

Amends 1 and 11

(c) Cover greater than 125mm

Amend 1 Sep 1993

NOTE:
1. Fill shall be:
-Ordinary fill where drains are located below gardens and open country.
-Compacted selected fill where the drains are located below residential driveways and similar areas subjected to light traffic.

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 ± 25 mm by 75 ± 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.

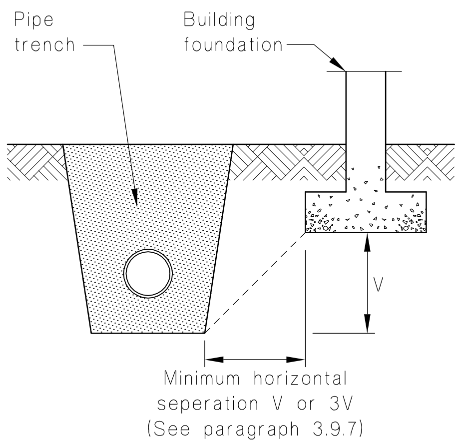
3.9.7 Proximity of trench to building

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.

Table 4: Acceptable Material Standards for Downpipes
Paragraph 4.1.1

Amend 1 Sep 1993 Amend 2 Aug 1994 Amend 8 Oct 2011 Amend 7 Sep 2010

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

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.

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/VM1 Paragraph 8.3. Amend 5 Jul 2001

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.

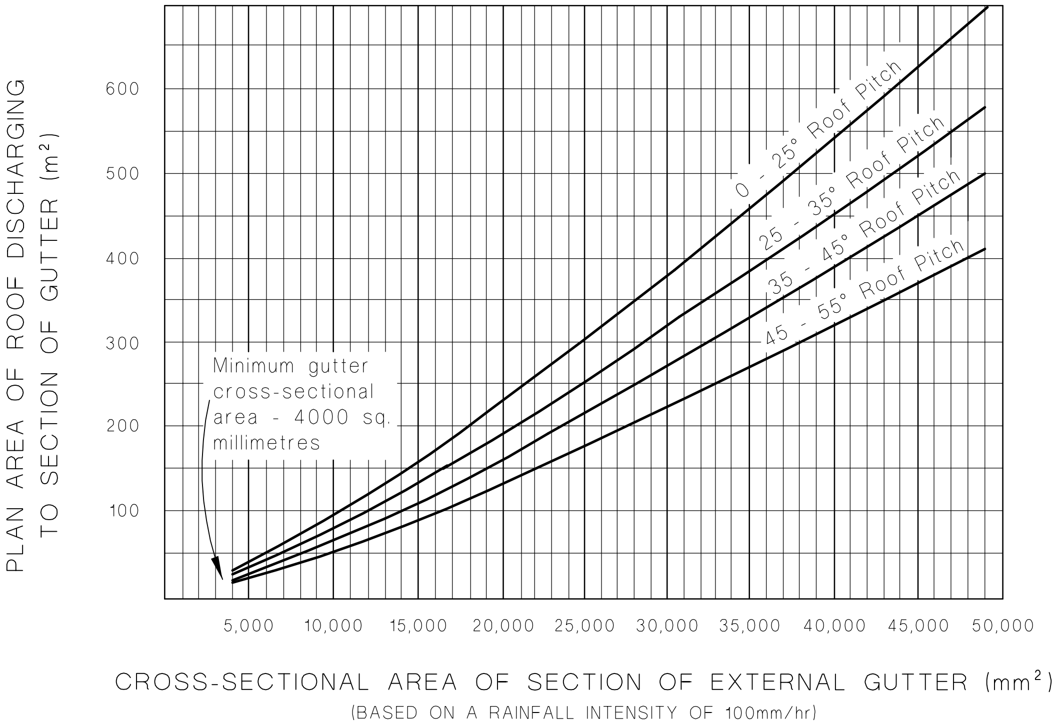
5.1.3 Figures 15 and 16 are based on a rainfall intensity "I" of 100 mm/hr. Where "I" exceeds 100 mm/hr the required gutter size shall be increased by taking the value read from the figures and multiplying it by the ratio of "I"/100. Paragraph 3.2.2 describes how to determine the value of "I". Amend 2 Aug 1994 Amend 2 Aug 1994 Amend 1 Sep 1993

Table 5: Downpipe Sizes for Given Roof Pitch and Area
Paragraph 4.2.1

Amend 1 Sep 1993 Amend 2 Aug 1994

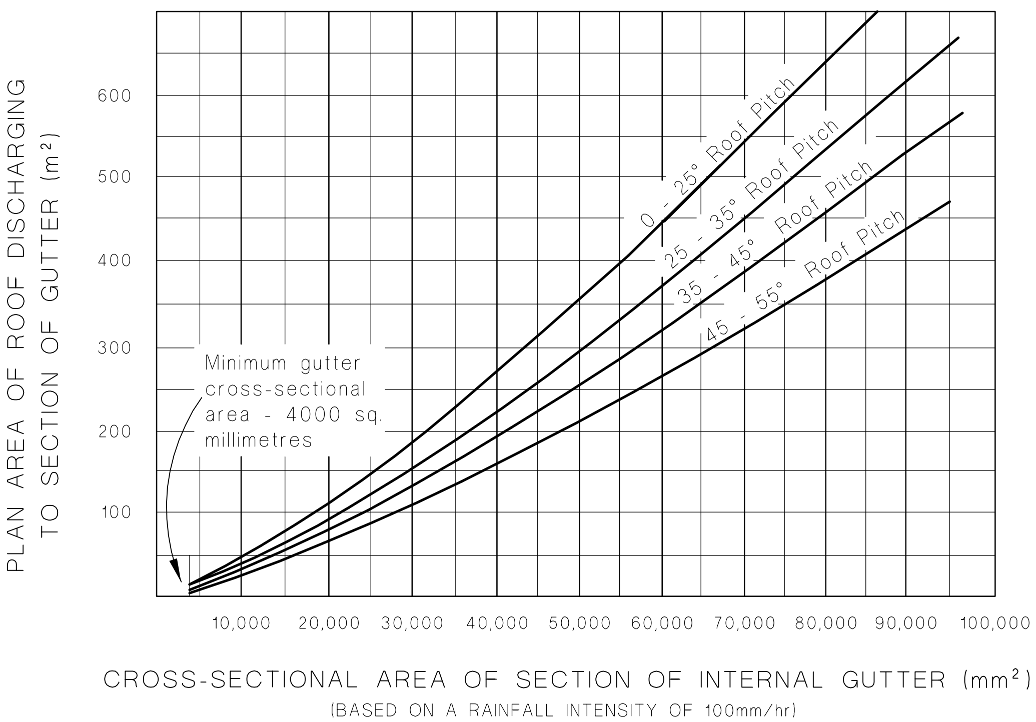
Downpipe size (mm) (minimum internal sizes)	Roof pitch **0-25°**	**25-35°**	**35-45°**	**45-55°**
	Plan area of roof served by the downpipe (m^2)			
63 mm diameter	60	50	40	35
74 mm diameter	85	70	60	50
100 mm diameter	155	130	110	90
150 mm diameter	350	290	250	200
65 x 50 rectangular	60	50	40	35
100 x 50 rectangular	100	80	70	60
75 x 75 rectangular	110	90	80	65
100 x 75 rectangular	150	120	105	90

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 mm².

5.1.5 Internal gutters shall be constructed with:

a) A minimum width of 300 mm, and

b) Freeboard allowance of at least 30 mm greater depth than that determined from Figure 16 in situations where overtopping could enter a *building.*

COMMENT:
Refer to Acceptable Solution E2/AS1 for the design of valley gutters.

Amend 11 Nov 2020

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 6: Acceptable Material Standards for Roof Gutters
Paragraph 5.2.1

PVC-U	AS 1273
Galvanised steel	AS 1397
Copper	BS EN 1172
Aluminium	AS/NZS 1734
Stainless steel	NZS/BS 970
Zinc aluminium	AS 1397

Amends 2 and 11

Amend 7 Sep 2010

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

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

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

E1/AS1 Appendix A Rainfall Intensities

Table A: Rainfall Intensities
10 minute duration rainfall intensities for various locations in New Zealand

Location	Latitude degrees	Longitude degrees	10% AEP intensity mm/hr	2% AEP intensity mm/hr
NORTHLAND				
Taipa Bay-Mangōnui	-35	173.5	86	117
Awanui	-35.05	173.25	85	116
Kaeo	-35.1	173.78	91	123
Kaitaia	-35.11	173.26	86	117
Ahipara	-35.17	173.17	86	116
Kerikeri	-35.23	173.95	101	135
Russell	-35.27	174.12	109	147
Paihia	-35.29	174.09	110	148
Ōkaihau	-35.32	173.77	97	130
Ōhaeawai	-35.35	173.88	99	132
Moerewa	-35.38	174.02	108	144
Kawakawa	-35.38	174.07	110	147
Rawene	-35.4	173.5	85	114
Kaikohe	-35.41	173.81	94	125
Ōmāpere and Opononi	-35.51	173.4	85	114
Whangārei	-35.72	174.3	103	140
Maungatapere	-35.75	174.2	101	137
Dargaville	-35.95	173.87	82	110
Te Kōpuru	-36.03	173.92	83	112
Mangawhai Heads	-36.05	174.59	94	130
Kaiwaka	-36.1	174.39	90	123
Maungaturoto	-36.12	174.35	89	121
Ruawai	-36.13	174.03	83	112
AUCKLAND				
Leigh	-36.19	174.63	95	130
Snells Beach	-36.21	174.69	93	127
Algies Bay-Mahurangi	-36.26	174.76	92	124
Wellsford	-36.3	174.52	100	135
Parakai	-36.38	174.45	95	128
Warkworth	-36.4	174.66	99	134
Muriwai Beach	-36.52	174.69	98	129
Helensville	-36.68	174.45	95	125
North Shore	-36.81	174.79	98	129
Waiheke Island	-36.81	175.12	102	137
Auckland	-36.87	174.77	97	127
Waitākere	-36.91	174.69	97	128
Manukau	-36.97	174.82	93	121
Bombay	-37.05	174.95	97	129
Pukekohe	-37.2	174.9	97	131
Waiuku	-37.25	174.73	92	122

Amend 11
Nov 2020

Amend 11 Nov 2020

Table A: Rainfall Intensities continued
10 minute duration rainfall intensities for various locations in New Zealand

Location	Latitude degrees	Longitude degrees	10% AEP intensity mm/hr	2% AEP intensity mm/hr
WAIKATO				
Coromandel	-36.74	175.5	96	132
Pauanui	-37.02	175.86	97	137
Te Puru-Thornton Bay	-37.04	175.52	91	127
Thames	-37.14	175.53	88	124
Whangamatā	-37.21	175.86	97	137
Ngatea	-37.27	175.5	88	123
Kerepehi	-37.3	175.53	87	121
Meremere	-37.32	175.07	96	132
Paeroa	-37.38	175.67	88	125
Te Kauwhata	-37.4	175.15	92	127
Waihi	-37.4	175.83	107	152
Te Aroha	-37.53	175.7	94	135
Huntly	-37.56	175.16	91	125
Waitoa	-37.6	175.63	90	129
Morrinsville	-37.65	175.53	91	130
Waharoa	-37.75	175.75	89	129
Hamilton	-37.78	175.27	92	129
Raglan	-37.8	174.86	89	121
Matamata	-37.82	175.77	89	129
Cambridge	-37.89	175.45	91	129
Te Awamutu	-38.02	175.32	92	129
Putāruru	-38.05	175.78	85	121
Mamaku	-38.06	176.05	102	143
Otorohanga	-38.18	175.19	94	132
Tokoroa	-38.23	175.84	85	121
Te Kuiti	-38.33	175.17	96	136
Mangakino	-38.38	175.74	75	107
Piopio	-38.47	175.02	95	134
Reporoa	-38.5	176.36	84	121
Taupō	-38.7	176.07	73	107
Tūrangi	-38.99	175.79	71	103
BAY OF PLENTY				
Waihi Beach	-37.4	175.93	99	141
Island View - Pios Beach	-37.46	175.99	95	136
Katikati	-37.56	175.9	93	133
Tauranga	-37.68	176.17	101	145
Maketu	-37.77	176.45	109	156
Te Puke	-37.78	176.33	103	148
Paengaroa	-37.82	176.42	106	152
Te Kaha	-37.82	177.67	96	136
Matatā	-37.89	176.75	116	163

Table A: Rainfall Intensities continued
10 minute duration rainfall intensities for various locations in New Zealand

Location	Latitude degrees	Longitude degrees	10% AEP intensity mm/hr	2% AEP intensity mm/hr
Edgecumbe	-37.97	176.83	112	160
Whakatāne	-37.97	176.99	100	142
Ōpōtiki	-38.01	177.28	102	146
Te Teko	-38.03	176.8	98	139
Tāneatua	-38.07	176.98	95	135
Kawerau	-38.1	176.7	95	136
Rotorua	-38.14	176.26	96	136
Kaingaroa Forest	-38.36	176.68	91	128
Murupara	-38.45	176.7	84	119
GISBORNE				
Ruatoria	-37.9	178.32	80	119
Tokomaru Bay	-38.12	178.3	68	103
Patutahi	-38.38	177.53	59	83
Tolaga Bay	-38.37	178.3	61	93
Manutuke	-38.41	177.55	52	74
Te Karaka	-38.47	177.87	47	73
Gisborne	-38.66	178.02	67	102
MANAWATU-WHANGANUI				
Ōhura	-38.85	174.98	86	124
Taumarunui	-38.88	175.26	84	123
Ohakune	-39.41	175.41	77	111
Raetihi	-39.42	175.27	90	130
Waiouru	-39.47	175.67	62	91
Taihape	-39.68	175.78	65	97
Whanganui	-39.93	175.03	68	100
Hunterville	-39.93	175.57	70	103
Rātana	-40.03	175.17	66	96
Marton	-40.08	175.38	69	101
Halcombe	-40.13	175.48	73	107
Bulls	-40.17	175.38	71	102
Sanson	-40.22	175.42	70	102
Feilding	-40.22	175.57	69	101
Dannevirke	-40.21	176.09	77	119
Rongotea	-40.3	175.42	67	97
Himatangi Beach	-40.32	175.24	66	93
Woodville	-40.33	175.87	66	99
Palmerston North	-40.36	175.62	65	94
Pahiatua	-40.45	175.83	61	91
Foxton	-40.47	175.28	71	100
Tokomaru	-40.47	175.5	68	98
Shannon	-40.55	175.4	70	100
Levin	-40.61	175.27	74	104

Amend 11 Nov 2020

Amend 11
Nov 2020

Table A: Rainfall Intensities continued
10 minute duration rainfall intensities for various locations in New Zealand

Location	Latitude degrees	Longitude degrees	10% AEP intensity mm/hr	2% AEP intensity mm/hr
Te Horo	-40.63	175.19	76	107
Eketāhuna	-40.65	175.7	73	105
HAWKES BAY				
Tuai	-38.82	177.15	69	98
Frasertown	-38.97	177.4	70	103
Wairoa	-39.04	177.42	82	121
Nūhaka	-39.03	177.75	84	126
Napier	-39.5	176.89	69	105
Hastings	-39.64	176.83	62	95
Ōtāne	-39.9	176.62	69	106
Waipawa	-39.95	176.57	67	104
Waipukurau	-40	176.56	65	100
Takapau	-40.03	176.35	72	113
TARANAKI				
Waitara	-39	174.23	98	136
Urenui	-39	174.38	95	133
New Plymouth	-39.05	174.07	100	138
Egmont Village	-39.14	174.12	114	158
Inglewood	-39.15	174.2	117	163
Ōkato	-39.2	173.88	111	153
Rahotu	-39.28	173.78	99	137
Stratford	-39.35	174.27	99	138
Kaponga	-39.43	174.15	94	132
Eltham	-39.43	174.3	97	137
Ōpunake	-39.46	173.84	87	121
Manaia	-39.55	174.12	83	117
Hāwera	-39.59	174.28	84	119
Pātea	-39.75	174.47	79	112
Waverley	-39.77	174.63	80	115
TASMAN				
Tākaka	-40.85	172.8	78	108
Riwaka	-41.05	173	77	108
Motueka	-41.11	173.02	68	94
Brightwater	-41.38	173.1	80	115
Wakefield	-41.4	173.05	81	117
Murchison	-41.8	172.33	56	85
WELLINGTON				
Ōtaki	-40.75	175.13	82	114
Kapiti	-40.94	174.99	75	103
Masterton	-40.95	175.67	54	80
Carterton	-41.02	175.52	57	83
Greytown	-41.08	175.45	57	82

Table A: Rainfall Intensities continued
10 minute duration rainfall intensities for various locations in New Zealand

Location	Latitude degrees	Longitude degrees	10% AEP intensity mm/hr	2% AEP intensity mm/hr
Upper Hutt	-41.12	175.07	72	99
Featherston	-41.12	175.32	63	88
Porirua	-41.13	174.83	76	105
Mākara-Ohariu	-41.2	174.75	74	102
Lower Hutt	-41.21	174.91	72	100
Martinborough	-41.22	175.44	54	77
Wellington	-41.28	174.77	70	97
WEST COAST				
Hector-Ngakawau	-41.63	171.87	84	122
Westport	-41.75	171.58	101	145
Reefton	-42.11	171.87	71	103
Blackball	-42.3	171.49	92	132
Dobson	-42.39	171.44	93	133
Greymouth	-42.45	171.21	95	133
Hokitika	-42.72	170.97	104	144
Ross	-42.9	170.82	110	149
Franz Josef/ Waiau	-43.38	170.17	92	124
Fox Glacier	-43.42	170.05	99	133
NELSON				
Nelson	-41.27	173.3	77	107
MARLBOROUGH				
Havelock	-41.28	173.77	70	98
Picton	-41.3	174.01	59	83
Blenheim	-41.52	173.95	48	69
Seddon	-41.67	174.07	49	70
CANTERBURY				
Kaikōura	-42.4	173.69	53	79
Hanmer Springs	-42.52	172.83	46	72
Culverden	-42.77	172.85	43	67
Cheviot	-42.81	173.26	45	70
Amberley	-43.15	172.72	42	65
Rangiora	-43.3	172.6	46	71
Oxford	-43.3	172.18	60	93
Woodend	-43.32	172.67	42	65
Cust	-43.32	172.37	53	84
Darfield	-43.48	172.12	47	75
Christchurch	-43.53	172.62	39	62
Rolleston	-43.58	172.38	48	77
Lyttelton	-43.60	172.72	26	41
Burnham Military Camp	-43.61	172.32	47	75
Lincoln	-43.63	172.48	51	82
Methven	-43.63	171.63	54	83

Amend 11
Nov 2020

Table A: Rainfall Intensities continued
10 minute duration rainfall intensities for various locations in New Zealand

Location	Latitude degrees	Longitude degrees	10% AEP intensity mm/hr	2% AEP intensity mm/hr
Dunsandel	-43.67	172.2	46	74
Tai Tapu	-43.68	172.54	41	65
Aoraki/Mount Cook	-43.66	170.17	72	102
Rakaia	-43.75	172.02	48	76
Leeston	-43.77	172.3	47	75
Akaroa	-43.81	172.97	45	69
Southbridge	-43.82	172.25	46	72
Ashburton	-43.88	171.76	52	80
Lake Tekapo	-44	170.5	33	53
Geraldine	-44.1	171.23	48	75
Fairlie	-44.1	170.83	55	86
Temuka	-44.23	171.27	44	71
Pleasant Point	-44.27	171.13	47	75
Twizel	-44.25	170.1	37	58
Timaru	-44.4	171.26	46	73
Pareora	-44.47	171.22	48	77
Omarama	-44.48	169.97	35	57
Otematata	-44.6	170.18	38	61
Waimate	-44.74	171.06	42	65
Kurow	-44.73	170.47	42	65
OTAGO				
Wanaka	-44.7	169.13	26	40
Arrowtown	-44.93	168.83	32	50
Oamaru	-45.09	170.98	42	65
Cromwell	-45.05	169.2	36	59
Queenstown	-45.04	168.65	34	53
Ranfurly	-45.12	170.1	52	85
Kakanui	-45.18	170.9	42	65
Clyde	-45.18	169.32	45	75
Alexandra	-45.25	169.38	44	73
Hampden	-45.33	170.82	43	67
Palmerston	-45.48	170.72	45	71
Roxburgh	-45.53	169.32	53	90
Waikouaiti	-45.6	170.68	44	69
Karitane	-45.63	170.65	44	70
Warrington	-45.72	170.59	43	68
Waitati	-45.75	170.57	43	69
Outram	-45.87	170.23	51	81
Dunedin	-45.89	170.5	47	73
Lawrence	-45.92	169.68	54	87
Tapanui	-45.95	169.27	54	90

Amend 11
Nov 2020

Table A: Rainfall Intensities continued
10 minute duration rainfall intensities for various locations in New Zealand

Location	Latitude degrees	Longitude degrees	10% AEP intensity mm/hr	2% AEP intensity mm/hr
Milton	-46.12	169.97	56	88
Clinton	-46.2	169.38	53	86
Balclutha	-46.23	169.73	55	87
Stirling	-46.25	169.78	54	85
Kaitangata	-46.28	169.85	54	85
Owaka	-46.45	169.65	49	77
OTAGO				
Te Anau	-45.42	167.72	48	75
Manapouri	-45.57	167.62	51	78
Lumsden	-45.73	168.43	52	87
Riversdale	-45.9	168.73	50	84
Ohai	-45.93	167.95	50	80
Gore	-46.1	168.93	57	95
Winton	-46.15	168.32	47	76
Tuatapere	-46.13	167.68	45	71
Otautau	-46.15	168	46	74
Edendale	-46.32	168.78	48	80
Wyndham	-46.33	168.85	49	82
Riverton/Aparima	-46.36	168	49	77
Invercargill	-46.41	168.32	54	87
Bluff	-46.49	168.29	51	81

Notes:

This table is based on information produced by the National Institute for Water and Atmospheric Research (NIWA) in December 2019, and the rainfall intensities are based on historical rain gauge data.

Rainfall intensity data is also available online in digital form from the National Institute for Water and Atmospheric Research (NIWA) High Intensity Rainfall Design System (HIRDS).

Amend 11 Nov 2020

HIRDS provides rainfall intensity estimates for any location in New Zealand based on historical rain gauge data and projections of future rainfall intensities for various climate change scenarios.

Acceptable Solution E1/AS2

(Included in Amendment 11)

1.0 AS/NZS 3500.3 Stormwater drainage

1.0.1 AS/NZS 3500.3, as modified by Paragraph 1.0.4, is an Acceptable Solution for the design and installation of *surface water* drainage systems.

COMMENT:

Comparable terminology

AS/NZS 3500.3	E1/AS1
Eaves gutter	External gutter
Box gutter	Internal gutter
Inlet pit	Surface water sump
Stormwater pit	Access/Inspection chamber

1.0.2 This Acceptable Solution is limited to *buildings* and *sitework* where *surface water* results only from rainfall, and which are:

a) Free from a history of flooding,

b) Not adjacent to a watercourse,

c) Not located in low lying area, and

d) Not located in a secondary flow path.

1.0.3 *Buildings* to which this Acceptable Solution is applied shall comply with the requirements of Acceptable Solution E1/AS1 Section 2.0 Minimum Acceptable Floor Level.

1.0.4 Modifications to AS/NZS 3500.3

Clause 1.2.2 Delete and replace with:

"In New Zealand, this Standard may be used for compliance with NZBC Clause E1 Surface Water, in accordance with NZBC Acceptable Solution E1/AS2.

Where alternative New Zealand Standards are referenced (e.g. NZS 5807) the New Zealand Standard shall be used for New Zealand only."

Clause 3.3.5.2 Delete and replace with:

"Ten minutes duration rainfall intensity (in mm/hr) for New Zealand shall be determined for ARIs of 10 years (10% AEP) and 50 years (2% AEP) using rainfall frequency duration information available from:

(a) the local territorial authority,

(b) NZBC Acceptable Solution E1/AS1 Appendix A, or

(c) the National Institute for Water and Atmospheric Research (NIWA).

NOTES:

1 Rainfall intensity data is available online in digital form from the National Institute for Water and Atmospheric Research (NIWA) High Intensity Rainfall Design System (HIRDS).

HIRDS provides rainfall intensity estimates for any location in New Zealand based on historical rain gauge data and also provides projections of future rainfall intensities for various climate change scenarios.

2 Where there are differences between the design rainfall intensities obtained using sources (a), (b) and (c) for a particular location, the most conservative rainfall intensity should be used for design calculations.

3 Territorial Authorities may refer to any available Regional Council rainfall data to establish design rainfall intensities for their city or district."

Clause 3.4.5 Delete and replace with:

"**3.4.5 Higher catchment area**

Stormwater from a higher catchment area shall be discharged directly to a rainhead or a sump, and the rainhead or sump shall be sized in accordance with this Standard.

Alternatively, a spreader that meets the requirements of NZBC Acceptable Solution E2/AS1 may be used.

The downpipe and gutter system of the lower catchment shall be sized in accordance with Clause 3.4 to take into account the total flow from both catchments.

1 The rainhead or sump may need to be larger than that sized in accordance with this Standard and include a device to dissipate energy. Sizing of such a rainhead or sump is beyond the scope of this Standard and may require hydraulic tests.

2 Where spreaders are used, an allowance for an increased overflow provision for the gutter on the lower catchment should be considered."

Clause 3.6 Delete and replace with:

"Refer to NZBC Acceptable Solution E2/AS1 for the design of valley gutters."

Clause 3.7.3 (c) NOTE 3 Delete and replace with:

"3 The minimum width of a box gutter is 300 mm."

Clause 3.7.7.1 Insert:

"NOTE: Overflow outlets should be located to give an early, conspicuous warning to the building occupier that maintenance is required."

Clause 3.8 Delete and replace with:

"**3.8 Balcony and terrace areas**

Systems for draining balconies and terraces shall be designed for —

(a) a 10 year ARI (10% AEP) rainfall intensity; and

(b) a 50 year ARI (2% AEP) rainfall intensity for overflow."

Clause 4.5.6 Insert:

"(f) *Connections to drains* Downpipes shall discharge directly into a site stormwater drain, and should not discharge via an inlet pit."

Clause 5.2.3 Delete and replace with:

"**5.2.3 Design rainfall intensity**

Elements shall be designed to contain minor storm flows of the appropriate annual exceedance probability (AEP) or average recurrence interval (ARI) specified in Table 5.4.3 within surface water drains, gutters or formed flow paths.

NOTE: Surface water drainage systems should be designed to ensure overflows, in storm events with an AEP of 1% in Australia or an ARI of 50 years (2% AEP) in New Zealand, do not present a hazard to people or cause damage to property."

Clause 5.3.1.1 Delete "Stormwater from roof areas shall…" and replace with "Stormwater from roof areas, including balconies and terraces, shall …"

Clause 5.4.5 (b) Delete and replace with:

"(b) In New Zealand from:

(i) the local territorial authority,

(ii) NZBC Acceptable Solution E1/AS1 Appendix A, or

(iii) the National Institute for Water and Atmospheric Research (NIWA).

NOTES:

1 Rainfall intensity data is available online in digital form from the National Institute for Water and Atmospheric Research (NIWA) High Intensity Rainfall Design System (HIRDS).

HIRDS provides rainfall intensity estimates for any location in New Zealand based on historical rain gauge data and also provides projections of future rainfall intensities for various climate change scenarios.

2 Where there are differences between the design rainfall intensities obtained using sources (i), (ii) and (iii) for a particular location, the most conservative rainfall intensity should be used for design calculations.

3 Territorial Authorities may refer to any available Regional Council rainfall data to establish design rainfall intensities for their city or district."

Clause 5.4.8 (b) (ii) Delete and replace with: "10 min duration in New Zealand."

Clause 5.4.11.1 (b) Delete and replace with: "be laid with any change of direction or cross-section occurring at either a fitting or at a stormwater pit;"

Clause 5.4.12 Delete.

Clause 5.5 Delete.

Clause 6.2.3 Insert:

"Alternatively, trenches shall be no less than the 300 mm wide for pipes DN 100 or smaller."

Table 6.2.5 1 (a) (i) and (a) (ii) Delete and replace with (a):

Table 6.2.5:	Minimum pipe cover–finished surface to top of pipe	
Location	Ductile iron, galvanised steel	Plastics
1 Not subject to vehicular loading:	Minimum cover, mm	
(a) Without pavement	100	300

Clause 6.2.8 (d) (ii) Delete and replace with:

"In New Zealand, as specified in NZBC Acceptable Solution E1/AS1."

Clause 6.3.1.1 (d) Delete and replace with:

"(d) using 45°, sweep or oblique junctions; and

(e) with changes in direction not exceeding 90° at any point."

Clause 6.3.3 (b) Delete and replace with:

"For other properties, the minimum diameter of a stormwater drain that is downstream of a stormwater pit or inlet pit shall be the greater of —

(i) the diameter of the largest pipe entering the pit; or

(ii) DN 100."

Clause 6.4 Subsoil drains Insert:

"In New Zealand, this Clause is informative only."

Clause 6.4.1 NOTES Insert:

"4 Subsoil drains should discharge to the site stormwater drainage system via an inlet pit or silt arrester.

5 Subsoil drains should be laid at grade with a uniform fall of not less than 1:300."

Clause 7.4.1 Delete and replace with:

"**7.4.1 Location**

For other than single dwellings, inspection openings for the maintenance of site stormwater drains shall be installed at —

(a) each point of connection;

(b) even spacings not more than 30 m apart;

(c) each end of any inclined jump-up that exceeds 6 m in length;

(d) each connection to an existing site stormwater drain; and

(e) at any change of direction greater than 45°.

NOTES:

1 Inspection openings may be replaced by a stormwater pit.

2 No inspection opening is needed at a connection to a site stormwater drain where the branch drain serves only a single external downpipe or an inlet pit."

Clause 7.4.3 Delete and replace with:

"**7.4.3 Access**

Access to below-ground inspection openings shall be either by—

(a) a stormwater pit,

(b) a sealed riser terminated at ground level or floor level in an accessible position; or

(c) a removable cap at drain level for drains of DN 150 or smaller.

NOTE: Options (a) or (b) are preferred in landscaped or sealed areas, or where the depth of an inspection opening would be greater than 1000 mm below finished ground level."

Clause 7.5.1.1 (b) Delete.

Clause 7.5.1.2 Delete and replace with:

"**7.5.1.2 Inlet pits**

Inlet pits shall be installed —

(a) to allow the collection and ingress of surface water to a site stormwater drain,

(b) with sufficient capacity at the bottom for the settlement of silt and debris, and

(c) with a submerged (or trapped) outlet which prevents floatable solids entering the site stormwater drain.

NOTES:

1. Inlet pits should not receive discharge from stormwater drains.

2. Refer to NZBC Acceptable Solution E1/AS1 Figure 8 and Figure 9 for examples of surface water sumps (inlet pits) which incorporate submerged outlets and provide sufficient capacity for the settlement of silt and debris."

Clause 7.7.1 (a) Delete and replace with:

"(a) a 45° junction, a sweep junction or an oblique junction at an upstream angle not greater than 60°, as shown in Figure 7.7.1(A);"

Clause 7.10 On-Site Stormwater Detention (OSD) Systems Insert:

"In New Zealand, this Clause is informative only."

Section 8 Pumped Systems Insert:

"In New Zealand, this Section is informative only."

Section 10 Siphonic Drainage Systems Insert: "In New Zealand, this Section is informative only."

Appendix D – D.2.2 New Zealand Delete and replace with:

"The procedure for the determination of rainfall intensities, in mm/hr, for the site considered is as follows:

(a) Use the applicable rainfall intensity figures provided by the local territorial authority, or

(b) Use the applicable rainfall intensity figures provided in NZBC Acceptable Solution E1/AS1 Appendix A, or

(c) Use the applicable rainfall intensity figures provided by the National Institute for Water and Atmospheric Research (NIWA) High Intensity Rainfall Design System (HIRDS).

NOTES:

1 Where there are differences between the design rainfall intensities obtained using sources (a), (b) and (c) for a particular location, the most conservative rainfall intensity should be used for design calculations.

2 Territorial Authorities may refer to any available Regional Council rainfall data to establish design rainfall intensities for their city or district."

Appendix F Delete.

Appendix I Figure I1 NOTE Delete and replace with:

"NOTE: The minimum width of a box gutter is 300 mm."

Appendix K Insert:

"This Appendix applies to Australia only.

NOTE: The design solution examples for surface water drainage systems shown in Appendix K do not address the modifications made to AS/NZS 3500.3 by NZBC Acceptable Solution E1/AS2 and do not reflect requirements in New Zealand."

Index E1/VM1 & AS1/AS2

(Revised by Amendment 4)

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 10), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 5 November 2020 and supersedes all previous versions of this document.

The previous version of this document (Amendment 9) will cease to have effect on 3 November 2021.

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.building.govt.nz

E2: Document History

	Date	Alterations	
First published	July 1992		
Second Edition	28 February 1998	Document revised – Second edition issued	
Third Edition	E2/VM1 effective from 1 July 2004	E2/AS1 effective from 1 February 2005	
Amendment 1 September 2004	E2/AS1 effective from 1 July 2005	p. 2 Document Status	
Reprinted incorporating Amendment 1		September 2004	
Amendment 2	Effective from 1 July 2005	p. 2 Document History, Document Status pp. 5-7, 9, 10 Contents pp. 13-16 References pp. 17-20 Definitions pp. 21-24 E2/VM1	pp. 25-43, 45-47, 49, 50, 55-57, 59-67, 69-89, 93-100, 102, 103, 105-107, 111-119, 121-125, 127-135, 138, 140-144, 146, 147, 149, 150, 153-155, 157,163-169 E2/AS1 pp. 173, 174, 177, 178 Index
Erratum 1	Effective from 1 December 2005	p. 166 Table 23	
Amendment 3	21 June 2007	pp. 3 and 4, Building Code Clause E2	
Amendment 4	Effective from 1 May 2008 until 31 January 2012	p. 2 Document History, Document Status pp. 8 and 12 Contents pp. 13-14 References	pp. 171-180 E2/AS2 p. 181 Index
Amendment 5	1 August 2011	p. 2 Document History, Document Status pp. 5-12 Contents pp. 13-16A References pp. 17-20 Definitions pp. 21-24 E2/VM1	pp. 25-180 E2/AS1 pp. 183-184,189-190 E2/AS2 p. 191 E2/AS3 pp. 193-204 Index
Errata 2	Effective from 24 December 2011 until 14 August 2014	p. 2 Document History, Document Status p. 9 Contents	pp. 29, 41, 43, 49, 55-57, 80, 81, 87, 91, 93, 94, 101, 106-108, 110-115, 117, 158, 160, 172, 176, 191 E2/AS1
Amendment 6	Effective from 14 February 2014 until 30 May 2017	p. 2A, Document History, Document Status p. 5, Contents pp. 13,15,16A References p. 17, Definitions	p. 23, E2/VM1 1.5.1, 1.5.2, 1.5.3 pp. 36, 68, 172, 175, 175 E2/AS1 4.3.4, 8.3.4.2, Tables 20, 21, 22
Amendment 7	Effective 1 January 2017 until 31 March 2019	p. 16A References	

E2: **Document History** *(continued)*			
	Date	**Alterations**	
Amendment 8	Effective from 30 November 2018 until 31 October 2019	p. 5 Contents p. 14 References	p. 21–23A E2/VM1 1.3, 1.3.1, 1.3.2, 1.3.2.1, 1.4.4.1, 1.4.5.1, 1.5, 1.6, 1.7
Amendment 9	Effective 27 June 2019 until 3 November 2021	p. 5 Contents	p. 21 E2/VM1 1.0
Amendment 10	Effective 5 November 2020	pp. 13, 16 References pp. 49–50 E2/AS1 Figures 11 and 12 p. 54 E2/AS1 7.3.2.1 pp. 60–61 E2/AS1 8.1.6, 8.1.7, 8.1.6.1 p. 86 E2/AS1 Figure 52 p. 91 E2/AS1 8.5.6	p. 93 E2/AS1 8.5.10 p. 96 E2/AS1 Figure 64 p. 148 E2/AS1 9.7.1, 9.7.3 p. 164 E2/AS1 Figure 124 p. 167 E2/AS1 9.9.10.2
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

New Zealand Building Code Clause E2 External Moisture

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

SR2007/124

Clause E2–External moisture

Provisions	Limits on application
Objective **E2.1** The objective of this provision is to safeguard people from illness or injury that could result from external moisture entering the *building*.	
Functional requirement **E2.2** *Buildings* must be constructed to provide *adequate* resistance to penetration by, and the accumulation of, moisture from the outside.	Requirement E2.2 does not apply to *buildings* (for example, certain bus shelters, and certain *buildings* used for horticulture or for equipment for washing motor vehicles automatically) if moisture from the outside penetrating them, or accumulating within them, or both, is unlikely to impair significantly all or any of their *amenity*, durability, and stability.

Performance

E2.3.1 Roofs must shed precipitated moisture. In locations subject to snowfalls, roofs must also shed melted show.

E2.3.2 Roofs and exterior walls must prevent the penetration of water that could cause undue dampness, damage to *building elements*, or both.

E2.3.3 Walls, floors, and structural elements in contact with, or in close proximity to, the ground must not absorb or transmit moisture in quantities that could cause undue dampness, damage to *building elements*, or both.

E2.3.4 *Building elements* susceptible to damage must be protected from the adverse effects of moisture entering the space below suspended floors.

E2.3.5 *Concealed spaces* and cavities in *buildings* must be constructed in a way that prevents external moisture being accumulated or transferred and causing condensation, fungal growth, or the degradation of *building elements*.

Amend 3
Jun 2007

SR2007/124

Provisions	Limits on application
Performance **E2.3.6** Excess moisture present at the completion of *construction* must be capable of being dissipated without permanent damage to *building elements*. **E2.3.7** *Building elements* must be constructed in a way that makes due allowance for the following: (a) the consequences of failure: (b) the effects of uncertainties resulting from *construction* or from the sequence in which different aspects of *construction* occur: (c) variation in the properties of materials and in the characteristics of the site.	

Amend 3
Jun 2007

Contents

Amend 9 Jun 2019

Amend 8 Nov 2018

Amend 2 Jul 2005

Amend 2 Jul 2005

Amend 5 Aug 2011

Amend 6 Feb 2014

Amend 2 Jul 2005

Amend 5 Aug 2011

Amend 2 Jul 2005

Amend 2 Jul 2005

Amend 5 Aug 2011

Amend 5 Aug 2011

Amend 6 Feb 2014

Amend 2 Jul 2005

Amend 5 Aug 2011

Amend 5 Aug 2011

Amend 5 Aug 2011

Amend 2 Jul 2005

Amend 5 Aug 2011

Amend 5
Aug 2011

Amend 4
May 2008

Amend 5
Aug 2011

Tables

Amend 5 Aug 2011

Figures

Figures – E2/AS2

Amend 5 Aug 2011

Amend 4 May 2008

Amend 5 Aug 2011

References

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in these Verification Methods and Acceptable Solutions (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 these Verification Methods and Acceptable Solutions must be used.

Amend 6 Feb 2014

Amend 4 May 2008

Amend 6 Feb 2014

			Where quoted	
	Standards New Zealand			
Amend 5 Aug 2011	AS/NZS 1734: 1997	Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate	AS1 4.3.2, 8.3.4.3, 8.4.3.3, 9.6.3.3	
Amends 2 and 5	AS/NZS 2269.0: 2008	Plywood – Structural	AS1 8.5.3, 9.3.6.1, 9.8.2	
	NZS 2295: 2006	Pliable, Permeable Building Membranes	AS1 8.1.5, Table 23	
Amend 6 Feb 2014	AS/NZS 2728: 2013	Prefinished/prepainted sheet metal products for interior/exterior building applications – Performance requirements	AS1 4.2.1, 8.3.4.1, 8.3.4.2, 8.3.4.3, 8.4.3.1,8.4.3.3, 9.6.3.1, 9.6.3.3, Table 20	
Amend 5 Aug 2011 Amend 6 Feb 2014	AS/NZS 2904: 1995	Damp-proof courses and flashings *Amend: 1*	AS1 4.3.10, 9.2.4	
	AS/NZS 2908: Part 2: 2000	Cellulose-cement products Flat sheet	AS1 9.3.6.2, 9.5.2, 9.7.2	
	NZS 3602: 2003	Timber and wood-based products for use in building	AS1 9.1.10, 9.4.2, 9.4.9, 9.7.3, 9.8.2, 10.2,Table 23	
Amend 5 Aug 2011	NZS 3604: 2011	Timber framed buildings	Definitions, VM1 1.1, 1.2, AS1 1.1, 1.3, 4.2.1, 7.2.1, 8.3.4.1, 8.4.3.1, 8.5.1, 9.1.3.1, 9.1.3.5, 9.2.1, 9.2.3, 9.2.7.1, 9.2.9, 9.3.2, 9.6.3.1, Table 1, Table 2, Table 4, Table 5, Table 6, Table 18, Table 18A, Table 20 and Table 24 AS2 Figure 5.11 a) and b)	Amend 10 Nov 2020 Amend 4 May 2008
	NZS 3617: 1979	Specification for profiles of weatherboards, fascia boards, and flooring	AS1 9.4.1.1	
Amend 5 Aug 2011	AS/NZS 4020: 2005	Testing of products for use in contact with drinking water	AS1 8.1.1	

		Where quoted
Amend 5 Aug 2011		
	NZS 4206: 1992 Concrete interlocking roofing tiles	AS1 8.2.1, 8.2.3
Amend 5 Aug 2011	NZS 4211: 2008 Specification for performance of windows	VM1 1.2, AS1 9.1.10
Amend 8 Nov 2018	*Amend: 1*	
	NZS 4217 Pressed metal tile roofs Part 1: 1980 Specification for roofing tiles and their accessories Part 2: 1980 Code of practice for preparation of the structure and the laying and fixing of metal roofing tiles	AS1 8.3.3
Amend 5 Aug 2011	SNZ HB 4236: 2002 Masonry veneer wall cladding	Definitions, AS1 Table 3
	NZS 4251: Solid plastering	
Amend 5 Aug 2011	Part 1: 2007 Cement plasters for walls, ceilings and soffits	AS1 9.3.2, 9.3.4.1, 9.3.4.2, 9.3.6.1, 9.3.6.2
	AS/NZS 4256 Plastic roof and wall cladding materials Part 2: 1994 Unplasticized polyvinyl chloride (uPVC) building sheets	AS1 4.3.1
Amend 5 Aug 2011	AS/NZS 4284: 2008 Testing of Building Facades	VM1 1.1, 1.4, 1.4.2, 1.4.3, 1.4.4
	NZS 4298: 1998 Materials and workmanship for earth buildings *Amend: 1*	AS2 5.1.8, 9.7.2, Figure 4.1, Figure 9.2 a), b), c) and d)
	NZS 4299: 1998 Earth buildings not requiring specific design *Amend: 1*	AS2 1.0, 1.1
Amend 4 May 2008	NZS 4431: 1989 Code of practice for earth fill for residential development *Amend: 1*	AS2 Figure 4.1
	AS/NZS 4534: 2006 Zinc and zinc/aluminium-alloy coatings on steel wire	AS1 9.1.8.5
Amend 5 Aug 2011	AS/NZS 4680: 2006 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles	AS1 9.9.4.1, Table 20
Amend 5 Aug 2011	AS/NZS 4858: 2004 Wet area membranes	AS1 9.7.7.1, 9.9.4.4, 9.9.10.1

		Where quoted
Standards Australia		
AS 1366	Rigid cellular plastics sheets for thermal insulation	
Part 3: 1992	Rigid cellular polystyrene – Moulded (RC/PS-M)	AS1 9.9.3.1
Part 4: 1989	Rigid cellular polystyrene – Extruded (RC/PS-E)	AS1 9.9.3.1
AS 1397: 2011	Continuous hot-dip metallic coated steel sheet and strip – Coatings of zinc and zinc alloyed with aluminium and magnesium *Amend: 1*	AS1 4.3.4, Table 20
AS 1566: 1997	Copper and copper alloys – Rolled flat products	AS1 4.3.6
AS 1804: 1976	Soft lead sheet and strip	AS1 4.3.7
AS 2049: 2002	Roof tiles	AS1 8.2.1
AS 2050: 2002	Installation of roof tiles	AS1 8.2.3
AS 3566	Self-drilling screws for the building and construction industries	
Part 2: 2002	Corrosion resistance	AS1 8.4.8, 8.4.9, 9.6.6, Table 20
AS 3730	Guide to the properties of paints for buildings	AS1 9.3.7, 9.4.9, 9.5.6, 9.7.3.1, 9.7.4, 9.8.9, 9.9.3, 9.9.6.3
Part 6: 2006	Solvent-borne – Exterior – Full gloss enamel	
Part 7: 2006	Latex – Exterior – Flat	
Part 8: 2006	Latex – Exterior – Low-gloss	
Part 9: 2006	Latex – Exterior – Semi-gloss	
Part 10: 2006	Latex – Exterior – Gloss	
AS 4046	Methods of testing roof tiles	
Part 9: 2002	Determination of dynamic weather resistance	VM1 2.1, AS1 8.2.3
British Standards Institution		
BS 6538: 1987	Air permeance of paper and board	AS1 Table 23
Part 3: 1987	Method for determination of air permeance using the Garley apparatus	
BS EN 988: 1997	Zinc and zinc alloys. Specification for rolled flat products for building	AS1 4.3.8

Amend 5 Aug 2011

Amend 6 Feb 2014

Amend 2 Jul 2005

			Where quoted
	American Society for Testing and Materials		
Amend 5 Aug 2011	ASTM C1549: 2009	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer	AS1 2.4
Amend 5 Aug 2011	ASTM D1667: 2005	Standard Test Specification for Flexible Cellular Materials – Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam)	AS1 9.1.10.7
Amend 5 Aug 2011	ASTM D2240: 2005	Standard Test Method for Rubber Property	AS1 9.1.10.7
Amend 5 Aug 2011	ASTM D6134: 2007	Standard Specification for Vulcanised Rubber Sheets Used in Waterproofing Systems	AS1 4.3.9, 8.5.4
Amend 5 Aug 2011	ASTM E96: 2005	Standard Test Methods for Water Vapour Transmission of Materials	AS1 Table 23
Amend 5 Aug 2011	ASTM E104: 2002	Standard Practice for Maintaining Constant Relative Humidity by Means of Aqueous Solutions	AS1 10.3.2
	ASTM E2098: 2000	Standard Test Method for Determining Tensile Breaking Strength of Glass Fibre Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to a Sodium Hydroxide Solution	AS1 9.9.3.2
	ASTM E2134: 2001	Standard Test Method for Evaluating the Tensile-Adhesion Performance of an Exterior Insulation and Finish System (EIFS)	AS1 9.9.6
Amend 5 Aug 2011	ASTM G154: 2006	Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials	AS1 9.1.10.7
Amend 5 Aug 2011	ASTM G155: 2005	Standard Practice for Operating Xenon Arc Light Apparatus for UV Exposure of Nonmetallic Materials	AS1 9.1.10.7
	Building Research Association of New Zealand		
Amend 5 Aug 2011	BRANZ Bulletin 330: 1995	Thin flooring materials – 2 Preparation and laying. Appendix 1	AS1 10.3.2
Amend 2 Jul 2005	BRANZ EM 4: 2005	Evaluation method for jointing systems for flush finished fibre cement sheet	AS1 9.7.4 (Amend 10 Nov 2020)
Amend 2 Jul 2005	BRANZ EM 5: 2005	Evaluation method for adhesives and seam tapes for butyl and EPDM rubber membranes	AS1 8.5.4
Amend 5 Aug 2011	BRANZ EM 6: 2010	Evaluation method for window and door support mechanisms or bars	AS1 9.1.10.5
	BRANZ Bulletin 411: 2001	Recommended timber cladding profiles	AS1 9.4.1.1

		Where quoted
SCION		
	Measurement of moisture content of wood	AS1 10.3.1
Other Organisations		
Federal Specification Standard TT-S-00230C	Elastomeric type, cold applied single component for caulking, sealing, and glazing in buildings, building areas (plazas, decks, pavements), and other structures	AS1 4.5.2, 8.4.11.1, 9.1.6, 9.1.9.3, 9.2.8.2, 9.5.3.2, 9.6.7, 9.9.3, 9.9.8
EIMA 101.91: 1992	EIFS Industry Members Association. Standard Guide for resin of resin coated glass fiber mesh in exterior insulation and finish systems (EIFS), Class PB.	AS1 9.9.3.2
ICBO Evaluation Services Inc	AC148 Acceptance criteria for flashing materials	AS1 4.3.11, 9.1.5, 9.9.4.4
ISO 9223: 1992	Corrosion of metals and alloys; corrosivity of atmospheres; classification	AS1 4.2.1, 8.3.4.1, 8.4.3.1, 9.6.3.1, Table 20
ISO 11600: 2002	Building Construction – Jointing products Classification and requirements for sealants 9.5.3.2, 9.6.7, 9.9.3,	AS1 4.5.2, 8.4.11.1, 9.1.6, 9.1.9.3, 9.2.8.2, 9.5.3.2, 9.6.7, 9.9.3, 9.9.8
ISO/TS 15510: 2003	Stainless steels – chemical composition	AS1 4.3.5
New Zealand Metal Roof and Wall Cladding Code of Practice: 2008	New Zealand Metal Roofing Manufacturers Inc.	AS1 4.3, 4.5.1, 4.5.2, 8.1.6.2, 8.3.1, 8.4.1, 8.4.12, 8.4.14, 8.4.15, 8.4.16.2, 8.4.17
Cement & Concrete Association of New Zealand		
CCANZ – CP01: 2014	Code of Practice for weathertight concrete and concrete masonry construction, incorporating errata 1, January 2015	AS3 1.0

Amend 5 Aug 2011 (SCION; Federal Specification; ISO 9223; ISO 11600; ISO/TS 15510 – NZ Metal Roof; Cement & Concrete Association)
Amend 6 Feb 2014 (CCANZ – CP01)
Amend 7 Jan 2017 (incorporating errata)

Definitions

Amends 2 and 6

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

Air seal A continuous seal fitted between a window or door reveal and the surrounding wall *framing* to prevent the flow of air into the interior of the *building*.

Anti-ponding board A board laid under the lowest row of concrete and clay roof tiles and supports the *roof underlay*.

The board is sloped to ensure moisture under the tiles is directed to the exterior of the roof.

Apron flashing A near flat or sloping *flashing* with a vertical upstand, used at junctions between roofs and walls.

Attached garage A garage that shares a common *wall* or *walls* with a habitable *building*, and is enclosed by *roof* and *wall claddings* that are continuous with the habitable part of the *building*.

Amend 5 Aug 2011

Base metal thickness (BMT) The thickness of the bare or base metal before any subsequent coating, such as galvanizing.

Bird's beak A double fold applied to the edge of a horizontal metal *flashing* to stiffen the edge and to assist in deflecting moisture away from the *cladding system* below. Refer also **Kick-out** and **Drip edge**.

COMMENT:
A *bird's beak* is used at the bottom of a *capping* to deflect water away from the *enclosed balustrade cladding*.

Amend 5 Aug 2011

Butt flashing A preformed wall *flashing*, used to flash windows and corners on horizontal profiled metal wall *cladding*.

A *butt flashing* is shaped to underflash the *cladding*, with the *cladding* butting against the exposed box portion of the *flashing*.

Cantilevered deck A *deck* where no support is provided at the outer extremities of the *deck*.

COMMENT:
Cantilevered decks are often *constructed* by extending *framing* members through the *cladding* beyond the *building* face. *Cantilevered decks* are sometimes known as balconies.

Amend 2 Jul 2005

Capping A *flashing* formed to cover the top of an *enclosed balustrade* or *parapet*. Also known as a coping.

Cavity batten A vertical packing member used to create a *drained cavity* as part of a *cladding system*.

Cavity wall A term used to describe a wall that incorporates a *drained cavity*.

Cavity spacer A short block used to provide intermittent support for fixings or pipe penetrations through a *drained cavity*, while not interrupting drainage within the cavity.

A *cavity spacer* is required to be set to a slight fall (5° minimum from horizontal) to allow drainage of any moisture from the top.

Cladding The exterior weather-resistant surface of a *building*.

COMMENT:
Includes any supporting substrate and, if applicable, surface treatment.

Cladding system The outside or exterior weather-resistant surface of a *building*; including *roof cladding* and *roof underlays*, wall *cladding* and *wall underlays*, and cavity components, rooflights, windows, doors and all penetrations, *flashings*, seals, joints and junctions.

Amend 5 Aug 2011

Where required by this Acceptable Solution, the *cladding system* shall include a *drained cavity*.

Control joint A joint designed to prevent damage by accommodating movement. See also **Expansion joint**.

Damp-proof course (DPC) A strip of *durable vapour barrier* placed between *building elements* to prevent the passage of moisture from one element to another.

Amend 5 Aug 2011

Damp-proof membrane (DPM) A sheet material, coating or *vapour barrier*, having a low water vapour transmission, and used to minimise water and water vapour penetration into *buildings*. Usually applied against concrete in contact with the ground. (Also known as a concrete underlay.)

Amend 5 Aug 2011

Deck An open platform projecting from an exterior wall of a *building* and supported by *framing*. A *deck* may be over enclosed internal spaces, or may be open underneath. Refer also **Enclosed deck**. Also known as a balcony.

Direct fixed A term used to describe a wall *cladding* attached directly to the wall *framing*, without the use of a *drained cavity*.

Dormer or **dormer window** A framed structure that projects from a sloping roof, and has a window at its outer end.

Drained cavity A cavity space, immediately behind a wall *cladding*, that has vents at the base of the wall. Also known as a drained and vented cavity and referred to in this Acceptable Solution as a cavity or drained cavity.

Amend 2 Jul 2005
Amend 5 Aug 2011

A *drained cavity* assists drying by allowing water which occasionally penetrates the wall *cladding system* to drain to the exterior of the *building*, and any remaining moisture to dry by evaporation. Where this Acceptable Solution requires a nominal 20 mm *drained cavity*, the depth shall be between limits of 18 mm and 25 mm.

For definition of masonry veneer cavity refer to SNZ HB 4236.

Amend 2 Jul 2005

Drip edge Fold(s) applied to the edge of a horizontal metal *flashing* to deflect moisture away from the *cladding system* below. Refer also **Bird's beak** and **Kick-out**.

Amend 5 Aug 2011

Dwang A short (usually horizontal) member fixed between *framing* timbers. Also known as nogging.

Amend 5 Aug 2011

Eaves That part of the roof *construction*, including *cladding*, fascia and eaves gutter (spouting), that extends beyond the exterior face of the wall.

EIFS (Exterior Insulation and Finish System). A polystyrene sheet-based *cladding system* that uses mesh reinforced polymer-modified cement-based or polymer-based plaster base coats and a protective top coating.

Electrolytic corrosion Galvanic corrosion commonly resulting from the contact of two dissimilar metals when an electrolyte such as water is present.

Enclosed balustrade A timber-framed barrier with *cladding* across all exposed faces. Refer also **Parapet**.

Amend 5 Aug 2011

Enclosed deck A *deck*, whether over an interior or exterior space, that has an impermeable upper surface and is closed on the underside. May also be known as a balcony.

Envelope complexity The categorisation of the complexity of the total *building* envelope into one of four classes, depending on the particular features of the *building* as specified in this Acceptable Solution.

EPDM (Ethylene Propylene Diene Monomer) A thermosetting synthetic rubber used as a resilient part of a sealing washer, or as a roof *membrane*.

Expansion joint A joint designed to prevent damage by accommodating movement. See also **Control joint**.

External wall Any vertical exterior face of a *building* consisting of *primary* and/or *secondary elements* intended to provide protection against the outdoor environment.

Amend 5 Aug 2011

Finished ground level (FGL) The level of the ground against any part of a *building* after all backfilling and/or landscaping and/or surface paving has been completed.

Amend 5 Aug 2011

Flashing A component, formed from a rigid or flexible *waterproof* material, that drains or deflects water back outside the *cladding system.*

Flexible flashing tape A flexible self-adhesive *waterproof* tape. Usually used as an accessory for *wall underlays*, to seal corners and intersections.

Amends 2 and 5

Flush-finished The description of a *cladding* and joints system which relies on a protective coating applied to the face of the *cladding* to prevent the penetration of water.

Framing Timber members to which *lining*, *cladding*, flooring, or decking is attached; or which are depended upon for supporting the structure, or for resisting forces applied to it.

Hem A flat fold, not completely closed, applied to the edge of a metal *flashing*.

Hidden gutter A gutter located within the boundaries of the roof *framing*. *Hidden gutters* may also be known as secret gutters or internal gutters. See also **Valley gutters**.

COMMENT:
Hidden gutters are distinct from gutters or spouting that are externally located beyond the bounds of the roof and wall *framing*.

Hook An open fold applied to the edge of a metal *flashing*.

COMMENT:
A *hook* is distinct from a *hem*, as it is open at an acute angle rather than flattened.

Kick-out A single fold applied to the edge of a horizontal metal *flashing* to deflect moisture away from the *cladding system* below. Refer also **Bird's beak.**

COMMENT:
A ***kick-out*** is used at the bottom of a *capping* or other *flashing* to deflect water away from the *cladding* below.

Lining The rigid sheet covering for a wall, ceiling or other interior surface.

Masonry tiles Clay or concrete tile roof *cladding*.

Masonry veneer Clay or concrete block veneer *cladding*.

Membrane A non-metallic material, usually synthetic, used as a fully supported roof *cladding*, *deck* surface or, in conjunction with other *claddings*, as gutters or *flashings*.

Amend 5 Aug 2011

NZBC New Zealand Building Code.

Parallel flashing A roof *flashing* that runs along the roof slope, parallel to the roof *cladding* profile. Also known as a longitudinal *flashing*.

Parapet A timber-framed wall that extends above the level of the roof *cladding*. Refer also **Enclosed balustrade.** Amend 5 Aug 2011

Purlin A horizontal member laid to span across *rafters* or trusses, and to which the roof *cladding* is attached.

Rafter A *framing* timber, normally parallel to the slope of the roof, providing support for sarking, *purlins* or roof *cladding*.

Risk matrix A table that allows the calculation of a *risk score* by the allocation and summing of scores for a range of design and location factors applying to a specific *building* design.

Risk score An aggregated numerical score for a proposed *building* as defined by this Acceptable Solution. The *risk score* is determined by completion of the *risk matrix.*

Roof That part of a *building* having its upper surface exposed to the outside and at an angle of 60° or less to the horizontal. Amend 5 Aug 2011

Roof underlay An absorbent permeable *building* paper that absorbs or collects condensation or water in association with *roof cladding* performance. Amend 5 Aug 2011

Saddle flashing A *flashing* used to weatherproof the junction between a horizontal and vertical surface.

Scupper An opening in a *parapet* or *enclosed balustrade* to allow water to drain into a rainwater head.

Sill support bar A bar or mechanism complying with EM6, E2/VM1 tests, and Clause B2 of the *Building Code*, and used to support the weight of aluminium window and door joinery that is installed over drained cavities. Amend 5 Aug 2011

Soft edge A compatible soft edging seamed onto *flashings* to provide closure to profiled *cladding*.

Specific design Design and detailing for compliance with the *Building Code*, of a proposed part or parts of a *building* which are not shown in this Acceptable Solution. Amend 5 Aug 2011 Amend 2 Jul 2005

Stanchion A connecting device, fixed into the structure of a building, that provides support for handrails, aerials and similar structures.

Stopend A turn-up at the upper edge of profiled metal *cladding*, or at the end of gutters and some types of *flashings*.

COMMENT:
A *stopend* assists the control of moisture by ensuring any moisture reaching the edge of the roofing is deflected from further entry.

Storey That portion of a *building* included between the upper surface of any floor and the upper surface of the floor immediately above, except the top *storey* shall be that portion of a *building* included between the upper surface of the topmost floor and the ceiling or roof above.

Stucco A wall *cladding system* formed from reinforced solid plaster over a rigid or non-rigid backing.

Stud A vertical *framing* timber.

Transverse flashing A roof *flashing* that runs across the roof slope, at right angles to the roof *cladding* profile.

Trapezoidal A type of profiled metal *cladding* with symmetrical or asymmetrical crests, with troughs between the crests.

Trough profile A type of profiled metal *cladding* comprising vertical ribs with flat, or lightly profiled pans between the ribs. Also known as ribbed, secret fixed or tray profile.

Amend 5 Aug 2011 **Underlay** The material used behind a *roof* or *wall cladding*. Refer **Wall underlay** and **Roof underlay**.

Valley gutter A gutter running down the valley formed by the intersection of two pitched roof surfaces.

Amend 5 Aug 2011 **Wall** refer **External wall.**

Amend 5 Aug 2011 **Wall underlay** A building paper, synthetic material or rigid sheathing used as part of the *wall cladding system* to assist the control of moisture by ensuring moisture which occasionally penetrates the *wall cladding* is directed back to the exterior of the *building*.

Waterproof and **waterproofing** The complete and total resistance of a *building element* to the ingress of any moisture.

Weathertightness and **weathertight** Terms used to describe the resistance of a *building* to the weather.

Weathertightness is a state where water is prevented from entering and accumulating behind the *cladding* in amounts that can cause undue dampness or damage to the *building elements*.

COMMENT:
The term *weathertightness* is not necessarily the same as *waterproof*.

However, a *weathertight building*, even under severe weather conditions, is expected to limit moisture ingress to inconsequential amounts, insufficient to cause undue dampness inside *buildings* and damage to *building elements*. Moisture that may occasionally enter is able to harmlessly escape or evaporate.

Wetwall The exterior *cladding* on a wall with a *drained cavity.*

Wind zone Categorisation of wind force experienced on a particular site as determined in NZS 3604, Section 5.

COMMENT:
Maximum ultimate limit state speeds are:

Low *wind zone*	=	wind speed of 32 m/s
Medium *wind zone*	=	wind speed of 37 m/s
High *wind zone*	=	wind speed of 44 m/s
Very high *wind zone*	=	wind speed of 50 m/s
Extra high *wind zone*	=	wind speed of 55 m/s.

Specific design is required for wind speeds greater than 55 m/s.

Amend 5 Aug 2011
Amend 2 Jul 2005

Verification Method E2/VM1

Amend 9 Jun 2019

1.0 Cladding systems of buildings up to 10 m in height, including junctions with windows, doors and other penetrations

1.1 General

This Verification Method is for determining compliance with *NZBC* E2.3.2 of *cladding systems* and associated window and door junctions only, for *buildings* of importance Levels 1 or 2 as described in Table 1.1(a) of NZS 3604.

The tests in this Verification Method shall be undertaken in a test facility with IANZ or equivalent accreditation for testing the *weathertightness* of *claddings* to the procedures of AS/NZS 4284, and as used to establish the performance criteria detailed in Paragraph 1.4 Test Procedures.

COMMENT:
The *weathertightness* testing of AS/NZS 4284 is modified in this Verification Method for generic domestic-oriented *cladding* because the Standard was developed primarily for testing specific, non-absorptive facades and curtain wall systems on high-rise commercial *buildings*.

1.2 Scope

1.2.1 The scope of this Verification Method shall be restricted to *buildings* that:

a) are in accordance with the scope of Paragraph 1.0 of E2/AS1, and within the *wind zones* covered by Section 5 of NZS 3604, and

b) have *claddings* that include a drained and vented cavity of nominal 20 mm minimum depth with minimum ventilation opening of 1000 mm²/m at the foot, including any *claddings* that require a rigid *wall underlay* in accordance with Paragraph 9.1.7.2 of E2/AS1, and

c) include window and door units that are manufactured to comply with the relevant requirements of NZS 4211, and

Amend 5 Aug 2011

d) may include *buildings* based on (a), (b) and (c) above, but with specific engineering design frame elements of at least equivalent stiffness to the *framing* provisions defined in NZS 3604.

Amend 5 Aug 2011

1.2.2 This Verification Method may also be used for individual *buildings* that comply with (a) to (d) above, and that are designed for a specific wind pressure up to a maximum ultimate limit state (ULS) of 2500 Pa.

COMMENT:
While the test specimens used for this Verification Method may include window and door units, it is only the junctions of these elements with other *cladding* elements that are assessed in the test.

1.3 Specimen details

The minimum size of the wall *cladding* specimen to be tested shall be 2.4 m x 2.4 m.

Any *cladding system* within an Extra High *wind zone* or subject to a specific design wind pressure up to ULS 2500 Pa that relies on this Verification Method shall have a rigid *underlay* installed in accordance with Paragraph 9.1.7 of E2/AS1. In either of these two circumstances, a rigid *underlay* is not necessary for the verification tests as a flexible *wall underlay* may suffice – unless the *cladding* to be tested specifically includes a rigid *underlay* as part of the *cladding system*, and its removal would compromise the structural fixings or support for the *cladding*.

COMMENT:
Testing a *cladding* with flexible *underlay*, but then verifying the *cladding* for use with rigid *underlay*, is allowed in order to make testing quicker and easier. It is expected that *cladding systems* with a cavity within the scope of E2/VM1 will perform better with a rigid *underlay* than with a flexible *underlay*, although this has not been proven.

For *cladding systems* intended to be available for use in multiple situations, including *cladding systems* for which a New Zealand supplier has commissioned the testing for the purposes of providing product assurance, Class 1 or Class 2 testing must be selected. Class 1 and Class 2 each include a mandatory

Amend 8 Nov 2018

minimum set of details to be included in the specimen. If any of the mandatory details from Class 1 or Class 2 are omitted from the specimen, then E2/VM1 compliance to Class 1 or Class 2 cannot be claimed.

Amend 8 Nov 2018

1.3.1 Class 1: *Cladding systems* where only vertical joints are required, and having no penetrations through the *cladding*.

Amend 8 Nov 2018

Test specimens shall include vertical joints, internal and external corners of the external *wall* junctions, and footer and header termination systems.

Amend 8 Nov 2018

1.3.2 Class 2: All *cladding systems* within the scope of this document that are not Class 1.

Testing is to include representative samples of penetrating *building elements* or joints to be used.

a) Test specimens must include vertical and horizontal *control joints*, internal and external *wall* junctions, windows and/or doors, a *parapet* or *enclosed balustrade capping* with a *saddle flashing*, a 200 mm diameter pipe penetration, and footer and header termination systems.

b) Test specimens may also include other details relevant to the use of the *cladding system* on the building, such as *scupper* penetrations, meter boxes, junctions with other *cladding systems* or *building elements*, and junctions where roof and *enclosed deck* terminations, *gutters*, or other features occur within walls (including within the sides of framed chimneys with *cladding*).

Amend 5 Aug 2011

COMMENT:

Although only certain details are mandatory for inclusion within test specimens, the inclusion of other additional details could enable manufacturers, suppliers and specifiers who commission tests to demonstrate compliance for a wider range of situations than those which the mandatory details cover. Manufacturers, suppliers and specifiers should ensure that test specimens include all *cladding* details or junctions for which compliance with this Verification Method is intended to be demonstrated and claimed.

Amend 8 Nov 2018

A 15 mm diameter round hole shall be formed in the internal *lining* below the window to simulate the effect of power points, light switches and other air leakage through the internal *lining*. Where a *cladding* specimen is larger than 2.4 m x 2.4 m, an additional 15 mm hole shall be added for each 7 m² of *cladding* area (or part thereof).

Amend 5 Aug 2011

1.3.2.1 To allow the observation of any water penetration, one of the following options must be followed:

a) For specimens that include a rigid *wall underlay*, adjacent to critical elements where visual access is required a proportion of the *underlay* shall be made using transparent material of sufficient structural capability and similar airtightness to the specified wall *lining* material, and able to resist the applied wind pressures. The proportion shall be at least 2%, but shall be small enough that it does not affect the ability of the specimen to represent the performance of the *underlay* within the *cladding system*; or

b) For specimens that do not include a rigid *wall underlay*, adjacent to critical elements where visual access is required, the *wall underlay* shall be cut through and removed, or fastened back onto the *framing*, with a rigid transparent internal *lining* used to support the air pressure. It is required that between 2% and 100% of the area of the *wall underlay* (or equivalent) be so removed; or

c) For specimens that include a flexible or a rigid *underlay*, small video cameras and/or borescopes shall be installed within the cavity to provide a clear view of all critical elements where visual access is required. Borescopes and cameras must be positioned clear of all junctions, and must be installed in a manner that does not affect the airtightness of the air barrier (rigid *underlay* or internal wall *lining*) or affect the path of any moisture that enters the cavity.

Amend 8 Nov 2018

COMMENT:
The use of borescopes and cameras requires care to achieve these requirements, but may be the most appropriate option in situations such as when other AS/NZS 4284 tests are to be performed on the same specimen, or to help resolve doubts about whether the replacement of a proportion of the *lining* or *underlay* with a transparent material will affect the performance of the *cladding*.

Amend 8 Nov 2018

Amend 5 Aug 2011

1.4 Test procedure

The Verification Method shall consist of the extended water penetration test methodologies of AS/NZS 4284, following a preconditioning pressure loading exposure.

1.4.1 Preconditioning

Apply a preconditioning loading to the external face of the test sample for a period of 1 minute of positive pressure, followed by a period of 1 minute of negative pressure (suction). The loading shall be 1515 Pa.

COMMENT:
As the ventilated cavity is subjected to the same applied pressure, it is necessary that the material serving as the *air seal* is able to sustain the same applied loading.

Where the test wall is utilising a permeable *wall underlay* or *membrane*, the internal wall *lining* will be required to sustain the serviceability limit state (SLS) wind pressures.

1.4.2 Series 1 Static Pressure Water Penetration

The water penetration test by static pressure shall be conducted in accordance with Clause 8.5 of AS/NZS 4284 and at the maximum test pressure of 455 Pa.

1.4.3 Series 1 Cyclic Pressure Water Penetration

The water penetration test by cyclic pressure shall be conducted in accordance with Clause 8.6 of AS/NZS 4284 and to the cyclic pressure of 455 – 910 Pa at the prescribed Stage 3, with the Stage 1 and Stage 2 tests deleted.

1.4.4 Series 2 'Water Management Testing'

Amend 5 Aug 2011

Paragraphs 1.4.2 and 1.4.3 shall be repeated, following the formation of 6 mm diameter holes through the *wetwall* as allowed in AS/NZS 4284 Clause 9.9 in at least 4 places, as noted below:

a) Through the window/wall joint at 3/4 height of both window/door jambs,

b) Immediately above the head *flashing*,

c) Through the external sealing of the horizontal and vertical joints, and

d) Above any other *wetwall* penetration detail.

The introduction of defects is intended to simulate the failure of the primary weather-defence/sealing. It must only penetrate to the plane of the back of the *wetwall* so the water management of the cavity can be assessed.

1.4.4.1 Immediately upon the conclusion of the Water Management Tests (within 30 minutes) (Paragraph 1.4.4), the layers behind the *wetwall* that support air pressure (including sealing in the window trim cavity) shall be removed, and any evidence of non-compliance (as defined in Paragraph 1.5) noted. Amend 8 Nov 2018

1.4.5 Series 3 'Wetwall Test'

1.4.5.1 Repeat Paragraph 1.4.2 with an air pressure of 50 Pa, applied across the *wetwall* only, for 15 minutes. Amend 8 Nov 2018

1.5 Non-compliance

1.5.1 Non-compliance shall be the presence of water (as defined in Paragraph 1.5.2), or evidence of any water, either:

a) On the removed surfaces of the cavity after carrying out the tests in Paragraphs 1.4.2 and 1.4.3, and the subsequent 'water management' tests in Paragraph 1.4.4, and/or

b) During or after the test in Paragraph 1.4.5.

Amend 8 Nov 2018

1.5.2 Water which is able to penetrate to the back of the *wetwall* through introduced defects and joints shall be controlled. It may contact battens and other cavity surfaces,

Amend 5 Aug 2011

but no water shall be transferred to the plane of the *wall underlay*, cavity air sealing or structural *framing* due to a design or systemic failure. Water that may arrive on the *underlay* due to an 'isolated blemish' may be disregarded. No water may drip through an airspace within the cavity where it is possible for water to impact on a surface in the cavity and splash onto the *wall underlay*. However, any spattering of water into the cavity through the introduced defects shall be ignored.

During the *Wetwall* Test, water is allowed to spatter up from the footer *flashing*, provided it is not held above any cavity obstruction.

Amends 5 & 6

1.6 Existing verification certificates as at 31 March 2019

1.6.1 E2/VM1, included in E2 Acceptable Solutions and Verification Methods Amendment 8, is effective from 30 November 2018.

1.6.2 E2/VM1, included in E2 Acceptable Solutions and Verification Methods Amendments 5 - 7 remains effective (excluding transitional arrangements for E2/VM1 included in E2 Acceptable Solutions and Verification Methods Amendment 4 or earlier) for all *cladding systems* with verification certificates issued prior to 31 March 2019 provided that any verification certificates issued under E2/VM1 from 31 March 2019 must be under E2 Acceptable Solutions and Verification Methods Amendment 8.

Amend 8 Nov 2018

Amends 5 & 6

Amend 8 Nov 2018

1.7 Pro-forma for test details

The pro forma attached as Appendix 1 to this Verification Method may be used to provide specifiers with a summary of test details and results.

Amend 5 Aug 2011

2.0 Pitched roofing systems over a ventilated roof space of 15° pitch or more

2.1 AS 4046 Part 9 provides a Verification Method for determining compliance with *NZBC* E2.3.2 of any tiled roofing system of 15° pitch or more above a *roof* space (i.e. not a skillion *roof*). Compliance is based on comparison of performance with a control roofing system described in the Standard. Compliance is achieved where the water penetration is less than, or equal to, the control sample. This test is also a Verification Method for other ventilated roofing systems or skylights with a pitch of 15° or more above a *roof* space.

3.0 Skillion roofs and commercial and industrial roofing

3.1 No specific method has been adopted for verifying compliance of skillion *roofs* or commercial or industrial roofing with *NZBC* E2.3.2.

Amend 5 Aug 2011

Appendix 1: Pro forma

Test results shall be expressed in the following tabulated format within the usual Test Report of the particular test laboratory.

Amend 5 Aug 2011 **Series 1: Static Water Penetration** Test pressure 455 Pa Duration 15 minutes	
Amend 5 Aug 2011 **Series 1: Cyclic Water Penetration** Test pressure 455–910 Pa Duration 5 minutes Amend 5 Aug 2011	
Series 2: Water Management Tests **Static Water Penetration** Amend 5 Aug 2011 Test pressure 455 Pa Duration 15 minutes	
Series 2: Water Management Tests **Cyclic Water Penetration** Test pressure 455–910 Pa Duration 5 minutes Amend 5 Aug 2011	
Series 3: Wetwall Test Static Water Penetration Test pressure 50 Pa Duration 15 minutes	

Additional water penetration requirements:

Comments:

Acceptable Solution E2/AS1

Amend 5 Aug 2011

1.0 Scope

This Acceptable Solution covers the *weathertightness* of the *building* envelope. Notes shown under 'COMMENT', occurring throughout this document are for guidance purposes only and do not form part of this Acceptable Solution.

Amend 2 Jul 2005

1.1 Construction included

The scope of this Acceptable Solution is limited to the materials, products and processes contained herein, for *buildings* within the scope of NZS 3604, and:

Amend 2 Jul 2005

a) Up to 3 *storeys* with a height measured from lowest ground level adjacent to the *building* to the highest point of the *roof* (except for chimneys, aerials and the like) of 10 m or less, and

b) With floor plan area limited only by seismic and structural *control joints*, and

c) *External walls* that are vertical, and *roofs* that are 60º or less above the horizontal.

Amend 5 Aug 2011

Where *buildings* are based on NZS 3604, but require specific engineering design input, the *framing* shall be of at least equivalent stiffness to the *framing* provisions of NZS 3604.

Amend 5 Aug 2011

COMMENT:

The floor plan limitations of NZS 3604 may be exceeded up to the point that *specific design* is required to accommodate seismic or wind movement. Beyond that point, *specific design* is required to demonstrate compliance with Clause E2 of the *Building Code*.

Amend 5 Aug 2011

Claddings also required to perform as bracing must comply with NZS 3604. Where a *drained cavity* is used, specific testing can be used to demonstrate that a *cladding* on *cavity battens* can provide the required bracing resistance.

Amend 5 Aug 2011

1.1.1 Attached garages

Attached garages that are integral with the *weathertightness* envelope of the *building* are included within the scope of this Acceptable Solution. Refer to Paragraph 9.1.3.4.

Amend 5 Aug 2011

1.2 Construction excluded

1.2.1 Outbuildings

Outbuildings, such as stand-alone garages and other structures that are unlined, are outside the scope of this Acceptable Solution.

Amend 5 Aug 2011

COMMENT:

Details contained in this Acceptable Solution can be used for outbuildings and unlined structures, but the requirements may be in excess of the minimum required by the *Building Code*.

Amend 5 Aug 2011

This is particularly the case in regard to unlined and uninsulated *buildings*, where a *drained cavity* is unlikely to be necessary.

However, care must be taken, as some *weathertight* details depend on the presence of an internal *lining* to provide pressure equalisation behind the *cladding*.

Amend 2 Jul 2005

1.2.2 Spread of flame

Buildings with *drained cavities* and spread-of-flame requirements, as specified in *NZBC* C Clauses, are outside the scope of this Acceptable Solution. Cavities in such circumstances must be specifically designed for both *weathertightness* and spread of flame.

Amend 5 Aug 2011

COMMENT:

Options could include the provision of a *fire rated* wall behind the battens, or breaking the cavity at each floor and providing a cavity *flashing* and *fire stop* at each level.

Amend 5 Aug 2011

Amend 2 Jul 2005

1.2.3 Acoustics

Buildings with *drained cavities* and acoustic requirements, as specified in *NZBC* Clause G6, are outside the scope of this Acceptable Solution.

Amend 2 Jul 2005

COMMENT:

Cavities in such circumstances must be specifically designed for both *weathertightness* and acoustic performance.

1.3 Provisions for snow

Amend 2 Jul 2005

Specific design for preventing the ingress of snow melt water is required when the open ground snow load S_g, as defined in NZS 3604, exceeds 1.0 kPa, and the roof is *constructed* in a way that is likely to cause a build-up of snow.

Amend 5 Aug 2011

COMMENT:
Hidden gutters, parapets and skylights are examples of features within a *roof* design that are likely to cause a build-up of snow.

Amend 2 Jul 2005

1.4 Specific design

Amend 5 Aug 2011

Buildings, components or junction details not included or shown in this Acceptable Solution require *specific design*.

Amend 2 Jul 2005

Amend 5 Aug 2011

1.5 Qualifications

Amend 2 Jul 2005

COMMENT:
Amend 5 Aug 2011
An understanding of the proper methods of design and installation and the importance of the correct *construction* sequence is essential if an NZBC compliant *building* is to be achieved. Adequate training by those designing and applying particular products and *claddings* is therefore highly recommended.
Amend 5 Aug 2011

The design, installation and alteration of *claddings* will be 'restricted work' under the licensed building practitioner scheme, due to take effect in 2012. Until then, the use of licensed designers, builders and installers is optional. It is important that product suppliers, manufacturers and NZ agents (for imported products) ensure those handling and applying their products are adequately trained to do so, and that site managers oversee the correct integration of adjoining *building elements* to achieve a complete weathering system.
Amend 5 Aug 2011
Amend 2 Jul 2005

2.0 General

2.1 Weathertightness

Cladding systems shall meet the requirements of NZBC E2.2 to E2.3.7, and the provisions of this Acceptable Solution are acceptable means of achieving this.

COMMENT:
Most manufacturers provide technical literature for their *cladding* materials and systems that include recommendations for design and installation.

Amend 5 Aug 2011
Manufacturers' recommendations may include information additional to that shown in this Acceptable Solution.

However, some additional work, such as extra fixings that penetrate *flashings*, can lead to details that need to be considered in terms of *specific design*.
Amend 2 Jul 2005

Additional or alternative details may be required that need supporting documentation or testing to demonstrate compliance in regard to *weathertightness*.

2.2 Materials

Materials used to *construct* the *building* envelope shall be:

a) In accordance with the *durability* requirements of NZBC B2,

b) Suitable for their end-use, location and environment as shown in Table 20, and

c) Compatible with adjoining materials as shown in Table 21 and Table 22.

2.3 Systems versus materials

All *building* products shall be considered as part of a system, even if the components of that system are provided from different sources. Materials used to *construct* the *building* envelope shall be designed as a complete *cladding system* rather than as separate items.
Amend 5 Aug 2011

COMMENT:
It is important that the compatibility and *durability* of the combination of materials is able to be demonstrated for any given application.
Amend 5 Aug 2011

2.4 Cladding finish colours

Finish colours for *flush-finished* fibre cement sheet and *EIFS* shall have a reflectivity of 40% or more when measured in accordance with ASTM C1549.
Amend 5 Aug 2011

COMMENT:
Dark colours cause *claddings* to reach higher temperatures, which results in more thermal expansion and a greater risk of cracking of joints in monolithic *wall claddings*. Risks of cracking are also associated with dark colours on painted timber *wall claddings* and trim. Expansion of metal roofing and *flashings* are affected by dark colours.
Amend 5 Aug 2011

Colour cards from some coating manufacturers may include reflectance values.

Amend 5 Aug 2011

2.5 Maintenance – general

Maintenance shall be carried out as necessary to achieve the required *durability* of materials, components and junctions.

The extent and nature of necessary maintenance is dependent on the:

a) Type of *cladding* or components used,

b) Position of *cladding* or components on the *building*,

c) Geographical location of the *building*, and

d) Specific site conditions.

COMMENT:
A deterioration in the appearance of the surface of a *cladding* does not necessarily relate to a deterioration in the *weathertightness* of the *cladding*.

Amend 5 Aug 2011

2.5.1 Regular maintenance

Regular maintenance of a *building* will include:

a) Washing exterior surfaces,

b) Inspecting surfaces and junctions, and repairing or replacing items when necessary, in order to preserve the *weathertightness* of the *building*.

c) Maintaining clearances between *cladding* and external ground or paving as per Paragraph 9.1.3.

d) Maintaining minimum 35 mm clearances between *roofing* and *membrane* decking, and *wall cladding* above

e) Maintaining finish coatings especially for *stucco*, *EIFS* and fibre cement *claddings*.

Amend 5 Aug 2011

COMMENT:
Washing by rain removes most accumulated atmospheric contaminants, but sheltered areas, such as walls directly below *eaves*, are protected from the direct effects of rain and require regular manual washing.

Some heavily textured surfaces will not be as effectively washed by rain as smoother surfaces, so will require more regular manual washing.

However, it is important that high pressure water is not directed at sensitive junctions such as window surrounds and other *flashings*. Great care must be taken to avoid water being driven past anti-capillary gaps and *flashings* into the *wall* cavities.

3.0 Weathertightness Risk Factors

COMMENT:
Analysis of inspection reports from leaking *buildings* shows that a high incidence of leaks is associated with junctions within, and penetrations through, the *building* envelope. It also shows serious problems are more commonly associated with *claddings* that have limited capacity to drain and dry out any water that gets behind them, when a leak occurs. Amend 5 Aug 2011

This Acceptable Solution addresses these problems in two ways:

a) By providing details for common junctions and penetrations of the *building* envelope, and

b) By classifying *buildings* within the scope of this document into risk categories, and requiring different *cladding* solutions depending on the *risk score*.

Using the risk assessment, risk factors can be identified and changes may be made to a design to lower the *risk score*.

3.1 Establishing the risk

A risk assessment of the proposed design shall be carried out using a *building* envelope *risk matrix*. This allows the risks related to various features to be aggregated, resulting in a *risk score* for the design.

Figure 1 shows the process that shall be followed in order to assess the risk.

3.1.1 Definitions of risk

Table 1 sets out the definitions of risk levels relating to the location and design features of the *building*.

3.1.2 The risk score

Table 2 sets out the *risk matrix* that shall be used to define the *risk score* for a *building* within the scope of this Acceptable Solution.

A *risk score* is calculated for each external face of the *building*. *Claddings* are then selected from Table 3 according to the *risk scores*, or the highest *risk score* may be used for all *walls*. Amend 5 Aug 2011

Amend 5 Aug 2011

Amend 2 Jul 2005

Amend 5 Aug 2011

3.3 Wall claddings

The following wall *cladding systems* are covered in this Acceptable Solution:

a) *Masonry veneer*	Paragraph 9.2
b) *Stucco*	Paragraph 9.3
c) Timber weatherboards	Paragraph 9.4
d) Fibre cement weatherboards	Paragraph 9.5
e) Profiled metal wall claddings (Amend 2 Jul 2005)	Paragraph 9.6
f) Fibre cement sheet	Paragraph 9.7
g) Plywood sheet	Paragraph 9.8
h) *EIFS*	

Amend 5 Aug 2011

Paragraph 9.9.

Other wall *claddings* are outside the scope of this Acceptable Solution.

Figure 1: How to assess risk
Paragraph 3.1

Step One: Obtain Detailed Drawings

Suitably detailed drawings are required to assess *weathertightness* risk. This documentation may include a site plan, floor plans, elevations, details of junctions and penetrations, and the presence of features like *decks* and pergolas.

Step Two: Assess Each External Face Against Risk Factors

Assess the drawings for each external face to determine the *risk score* for each risk factor. These are:
Wind zone
Number of storeys
Roof/wall intersection design
Eaves width
Envelope complexity
Deck design
Refer Table 1.

Step Three: Complete the Building Envelope Risk Matrix Table

Complete the "Building envelope risk matrix" (Table 2) for each face of the *building*.

It is possible for different elevations to have different *risk scores*.

Step Four: Determine Suitable Cladding

Consult Table 3: Suitable wall *claddings* to determine what *cladding* types are recommended with the *risk score* for each face.

The *cladding* selected must be appropriate for the score on that face, but can be beyond the minimum required (i.e. *cladding* suitable for a higher score can be used).

Table 1: Definitions of risk levels
Paragraph 3.1.1, Figure 1

Risk Factor	Score(5)	Risk severity	Comments
A: Wind zone	**0**	**Low risk**	Low *wind zone* as described by NZS 3604
	0	**Medium risk**	Medium *wind zone* as described by NZS 3604
	1	**High risk**	High *wind zone* as described by NZS 3604
	2	**Very high risk**	Very High *wind zone* as described by NZS 3604
	2	**Extra high risk**	Extra High *wind zone* as described in NZS 3604 (4)
B: Number of storeys	**0**	**Low risk**	One *storey*
	1	**Medium risk**	Two *storeys* in part
	2	**High risk**	Two *storeys*
	4	**Very high risk**	More than two *storeys*
C: Roof/wall junctions	**0**	**Low risk**	Roof-to-wall intersection fully protected (e.g. hip and gable roof with *eaves*)
	1	**Medium risk**	Roof-to-wall intersection partly exposed (e.g. hip and gable roof with no *eaves*)
	3	**High risk**	Roof-to-wall intersection fully exposed (e.g. *parapets, enclosed balustrades* or *eaves* at greater than 90° to vertical with soffit *lining*)
	5	**Very high risk**	Roof elements finishing within the boundaries formed by the exterior walls (e.g. lower ends of aprons, *chimneys, dormers* etc)
D: Eaves width (1)(2)	**0**	**Low risk**	Greater than 600 mm for single storey
	1	**Medium risk**	451–600 mm for single storey, or over 600 mm for two storey
	2	**High risk**	101–450 mm for single storey, or 451–600 mm for two storey, or greater than 600 mm above two storey
	5	**Very high risk**	0–100 mm for single storey, or 0–450 mm for two storey, or less than 600 mm above two storey
E: Envelope complexity	**0**	**Low risk**	Simple rectangular, L, T or boomerang shape, with single *cladding* type
	1	**Medium risk**	Moderately complex, angular or curved shapes (e.g. Y or arrowhead) with no more than two *cladding* types
	3	**High risk**	Complex, angular or curved shapes (e.g. Y or arrowhead) with multiple *cladding* types
	6	**Very high risk**	As for High risk, but with junctions not covered in C or F of this table (e.g. box windows, pergolas, multi-storey re-entrant shapes etc)
F: Decks(3)	**0**	**Low risk**	None, timber slat *deck* or porch at ground floor level
	2	**Medium risk**	Fully covered in plan by *roof*, or timber slat *deck* attached at first or second floor level
	4	**High risk**	*Enclosed deck* exposed in plan or cantilevered at first floor level
	6	**Very high risk**	*Enclosed deck* exposed in plan or cantilevered at second floor level or above

NOTES:

(1) *Eaves* width measured horizontally from external face of *wall cladding* to outer edge of overhang, including fascias and external gutters/spoutings.

(2) Balustrades and *parapets* count as 0 mm *eaves*.

(3) The term *deck* includes balconies, as described in the Definitions.

(4) *Buildings* in Extra High *wind zones* require rigid *underlays* and *drained cavities,* refer to Table 3.

(5) Refer also to Table 2.

Errata 2 Dec 2011
Amend 2 Jul 2005
Amend 2 Jul 2005
Amend 2 Jul 2005
Amend 2 Jul 2005
Amend 2 Jul 2005
Amend 2 Jul 2005
Errata 2 Dec 2011
Amend 5 Aug 2011

Amend 5 Aug 2011

Table 2: Building envelope risk scores
Paragraph 3.1.2, Figure 1

Risk factor	Risk severity								Subtotals for each risk factor
	LOW	**score**	**MEDIUM**	**score**	**HIGH**	**score**	**VERY HIGH (1)**	**score**	
Wind zone (per NZS 3604)(1)	0		0		1		2		
Number of storeys	0		1		2		4		
Roof/wall intersection design	0		1		3		5		
Eaves width	0		1		2		5		
Envelope complexity	0		1		3		6		
Deck design	0		2		4		6		
(Enter the appropriate risk severity score for each risk factor in the score columns. Transfer these figures across to the right-hand column. Finally, add up the figures in the right-hand column to get the total risk score.)							**Total risk score for use in Table 3:**		

Amend 5 Aug 2011

Amend 5 Aug 2011

NOTE: (1) For *buildings* in Extra High *wind zones*, refer to Tables 1 and 3 for rigid *underlay* and *drained cavity* requirements.

Table 3: Suitable wall claddings
Paragraphs 3.1.2, 7.4, 9.1.1,9.1.7.2, 9.4.1.2, 9.4.1.3, 9.6, 9.6.1, Figure 1

Risk Score from Table 2	Suitable wall claddings(1): Direct fixed to framing	Suitable wall claddings(1): Over nominal 20 mm drained cavity
		Claddings on *parapets*, *enclosed balustrades*, and in Extra High *wind zones* shall be installed over *drained cavities*.(5)(6)
0 – 6	a) Timber weatherboards – all types b) Fibre cement weatherboards c) Vertical profiled metal – corrugated and symmetrical *trapezoidal* (3) d) Fibre cement sheet(4) (Jointed finish) e) Plywood sheet	a) *Masonry veneer* (2) b) *Stucco* c) Horizontal profiled metal(3) – corrugated and *trapezoidal* only d) Fibre cement – *flush-finished* e) *EIFS*
7 – 12	a) Bevel-back timber weatherboards b) Vertical timber board and batten c) Vertical profiled metal – corrugated only(3)(6)	a) *Masonry veneer* (2) b) *Stucco* c) *Horizontal* profiled metal – corrugated and *trapezoidal* only d) Rusticated weatherboards e) Fibre cement weatherboard f) Fibre cement sheet – flush and jointed finish g) Plywood sheet h) *EIFS*
13 – 20	a) Vertical profiled metal – corrugated only(3)(6)	a) *Masonry veneer* (2) b) *Stucco* c) Horizontal profiled metal – corrugated and *trapezoidal* only d) Rusticated weatherboards e) Fibre cement weatherboards f) Fibre cement sheet – flush and jointed finish g) Plywood sheet h) *EIFS* i) Bevel-back weatherboards
Over 20	a) Redesign the *building* to achieve a lower score, or b) *Specific design* – The design may need changing to reduce the risk – The *building consent authority* may require more comprehensive details and documentation providing evidence of *weathertightness* – The *building consent authority*, designer or *owner* may require more inspections – A third party audit of the design may be required.	

NOTES:
(1) The wall claddings in this table are limited to those covered in this Acceptable Solution.
(2) Traditional *masonry veneer* as per SNZ HB 4236, with minimum 40 mm cavity.
(3) Refer Figure 38 for profiles.
(4) Except *stucco* over a fibre cement backing.
(5) *Claddings* in Extra High *wind zones* require rigid *underlays* – refer to Paragraph 9.1.7.2
(6) Direct fix vertical corrugated steel is included as cavity construction.

Amend 5 Aug 2011
Amend 2 Jul 2005
Amend 5 Aug 2011
Amend 5 Aug 2011
Amend 2 Jul 2005
Amend 5 Aug 2011
Amend 2 Jul 2005
Amend 5 Aug 2011
Amend 5 Aug 2011
Amend 2 Jul 2005
Amend 5 Aug 2011
Amend 2 Jul 2005
Amend 2 Jul 2005
Amend 5 Aug 2011

3.4 Examples using the risk matrix

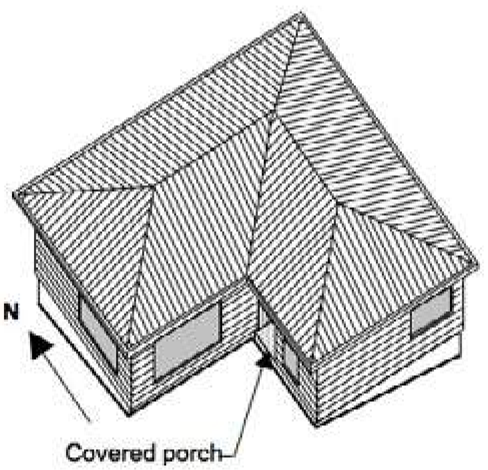
Paragraphs 3.4.1 to 3.4.3 provide examples that show a range of *building* styles. The completion of the *risk matrix* for each design is shown, together with the choice of wall *claddings* the *risk scores* indicate.

COMMENT:
The examples have been selected to show a range of design complexities, features and materials. Refer also to *Guide to the Risk Matrix.* Amend 5 Aug 2011

3.4.1 Example 1

The first example illustrates the use of the *risk matrix* for a simple traditionally-styled *building*.

Figure 2: Risk matrix example 1



COMMENT:
The house in this example is a simple single *storey* L shape and is considered low risk in terms of *envelope complexity*.

The *eaves* are 500 mm wide, and the site is in a High *wind zone*.

The covered porch is at ground level and so is considered low risk.

For this example, the calculations have been done for the south elevation, and this face scores as very low risk. A similar *risk score* would result for all elevations of this *building*.

3.4.1.1 Cladding options

As all faces score low, *cladding* options from Table 3 are:

a) *Direct fixed claddings*:
  i) Timber weatherboards – all types shown Amend 5 Aug 2011
  ii) Fibre cement weatherboards
  iii) Vertical profiled metal – corrugated and symmetrical *trapezoidal* only
  iv) Fibre cement sheet – not *flush-finished* Amend 5 Aug 2011
  v) Plywood sheet

b) Wall *cladding* with a nominal 20 mm *drained cavity* (note: claddings in Extra High *wind zones* require rigid *underlays*): Amend 2 Jul 2005 Amend 5 Aug 2011
  i) *Masonry veneer*
  ii) *Stucco*
  iii) Horizontal profiled metal – corrugated and *trapezoidal* only Amend 2 Jul 2005
  iv) Fibre cement – *flush-finished*
  v) *EIFS*. Amend 5 Aug 2011

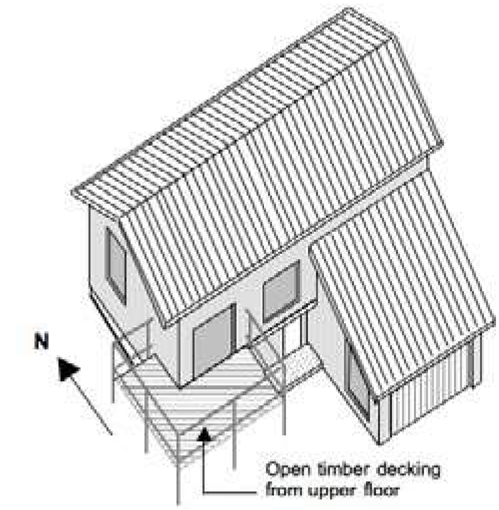
Table 4: Risk matrix example 1 – south face

Risk factor	Risk severity								Subtotals for each risk factor
	LOW	score	MEDIUM	score	HIGH	score	VERY HIGH	score	
Wind zone (per NZS 3604)	0		0		1	***1***	2		***1***
Number of storeys	0	***0***	1		2		4		***0***
Roof/wall intersection design	0	***0***	1		3		5		***0***
Eaves width	0		1	***1***	2		5		***1***
Envelope complexity	0	***0***	1		3		6		***0***
Deck design	0	***0***	2		4		6		***0***
								Total risk score:	***2***

3.4.2 Example 2

The second example illustrates the use of the *risk matrix* for a moderately complex *building*. Amend 2 Jul 2005

Figure 3: Risk matrix example 2



COMMENT:

Overall the house in this example is still a relatively simple design with a single *cladding* type. It would be considered to be medium risk in terms of *envelope complexity*.

The lean-to style room on the ground floor is quite simple but does introduce a roof-to-wall intersection which requires the correct *flashing* and particular care with the *kick-out* at the west end of the junction. This would make this factor very high risk. Amend 5 Aug 2011

The timber *deck*, itself low risk, connects to the house at the first floor level, and so is considered to be medium risk. Any leaks at the connection points have an opportunity to enter the *wall* below.

The *eaves* are less than 450 mm wide, and the site is in a High *wind zone*.

The calculations have been done for the south elevation. The other elevations of this *building* score lower because they are simpler.

The west elevation still has the *deck* connection and scores 7. *Cladding* options would be the same as for the south face.

The east elevation scores 6 and the north elevation scores 5, so these have more *cladding* options.

Table 5: Risk matrix example 2 – south elevation

Risk factor	Risk severity								
	LOW	score	MEDIUM	score	HIGH	score	VERY HIGH	score	Subtotals for each risk factor
Wind zone (per NZS 3604)	0		0		1	***1***	2		***1***
Number of storeys	0		1	***1***	2		4		***1***
Roof/wall intersection design	0		1		3		5	5	***5***
Eaves width	0		1		2	***2***	5		***2***
Envelope complexity	0		1	***1***	3		6		***1***
Deck design	0		2	***2***	4		6		***2***
								Total risk score:	***12***

Amend 5 Aug 2011

3.4.2.1 Cladding options – south and west elevations

Cladding options from Table 3, are:

a) *Direct fixed claddings*:
   i) Bevel-back weatherboards
   ii) Vertical board and batten weatherboards
   iii) Vertical corrugated metal, and Amend 2 Jul 2005

b) Wall *cladding* with a nominal 20 mm *drained cavity*: Amend 2 Jul 2005
   i) *Masonry veneer* (with 40 mm cavity)
   ii) *Stucco*
   iii) Horizontal profiled metal – corrugated and *trapezoidal* only Amend 2 Jul 2005
   iv) Rusticated weatherboards
   v) Fibre cement weatherboards
   vi) Fibre cement sheet
   vii) Plywood sheet
   viii) *EIFS*.

3.4.2.2 Cladding options – north and east elevations

Cladding options from Table 3, for east and north faces, are:

a) *Direct fixed claddings*:
   i) Timber weatherboards – all types
   ii) Fibre cement weatherboards
   iii) Vertical profiled metal – corrugated and symmetrical *trapezoidal* only
   iv) Fibre cement sheet
   v) Plywood sheet
   vi) *EIFS*, and

b) Wall *cladding* with a nominal 20 mm *drained cavity*: (Amend 2 Jul 2005)
   i) *Masonry veneer* (with 40 mm cavity)
   ii) *Stucco*
   iii) Horizontal profiled metal – corrugated and *trapezoidal* only. (Amend 2 Jul 2005)

3.4.3 Example 3

The third example illustrates the use of the *risk matrix* for a complex *building*.

COMMENT:

The combination of features present on the south elevation results in a very high *risk score*. The presence of a *parapet* at the roof, *decks, enclosed balustrade*-to-*wall* junctions and pergola connections all contribute to this risk. The site is in a High *wind zone*.

(Amend 2 Jul 2005) The *risk score* is sufficiently high that the south elevation would require *specific design*, or redesign to lower the risk.

(Amend 2 Jul 2005) *Specific design* may result in the *building consent authority* possibly:
a) Needing more details to be provided,
b) Requiring more inspections during *construction*,
c) Requiring a third party audit of the design. (Amend 2 Jul 2005)

The east and west elevations also score very highly at 18-20, and would require a *cladding* with a cavity such as vertical profiled steel, *masonry veneer* or any other *cladding* with a nominal 20 mm *drained cavity*. (Amend 2 Jul 2005)

The north elevation scores 14, so would require the use of the same *cladding* option as the east and west elevations.

Figure 4: Risk matrix example 3

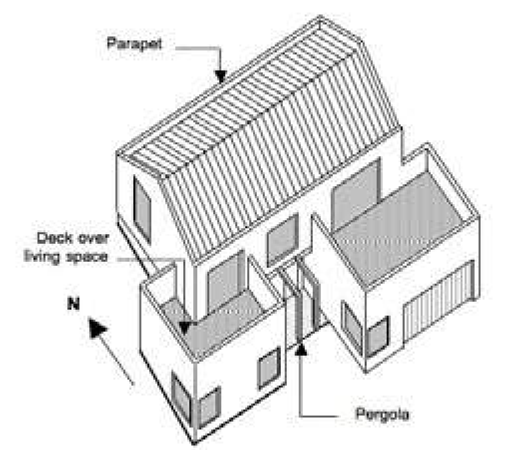


Table 6: Risk matrix example 3 – south elevation

Risk factor	Risk severity LOW	score	MEDIUM	score	HIGH	score	VERY HIGH	score	Subtotals for each risk factor
Wind zone (per NZS 3604)	0		0		1	***1***	2		***1***
Number of storeys	0		1	***1***	2		4		***1***
Roof/wall intersection design	0		1		3		5	***5***	***5***
Eaves width	0		1		2		5	***5***	***5***
Envelope complexity	0		1		3		6	***6***	***6***
Deck design	0		2		4	***4***	6		***4***
								Total risk score:	***22***

3.4.3.1 Cladding options – south elevation

As the south face scores over 20, it will require:

Amend 2 Jul 2005

a) *Specific design*, or

b) Redesigning the proposal to reduce the risk, so reducing the *risk score*.

3.4.3.2 Cladding options – other elevations

As the other faces score from 14 to 20, *cladding* options from Table 3 are:

a) *Direct fixed claddings*:
   i) Vertical corrugated metal, and

Amend 2 Jul 2005

b) Wall *cladding* with a nominal 20 mm *drained cavity*:
   i) *Masonry veneer* (with 40 mm cavity)
   ii) *Stucco*
   iii) Horizontal profiled metal – corrugated and *trapezoidal* only
   iv) Rusticated weatherboards
   v) Fibre cement weatherboards
   vi) Fibre cement sheet
   vii) Plywood sheet
   viii) *EIFS*
   ix) Bevel-back weatherboards.

Amend 2 Jul 2005

4.0 Flashings

4.1 Materials for flashings

Acceptable materials for *flashing* junctions and penetrations are described in Paragraph 4.3.

4.2 Selection of flashing materials

Amend 5 Aug 2011

Flashing materials shall take into account the following factors:

a) The requirements of NZBC Clause B2 Durability,

b) The environment where the *building* is located,

c) The specific conditions of use, and

d) Consideration of the surrounding materials.

Amend 5 Aug 2011

Amend 2 Jul 2005

COMMENT:
Generally, the *durability* requirements for *flashings* specified in B2 are:

a) 50 years, where *flashings* are:
   i) completely hidden behind *claddings* such as *masonry veneer*, or
   ii) not accessible,

b) 15 years, where *flashings* are:
   i) exposed, partially exposed, or
   ii) accessible.

   Two part *flashings* allow replacement of the *flashing* without *cladding* alteration.

An example of a two part *flashing* is shown in Figure 7.

Amend 2 Jul 2005

4.2.1 Environment

Flashing materials shall be selected according to the relevant exposure conditions as defined in Table 20 to minimise corrosion.

Amend 5 Aug 2011

COMMENT:
The exposure zone in which a *building* is located can affect the *durability* of *flashings*.

Exposure zones are defined in NZS 3604, based on the likely exposure to wind-driven sea-salt. Corrosion due to geothermal or corrosive industrial atmospheres, as defined in NZS 3604, require *specific design*.

Exposure zones are based on AS/NZS 2728.
AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand.

Amend 5 Aug 2011

Amend 5 Aug 2011

4.2.2 Surrounding materials

Metals which are in contact in locations where they will become wet, or where water can flow over metals or certain plastics onto another metal, shall be selected in accordance with Table 21 and Table 22.

Uncoated metals shall not be used where carbon deposits or chemical contaminants may accumulate.

COMMENT:
Undesirable effects can occur when some materials are in contact with each other. Examples are corrosion of metals, stress cracking of plastics and staining of glass.

Carbon deposits such as soot will cause accelerated corrosion of damp uncoated metal.

4.3 Acceptable flashing materials

Amend 5 Aug 2011

Tables 20, 21 and 22 shall be used to assess suitability of *flashing* materials for the required *durability*.

COMMENT:
Additional guidance on *flashing* materials can be found in the New Zealand Metal Roof and Wall Cladding Code of Practice.

4.3.1 uPVC flashings

Amend 2 Jul 2005

uPVC *flashings* shall be a minimum of 0.75 mm thick.

uPVC *flashings* shall comply with the requirements of the following Clauses of AS/NZS 4256: Part 2:

a) Clause 9.2 Impact resistance,

b) Clause 9.3 Tensile strength, and

c) Clause 9.4 Colourfastness and impact resistance following ultraviolet light exposure.

Where uPVC *flashings* are exposed to the weather, they shall also comply with Section 8 of AS/NZS 4256: Part 2.

uPVC *flashings* shall have a finish colour with a reflectance of 40% or more, as outlined in Paragraph 2.4.

COMMENT:
Manufacturers of uPVC *flashings* which have a proven performance in use may be able to show compliance with NZBC Clause B2 Durability as detailed in B2/VM1.

4.3.2 Aluminium flashings

Aluminium *flashings* shall be a minimum thickness of 0.7 mm, and formed from 5000 series in accordance with AS/NZS 1734.

Amend 2 Jul 2005

Amend 5 Aug 2011

4.3.3 Galvanized steel flashings

Galvanized steel *flashings* shall:

a) have a *BMT* of 0.55 mm minimum

b) be grade G550, or G300 for rolled or crimped *flashings*

c) be selected for corrosion protection according to the intended exposure zone as shown in Table 20.

Amend 2 Jul 2005

Amend 5 Aug 2011

4.3.4 Aluminium-zinc-magnesium (combinations) coated steel flashings to AS 1397

Amend 6 Feb 2014

Amend 5 Aug 2011

Aluminium-zinc-magnesium coated steel shall:

Amend 6 Feb 2014

a) have a *BMT* of 0.55 mm minimum

b) be grade G550, or G300 for curved or crimped *flashings*

c) be selected for corrosion protection according to the intended exposure zone as shown in Table 20.

Amend 2 Jul 2005

4.3.5 Stainless steel flashings

Stainless steel *flashings* shall be:

a) Minimum thickness of 0.45 mm, and

b) 304 or 316 stainless steel in accordance with Table 1 of ISO/TS 15510.

Amend 2 Jul 2005

Amend 5 Aug 2011

Amend 2 Jul 2005

4.3.6 Copper flashings

Copper *flashings* shall be:

Amend 2 Jul 2005

a) A minimum thickness of 0.5 mm,

b) In compliance with AS 1566, and

c) Alloy, designation C11000 or C12200.

4.3.7 Lead sheet flashings

Lead sheet *flashings* shall:

a) Comply with AS 1804, and

b) Have a minimum unit mass of 17 kg/m^2.

Amend 2 Jul 2005

4.3.8 Zinc sheet flashings

Zinc sheet *flashings* shall only be used in accordance with Tables 20, 21 and 22.

Zinc sheet *flashings* shall be:

a) A minimum thickness of 0.7 mm, and

b) In compliance with BS EN 988.

4.3.9 Butyl rubber and EPDM flashings

Amend 5 Aug 2011

Butyl rubber *flashings* shall only be used in accordance with Tables 20, 21 and 22.

Butyl rubber and *EPDM flashings* shall be a minimum thickness of 1.0 mm, and shall comply with the following parts of Table 1 in ASTM D6134:

a) Tensile strength,

b) Elongation,

c) Water absorption,

d) Water vapour permeance, and

e) Heat aging followed by:
   i) tensile strength
   ii) elongation.

4.3.10 Bituminous flashings

Bituminous *flashings* shall only be used in accordance with Table 20.

Flashings made from bitumen-impregnated material shall:

a) Comply with AS/NZS 2904, and

b) Be used only in fully concealed applications.

4.3.11 Flexible flashing tape

Flexible flashing tape shall comply with Parts 3.2 and 4 of ICBO Acceptance Criteria AC148, shall be compatible with adjacent *building wall underlay* or *roof underlay,* and be used only in fully concealed applications.

Amend 5 Aug 2011

4.4 Fixings

Fixings of metal *flashings* shall comply with Tables 20, 21 and 22.

Amend 5 Aug 2011

Exposed *flashings* such as barge and ridge *flashings* are to be fixed along both edges.

Amend 2 Jul 2005

COMMENT:
Fixings that penetrate *flashings* should be avoided where possible.

Amend 5 Aug 2011

4.5 Flashing requirements

All *flashings* shall have *expansion joints* where required in Paragraph 4.5.2 to provide for thermal expansion.

Amend 5 Aug 2011

Flashings are required to shed or divert water at sensitive areas of the *building cladding*. These include at:

a) The *building* periphery, except where gutters are present,

b) Changes of direction in *cladding* materials,

c) Intersections between *cladding* materials or with other *buildings*, and

d) Roof or wall penetrations, including windows, doors and other penetrations.

4.5.1 Edge treatments for flashings

Amend 5 Aug 2011

Flashings shall be to the dimensions shown throughout this Acceptable Solution.

Exposed bottom edges of *flashings* shall be folded to a *kick-out* or a *bird's beak* as shown in Figure 5.

For Low, Medium, High and Very High *wind zones*, *flashing upstands* shall have either:

1) A *hem* or *hook* to Figure 5, with upstand dimensions as shown throughout the document, or

2) No *hooks* or *hems*, and *flashing upstand* dimensions increased by 25 mm beyond those shown.

For Extra High *wind zones*, *hooks* and *hems* shall be used, and *flashing upstand* dimensions increased by 25 mm beyond those shown in Table 7 or elsewhere in the document.

Amend 2 Jul 2005
Amend 5 Aug 2011

COMMENT:
Refer to the New Zealand Metal Roof and Wall Cladding Code of Practice for further edge treatments.

Amend 2 Jul 2005

Amend 2 Jul 2005

Where the pitch of the *flashing* is 15° or less at the join, the lap at the join shall be 200 mm minimum and the *flashing* underneath the lap shall have a *hook* at the edge,

g) Lap joins on other metal *flashings* shall be sealed using a neutral cure silicone sealant in conjunction with mechanical fasteners. The sealant shall comply with:
   i) Type F, Class 20LM or 25LM of ISO 11600, or
   ii) low modulus Type II Class A of Federal Specification TT-S-00230C.

COMMENT:
Further information may be found in the New Zealand Metal Roof and Wall Cladding Code of Practice for joints in metal *flashings*.

Amend 5 Aug 2011

4.6 Flashing overlaps and upstands

Overlaps and upstands to *flashings* shall be as specified in this paragraph and Table 7, unless specifically shown otherwise. Refer to Paragraph 8.1 to Paragraph 9.9 for requirements for specific *claddings*.

Flashing edges, with *hooks*, *hems*, *kick-outs* and *bird's beaks* shall be as required in Table 7 and Paragraph 4.5.1.

Amend 5 Aug 2011

Where a turn-down to the cover *flashing* for profiled metal *claddings* is required, use:

a) A *soft edge flashing* for corrugated profiles, or
b) A notched turn-down or soft edge *flashing* for *trapezoidal* profiles with rib height not exceeding 30 mm and/or rib centres not exceeding 200 mm, or
c) A notched turn-down for *trapezoidal* profiles with rib height exceeding 30 mm and/or rib centres exceeding 200 mm, or
d) A notched turn-down for *trough profiles*.

Amend 5 Aug 2011

Where a notched turn-down is used there shall be a gap between the edge of the *flashing* and the pan of the roof *cladding*. The gap shall be a maximum of 5 mm.

Amend 2 Jul 2005

4.6.1 Overlap with roof claddings

4.6.1.1 Apron flashing cover over metal roofing

a) *Transverse flashing*:
Refer to Figure 7 for example of use. The apron shall have:
   i) for notched turn-downs, a gap between the *flashing* and the pan of the *roof cladding*. The gap shall be a maximum of 5 mm, and
   ii) a minimum effective cover to *roof cladding*, excluding any *soft edge* or turn-down to the *flashing*, as shown in Table 7.

Amend 2 Jul 2005

Amend 2 Jul 2005

b) *Parallel flashing*:
Refer to Figure 48 for example of use. The apron shall:
   i) be dimensioned to suit the roof *cladding* profile,
   ii) for profiled metal *roof cladding*, cover at least two crests, (turned-up edge to full crest height constitutes a crest), and
   iii) for profiled metal *roof cladding*, overhang *flashing* a minimum 10 mm clear of crest and maximum 5 mm clear of trough as shown in Figure 47.

Amend 2 Jul 2005

Amend 5 Aug 2011

4.6.1.2 Ridges and hips

Refer to Figure 46 for example of use.

a) For notched turn-downs of the *flashing* leave a gap between the *flashing* and the *roof cladding*. The gap shall be a maximum of 5 mm.
b) There shall be a minimum effective cover to *roof cladding*, excluding any *soft edge* or turn-down to the *flashing*, in accordance with Table 7.

Amend 2 Jul 2005

4.6.1.3 Change in metal roof pitches

Refer to Figure 44 for example of use.

a) There shall be a minimum effective lap under *roof cladding* in accordance with Table 7, with a *hem* at upper edge.
b) The apron cover over the *roof cladding* shall be in accordance with Table 7.

Amend 2 Jul 2005

4.6.1.4 Roof- or deck-to-wall junctions

Refer to Figure 7 for example of use.

Amend 2 Jul 2005

a) There shall be a total minimum upstand height of 110 mm, in accordance with Table 7, comprising a minimum:
   i) overlap cover of *cladding* to the *flashing* upstand of 75 mm, and
   ii) 35 mm clearance from bottom of the wall *cladding* to *roof cladding* or finished *deck* material.

Amend 5 Aug 2011

Table 7: Metal flashings – general dimensions
Paragraphs 4.6, 4.6.1.1, 4.6.1.2, 4.6.1.3, 4.6.1.4, 4.6.1.5, 4.6.1.6, 4.6.1.7, 5.1, 6.4, 6.5, 7.4.4, .9.1.3, 9.1.10.2, 9.1.10.4 and 9.4.5.3

Type	Description	All (1)	Situation 1 (2) minimum mm	Situation 2 (3) minimum mm	Situation 3 (3a) minimum mm	Figure reference (as example)
Aprons: general	*Transverse flashing* over roofing		130 (4)	200 (4)	200 mm	Figure 7 and Figure 44 (X values)
	Parallel flashing over roofing		Two crests, finish in next trough – refer 4.6.1.1b)			Figures 47, 48 (Y values)
Ridges/ hips	*Transverse flashing* over roofing		Refer **Aprons: general**			Figures 43, 45b, 46
Changes in roof pitches	Upper lap under roofing	250 mm min.			Not permitted under E2/AS1	Figure 44
	Transverse flashing over roofing		Refer **Aprons: general**			
Barges	Overlap to barge board		50 (8)	70 (8)	90 mm	Figure 47 (Z values)
Cappings	Overlaps to *cladding*		50 (8)	70 (8)	90 mm	Figure 10 (Z values)
	Slope to top: *parapet* and balustrade – metal capping	5° min.				Figures 10, 11, 12, 130
	Slope to balustrade – *flush-finished EIFS* and fibre cement(5)	10° min.				Figures 117, 129, 130
Roof or Deck to Wall	Overlaps to roofing		Refer **Aprons: general**			
– See membranes below	Lap under *cladding* above	75 mm min.			90 mm	Figures 7, 26, 30, 35, 37, 44, 48, 50
	Clearance below *cladding*	35 mm min.				
	Total upstand	**110** mm min.				

Amend 5 Aug 2011

Table 7: continued **Metal flashings – general dimensions**
Paragraphs 4.6, 4.6.1.1, 4.6.1.2, 4.6.1.3, 4.6.1.4, 4.6.1.5, 4.6.1.6, 4.6.1.7, 5.1, 6.4, 6.5, 7.4.4, .9.1.3, 9.1.10.2, 9.1.10.4 and 9.4.5.3

Membrane roofs and decks	Lap under *cladding* above	**115 min.**				Figures 18, 62a, c, 64b
Type	**Description**	**All** (1)	**Situation 1** (2) **minimum mm**	**Situation 2** (3) **minimum mm**	**Situation 3** (3a) **minimum mm**	**Figure reference (as example)**
Windows	Window flange clearance for *direct fixed claddings* and ply or fibre cement on cavities	5 mm				Eg. Figure 81
	Cover to window/ door jamb flange	10 mm(7) min.				Eg. Figure 81c
	Cover to window/ door sill flange	8 mm(7) min.				Eg. Figure 81c
Sills	Sill *flashing* slope (6)	Flat(6)				Eg. Figures 72a, 81b
Heads	Head *flashing* slope	15° min.				Eg. Figure 81a
	Lap under *cladding* above	35 mm min.			60 mm	Eg. Figure 81a
	Anti-capillary gap to *cladding*	5 mm				Eg. Figure 81a
	Total upstand	**40** mm min.				
Corners	Corner *flashings* (1)	50 mm x 50 mm minimum			75 x 75 mm	Eg. Figure 79
Inter-storey junctions	Junction *flashing*: slope	15° min.				Figure 70
	Lap over *cladding* below (1)	35 mm min.(8)			60 mm	
	Lap under *cladding* above	35 mm min.			60 mm	
	Clearance under *cladding*	5 mm min.				
	Total upstand	**40** mm min.				

Amend 2 Jul 2005

Amend 5 Aug 2011

Amend 5 Aug 2011

NOTES:
(1) Unless otherwise dimensioned in details.
(2) **Situation 1:** Low, Medium, High *wind zones*, where roof pitch ≥10° (X or Z values)
(3) **Situation 2:** All roof pitches in Very High *wind zones*,
Low, Medium and High *wind zones* where roof pitch ≤10°. (X or Z values)
(3a) **Situation 3:** For all *roof* pitches in Extra High *wind zone*.
(4) Excluding any *soft edge* or turn-down to roofing.
(5) For *buildings* other than housing, slope shall be as per F4/AS1.
(6) For *direct fixed* window/doors, unless shown. Sill *flashing* must extend past the condensation channel. Ensure sill *flashings* are not installed with backwards slope.
(7) Excluding *drip edge*.
(8) Excluding *drip edge*.

Amend 2 Jul 2005

Errata 2 Dec 2011

Amend 5 Aug 2011

6.0 Parapets

Parapets require a *drained cavity* for *claddings* except for vertical corrugated steel as outlined in Table 3. Refer also to Paragraph 7.4 Enclosed balustrades.

COMMENT:
Vertical corrugated profiled metal is considered to have drainage capabilities the equivalent of *drained cavities.*

Amend 5 Aug 2011

6.1 Limitations

This Acceptable Solution does not cover *parapet cappings* that use *stucco*, *EIFS* and *flush-finished* fibre cement materials.

Amend 5 Aug 2011

6.2 General

Amend 5 Aug 2011

Parapets shall be *constructed* as shown in Figure 10, and shall comply with the following requirements:

a) Timber for *framing* and *cavity battens* shall comply with B2/AS1,

b) Sloped packers under *cappings* shall be polystyrene or timber treated to B2/AS1, or minimum 9 mm H3 plywood on packers, and

c) *Framing* shall be fully enclosed with *wall underlay* or *roof underlay*, in accordance with Table 23 for the specific *cladding*.

Amend 2 Jul 2005

d) *claddings* shall be installed over a cavity in accordance with Paragraph 9.1.8.

Amend 5 Aug 2011

Details for specific *wall cladding systems* are given in Paragraph 9.0.

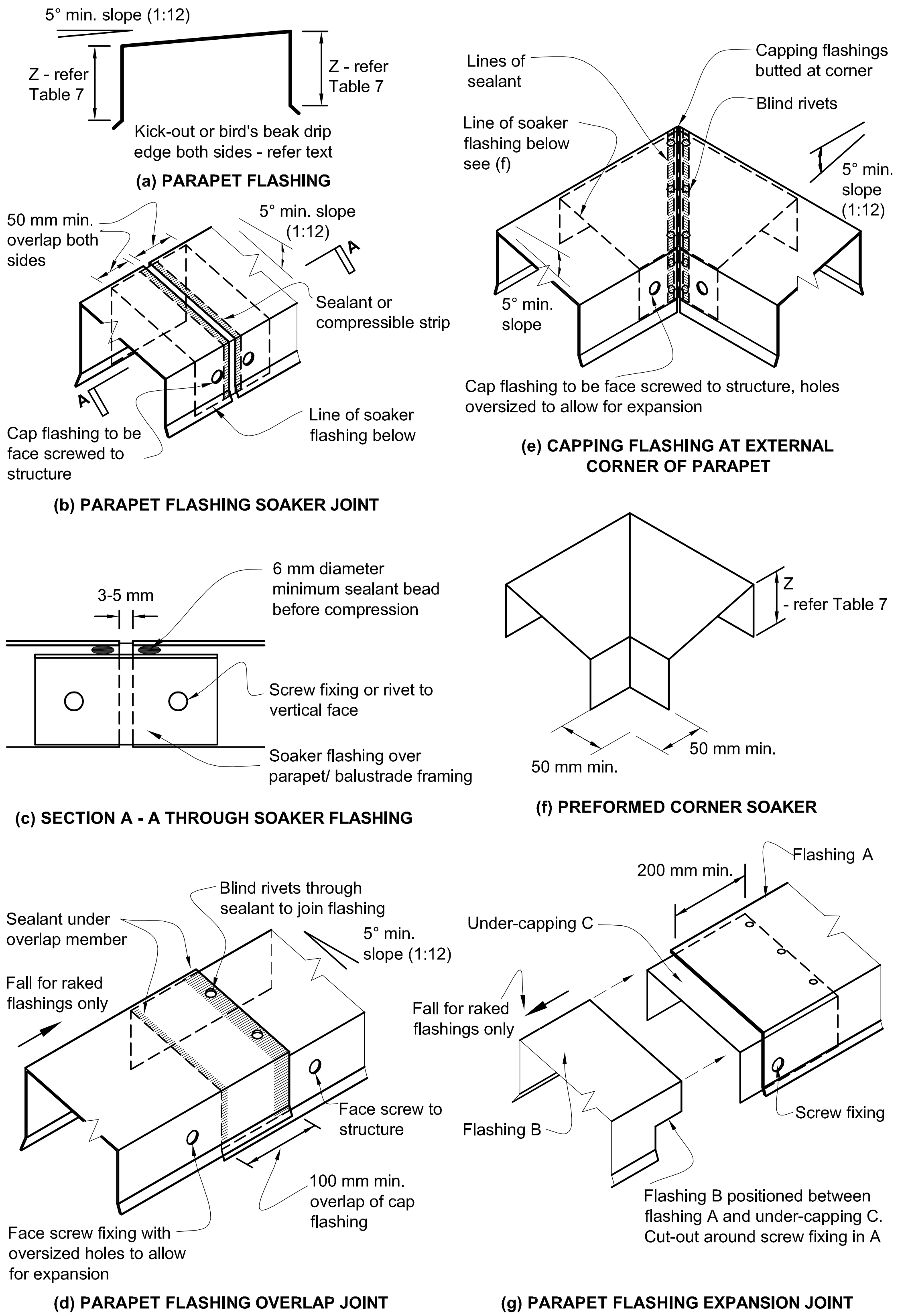
Specific requirements for *enclosed balustrades* are given in Paragraph 7.4.

6.3 Capping materials

Parapets shall be capped with metal, butyl or *EPDM membrane. Cappings* shall comply with the requirements of Paragraph 4.0.

Figure 9: General capping joints for parapets and enclosed balustrades
Paragraphs 6.3, 6.4, 7.4.4, 9.8.7, 9.9 and 10.2

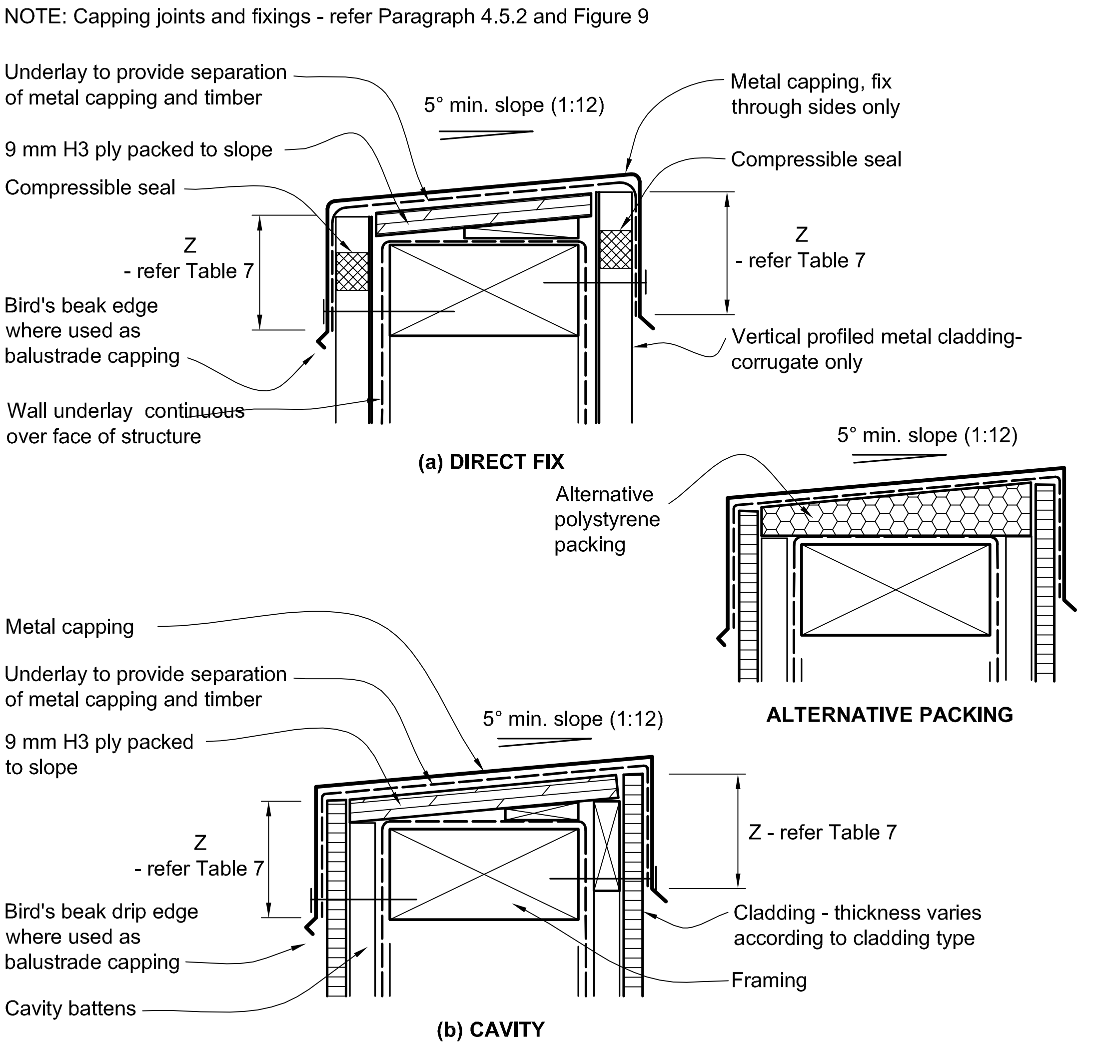
NOTE: Capping joints and fixings - refer Paragraph 4.5.2 and Figure 9



Amend 2 Jul 2005

Amend 5 Aug 2011

Figure 10: General construction of parapet and enclosed balustrade
Paragraph 6.0, 6.2, 6.4, 7.4, 9.7.7.1, Figures 12, 13, 117, 129 and 130



Amend 5 Aug 2011

6.4 Metal cappings

Amend 5 Aug 2011

Metal *cappings* installed over *parapets* and *enclosed balustrades*, shall be as outlined in Paragraphs 6.0 and 7.4, and comply with the following requirements:

a) Tops of *cappings* shall be free of any penetrations,

b) Slope of top shall be 5° (1:12) minimum,

c) The cover at the sides of the *capping* shall be in accordance with Table 7,

d) All *cappings* shall have *drip edges*. The details shown in Figure 5 are acceptable minimum *drip edges* for *parapets*,

e) *Cappings* shall be separated from underlying timber by *roof underlay* as shown in Figure 10,

f) Lengths of *capping* shall be joined as shown in Figure 9 (b) or Figure 9 (d),

g) External corners of *cappings* shall be as shown in Figure 9 (e),

h) *Expansion joints* shall be provided for joined *cappings* with a combined length exceeding:

i) 12 metres for light coloured steel and stainless steel, 8 metres for dark coloured steel
ii) 8 metres for copper
Amend 2 Jul 2005 iii) 8 metres for aluminium.

i) Where both ends of a *capping* are constrained, allowance shall be made for expansion, and

j) Where necessary, *expansion joints* shall be formed as shown in Figure 9 (g), and with:
Amend 2 Jul 2005 i) minimum 200 mm laps
ii) sliding clips at both sides of the lap.

Any textured coating application, except for the finished coat, over *flush-finished cladding* shall be completed prior to the installation of metal *cappings*. Amend 5 Aug 2011

6.4.1 Parapet-to-wall junctions

Junctions of *parapets* to *walls* shall be flashed to direct water clear of the outside face of the *cladding system*, using a *saddle flashing* as shown in Figure 11 and Figure 12.

Parapets that are continuous and in-plane with adjacent *wall* surfaces are outside the scope of this Acceptable Solution. An offset in *wall* line between *parapet* and adjacent *wall* is required as in Figures 11 and 12. Amend 5 Aug 2011

COMMENT:

Reports on leaky *buildings* show these junctions have been prone to leakage and care must be taken to detail and build them correctly.

Amend 5 Aug 2011 In-plane junctions require specific design of *flashing* arrangements.

6.5 Membrane cappings

Butyl rubber and *EPDM cappings* shall be in accordance with Paragraph 4.3.9, and comply with the following requirements:

a) Tops of *membrane cappings* shall be free of any penetrations, and shall have a minimum slope of 10° (1:6),

b) Sides of *membrane cappings* shall overlap the *wall claddings* as outlined in Table 7, and Amend 5 Aug 2011

c) Joints shall be in accordance with Paragraph 8.5.5.2.

6.6 Integral surface cappings

Cappings formed by using *stucco*, *EIFS* and *flush-finished* fibre cement materials shall not be used for *parapets*, (but may be used for *enclosed balustrades* as described in Paragraph 7.4).

COMMENT:

The tops to *parapets* are considered to be more risky locations than the tops to *enclosed balustrades*, as they are less accessible for inspection and regular maintenance. Amend 5 Aug 2011

Figure 13 deleted

7.0 Decks and Pergolas

Timber used to construct *decks*, *enclosed balustrades* and other attachments such as pergolas shall comply with B2/AS1. Amend 5 Aug 2011

7.1 Thresholds for decks

The vertical separation between the opening threshold level and the upper surface of the *deck* shall be as shown in Figure 14. Amend 5 Aug 2011

Opening threshold level may be at or above floor level. Amend 5 Aug 2011

7.1.1 Slatted decks

The level of the upper surface of the slatted *deck*: Amend 5 Aug 2011

a) Shall be a minimum of 50 mm below the threshold level for *cantilevered decks* as shown in Figures 14(b) and 16, or Amend 5 Aug 2011

b) May be at the same level as the threshold for non-cantilevered *decks* that are formed as shown in Figure 14(c). Amend 5 Aug 2011

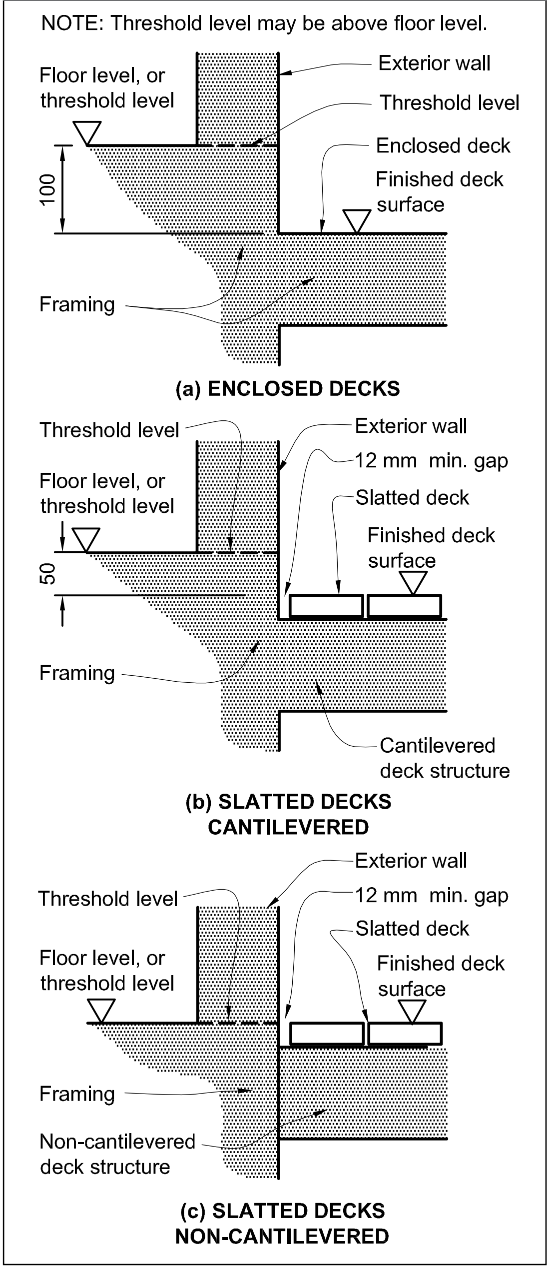
For slatted *decks*, a minimum gap of 12 mm shall be provided between the exterior *wall* and the adjacent decking slat. Amend 5 Aug 2011

7.1.2 Enclosed decks

This Acceptable Solution is limited to *enclosed decks* with a maximum area of 40 m^2.

For *enclosed decks*, the vertical separation between the opening threshold level and the upper surface of the finished *deck* surface shall be a minimum of 100 mm. Amend 5 Aug 2011

Figure 14: Threshold separations
Paragraphs 7.1, 7.3, 8.5.6, Figures 17A, 56, 62 and 64



Amend 5 Aug 2011

7.2 Attachment to building structure

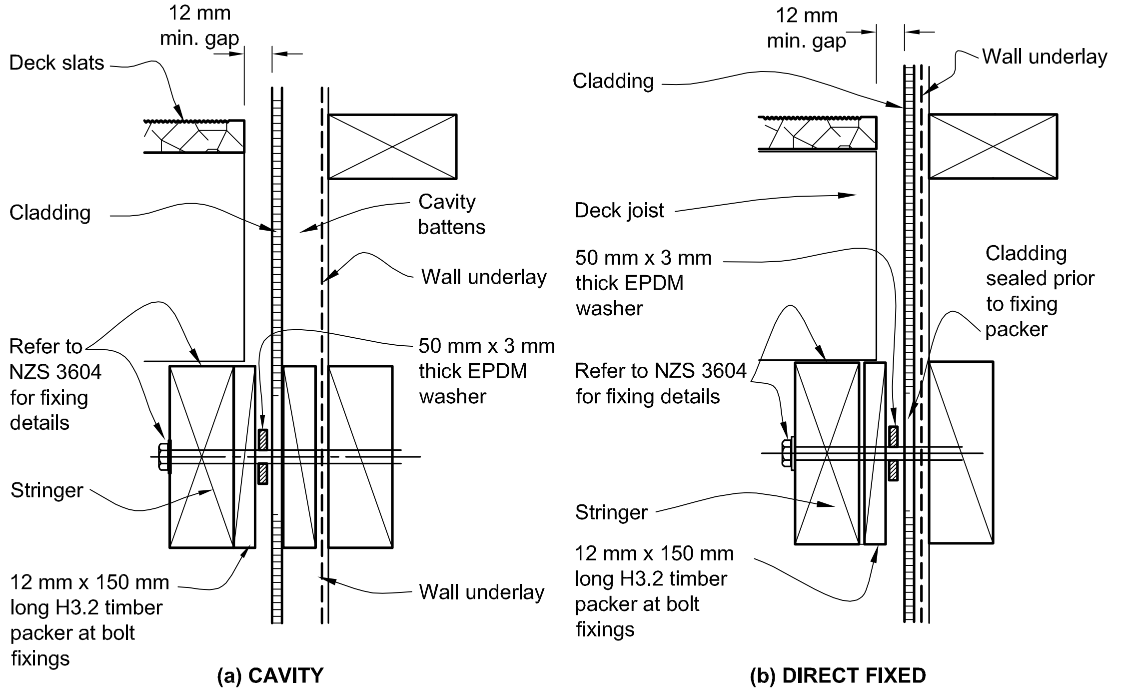
7.2.1 Slatted timber decks to walls

Junctions of slatted timber *decks* with *walls* shall be made *weathertight* as shown in Figures 15 and 16. Amend 5 Aug 2011

Fixings for stringers shall be in accordance with NZS 3604.

COMMENT:
Separating *decks* from *buildings* reduces the risk of water penetration into the *framing*.

Figure 15: Junction with wall for non-cantilevered timber deck
Paragraphs 7.1.1, 7.2.2 and Figure 14



NOTE:
(1) Not suitable for *stucco*, *EIFS* or profiled metal.
(2) The top of the *deck* slats may be level with the interior threshold.
(3) The same stringer to wall junction applies when joist hangers are used.

Amend 5
Aug 2011

Wall claddings that rely on surface coatings to reduce water absorption shall be sealed on outer faces and edges prior to fixing the stringers.

Amend 5
Aug 2011

7.2.1.1 Cantilevered decks

Cantilevered decks shall have the junction with the exterior *wall* made *weathertight* as shown in Figure 16. *Cladding* shall be sealed to the *saddle flashing*.

7.2.2 Pergolas

Connections of other structures, such as pergolas, shall have the junction with the exterior *wall* made *weathertight* by using the *deck framing* connections shown in Figure 15.

7.3 Level thresholds

Where provision for level access is required, this shall be provided as shown in Figure 17A and Figure 17B.

7.3.1 Enclosed decks

Where provision for level access is required for an *enclosed deck*, this shall be provided in Figure 17A. The underlying *membrane deck* surface shall be made *weathertight* as described in Paragraph 8.5.

7.3.1.1 Removable surfaces

Amend 5 Aug 2011

Raised removable surfaces of tiles, pavers or timber shall be provided over the underlying *weathertight enclosed deck* surface for cleaning and maintenance, as shown in Figure 17A. A minimum gap of 12 mm shall be provided against the *wall* or balustrade *cladding*.

7.3.1.2 Timber removable surface

Amend 5 Aug 2011

Timber decking shall be over *framing* supported off the *deck membrane* as shown in Figure 17A, with spacing in accordance with B2/AS1.

No fixings shall penetrate the underlying *deck membrane*.

COMMENT:

Amend 5 Aug 2011

Tiled boards or structural pavers sitting on proprietary supports can be adjusted according to level changes in the underlying *deck* surface.

The pavers or tiled boards are spaced to allow free drainage and the ability to lift the top surface off when necessary.

Amend 5 Aug 2011

The timber option allows access by fixing the timber decking with stainless steel screws, so they may be removed when necessary.

7.3.2 Ground floor level access

Where provision for level access is required, this may be provided as shown in Figure 17B, with exterior paving or decking that complies with the *access route* requirements of D1/AS1.

COMMENT:

The specific features of a *building* and its site can have a significant effect on the options available for providing level access at doors. These features include the provision of shelter, prevailing winds and ground levels. Where level access is required, it is highly recommended that the services of a designer experienced in this field be obtained.

7.3.2.1 Concrete slab

Where provision for level access is required from a concrete floor slab to exterior paving, this shall be as shown in Figure 17B with:

a) A channel, together with drainage provisions, across the door opening, with: Amend 5 Aug 2011
   i) width and depth dimensions to provide capacity that meets the requirements of NZBC Clause E1,
   ii) a minimum width of 200 mm and minimum depth of 150 mm, Amend 10 Nov 2020
   iii) a maximum length of 3700 mm, and Amend 5 Aug 2011
   iv) 1:200 minimum fall along length of channel towards a drainage outlet, Amend 2 Jul 2005
   v) the channel discharging to the surface water drainage system via a sump installed in accordance with the requirements of NZBC Clause E1, Amend 10 Nov 2020

b) Grating, in accordance with Tables 21 and 22, over the channel, that: Amend 5 Aug 2011
   i) is supported independently of the door frame,
   ii) is removable to allow access for cleaning,
   iii) is specifically designed to accommodate imposed loads,
   iv) has gaps sized to prevent the wheels of wheel chairs or mobility aids entering or being trapped, and
   v) has a continuous gap of 12 mm minimum from door frame and *wall cladding*, and

COMMENT:

The grating support must be specifically detailed to suit the condition of the *building* and site.

c) Exterior paving that:
   i) has a minimum fall of 1:40 away from the channel for a minimum distance of 1 m, Amend 5 Aug 2011
   ii) together with the surrounding paving and ground levels, meets the drainage requirements of NZBC Clause E1. Amend 10 Nov 2020

7.3.2.2 Timber floor

Where provision for level access is required from a timber floor structure to the exterior, this may be provided as shown in Figure 17B, with clearances in accordance with Paragraph 9.1.3. Amend 5 Aug 2011

7.4 Enclosed balustrades

Enclosed balustrades require a *drained cavity* for *claddings*, except for vertical corrugated steel, as outlined in Table 3, and shall be detailed as required for *parapets* described in Paragraphs 6 and 9.1.8 and Figures 10, 11 and 12. Details for specific *cladding systems* are given in Paragraph 9.0. *Enclosed balustrade cappings* for *EIFS* and *flush finished* fibre cement may include flush finishes as outlined in Paragraphs 9.7.7 and 9.9.10.

Errata 2 Dec 2011

COMMENT:
Reports on leaky *buildings* show these junctions have been prone to leakage and care must be taken to detail and build them correctly.

Amend 5 Aug 2011

7.4.1 Deck drainage

For *decks* with *enclosed balustrades*, provision for drainage shall be in accordance with Paragraph 8.5.6 and Paragraph 8.5.10.

7.4.2 Balustrade-to-wall junctions

Enclosed balustrade-to-*wall* junctions shall be flashed to direct water clear of the outside face of the *cladding system* using a *saddle flashing* as shown in Figures 11 and 12.

Amend 5 Aug 2011

COMMENT:
Reports on leaky *buildings* show that these junctions are prone to leakage and care must be taken in detailing and in building them correctly.

7.4.3 Balustrade-to-deck floor junction

The junction of the *enclosed balustrade* with the floor of the *enclosed deck* shall be made *weathertight* as shown in Figure 18.

Junctions with *wall claddings* shall be as shown in Figure 62.

7.4.4 Metal cappings

Metal *cappings* to *enclosed balustrades* shall have dimensions as outlined in Table 7.

Metal *cappings* shall have the same requirements as outlined for *parapets* in Paragraph 6.4, with the exception of the:

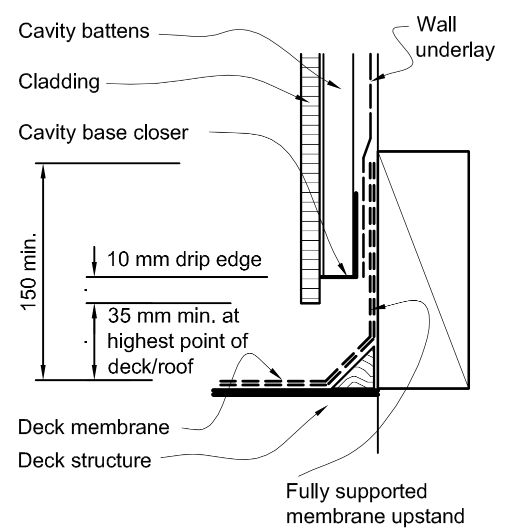
a) Slope to the top of the *capping*, for *buildings* other than housing to be as in F4/AS1,

b) *Drip edges* are required to both sides of the *capping*. The *drip edge* to the *deck* side of the *capping* shall be a *bird's beak* as shown in Figure 5.

Amend 5 Aug 2011

COMMENT:
A *bird's beak drip edge* will avoid danger of injury resulting from the sharp edge of a *kick-out*.

Figure 18: Enclosed balustrade – bottom of cladding
Paragraphs 7.4.3, 9.1.3, Figures 56, 62, 63 and 64



Amend 5 Aug 2011

8.0 Roof Claddings

8.1 General

8.1.1 Weathertightness

Roof claddings shall meet the requirements of NZBC E2.2, and be specified and *constructed* in accordance with the provisions of Paragraph 8.1.2 to Paragraph 8.5.

COMMENT:
For *roofs* used to collect water for human consumption, refer AS/NZS 4020.

Amend 5 Aug 2011

8.1.2 Limitations

The following *roof cladding systems* are covered in this Acceptable Solution:

a) *Masonry tiles* Paragraph 8.2

b) Pressed metal tiles Paragraph 8.3

c) Profiled metal *roof claddings* Paragraph 8.4

d) *Membrane* roofing Paragraph 8.5.

Other *roof claddings* are beyond the scope of this Acceptable Solution.

8.1.3 Maintenance

Maintenance of *claddings* shall be carried out as necessary to achieve the expected *durability* of the materials – refer to Paragraph 2.5.

Amend 5 Aug 2011

Amend 5 Aug 2011

COMMENT:
A deterioration in the appearance of the coating of the metal does not necessarily relate to a deterioration in the *weathertightness* of the roof *cladding*.

Care should be taken to avoid post-installation damage to the *cladding* when accessing the roof. Additional support is required around roof-mounted units such as air-conditioners to avoid roof distortion.

8.1.3.1 Projecting eaves

Soffits and verges of all projecting *eaves* shall be closed in. Refer to Paragraph 5.3 for details.

Amend 5 Aug 2011

Amend 5 Aug 2011

8.1.4 Fixings

Fixings shall be as specified in Paragraph 8.2 to Paragraph 8.5.

Materials for fixing *roof claddings* and *flashings*, where necessary, shall be selected from Tables 20, 21 and 22 to minimise corrosion.

Amend 5 Aug 2011

COMMENT:
The use of stainless steel fixings is not recommended by steel manufacturers for use with coated steel in severe marine and industrial environments, as they are considered to cause deterioration.

Amend 5 Aug 2011

8.1.5 Roof underlays

Roof underlays shall be to Table 23 and NZS 2295, and be either:

Amend 2 Jul 2005

- R1 heavy weight kraft, or
- R2 self supporting kraft.

Underlays shall be:

- Layed with minimum numbers of laps
- Lapped at all side and end laps by minimum 150 mm
- Run horizontally for *roof* pitches below 10°
- Run horizontally or vertically for *roof* pitches above 10°
- Have *anti-ponding boards* at lower edges of masonry tiles, refer Figure 25(b) and Paragraph 8.2.5.

8.1.5.1 Underlay support

Prevent sagging of *roof underlay* by either:

- For R1 *underlays*, fully support with a corrosion resistant material
- For R2 self supporting *underlays*, laid to maximum 1.2 metre span between adjacent supports

Amend 5 Aug 2011

COMMENT:
Solvent in freshly LOSP-treated timber can affect bitumen in *underlays*. Any solvent should be allowed to evaporate before the *roof underlay* is installed.

Amend 5 Aug 2011

8.1.6 Gutters general

Gutters, downpipes and spreaders, including *eaves* gutters/spoutings are required for the drainage of *roof* water, and shall:

a) Be to the minimum dimensions shown in this Acceptable Solution, or calculated to provide capacity that meets the requirements of NZBC Clause E1, whichever is the greater

Amend 10 Nov 2020

b) If a gutter depth is reduced to allow entry of a *valley gutter*, the reduced depth must be used to calculate the capacity of the gutter

c) For internal, *valley*, and *hidden gutters*, have no fixings in gutter bottoms or sides, and be continuously supported on H1.2 minimum treated timber gutter boards or H3 ply which is separated from metal by *roof underlay* strip.

Eaves gutters/spoutings shall:

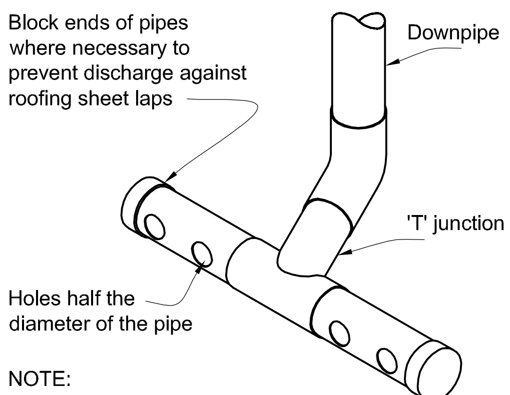
d) Be to any of the materials outlined for *flashings* in Paragraph 4.1 except 4.3.9, 4.3.10 and 4.3.11

e) Have a minimum cross sectional area of 2500 mm^2

f) Be designed to overflow water to the outside.

Amend 5 Aug 2011

Figure 20: Spreader for roof discharge
Paragraph 8.1.6



NOTE:
(1) Hole positions to avoid joints in roofing.
(2) When downpipe is located in corner, spreader to be L-shaped.

Amend 5 Aug 2011

Downpipes shall:

g) Be formed from any of the materials outlined for flashings in Paragraph 4.1 except 4.3.9, 4.3.10 and 4.3.11

h) Upper *roofs* shall drain via downpipes directly to ground level where possible, or

i) Where discharging to a lower *roof*, be fitted with a spreader as detailed in Figure 20

j) Have a maximum catchment area of 25 m^2 if discharging on to a lower *roof* area.

Spreaders shall:

k) Be to any of the materials outlined for *flashings* in Paragraph 4.1 except 4.3.9, 4.3.10 and 4.3.11

l) Be to Figure 20 and not be used on masonry tile roofs unless a *roof underlay* is installed

m) Discharge directed away from roofing laps and clear of *roof* penetrations.

Amend 5 Aug 2011

COMMENT:
Design calculations for a specific *roof* may allow larger catchment areas per spreader to be used.

The alternative to a spreader is to direct an upper level downpipe into a rainwater head.

The ends of spreaders should be blocked off where a sideways flow of water is against laps in *roof claddings*.

Amend 5 Aug 2011

8.1.6.1 Internal gutters

Internal gutters shall:

a) Be formed with continuous butyl or *EPDM* strip complying with Paragraph 4.3.9, with no cross-joints in the gutter, or aluminium, copper, stainless steel, or zinc sheet to Paragraph 4.3, with joints that are welded

b) Where butyl or *EPDM*, be minimum 1.5 mm *membrane* thickness, or 1.0 mm thickness for gutters less than 1 metre wide

c) Have a minimum slope of 1:100

d) Have capacity that meets the requirements of NZBC Clause E1 and have a freeboard depth of at least 30 mm, but in no case have any dimension less than those shown in Figure 52.

Amend 10 Nov 2020

COMMENT:

The minimum dimensions shown in Figure 52 provide sufficient working space to ensure the gutter is able to be accessed, constructed and maintained without undue risk of failure, for *buildings* within the scope and construction methodologies of this Acceptable Solution. In some *buildings*, specific design may be able to show that smaller dimensions do not prevent adequate access, construction and maintenance of the gutter; however such gutters are outside the scope of this Acceptable Solution. The requirements of NZBC Clause E1 ensure the gutter has sufficient flow capacity to handle the runoff from the particular *roof* catchment area. Flow capacity will govern the sizing of internal gutters when the *roof* area and/or rainfall intensity require a gutter of more than the minimum dimensions.

Acceptable Solutions E1/AS1 and E1/AS2 provide means of calculating the capacity of internal gutters. If E1/AS1 is used, a freeboard depth of 30 mm must be added. If E1/AS2 is used, the calculation method already includes a freeboard depth of 30 mm.

Amend 10 Nov 2020

For *roofs* other than *membrane roofs*:

e) Discharge into a rainwater head as shown in Figure 63 (a) and (b), or

f) Discharge to an internal outlet to Figure 64 (b) or (c) with overflows provided by either:

i) a second outlet to a rainwater head, or
ii) an overflow as shown in Figure 63(c), and positioned below the level of any potential overflow into the *building*.

For internal gutters and *membrane roofing*, refer to Paragraph 8.5.

8.1.6.2 Valley gutters and hidden gutters

Valley gutters and *hidden gutters* shall be constructed as shown in Figures 50 and 51 for the applicable *roof cladding* (except for *membrane roofing*) and:

a) Not change direction in plan

b) Have a minimum underlap to *roof cladding* as specified in Figures 27, 37, 50, and 51 for the relevant *roof cladding*

c) Be formed from any of the materials outlined for *flashings* in Paragraph 4.3 except 4.3.10 and 4.3.11

d) Be fixed at upper ends only, and be secured with a purpose-made clip system for the remaining length to enable expansion/contraction along the length of the gutter

Amend 5 Aug 2011

e) Discharge into an internal gutter or *eaves* gutter/spouting.

In addition:

f) Have minimum slopes of 8° for *hidden gutters*, and to Table 8 for *valley gutters*

g) *Hidden gutters* receive no discharge from downpipes or spreaders

h) Spreaders not discharge directly into a *valley gutter*

i) *Valley gutters* be minimum 250 mm wide where receiving run off from spreaders.

Table 8: Maximum catchment areas for valley gutters
Paragraphs 8.1.6.2, 8.4.16.2, 9.7.7.1, 9.9.4.4, 9.9.10.1, Figures 27, 37 and 51

Gutter width	Maximum catchment area	Minimum roof pitch
250 mm	25 m^2	8°
160 mm to 249 mm	16 m^2	12.5°

NOTE: Catchment areas are limited to:
(1) Gutters in accordance with Paragraph 8.1.6.2.
(2) Rainfall intensity with average recurrence interval (ARI) no greater than 200 mm per hour.

Amend 5 Aug 2011

COMMENT:

Gutters for lower-pitched *roofs*, or for catchment areas other than those shown in Table 8, require *specific design*. Additional information may be found in the New Zealand Metal Roof and Wall Cladding Code of Practice.

Amend 5 Aug 2011

Amend 5 Aug 2011

8.1.7 Roof penetrations

Roof penetrations shall be made *weathertight* in accordance with Paragraph 8.2 to Paragraph 8.5.

Where *roof* penetrations are required for large openings such as *roof* lights and *chimneys*, this Acceptable Solution is limited to the following requirements:

a) The edge of roofing penetrations over 200 mm wide shall be supported in either direction with additional *framing* as shown in Figure 21, and

b) For the catchment area of the *roof* above the penetration as shown in Figure 22, the *roof* length shall be limited to:
   i) for profiled metal roofing, Table 17
   ii) for other *roof claddings*, the areas shown in Table 9.

COMMENT:

Amend 5 Aug 2011

Flashings for *roof* penetrations not included in this Acceptable Solution require *specific design*.

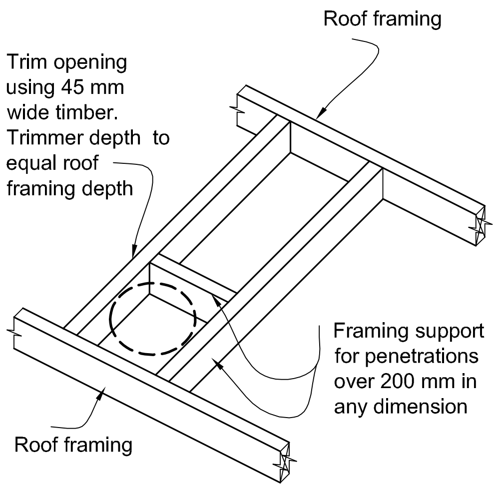
For pipe penetrations, refer to details for the *roof cladding* material used.

Table 9: Maximum catchment areas above penetrations
Paragraph 8.1.7 and Figure 22

Penetration width	Maximum roof length above penetrations in metres
800 to 1200 mm	4 m
600 to 800 mm	6 m
400 to 600 mm	8 m
0 to 400 mm	10 m

NOTE: Refer to Table 17 for profiled metal roofing.

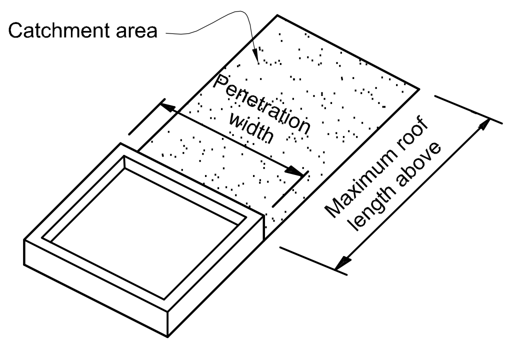
Figure 21: Penetration support
Paragraphs 8.1.7 and 8.4.17



Amend 5 Aug 2011

Figure 22: Catchment area for penetrations
Paragraphs 8.1.6, 8.1.7, Tables 9 and 17

NOTE:
(1) Profiled metal roofing - refer Table 17 for maximum roof lengths above penetrations.
(2) Other roof cladding - refer Table 9 for maximum roof lengths above penetrations.



Amend 5 Aug 2011

8.2 Masonry Tiles

8.2.1 Materials

Concrete tiles shall meet the requirements of NZS 4206 or AS 2049. Clay tiles shall meet the requirements of AS 2049.

8.2.1.1 Tile profiles

For the purposes of this paragraph, tiles shall be divided into three types as listed below:

a) Type I: Double profile tiles having two distinct watercourses with a minimum watercourse depth of 18 mm,

b) Type II: Single profile tiles having one water-course depth of a minimum of 25 mm, or

c) Type III: Tiles not fitting the Type I or Type II categories, and includes flat tiles and those resembling slates, shakes and shingles.

8.2.2 General

Amend 2 Jul 2005

COMMENT:
Refer to Paragraph 1.5 for qualification of installers.

Amends 2 and 5

8.2.3 Installation

Masonry tile roof cladding shall be installed in accordance with NZS 4206 or AS 2050 onto minimum H1.2 treated timber battens, except the minimum pitch shall be as specified in Table 10. Where required in AS 2050 and Table 20, *underlay* shall comply with Table 23.

Fixing and fixing patterns shall be to NZS 4206, with the exception that nails shall penetrate a minimum of 35 mm into timber battens, and the minimum pitches and *roof underlay* shall be as described in Table 10 and Table 23.

Use 304 or 316 stainless steel fixings for corrosion zones B, C, D and E, or hot dip galvanised fixings at 450 g/m^2 for Zone B and Zone C. Refer to Table 20 for corrosion zones.

Amend 5 Aug 2011

Table 10: Minimum pitches for masonry tiles
Paragraph 8.2.3, Figure 25

Tile material	Profile type	With underlay (1)(2)	Without underlay (1)(2)
Concrete	Type I	15°	20°
tiles (to *rafter*	Type II	20°	–
length 4.5 m)	Type III	25°	–
Clay tiles	Type I	20°	25°
(to *rafter*	Type II	20°	–
length 4.5 m)	Type III	25°	–

NOTE: (1) Increase pitch by 1° per additional 0.5 metres of rafter length over 4.5 m.
(2) Roof underlay is required for any roof receiving discharge from a spreader, or for roofs in *wind zone* Very High or Extra High.

Amend 2 Jul 2005
Amend 2 Jul 2005
Amend 5 Aug 2011

COMMENT:
Rafter length, tile profile and *wind zone* all affect the allowable minimum pitch of a tile *roof*. *Rafters* longer than in Table 10 may require the addition of *underlay*.

Manufacturers may have specific profiles that are suitable for pitches lower than those shown in Table 10, but these are outside the scope of this Acceptable Solution.

Amend 5 Aug 2011

Where *masonry tiles* have been shown to comply with the dynamic *weathertightness* test requirements of AS 4046: Part 9, a lower pitch may be used providing it is not less than 15°.

8.2.4 Flashings and fixings

Materials for *flashings*, gutters and fixings shall be in accordance with Paragraph 4.0, and:

a) Be selected from Table 20 to minimise corrosion, and

b) Be compatible with mortar and bedding in accordance with Table 21 and Table 22.

8.2.5 Anti-ponding boards

Masonry tile roofs with *underlays* shall have *anti-ponding boards* installed to Figure 25. Where *anti-ponding boards* are used, these shall be set to a minimum fall of 5° (1:12), and shall be treated minimum H1.2 for solid timber and H3 for plywood.

Amend 5 Aug 2011
Amend 5 Aug 2011

8.2.6 Details and flashings

Hips, ridges, valleys and barges shall be made *weathertight* by using *flashings* and seals as shown in Figure 23 to Figure 28.

8.3 Pressed Metal Tiles

8.3.1 Limitations

This Acceptable Solution is limited to pressed metal tile *roofs*.

Amend 5 Aug 2011
Amend 2 Jul 2005

COMMENT:
Additional guidance on pressed metal tiles can be found in the New Zealand Metal Roof and Wall Cladding Code of Practice.

8.3.2 Installation

Amend 2 Jul 2005

COMMENT:
Refer to Paragraph 1.5 for qualification of installers.

Amends 2 and 5

8.3.3 Tiles and accessories

Amend 5 Aug 2011

Tiles and their accessories shall meet the requirements of NZS 4217.

8.3.4 Metal substrate

8.3.4.1 Choice of metal

COMMENT:

The exposure zone in which a *building* is located can affect the *durability* of *flashings*.

Exposure zones are defined in NZS 3604, based on the likely exposure to wind-driven sea-salt. Corrosion due to geothermal or corrosive industrial atmospheres, as defined in NZS 3604, require *specific design*.

Exposure zones are based on AS/NZS 2728. AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand.

Amend 5 Aug 2011

8.3.4.2 Steel

Steel for the manufacture of pressed metal tile and *flashing* systems shall:

Amend 2 Jul 2005

a) have a *base metal thickness (BMT)* of 0.39 mm minimum,

Amend 5 Aug 2011

b) be grade G300 or G250,

Amend 6 Feb 2014

c) be selected for corrosion protection according to the intended exposure zone as shown in Table 20.

Amend 2 Jul 2005

Paint coatings may include factory-applied finishes complying with AS/NZS 2728, or factory-painted or bonded resin and chip finishes of minimum 15 year *durability*.

Amend 5 Aug 2011

8.3.4.3 Aluminium

Aluminium for the manufacture of pressed metal tiles and *flashing* systems shall comply with AS/NZS 1734, and shall:

Amend 5 Aug 2011

a) Have a *base metal thickness (BMT)* of 0.7 mm minimum,

b) Be minimum 5000 series,

c) For pre-painted aluminium, have a factory-applied finish complying with AS/NZS 2728.

Amend 2 Jul 2005

8.3.5 Roof pitch

General approximations of profile types for standard profile and shake or shingle profile metal roof tiles are shown in Figure 32.

Amend 5 Aug 2011

The minimum *roof* pitches for metal tiles where *rafter* length does not exceed 12 m shall be limited to:

Amend 2 Jul 2005

a) 12° (1:4.75) for profiles resembling standard profiles, and

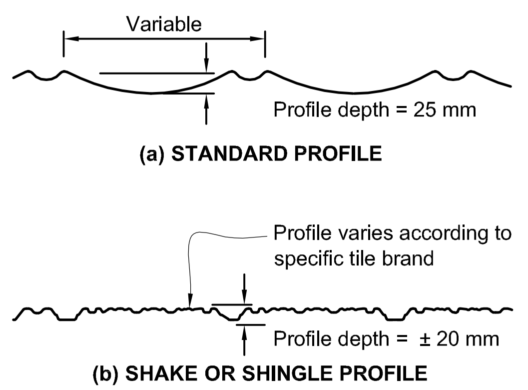
b) 15° (1:3.75) for profiles resembling shingle or shake profiles.

Amend 5 Aug 2011

Where *rafter* length exceeds 12 m, increase minimum pitch by 1° per additional 0.5 m.

Amend 2 Jul 2005

Figure 32: Metal tile profiles
Paragraph 8.3.5



Amend 5 Aug 2011

Amend 5 Aug 2011

COMMENT:
Panels are available in a wide range of profiles.

Where manufacturers have more stringent requirements, these should be followed to optimise performance and to avoid invalidating guarantees.

8.3.6 Underlay

Amend 5 Aug 2011

All metal tile roofing shall have a *roof underlay* installed. *Roof underlay* shall be to Table 23. Refer to Paragraph 8.1.5 for installation details.

Amend 5 Aug 2011

If LOSP-treated timber is used, *roof underlay* shall not be applied until the LOSP solvent has been allowed to evaporate.

Amend 5 Aug 2011

COMMENT:
Solvent in freshly LOSP-treated timber can affect bitumen in *underlays*. Any solvent should be allowed to evaporate before the *roof underlay* is installed.

8.3.7 Fixings

Pressed metal tiles shall be fixed as shown in Figure 33, with:

a) 50 x 2.8 mm hot-dipped galvanized painted flat-head annular-grooved nails. For fixings through the top of the tiles, use neoprene washers containing no more than 15% by weight carbon black content, with

Amend 2 Jul 2005

b) Four fixings per sheet through:
   i) the turn-down of the tiles for the body of the roof, and
   ii) the top of the profile slope for sheets at the *eaves*, avoiding the weather channel of the tiles.

8.3.8 Flashings

The *roof* shall be flashed at all boundaries, except at the discharge to a gutter, using the details shown in Figure 34 to Figure 37.

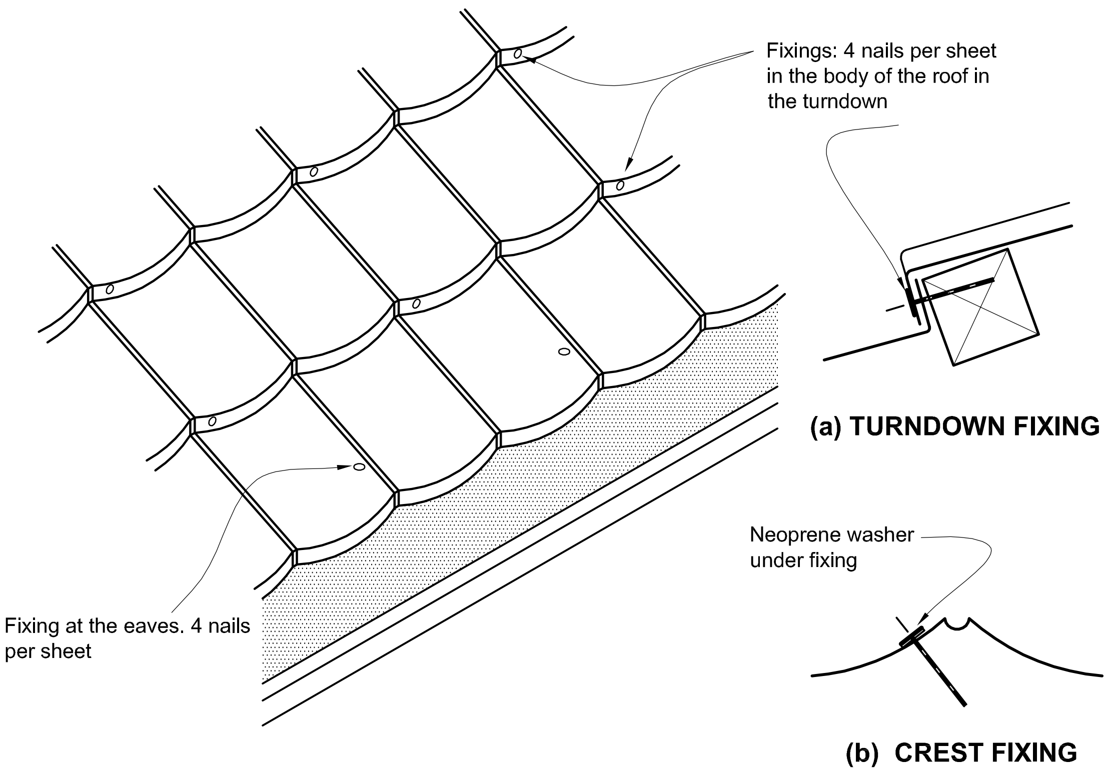
Metal *flashings* are generally supplied by the metal tile manufacturer, and shall comply with Paragraph 8.3.4.2 and Table 7, unless specifically shown otherwise in the details.

Amend 5 Aug 2011

COMMENT:
Metal tile manufacturers supply pre-folded or formed accessories and recommendations for their installation.

Amend 5 Aug 2011

Figure 33: Metal tile fixings
Paragraph 8.3.7



Amend 2 Jul 2005

Amend 5 Aug 2011

8.3.9 Gutters, ridges, barges and fascias

Gutters, ridges, barges and fascias shall be as shown in Figures 34–37.

Refer to Paragraph 5.2 for termination of *roofs* against *wall claddings*.

Amend 5 Aug 2011

8.3.10 Roof penetrations

Pipe penetrations shall be flashed using *EPDM flashings* similar to that shown for masonry tiles, Figure 29.

Amend 5 Aug 2011

COMMENT:
Use purpose-made preformed rooflights and ventilators supplied by the manufacturer of the tiles where available.

Amend 2 Jul 2005

8.4 Profiled Metal Roof Cladding

8.4.1 Limitations

This Acceptable Solution is limited to the following types of profiled metal *roof cladding*:

a) Profiled as outlined in Paragraph 8.4.4,

Amend 5 Aug 2011

b) *Valley gutters* that do not change direction in plan,

c) Not curved, and

d) With sheets no more than 18 metres long.

Amend 2 Jul 2005

COMMENT:
If curved profiled metal sheet is used, the radius of the curve may affect *durability*. *Specific design* is required, and manufacturers and the New Zealand Metal Roof and Wall Cladding Code of Practice should be consulted for recommendations.

8.4.2 General

Amend 2 Jul 2005

COMMENT:
Refer to Paragraph 1.5 for qualification of installers.

Amends 2 and 5

8.4.3 Materials

8.4.3.1 Choice of metal

Amend 2 Jul 2005

Metal roof *cladding* and *flashings* shall be selected according to the exposure conditions in Table 20 as defined in:

Amend 5 Aug 2011

a) NZS 3604, or

b) AS/NZS 2728.

Amend 5 Aug 2011

COMMENT:
The exposure zone in which a *building* is located can affect the *durability* of *flashings*.

Exposure zones are defined in NZS 3604, based on the likely exposure to wind-driven sea-salt. Corrosion due to geothermal or corrosive industrial atmospheres, as defined in NZS 3604, require *specific design*.

Exposure zones are based on AS/NZS 2728. AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand.

Amend 5 Aug 2011

8.4.3.2 Steel

Amend 5 Aug 2011

Amend 2 Jul 2005

Materials for the manufacture of profiled steel *roof cladding* shall:

a) have a *BMT* of 0.4 mm minimum

b) be grade G550, or G300 for rolled, crimped, or trough profile roofing

c) be selected for corrosion protection according to the intended exposure zone as shown in Table 20.

Amend 2 Jul 2005

Amend 2 Jul 2005

Amend 2 Jul 2005

8.4.3.3 Aluminium

Aluminium for the manufacture of profiled aluminium roofing shall comply with AS/NZS 1734, and be a minimum:

a) *Base metal thickness (BMT)* of 0.7 mm,

b) 5000 series.

Amend 5 Aug 2011

Pre-painted aluminium roofing shall have a factory-applied finish complying with AS/NZS 2728.

Amend 2 Jul 2005

COMMENT:
A deterioration in the appearance of the coating of the metal does not necessarily relate to a deterioration in the *weathertightness* of the *roof cladding*.

8.4.4 Profiles

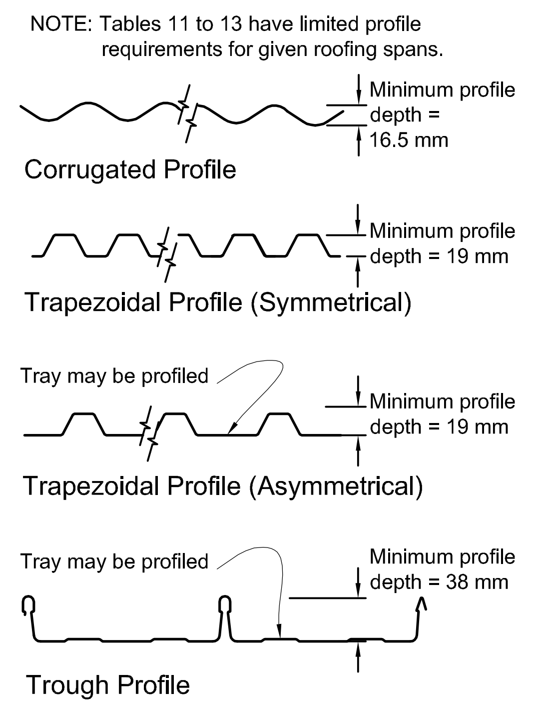
Profiles covered in this Acceptable Solution are shown in Figure 38, and consist of:

a) **Corrugated** – curved with a crest height of 16.5 mm minimum, (Amends 2 and 5)

b) ***Trapezoidal*** – symmetrical or asymmetrical with a minimum crest height of 19 mm, and for asymmetrical a flat or lightly profiled pan width of 210 mm maximum between crests, and (Amend 5 Aug 2011)

c) ***Trough profile*** – with vertical ribs at a minimum height of 38 mm, and flat or lightly profiled pans of 210 mm maximum between crests. (Amend 5 Aug 2011)

Figure 38: Profiled metal profiles
Paragraphs 8.4.4, 9.6.1, 9.6.5 and Table 3



(Amend 2 Jul 2005) (Amend 2 Jul 2005) (Amend 5 Aug 2011)

8.4.5 Roof pitch

For *roofs* up to 18 metres in length without end laps, pitches shall be: (Amend 2 Jul 2005)

a) Corrugated – not less than 8° (1:7).

b) *Trapezoidal* – not less than:
   i) 4° (1:14) where the crest height is less than 27 mm, or
   ii) 3° (1:20) where the crest height is 27 mm or higher.

c) *Trough profile* – not less than 3° (1:20). (Amend 5 Aug 2011)

COMMENT:
For *roofs* over 18 metres in length refer to the manufacturer for minimum pitch requirements. Where manufacturers have more stringent requirements, these should be followed to optimise performance and to avoid invalidating guarantees. (Amend 2 Jul 2005)

8.4.6 Structure

The maximum span and fixing patterns of profiled metal *roof cladding* between *purlins* to comply with this Acceptable Solution are given in Table 11, Table 12 or Table 13, 14 and 15. Spans shown are for steel with *BMT*, grade and profile as specified in each Table. (Amend 5 Aug 2011) (Amend 2 Jul 2005)

COMMENT:
For *purlin* sizes, spacing and fixing, refer to NZS 3604. (Amend 2 Jul 2005)

Additional support will be required around roof-mounted services such as air-conditioning in order to avoid roof distortion. (Amend 5 Aug 2011) (Amends 2 and 5)

Table 11: Steel corrugate profiled roofing – 0.4 mm BMT and minimum profile height 16.5 mm
Maximum spans and fixing patterns. Refer to Paragraph 8.4.6

Purlin spacings (metres)		Wind zones		
End span	**Intermediate span**	**Low and Medium**	**High and Very High**	**Extra High**
0.4	0.6	C2	C2	C2
0.6	0.9	C2	C2	C1
0.8	1.2	C2	C1	C1

NOTE: C1 fixing pattern is – Hit 1, miss 1…
C2 fixing pattern is – Hit 1, miss 1, hit 1, miss 2…

Amend 5 Aug 2011

Table 12: Steel corrugate profiled roofing – 0.55 mm BMT with minimum profile height 16.5 mm
Maximum spans and fixing patterns. Refer to Paragraph 8.4.6

Purlin spacings (metres)		Wind zones		
End span	**Intermediate span**	**Low and Medium**	**High and Very High**	**Extra High**
0.4	0.6	C3	C3	C3
0.6	0.9	C3	C3	C3
0.8	1.2	C3	C3	C3
1.15	1.6	C3	C3	C2

NOTE: C2 fixing pattern is – Hit 1, miss 1, hit 1, miss 2…
C3 fixing pattern is – Hit 1, miss 2, hit 1, miss 3…

Amend 5 Aug 2011

Table 13: Steel trough profile roofing – 0.55 mm BMT with profile height 46 mm minimum, and pan width 210 mm maximum(2)
Maximum spans. Refer to Paragraph 8.4.6

All building wind zones	
Maximum span of roof cladding mm	
End span	Intermediate span
1100	1600

NOTE: (1) *Trough profile* with 0.4 mm *BMT* steel is excluded from this Acceptable Solution
(2) For profile heights and pan widths outside this range, refer to supplier's literature for fixing patterns and spans

Amend 5 Aug 2011

Amend 2 Jul 2005

COMMENT:
It is recommended that access to the *roof* is limited to within 100 mm of purlin lines to avoid damaging the *roof cladding*.

Amend 2 Jul 2005

8.4.7 Underlay

All profiled metal long-run roofing shall have a *roof underlay* installed to Table 23. See Paragraph 8.1.5 for installation details.

Amend 5 Aug 2011

8.4.8 Fixings: corrugated and trapezoidal

Fixings shall be as shown in Tables 11, 12, 14 and 15, and shall be a minimum 12-gauge screw, as shown in Figure 39, which complies with Class 4 of AS 3566: Part 2.

Amend 2 Jul 2005

Amend 2 Jul 2005

COMMENT:
Screw fixing is recommended for metal roofing as there is less likelihood of the fixing 'backing out' than with a nail.

The spacing requirements for fixings are conservative, and a *specific design* may produce a more optimum spacing, especially with the use of load-spreading washers. Consult roofing manufacturers for information.

Amend 5 Aug 2011

Amend 2 Jul 2005

8.4.8.1 Fixing requirements

Amend 2 Jul 2005

Amend 5 Aug 2011

Fixings shall:

a) Be fixed through crests,

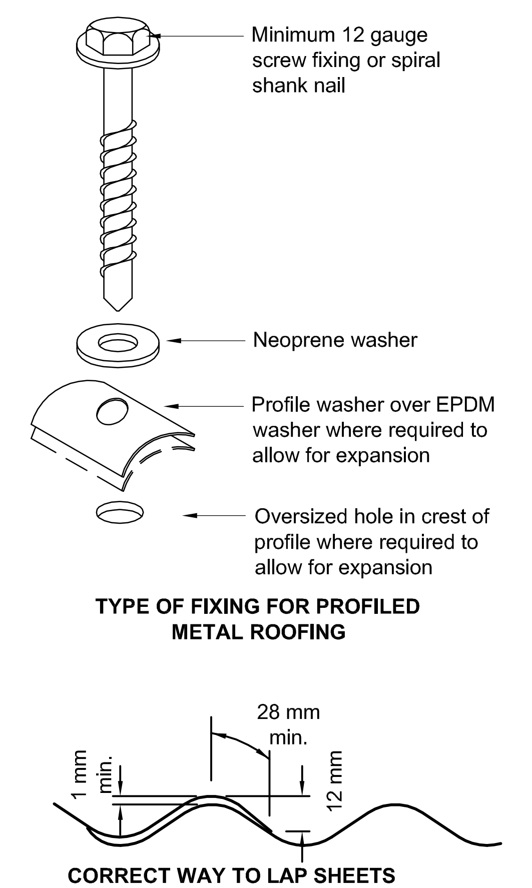
b) Penetrate *purlins* by a minimum of 40 mm for nail fixings and 30 mm for screw fixings,

Amends 2 and 5

c) Include sealing washers of:
   i) neoprene (having a carbon black content of 15% or less by weight),
   ii) profiled washer and *EPDM* washer where required to allow for expansion of the profiled metal *roof cladding*.

Amend 2 Jul 2005

Figure 39: Corrugated and trapezoidal fixings and sheet lap
Paragraphs 8.4.8, 9.6.6, Tables 20, 22 and 24



Amend 2 Jul 2005

Amend 5 Aug 2011

Table 14: Steel trapezoidal profiled roofing – 0.4 mm BMT and profile height 27 mm minimum(1), and minimum 5-rib profiles
Maximum spans and fixing patterns. Refer to Paragraph 8.4.6

Purlin spacings (metres)		Wind zones		
End span	Intermediate span	Low and Medium	High and Very High	Extra High
0.4	0.6	T2	T2	T1
0.6	0.9	T2	T1	T1
0.8	1.2	T2	T1	T1
1.2	1.8	SED	SED	SED

NOTE: T1 fixing pattern is – Fix every crest…
T2 fixing pattern is – Hit 1, miss 1…
SED Specific Engineering Design
(1) For profile heights and pan widths outside this range, refer to supplier's literature for fixing patterns and spans

Amend 5 Aug 2011

Table 15: Steel trapezoidal profiled roofing – 0.55 mm BMT, profile height 27 mm minimum(1) and minimum 5-rib profiles
Maximum spans and fixing patterns. Refer to Paragraph 8.4.6

Purlin spacings (metres)		Wind zones		
End span	Intermediate span	Low and Medium	High and Very High	Extra High
0.4	0.6	T2	T2	T2
0.6	0.9	T2	T2	T2
0.8	1.2	T2	T2	T2
1.2	1.8	T2	T1	T1

NOTE: T1 fixing pattern is – Fix every crest…
T2 fixing pattern is – Hit 1, miss 1…
(1) For profile heights and pan widths outside this range, refer to supplier's literature for fixing patterns and spans

Amend 5 Aug 2011

Amend 2 Jul 2005

Amend 5 Aug 2011

8.4.9 Fixings: trough profile

Amend 2 Jul 2005

Clip fixings for *trough profiles* and spans as shown in Table 13 shall be as shown in Figure 40, and shall:

Amend 2 Jul 2005

a) Have a minimum *BMT* of 0.9 mm

Amend 5 Aug 2011

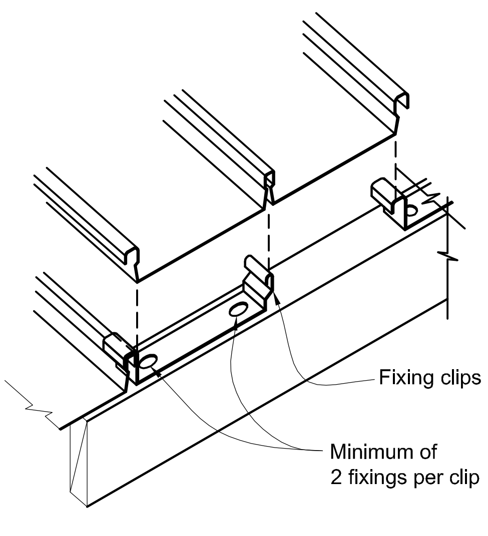
b) Be a minimum width of 30 mm

c) Be made from a material compatible with the *cladding*, refer to Tables 20 and 21

d) Have clips fastened with a minimum of two 10-gauge by 30 mm waferhead hot-dipped galvanised screws which comply with Class 3 of AS 3566: Part 2.

Amend 2 Jul 2005

Figure 40: Typical trough profile fixings
Paragraph 8.4.9



Amend 2 Jul 2005

Amend 5 Aug 2011

Amends 2 and 5

8.4.10 Allowance for expansion

Allowance shall be made for expansion of corrugated and *trapezoidal* roof *cladding* as shown in Table 16.

Amend 5 Aug 2011

Where Table 16 requires profiled washers, allowance shall be made for expansion by:

a) Fixing the top 50% (closest to the ridge) with conventional fixings, and

Amend 5 Aug 2011

b) Fixing the lower 50% with sealing washers fixed over profiled washers as shown in Figure 39, and:

i) using oversized holes, and

ii) positioning fixing in centre of hole.

Table 16: Expansion provisions
Paragraph 8.4.10, Figure 39

Material	< 8 m	8-12 m	12-18 m	>18 m
Steel	NSR	Profiled washers	Profiled washers	SD
Aluminium	Oversized holes	Profiled washers	SD	SD

SD – Requires *specific design*
NSR – No special requirements

Amend 5 Aug 2011

Amend 5 Aug 2011

Amend 2 Jul 2005

8.4.11 Flashing requirements

The roofing shall be flashed at all boundaries to comply with the following:

a) At edges discharging to gutters with *eaves flashings* where required in Figure 45(a)

Amend 2 Jul 2005

b) *Soft edge* to cover *flashings* complying with Paragraph 4.6. Refer to Figure 41 for example of use and Tables 21 and 22.

c) Notched turn-downs to cover *flashings* shall comply with Paragraph 4.6. Refer to Figure 42 for example of use.

Amend 2 Jul 2005

Amend 5 Aug 2011

d) Materials for *flashings* shall be compatible with the *roof cladding* material as per Table 21 and Table 22, and shall be in accordance with Paragraph 4.3.

e) Provide *expansion joints* in accordance with Paragraph 4.5.2.

Amend 2 Jul 2005

8.4.11.1 Fixing flashings

a) When fixing *flashings* to the structure, use screws as for roofing (see Paragraph 8.4.8).

b) When fixing *flashings* to other *flashings* or to roofing use:
   i) for galvanized steel, 4 mm diameter monel metal or stainless steel rivets, where compatible as per Table 21,
   ii) for aluminium-zinc coated steel, 4 mm diameter aluminium rivets,
   iii) for aluminium, 4 mm diameter aluminium rivets.

Amend 2 Jul 2005

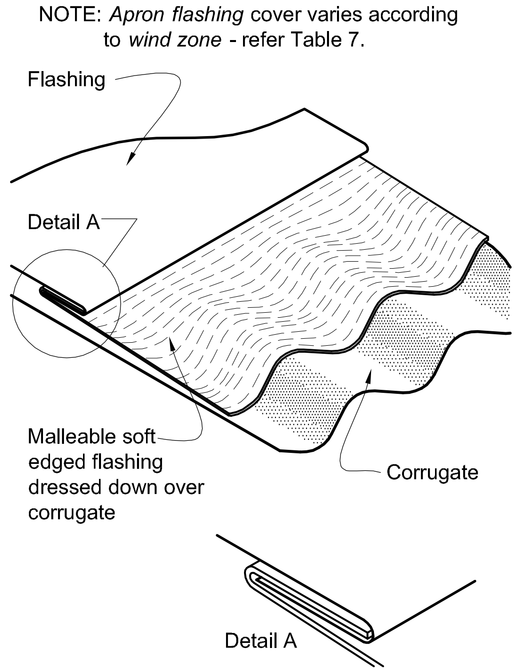
COMMENT:
The use of stainless steel fixings is not recommended by steel manufacturers for use with coated steel, in severe marine and industrial environments, as they are considered to cause deterioration.

Amend 5 Aug 2011

c) *Flashing* joins, including *expansion joints* where required, shall be in accordance with Paragraph 4.5.2 and as shown in Figure 6.

d) Where end-laps are required in *flashings*, form these as shown in Figure 6 and, before joining the two parts, apply an 8 mm diameter bead of neutral cure sealant complying with:
   i) Type F, Class 20LM or 25LM of ISO 11600, or
   ii) low modulus Type II Class A of Federal Specification TT-S-00230C.

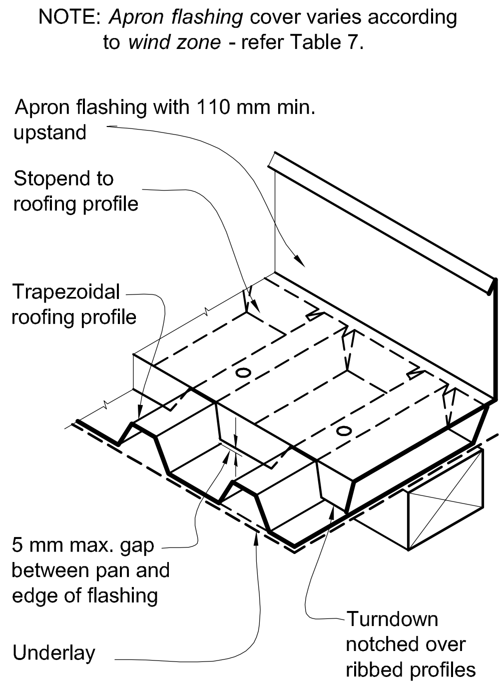
Figure 41: Soft edge flashing
Paragraphs 4.6, 8.4.12 and 8.4.11



Amend 2 Jul 2005

Amend 5 Aug 2011

Figure 42: Trapezoidal notched flashing
Paragraphs 4.5, 8.4.11 and 8.4.12



Amend 2 Jul 2005

Amend 5 Aug 2011

8.4.12 Flashing details

The *roof* shall be flashed using details shown below:

Amend 5 Aug 2011

a) Ridge to hip as shown in Figure 43,

Amend 5 Aug 2011

b) *Apron flashing* and change in pitch as shown in Figure 44,

c) *Eaves* and roof/wall ridge as shown in Figure 45,

d) *Eaves flashing* as in Figure 45(a) required for all roofs under 10º pitch and soffit widths less than 100 mm,

Amend 5 Aug 2011

e) Ridge and hip as shown in Figure 46,

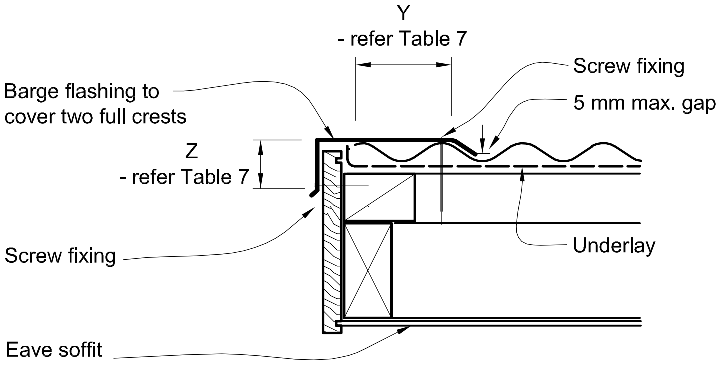
Amend 2 Jul 2005

f) Barge *flashings* as shown in Figure 47,

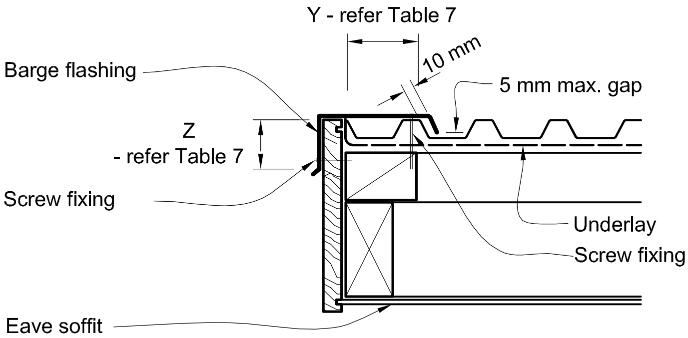
g) *Apron flashing* – *parallel flashing* to profile as shown in Figure 48.

Amend 5 Aug 2011

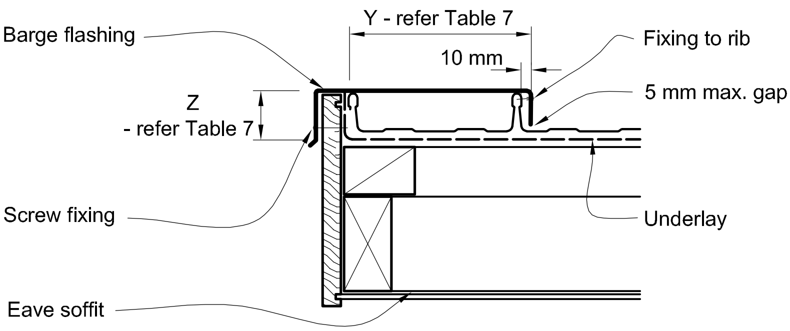
Figure 47: **Barge flashings for profiled metal**
Paragraphs 8.4.11, 8.4.12, Table 7



(a) CORRUGATED PROFILE



(b) TRAPEZOIDAL PROFILE



(c) TROUGH PROFILE

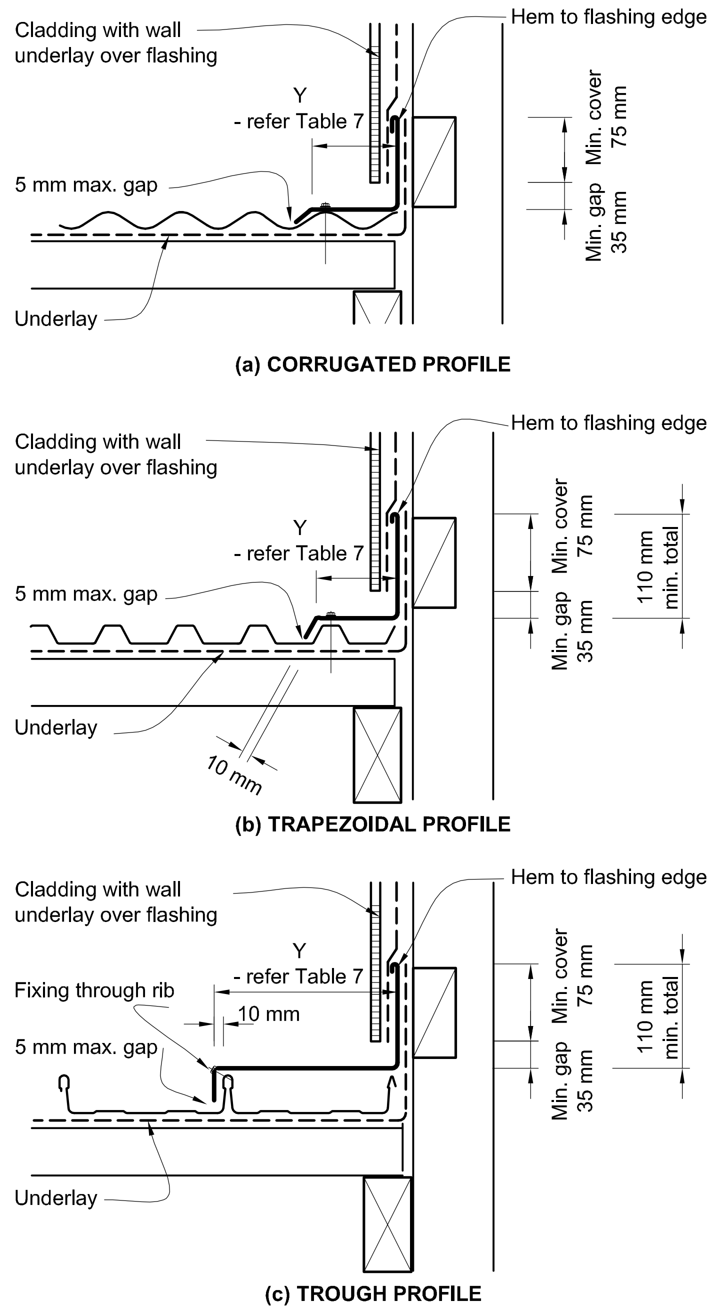
Amend 2 Jul 2005

Amend 2 Jul 2005

Amend 2 Jul 2005

Amend 5 Aug 2011

Figure 48: Parallel apron flashings for profiled metal
Paragraphs 8.4.11, 8.4.12, Table 7



(a) CORRUGATED PROFILE

(b) TRAPEZOIDAL PROFILE

(c) TROUGH PROFILE

Amend 2 Jul 2005

Amend 2 Jul 2005

Amend 2 Jul 2005

Amend 5 Aug 2011

Amend 5 Aug 2011

8.4.13 Stopends

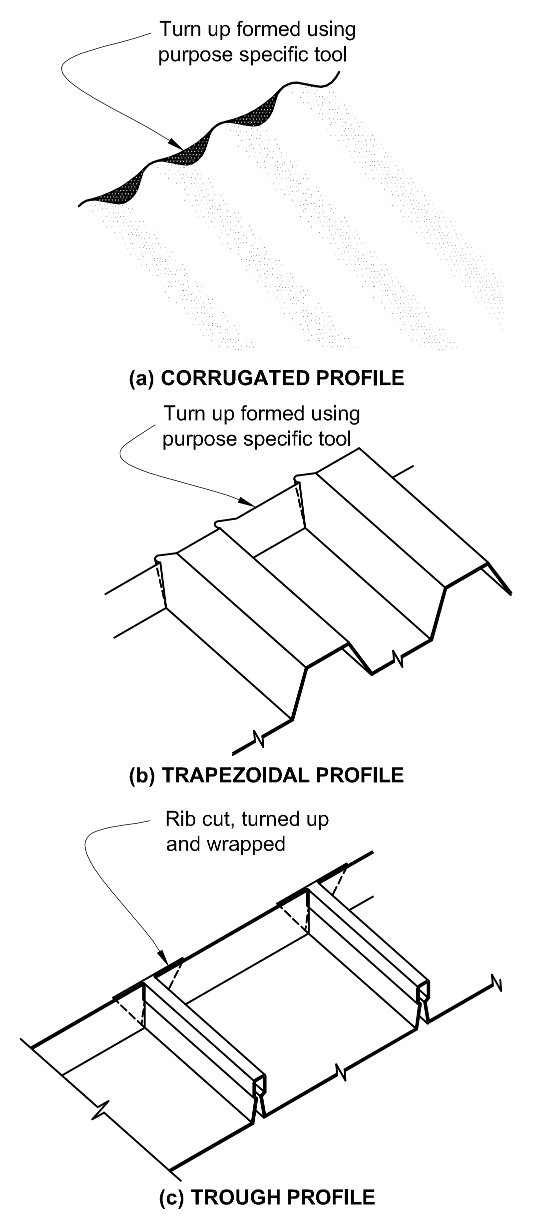
The top ends of profiled metal roof *cladding* shall have *stopends* as shown in Figure 49 for *trapezoidal* and *trough profile* metal *roof cladding*, where:

a) The *roof pitch* is less than 25°, or

b) The *building* is in a High/Very High/Extra High *wind zone*.

Amend 5 Aug 2011

Figure 49: Profiled metal stopends
Paragraph 8.4.13, Figure 92



Amend 5 Aug 2011

8.4.14 Turn-downs at gutters

Amend 5 Aug 2011

The lower ends of *trapezoidal* and *trough profile* roofing shall be turned down at gutters, where the *roof* pitch is less than 10°.

The turn-down shall be 30° from the plane of the sheet.

COMMENT:
Specific tools are available and should be used to turn up or turn down ends. Care should be taken to ensure the sheet does not split.

Refer to the New Zealand Metal Roof and Wall Cladding Code of Practice for guidance on methods.

Amend 2 Jul 2005

8.4.15 Profile closure

Preformed compressible seals shall not be used at the *eaves*.

Amend 5 Aug 2011

COMMENT:
Refer to the New Zealand Metal Roof and Wall Cladding Code of Practice for guidance.

8.4.16 Hidden, valley and internal gutters

Amend 5 Aug 2011

Hidden, *valley* and internal *gutters* shall be in accordance with Paragraph 8.1.6.

8.4.16.1 Hidden gutters

Parallel *hidden gutters* shall be as shown in Figure 50 and Paragraph 8.1.6.2.

Amend 2 Jul 2005

8.4.16.2 Valley gutters

Valley gutters shall be in accordance with catchment areas shown in Table 8, and as shown in Figure 51 and Paragraph 8.1.6.2.

Amend 2 Jul 2005 Amend 5 Aug 2011

COMMENT:
Refer to the New Zealand Metal Roof and Wall Cladding Code of Practice for additional guidance on sizing, materials and fixing.

8.4.16.3 Internal gutters

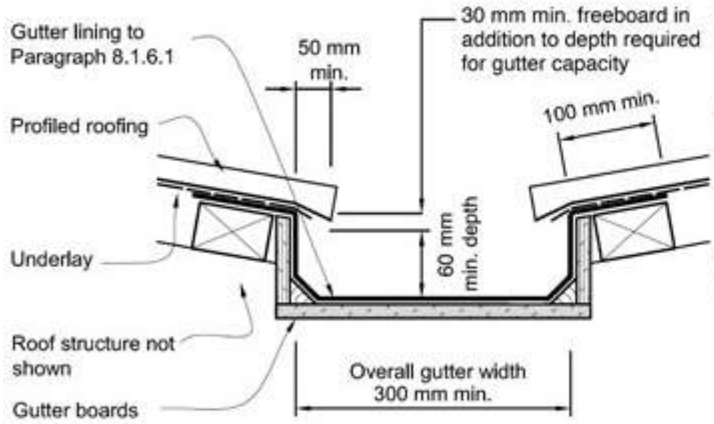
Internal gutters shall be as shown in Figure 52 and Paragraph 8.1.6.1.

Amend 5 Aug 2011

Figure 52: Internal gutter for profiled metal
Paragraphs 4.3, 4.5, 8.1.6.1 and 8.4.16

Amend 2 Jul 2005

Amends 5 and 10



NOTES:
(1) Butyl rubber gutter lining to comply with Paragraph 4.3.9. Butyl cross joins in gutter are not permitted.
(2) Internal gutter shall be sized to meet the requirements of NZBC Clause E1 for the particular *roof* catchment area, but in no case have dimensions less than those shown in this figure.
(3) 1:100 minimum gutter fall.
(4) For gutter drainage refer Paragraph 8.1.6.1.

8.4.17 Roof penetrations

The maximum length of profiled *roof cladding* above penetrations shall be as shown in Table 17.

The edge of roofing penetrations over 200 mm wide shall be supported in either direction with additional *framing* as shown in Figure 21.

Roof penetrations shall be flashed as follows:

Amend 5 Aug 2011

a) Pipe penetrations up to 85 mm shall be flashed using an *EPDM* boot *flashing* as shown in Figure 53,

Amend 2 Jul 2005

b) Pipe penetrations up to 500 mm shall be flashed using a soaker *flashing* and *EPDM* boot *flashing* as shown in Figure 54,

c) Rectangular penetrations up to 1200 mm wide shall be flashed using a soaker type *flashing* as shown in Figure 55.

COMMENT:
Penetrations on lower pitched *roofs*, larger penetrations, or needing specialised complex *flashings* will require *specific design* to suit the particular circumstances. Amend 2 Jul 2005

The New Zealand Metal Roof and Wall Cladding Code of Practice should be consulted for guidance.

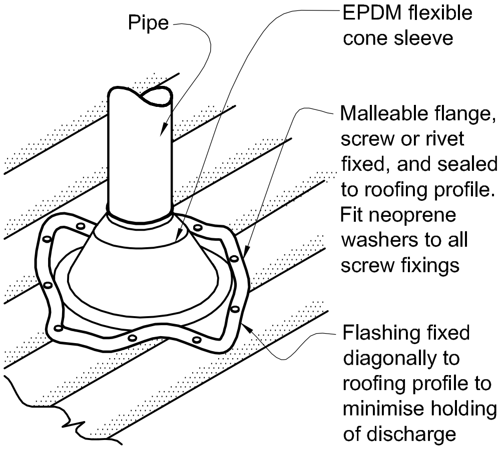
Amend 5 Aug 2011

Table 17: Catchment areas for profiled metal
Paragraphs 8.1.7, 8.4.17, Table 9, Figure 22

Penetration width	Maximum roof length above penetration in metres		
	Corrugated	Trapezoidal	Trough profile
800 to 1200 mm	4 m	8 m	16 m
600 to 800 mm	6 m	12 m	18 m (refer Note)
400 to 600 mm	8 m	16 m	18 m (refer Note)
0 to 400 mm	12 m	18 m (refer Note)	18 m (refer Note)

NOTE: Limited to 18 m as per the limitations of this Acceptable Solution.

Figure 53: Flashing for small pipes
Paragraphs 8.3.10, 8.4.17, 9.6.8.5 and 9.6.9.6



NOTE:
(1) Max. roof pitch for this flashing 45°, minimum pitch 10° if base of flange covers one or more complete troughs.
(2) For pipes up to 85 mm diameter.

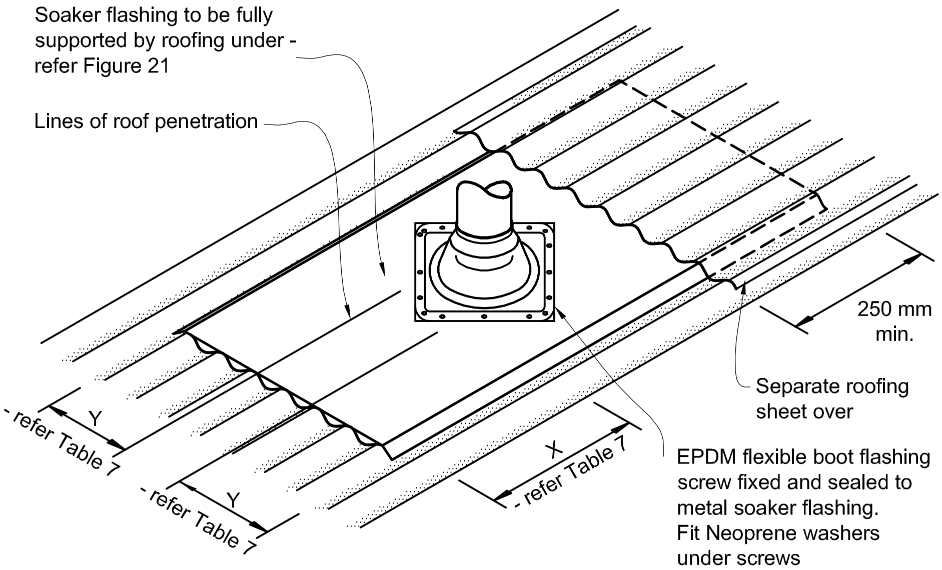
Amend 5 Aug 2011

Figure 54: Soaker flashing for pipe penetrations
Paragraph 8.4.17

Errata 2 Dec 2011

NOTE: (1) Suitable for pipes from 86 mm to 500 mm diameter.
(2) Suitable only for roof pitches of 10° or more.

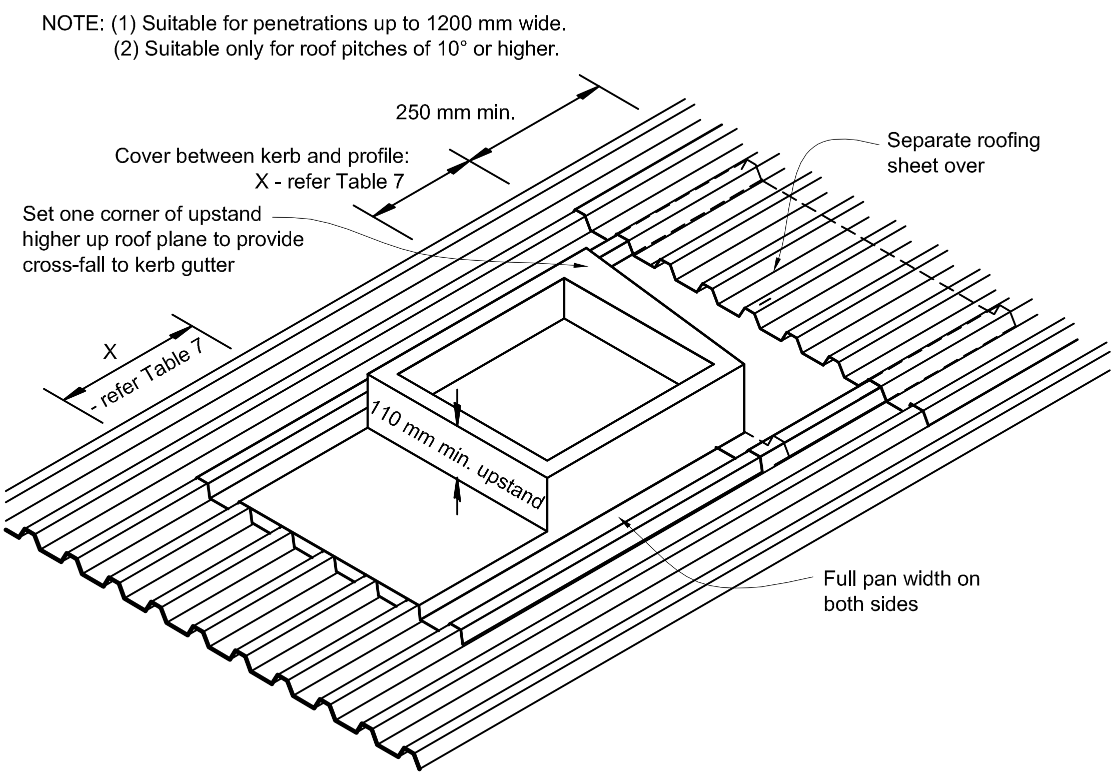
Amend 2 Jul 2005



Amend 2 Jul 2005

Amend 5 Aug 2011

Figure 55: Soaker flashing for other penetrations
Paragraph 8.4.17, Table 17



Amend 5 Aug 2011

Amend 2 Jul 2005

8.5 Membrane Roofs and Decks

8.5.1 Limitations

This Acceptable Solution is limited to *membranes* composed of butyl or *EPDM* installed over plywood substrates for:

Amend 5 Aug 2011

a) *Roofs* with a minimum fall of 2° (1:30),

b) *Decks* with:
   i) a minimum fall of 1.5° (1:40), (Amend 5 Aug 2011)
   ii) a maximum area of 40 m^2,
   iii) no steps in level within *deck* area except into gutters, (Amend 2 Jul 2005)
   iv) no integral roof gardens, and
   v) no downpipe direct discharge to *deck*,

Amend 5 Aug 2011

c) Internal gutters with a minimum fall of 1 in 100, with no cross seams in the gutters, and

Amend 5 Aug 2011

d) *Decks* with removable raised surfaces to give level access as shown in Figure 17A.

The application of directly applied wearing or decorative surfaces to *membranes* is not covered in this Acceptable Solution.

COMMENT:
EPDM and butyl rubber *membranes* are subject to damage when on trafficable roof-*decks.* A suitable wearing surface will help reduce such damage.

Increases in slopes from the previous version recognise deflection tolerances in NZS 3604 and in-service loadings by *building* owners.

8.5.2 General

Amend 2 Jul 2005

Closed-in *construction* spaces under *membrane roofs* and *decks* require adequate ventilation to prevent the accumulation of moisture under the *membrane*. Maintain a minimum gap of 20 mm between the underside of the substrate and any insulation, and for *membrane roofs* greater than 40 m^2, refer to manufacturer's details for *roof* cavity vents and/or substrate vent requirements.

Amend 5 Aug 2011

COMMENT:
Refer to Paragraph 1.5 for qualification of installers.

Amends 2 and 5

8.5.3 Plywood substrates

Plywood shall be:

a) A minimum of 17 mm complying with AS/NZS 2269,

b) At least CD Grade Structural plywood with the sanded C face upwards, and

c) H3 with treatment type compatible with *membrane* and adhesives used, and kiln dried after treatment. (Amend 2 Jul 2005)

COMMENT:
The compatibility of LOSP-treated timber must be checked with *membrane* suppliers. (Amend 5 Aug 2011)

If using plywood containing copper-based preservatives, check the compatibility of adhesives and *membranes* with copper with the product manufacturers.

8.5.4 Butyl and EPDM

Butyl rubber and *EPDM* rubber sheet and system components used for *membrane* roofing or *decks* shall: (Amend 5 Aug 2011)

a) Be a minimum thickness of:
   i) 1 mm for roofing, or (Amend 2 Jul 2005)
   ii) 1.5 mm for *decks*, and

   Refer to Paragraph 8.1.6.1 for *membranes* to gutters (Amend 5 Aug 2011)

b) Comply with the following parts of Table 1 in ASTM D6134:
   i) tensile strength,
   ii) elongation,
   iii) water absorption,
   iv) water vapour permeance, and
   v) heat aging followed by:
      a. tensile strength
      b. elongation, and

c) Have adhesives, primers, seam tapes and pre-formed components where supplied by the manufacturer that: (Amend 5 Aug 2011)
   i) comply with BRANZ EM 5, and
   ii) are part of a complete system approved by the manufacturer or supplier of the *membrane*.

8.5.5 Installation

8.5.5.1 Plywood

Substrates must be dry when *membranes* are applied. The plywood and timber substructure must be a maximum moisture content of 20% when a *membrane* is adhered. Amend 5 Aug 2011

COMMENT:

This will generally require substrates to be covered to prevent rain wetting, or to be pre-primed to avoid moisture uptake.

Manufacturers' recommendations should be consulted, as some require a lower moisture content in order to validate guarantees.

Plywood substrates shall be fixed according to the following requirements:

a) Panels shall be laid with staggered joints (brick bond),

b) Panels shall be laid with the face grain at right angles to the main supports,

c) Supports in b) shall be at 400 mm maximum centres, Amend 2 Jul 2005

d) The edge of sheets shall be supported with *dwangs* or *framing,*

e) External edges shall be chamfered with a minimum radius of 5 mm,

f) A 20 mm H3.2 triangular fillet shall be used at the base of any 90° upstand, and

g) Shall be fixed:

i) with 3 mm gaps between all sheets,
i) using 10 g x 50 mm stainless steel countersunk head screws,
iii) at 150 mm centres on edges, and
iv) at 200 mm centres in the body of the sheets.

Amend 5 Aug 2011

8.5.5.2 Butyl and EPDM

Seam tapes shall be used on all joints of:

a) *Roofs* or *decks* with falls less than 5° (1:12),

Amend 5 Aug 2011

c) Penetrations through the *membrane* where butyl or *EPDM flashing* is required,

d) *EPDM membrane*, and

e) Butyl *membranes* that contain *EPDM*.

COMMENT:

Coloured butyl *membranes* contain *EPDM*, which makes them more difficult to adhere properly.

Seams should be aligned parallel to the fall of the *deck* to minimise ponding.

Amend 5 Aug 2011

Where a penetration is made through the *membrane* subsequent to laying, the *flashing* should be installed by the applicator of the *membrane* system.

All joints in the plywood and junctions of plywood with other materials shall have 25 mm polyethylene release tape applied before application of the *membrane*.

8.5.6 Roof and deck drainage

Membrane roofs and *decks* shall be constructed to provide:

a) Falls as shown in Figure 56 and details in Figures 57–64 Amend 2 Jul 2005

b) A minimum of 100 mm below an adjoining threshold as shown in Figure 62

c) *Membrane upstands* against all *walls*, *parapets*, or *enclosed balustrades* extending to a minimum level of 150 mm above *deck* level as shown in Figure 62.

COMMENT:

If the clearance of the *cladding* from the *deck* or *roof* surface is at the minimum of 35 mm, give an overlap of 115 mm to the *cladding*.

d) Water discharging either:

i) into a *roof* or gutter outlet with a minimum diameter of 75 mm as shown in Figure 64 with either:
- an overflow as shown in Figure 63 (c) or
- an extra outlet, with both outlets sized to take the full required capacity.

or,

Amend 5 Aug 2011

Errata 2 Dec 2011

ii) via a *scupper*, into a gutter, or rainwater head, as shown in Figure 63 (a), (b) and (d).

e) Gutters formed with continuous butyl or *EPDM* strip complying with Paragraph 4.3.9, with no cross-joints.

Amend 5 Aug 2011

COMMENT:
In addition to this paragraph, *membrane roof* and *deck* drainage must comply with NZBC Clause E1, and Acceptable Solutions E1/AS1 and E1/AS2 are options for achieving such compliance.

Seams in gutters are particularly difficult to form at outlets through *enclosed balustrade walls*, and the risk of failure is high. Failure of a seam can result in damage to underlying *walls*.

Amend 10 Nov 2020

Amend 5 Aug 2011

8.5.7 Control joints

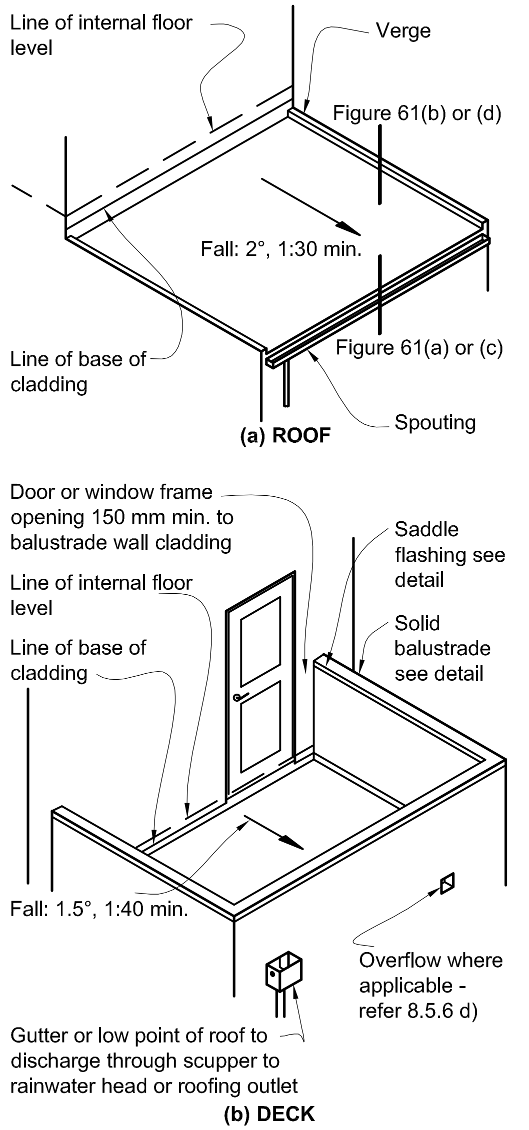
All *control joints* in the substrate shall be accommodated in the *membrane roof* design.

The design of *control joints* for *membrane* roofing is subject to *specific design* and is outside the scope of this Acceptable Solution.

Amend 2 Jul 2005

Figure 56: Falls in membrane roofs and decks
Paragraph 8.5.6, Figures 61, 62, 63 and 64

NOTE:
(1) Refer Figure 62 for thresholds and clearances.
(2) Junction *saddle flashing* - refer Figure 13.

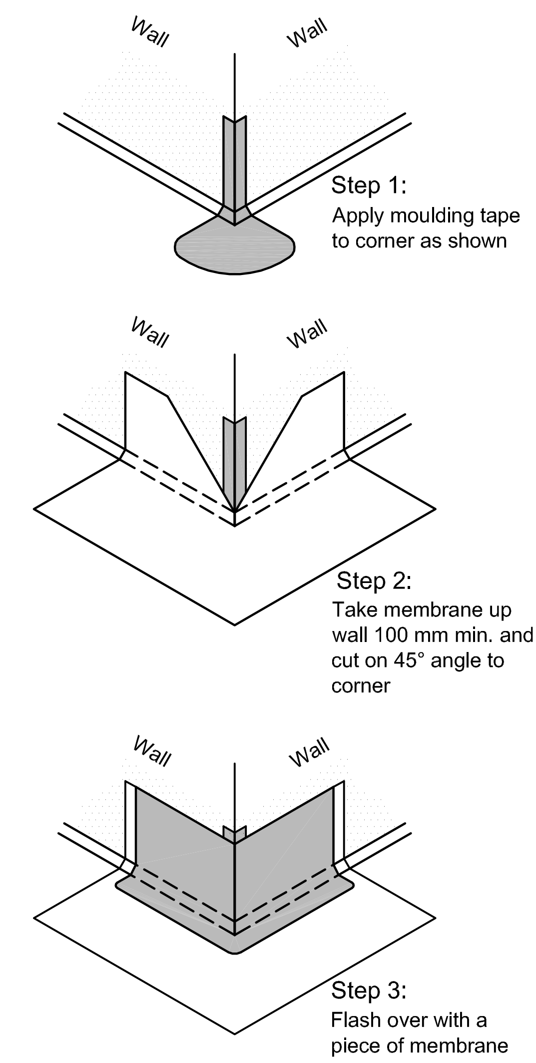


Amend 2 Jul 2005

Errata 2 Dec 2011

Amend 5 Aug 2011

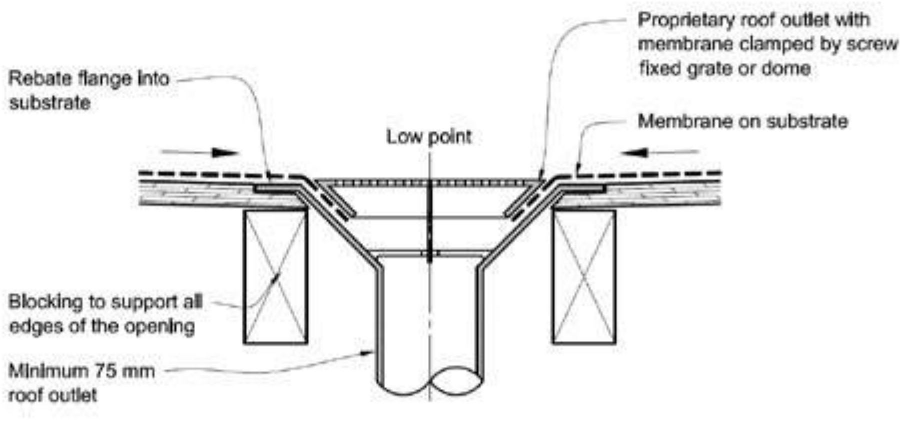
Figure 57: External corner in upstand
Paragraph 8.5.8, Figures 59, 62, 63 and 64



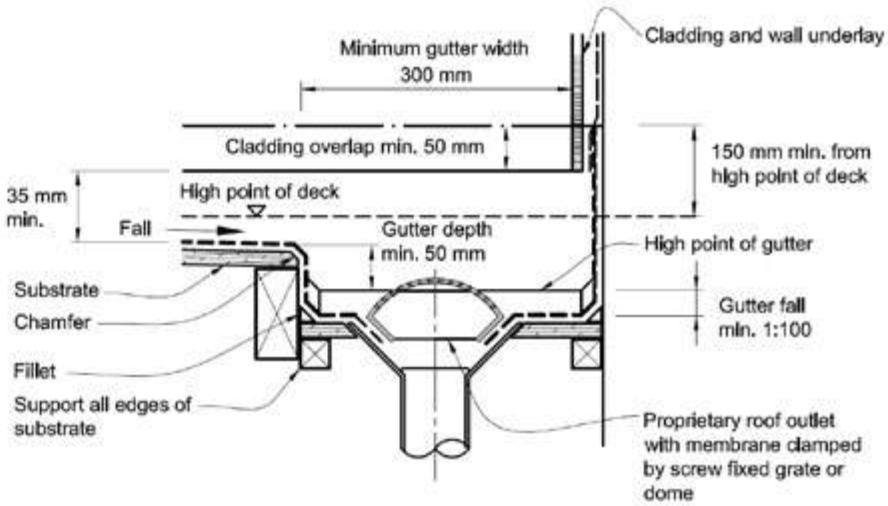
Amend 5 Aug 2011

Amend 5
Aug 2011

Figure 64: Gutters and outlets in membrane
Paragraphs 8.5.6 and 8.5.10



(a) TYPICAL ROOF OUTLET

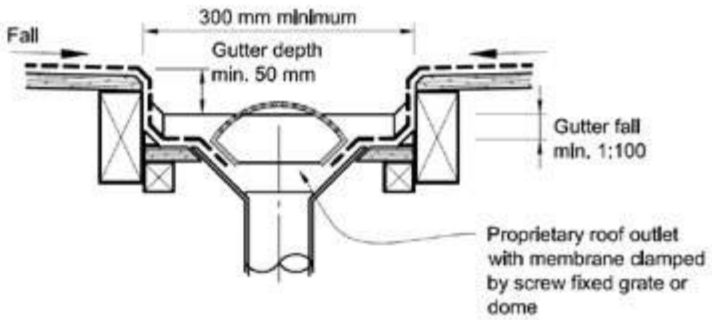


(b) EDGE GUTTER

NOTES:

1) Gutters shall be sized to meet the requirements of NZBC clause E1 for the particular catchment area, but in no case have dimensions less than those shown in this figure.

2) A freeboard allowance is not required in addition to the gutter capacity required to meet NZBC Clause E1 for gutters constructed to (b) or (c) of this figure, provided that the *membrane roof* or *deck* has at least 30 mm fall into the gutter channel, and all *membrane* perimeter details comply with Figures 61, 62, 63 and 64(b) of this Acceptable Solution.



(c) CENTRAL GUTTER

Amend 10
Nov 2020

Amend 5 Aug 2011

9.1.3.3 Bottom of wall claddings for concrete ground slabs (except masonry veneer)

At concrete slab level, the base of the *cladding system* shall be as shown in Table 18, and:

a) Finish a minimum of:
   i) 100 mm above a paved surface, or
   ii) 175 mm above finished unpaved surface, Amend 5 Aug 2011

b) Overlap the concrete slab by 50 mm, and

c) Be offset horizontally by a minimum of 6 mm for *direct fixed claddings* to prevent capillary action. Amend 5 Aug 2011

9.1.3.4 Garages and openings to garages

Amend 5 Aug 2011

Refer to Figure 65 and Table 18 for overall level change requirements.

COMMENT:
This paragraph does not apply to garages that are detached outbuildings.

Garage spaces within, or attached to, the *building* envelope shall have:

a) Openings provided with a 50 mm minimum total level change between the interior and the exterior paving,

COMMENT:
Methods for achieving the required step may include:
- A 50 mm difference in *finished ground level* adjacent to the opening, or
- A raised threshold at the opening, or
- Concrete nibs at the opening.

b) Provision to drain water away from the threshold of the opening

c) Rigid *wall underlays*, to Table 23, where external garage *walls* are unlined

d) linings to garage *walls* adjoining habitable spaces

e) weather resisting garage doors

f) window and door details (where included) to Paragraphs 9.2 to 9.9.

Amend 5 Aug 2011

9.1.3.5 Bottom of wall claddings for timber floor framing

Amend 5 Aug 2011

Suspended timber floors shall meet the requirements of NZS 3604. Clearances from paved and unpaved surfaces to the wall *framing* shall be in accordance with NZS 3604, and Table 18. Amend 5 Aug 2011

At ground floor level, the base of the *cladding system* shall:

a) Overlap the timber floor structure by 50 mm minimum, and

b) For walls with *direct fixed claddings*, be offset horizontally from a concrete foundation *wall* by a minimum of 6 mm

c) Have no direct connection between sub-floor spaces and *drained cavities*. Amend 5 Aug 2011

COMMENT:
Where *claddings* require *drained cavities*, care must be taken to ensure air from the subfloor space cannot enter the cavity. This is important, as moisture levels in subfloor air can be high.

9.1.4 Barriers to airflow

This Acceptable Solution requires *external walls* to have barriers to airflow, in the form of:

a) Interior *linings* with all joints stopped for *wind zones* up to Very High, or

b) Rigid *underlays* (and *drained cavities*) for *buildings* in Extra High *wind zones* – refer to Paragraph 9.1.7.2

c) Where walls are not lined, such as attic spaces at gable ends, an air barrier complying with Table 23, fixed to *framing* prior to fixing *cladding* or *cavity battens*

d) For attached garages, *underlays* to Paragraph 9.1.3.4. Amend 5 Aug 2011

.

COMMENT:

The primary function of air barriers and *air seals* is to moderate airflows at junctions and inside the *wall* cavity.

Airflows in certain weather conditions encourage significant amounts of water to move along their path, and it is therefore important to manage airflow in *cavity walls* with barriers and *air seals*.

In the absence of internal *linings*, an air barrier is required to support wind pressures at locations such as gable ends and unlined garage spaces. Air pressure drop is not always across the internal *lining*, indicating the *wall underlay* acts as an air barrier as well.

Amend 5 Aug 2011

9.1.5 Wall underlays to wall openings

Prior to window or door installation:

a) Flexible *wall underlay* shall be cut and dressed into all sides of openings as per Figure 72A and B,

Amend 5 Aug 2011

b) *Flexible flashing tape* shall be applied to head and sill *framing* as shown in Figures 72A and 72B. *Flexible flashing tape* shall:
   i) comply with Parts 3.2 and 4 of ICBO Acceptance Criteria AC148, and
   ii) be compatible with the *wall underlay*.

Amend 5 Aug 2011

Amend 5 Aug 2011

COMMENT:

Amend 5 Aug 2011

Dressing the *wall underlay* around the *framing* timber and providing a flexible *air seal* limits airflows around the window reveal.

The *flexible flashing tape* keeps any water that does get past the *cladding*, or through the joinery, from direct contact with the timber.

9.1.6 Air seals

Window, door and other penetration openings shall be provided with flexible *air seals* to minimise the risk of airflows carrying water into the *building* wall. The *air seal* shall be:

a) Provided between the reveal or frame and the wrapped opening (for example of use, refer to Figure 81),

b) Installed over a closed cell polyethylene foam (PEF) backing rod, or similar

Amend 5 Aug 2011

c) Made of:
   i) self-expanding polyurethane foam, or
   ii) sealant complying with:
      a. Type F, Class 20LM or 25LM of ISO 11600, or
      b. low modulus Type II Class A of Federal Specification TT-S-00230C.

COMMENT:

Some sealants can react with bitumen based *flashing* tape, preventing full curing of the sealant. Where necessary, consult sealant manufacturers for application requirements.

Amend 5 Aug 2011

Backing rods are used for sealant and for self-expanding polyurethane foam as there is a danger foam will expand to the outside of the *wall* and form a moisture bridge to the interior.

For further information refer to ASTM C1330 for backing rod material performance.

Amend 5 Aug 2011

9.1.7 Wall underlay

9.1.7.1 Flexible *wall underlays* shall be in accordance with Table 23, and shall:

a) Be run horizontally,

b) Have upper sheets lapped over lower sheets to ensure that direction of laps will allow water to be shed to outside of the *wall underlay*, Amend 5 Aug 2011

c) Be lapped not less than 75 mm at horizontal joints,

d) Be lapped not less than 150 mm over *studs* at vertical joints, and

e) Extend 35 mm below bottom plate or bearer,

f) Be restrained from bulging into a *drained cavity*. Refer to Paragraph 9.1.8.5.

9.1.7.2 Rigid *wall underlays*, in association with *drained cavities* (including *direct fixed* corrugated profiled metal), are required in Extra High *wind zones*. Refer to Table 3 and Table 23. Rigid *underlays* are also required to *external walls* of attached garages that are unlined. Refer Paragraphs 1.1.1 and 9.1.3.4 c).

Rigid *wall underlays* shall be in accordance with Table 23, and shall:

a) Be minimum 7 mm H3 plywood, or 6 mm fibre cement sheet

b) Be installed with sheet edges fixed over solid framing

c) Be over-fixed with a flexible *wall underlay* from Table 23 and installed as in Paragraph 9.1.7.1

COMMENT:

Some proprietary systems may not require the addition of a flexible *underlay*

d) Have flexible *underlay* folded into opening reveals as in Paragraph 9.1.5 a)

e) Have *cavity battens* at maximum 600 mm centres

Amend 5 Aug 2011

f) Be *finish flushed* with underside of bottom plate or bearer.

COMMENT:
External air pressures in higher *wind zones* can transfer to interior linings, and exceed recommended loadings prescribed by some *lining* manufacturers. Rigid *underlays* will protect *linings* from undue air pressure loadings, and help ensure cavity depths are maintained for the proper functioning of the *drained cavity*.

Amend 5 Aug 2011

9.1.8 Drained cavities

Based on the *risk score* for an *external wall* calculated as per Paragraph 3.1, a *wall cladding* may require the inclusion of a *drained cavity*. Where a *drained cavity* is required, it shall meet the requirements of Paragraphs 9.1.8 to 9.1.9.4.

Amend 2 Jul 2005

COMMENT:
Cavities manage occasional ingress of water past the *cladding*, but should not act as gutters or drains.

9.1.8.1 Limitations

This Acceptable Solution is limited to systems where:

a) *Cavity battens* are fixed, by the *cladding* fixings, to the *wall framing*,

b) *Claddings* are fixed through the *cavity battens* into the *wall framing*, and

c) The *drained cavity* behind *claddings*, except in *masonry veneer*, is not vented at the top.

Systems where the *cladding* is fixed into the *cavity batten* only are outside the scope of this Acceptable Solution.

9.1.8.2 Requirements

Where a *drained cavity* is required, it shall:

a) Be installed over a *wall underlay,* either flexible or rigid, that:
   i) complies with Table 23, and
   ii) is fixed to *wall framing*,

Amend 5 Aug 2011

b) Be formed using vertical *cavity battens*,

c) Restrict air movement between the *drained cavity* and:
   i) floor, *wall* and *roof framing*,
   ii) attic *roof* space, and
   iii) subfloor space,

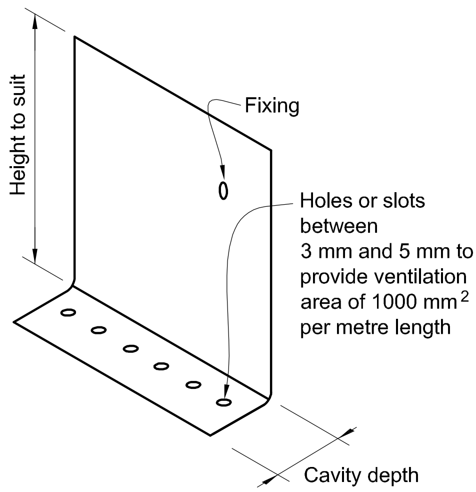
d) Be drained and open to the exterior at the bottom of cavities,

Amend 2 Jul 2005

e) Use vermin-proofing at the cavity base as per Paragraph 9.1.8.3 and Figure 66,

Amend 2 Jul 2005

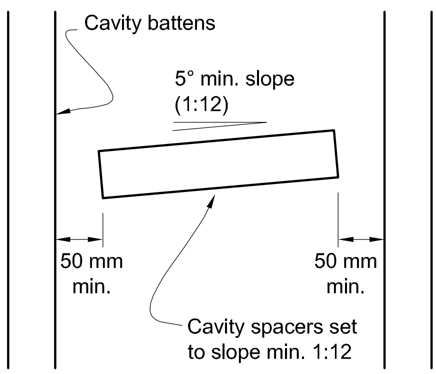
Figure 66: Cavity base closer/vermin proofing
Paragraph 9.1.8.2



NOTE: To be used in *drained cavities* at the base of walls and above window head and inter-storey *flashings*.

Amend 5 Aug 2011

Figure 67: Cavity spacers
Paragraphs 9.1.8.2 and 9.1.8.4



NOTE: Spacing of *cavity spacers* will vary to suit individual *cladding* fixings.

Amend 5 Aug 2011

) Use *cavity spacers* as shown in Figure 67, where fixing is required between *cavity battens*. Alternative *cavity spacers* to those described in Paragraph 9.1.8.2 are permitted. Refer to Paragraph 9.1.8.4 f).

Amend 5 Aug 2011

COMMENT:
Solid horizontal *cavity spacers* risk obstruction of air flow in cavities and risk bridging moisture across the *cavity*.

Amend 5 Aug 2011

9.1.8.3 Vermin-proofing

Amend 5 Aug 2011 Vermin-proofing shall be provided above window and door heads and at the base of the *drained cavity*. Figure 66 provides one example of an appropriate cavity closer.

Aluminium, stainless steel or uPVC in accordance with Paragraph 4.1 shall be used where vermin-proofing material is not readily accessible or replaceable.

Vermin-proofing shall:

a) Provide holes or slots between 3 mm and 5 mm,

b) Provide an area of opening of 1000 mm^2 per lineal metre of *wall*, and (Amend 2 Jul 2005)

c) Be positioned to allow a minimum *drip edge* to the *wall cladding* of:
   i) 10 mm at the base of *walls*, and
   ii) 15 mm above window and door head *flashings*.

COMMENT:
It is important the openings in vermin-proofing are kept clear and unobstructed in order to maintain draining and venting of the cavity. The closure shown is only one option for vermin-proofing. Provided openings are as specified, other dimensions can vary, so allowing the use of other shapes such as channels and right-angles.

Errata 2 Dec 2011

9.1.8.4 Cavity battens and jamb battens

Cavity battens shall:

a) Be nominal 20 mm (between limits of 18 mm and 25 mm in thickness), (Amend 2 Jul 2005)

b) Be a minimum 45 mm wide, (Amend 5 Aug 2011)

c) Be fixed, by the *cladding* fixings, through the *wall underlay* into the *framing*, (Amend 5 Aug 2011)

d) If timber, comply with B2/AS1,

e) If polystyrene, comply with Paragraph 9.9.3.1, and be protected from any incompatible vapours from timber treatment.

Cavity battens and/or cavity spacers that meet E2/VM1 Class 1 testing and B2/AS1, permit air circulation are allowed. The Class 1 test must include a horizontal *cladding* joint supported on a cavity spacer batten of a proposed type. (Amend 5 Aug 2011)

Jamb battens shall:

f) be nominal 20 mm (between limits of 18 mm and 25 mm in thickness), minimum 45 mm wide, and of timber complying with B2/AS1. Refer to Figure 72A. (Errata 2 Dec 2011)

COMMENT:
The solvents from freshly LOSP-treated timber may melt polystyrene, so these should not be used together.

Solid horizontal cavity spacers risk obstruction of air flow in cavities and risk bridging moisture across the cavity. (Amend 5 Aug 2011)

Battens will be fixed by the *cladding* fixings, which will penetrate the *wall framing*. Battens will therefore need only temporary fixing until the *cladding* is fixed. Polystyrene battens may be temporarily adhered to the *wall underlay*. (Amend 5 Aug 2011)

9.1.8.5 Wall framing behind cavities

Dwangs shall be at a maximum of 1350 mm centres generally and maximum 480 mm centres for *direct-fixed* vertical weatherboard profiles, and vertical metal corrugated and symmetrical *trapezoidal claddings*.

Where *stud* spacings are greater than 450 mm, and flexible *wall underlays* only are used, an intermediate means of restraining the flexible *wall underlay* and insulation from bulging into the *drained cavity* shall be installed. Acceptable means of achieving this are by using:

a) 75 mm galvanized mesh or wire galvanized in accordance with AS/NZS 4534,

b) Polypropylene tape or galvanized wire at 300 mm centres fixed horizontally and drawn taut, or

c) Vertical cavity battens at 300 mm centres maximum. (Amend 5 Aug 2011)

9.1.9 Penetrations

9.1.9.1 Penetrations through cavities

Window penetrations through cavities shall meet the requirements of Paragraph 9.2 to Paragraph 9.9.

9.1.9.2 Other cavity penetrations

Where penetrations of the *wall cladding* are wider than the *cavity batten* spacing, allowance shall be made for air flow between adjacent cavities by leaving a minimum gap of 10 mm between the bottom of the vertical *cavity batten* and the *flashing* to the opening.

9.1.9.3 Pipes and service penetrations

Pipes and service penetrations shall be made *weathertight* by using methods shown in Figures 68 and 69. *Flashing* tape complying with Paragraph 4.3.11, and sealant complying with: (Amend 5 Aug 2011)

a) Type F, Class 20LM or 25LM of ISO 11600, or

b) low modulus Type II Class A of Federal Specification TT-S-00230C.

9.1.10.4 Head flashings

Head *flashings* shall be in accordance with Paragraph 4.6.1.6 and Table 7, unless specifically shown otherwise, and shall:

a) Direct water to the outside of the *wall cladding*, and

b) Finish to the window head with clearance dimensions shown in Figure 71

c) For *direct fixed claddings*, have 50 mm bead of sealant installed between *cladding* and each end of the head *flashing*

d) For *wall claddings* on cavity *walls*:

i) incorporate 10 mm turn-ups as *stop-ends*, terminating at the inside face of the *cladding* so they do not pass through the *cladding*, and

ii) permit ventilation of the *drained cavities* above, by the installation of cavity base closers as shown in Figure 66.

e) For Very High and Extra High *wind zones*, have sealant installed between underside of head *flashing* and top edge of window head flange – refer Figure 71 (c) .

COMMENT:
Stopends are useful to prevent water moving past the ends of head *flashings*. However, additional problems of weatherproofing occur where the *stopend* penetrates the *cladding*.

9.1.10.5 Window and door sills

a) *Direct fixed claddings* shall have

i) sill tray *flashings* as shown in Paragraphs 9.2 to 9.9 for each *cladding* type. The sill *flashing* shall extend back past the condensation channel of the window. Ensure flat sill trays do not slope backwards. The 5 mm gap between the window facing and sill tray must not be sealed.

ii) *direct fixed* door sills, installed as for windows, and as shown in Figure 17D.

b) *Claddings* over a *drained cavity* shall have:

iii) window sills as shown in Paragraphs 9.2 to 9.9, without sill *flashings*

iv) door sills as shown in Figure 17C.

Amend 5 Aug 2011

v) Sill support bars and mechanisms for all doors, and for windows with a trim opening wider than 600 mm. Support bars and mechanisms shall comply with BRANZ Evaluation Method EM6, E2/VM1 and B2/AS1. Support bars and mechanisms must be installed prior to installation of the window or door.

COMMENT
Support bars and mechanisms are rated for their capacity to support the total weight of a joinery unit when installed at given offsets from the frame depending on *cladding* type. Designers select the an appropriate complying support mechanism for the joinery weight. Manufacturers provide build-in instructions for support bars and mechanisms.

c) Mitred aluminium window and door sills, for both *cavity* and *direct fixed*, shall have a corner soaker fitted to the back of the sill/jamb joint and installed at point of manufacture. The soaker will be designed to act as a secondary device to prevent water ingress to the *building* in support of the primary mitre seals. Soaker materials shall be either uPVC, aluminium, polypropylene, high impact styrene or other semi rigid moulded polymeric material.

Sill support bars and mechanisms must be designed to not impede the possible drainage of water from surfaces of sill *flashing* tape, and permit an air passage (of at least 1000 mm^2/m sill width) from the *drained cavity* to the window/door trim cavity.

9.1.10.6 Window and door jambs

Jamb *flashings* shall be installed as shown in Paragraphs 9.2 to 9.9. Amend 5 Aug 2011

Where required, jamb *flashings* shall overlap sill *flashings*, and direct moisture to the outside face of the *cladding system*.

Amend 5 Aug 2011

9.1.10.7 Closed cell foam tape

Compressible foam tape shown behind window facings and *cladding* joints shall be closed cell PVC foam, with:

a) Hardness 55-60 to ASTM D2240 Scale OO,

b) Grade VE-43 to ASTM D1667,

c) Compression set of 20% maximum to ASTM D1667, and

d) UV weathering in UV Weatherometer for 1500 light hours to ASTM G154 or ASTM G155 with no visible deterioration in appearance.

9.1.10.8 Attachments for windows and doors

Install windows and doors using pairs of minimum 75 x 3.15 galvanised jolt head nails or 8 gauge x 65 mm stainless steel screws, through reveals into surrounding *framing* at:

a) Maximum 450 mm centres along sills, jambs and heads, and

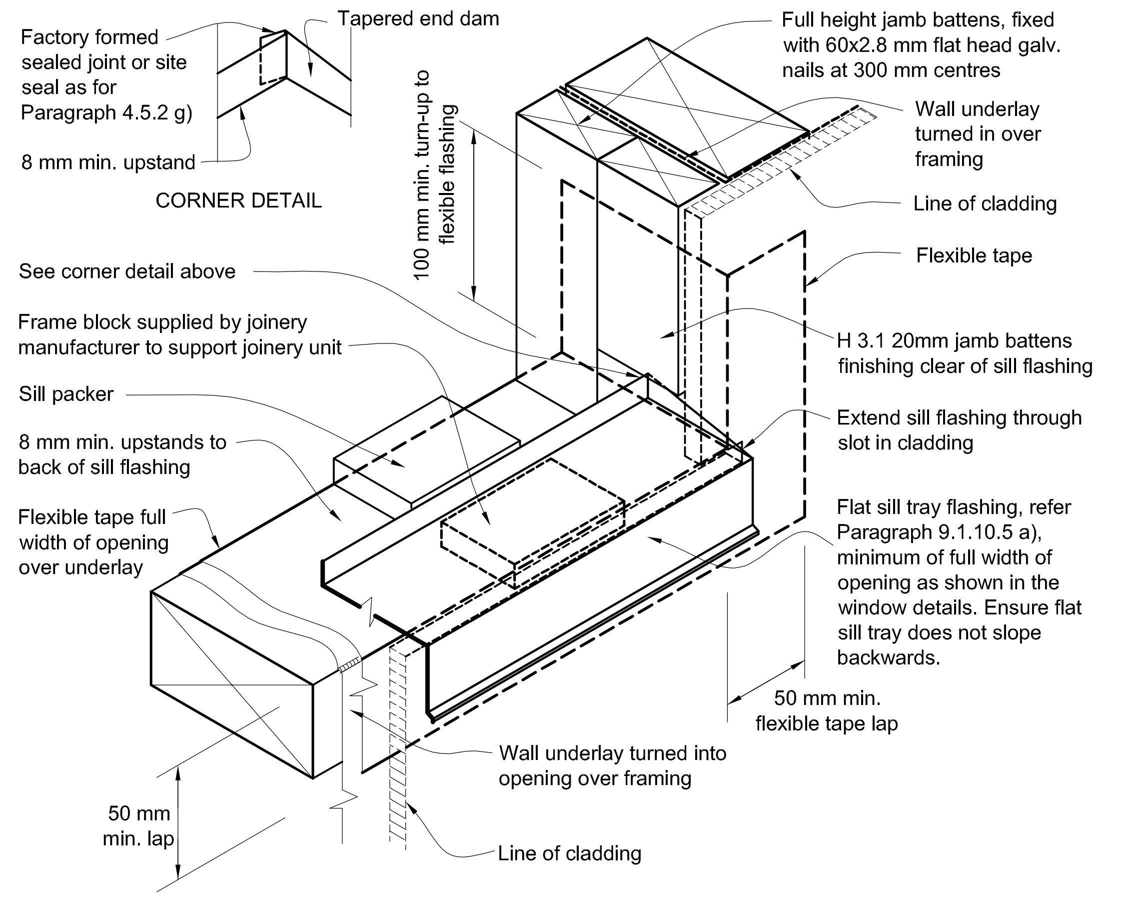
b) Maximum 150 mm from reveal ends.

Install packers between reveals and *framing* at all fixing points, except between head reveals and lintels.

Amend 5
Aug 2011

Figure 72A: General window and door opening for direct fixed
Paragraphs 9.1.5, 9.1.10.2, Figures 81, 82, 83, 84, 90, 95 and 115

NOTE:
(1) Detailed *cladding* omitted for clarity, refer to specific *claddings*.
(2) Sill *flashing* shall extend back past the condensation channel of the window.
(3) Head to be treated similarly with continuous *building underlay* and *flexible tape* at corners.
(4) Refer individual *cladding* details for jamb *flashings* and sill tray return requirements

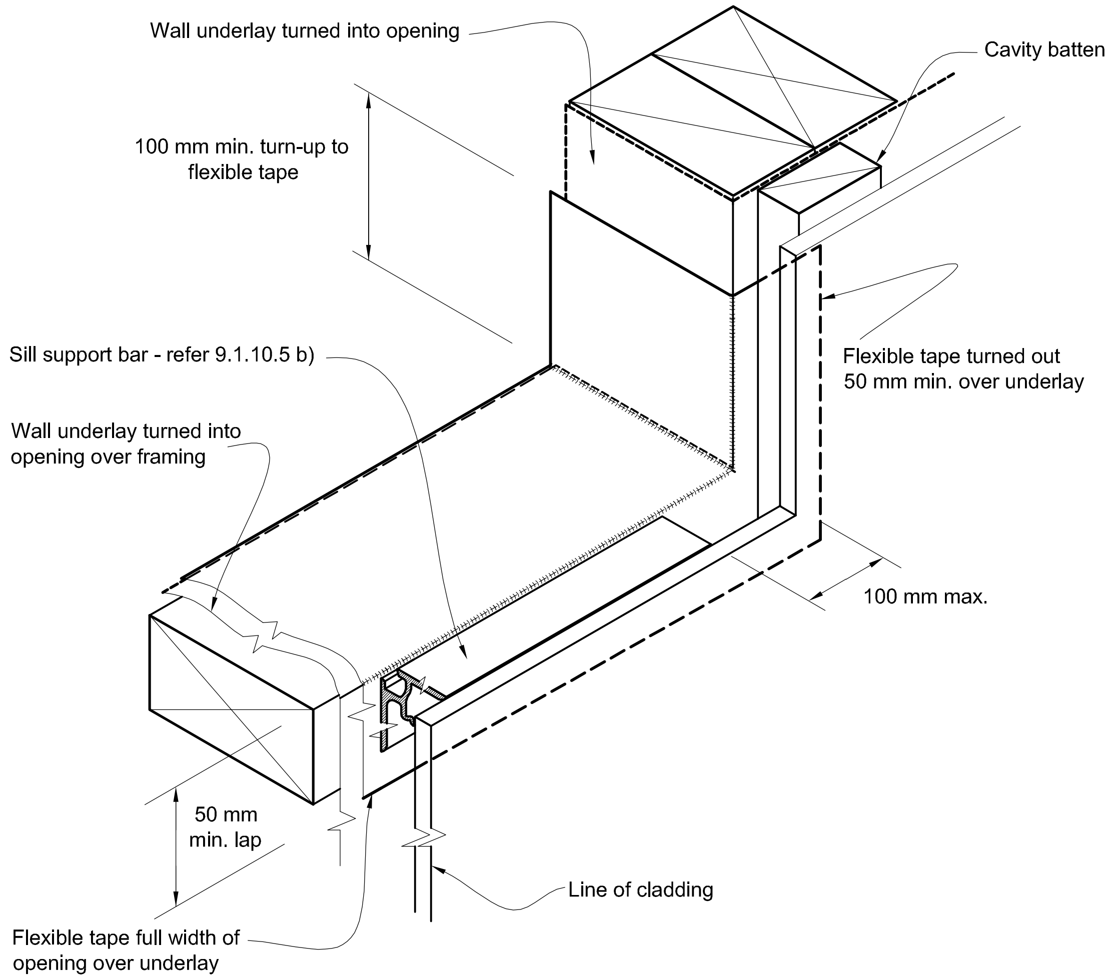


Errata 2
Dec 2011

Amend 5
Aug 2011

Figure 72B: General window and door opening with drainage cavity
Paragraphs 9.1.5, 9.1.9.3, 9.1.10.2, Figures 73C, 76, 85, 86, 91, 99, 116 and 128

NOTE:
(1) Detailed *cladding* omitted for clarity, refer to specific *claddings*.
(2) Head to be treated similarly with continuous *wall underlay* and *flexible tape* at corners.
(3) Refer individual cladding details for jamb flashings.



Errata 2
Dec 2011

Amend 5
Aug 2011

9.2 Masonry Veneer

9.2.1 Limitations

This Acceptable Solution is limited to *masonry veneer cladding* attached to timber *wall framing* outlined in NZS 3604. *Masonry veneer* is either:

a) Clay brick, or

b) Concrete brick or block.

COMMENT:

Natural stone bricks or blocks may be suitable. However, they are not part of this Acceptable Solution. Refer to the manufacturer's recommendations for *specific design* information.

Refer to Paragraph 1.5 for qualification of installers.

9.2.2 General

1) The materials and workmanship of *masonry veneer* shall be in accordance with SNZ HB 4236 and have a maximum mass of veneer of 220 kg/m^2 and minimum veneer thickness of 70 mm

Errata 2 Dec 2011

2) Masonry units shall be laid-up in running bond

3) Mortar, materials (cement, sand and admixtures) shall comply with NZS 4210

(4) Mortar joints less than 24 hours old shall not be subject to vibration, such as would result from the nailing of interior *linings*

9.2.3 Installation

Masonry veneer construction shall be as shown in Figure 73B, and have:

a) A maximum height of veneer above adjacent *finished ground level* of 7 m.

b) A maximum height of veneer of 4.0 m, measured from the top of the concrete masonry *wall*, foundation *wall* or slab edge foundation. In the case of a veneer faced concrete block *wall* or foundation *wall* height is measured from the top of that *wall*.

c) A maximum height of veneer of 5.5 m on a gable end *wall*.

d) A minimum *wall* or panel width of 230 mm.

Amend 5 Aug 2011

Note: The bracing demand for framing supporting *masonry veneer* is determined from values listed in NZS 3604.

Errata 2 Dec 2011

COMMENT:

Refer to Paragraph 1.5 for qualification of installers

9.2.4 Flashings

1) Sill and head *flashings* shall be as described in Paragraph 4.3 and be either:

a) 1.5 mm butyl rubber– refer to Paragraph 4.3.9

b) 2 ply asphaltic pliable *waterproofing membrane* – refer to Paragraph 4.3.10

c) Pliable polyethylene minimum 0.5 mm thick complying with DPC/DPM Table 23.

2) Jamb *flashings* shall be:

d) 2 ply asphaltic pliable *waterproofing membrane* complying with AS/NZS 2904

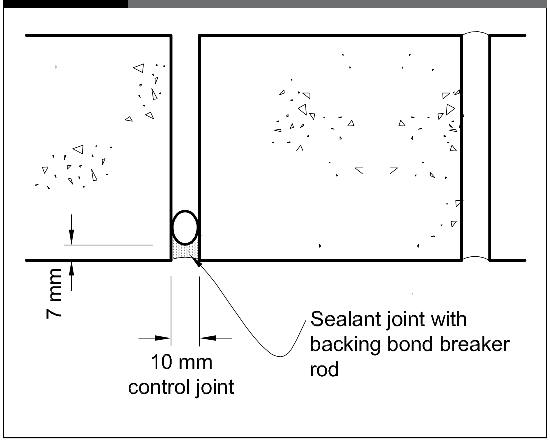
e) Pliable polyethylene minimum 0.5 mm thick complying with DPC/DPM Table 23.

COMMENT:

For further information refer to ASTM C1330 for backing rod material performance.

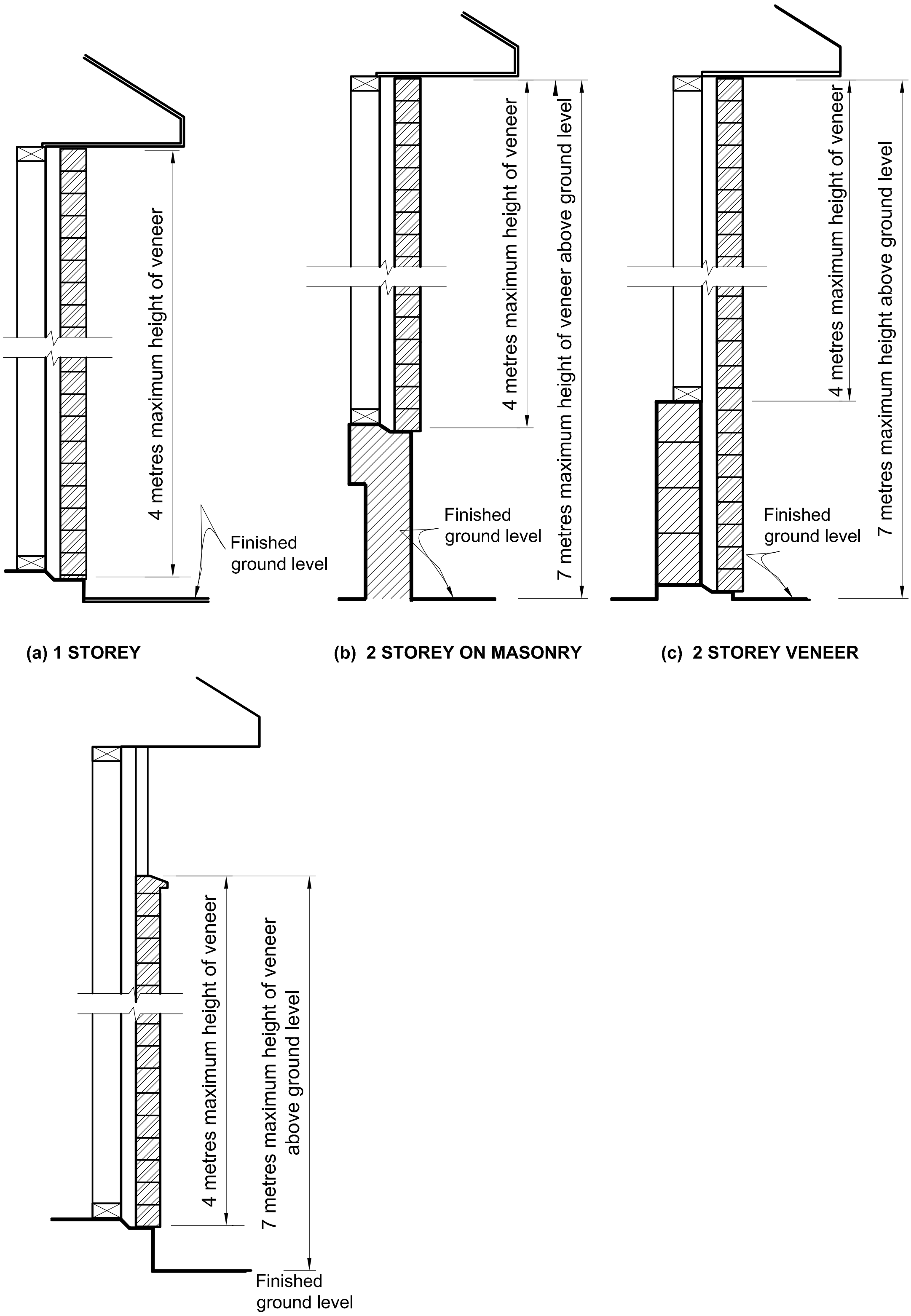
Amend 5 Aug 2011

Figure 73A: Vertical control joint
Paragraph 9.2.8



Amend 5 Aug 2011

Figure 73B: Masonry veneer height limitations
Paragraph 9.2.3



(a) 1 STOREY

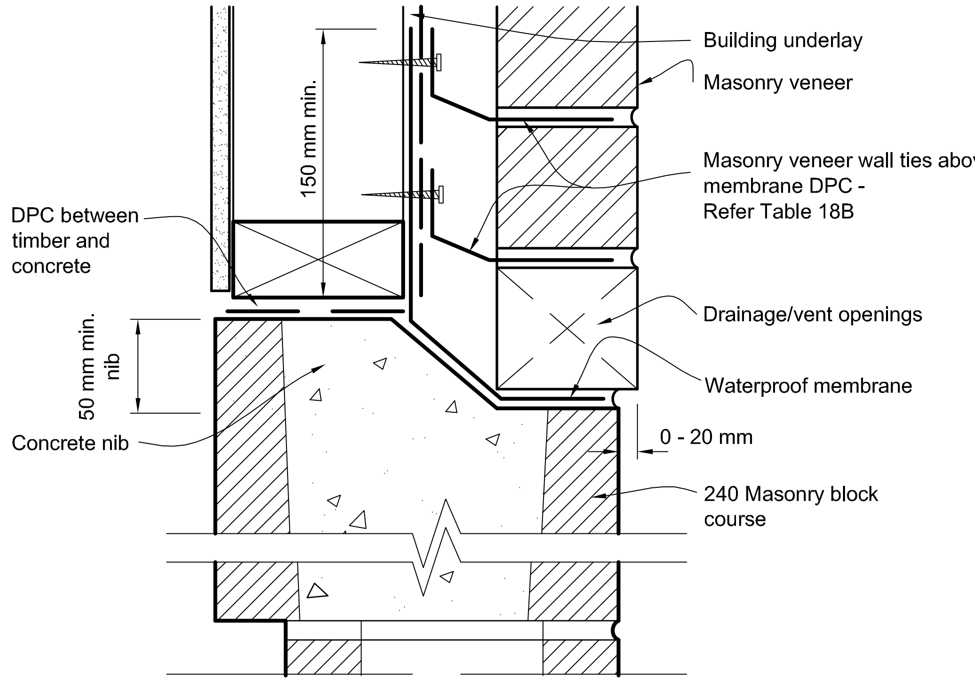
(b) 2 STOREY ON MASONRY

(c) 2 STOREY VENEER

(d) 1 STOREY WITH PART STOREY

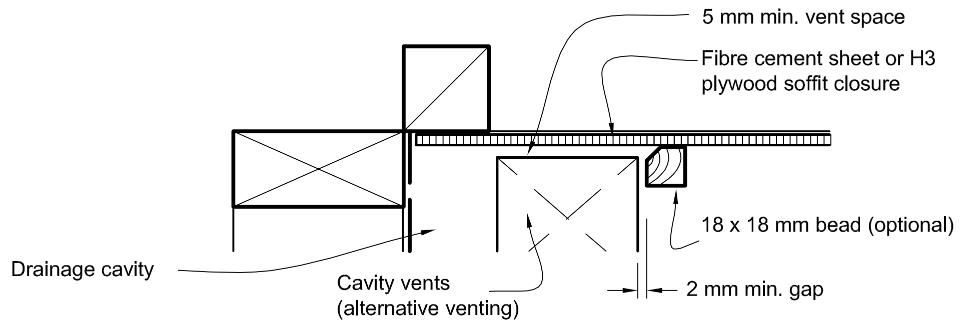
Amend 5
Aug 2011

Figure 73E: Masonry veneer details
Paragraphs 9.2.5 and 9.2.6



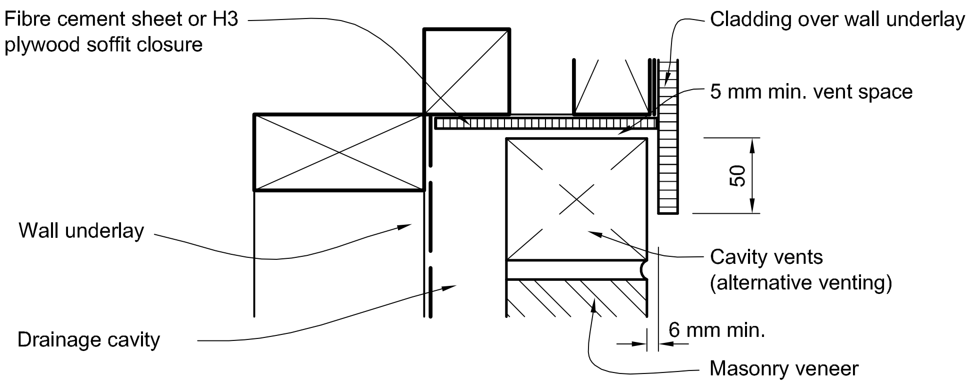
(k) MASONRY VENEER - ABOVE GROUND SUPPORT

Errata 2
Dec 2011



(l) MASONRY VENEER - SOFFIT DETAIL

Errata 2
Dec 2011



(m) MASONRY VENEER - CANTILEVER UPPER FLOOR

Errata 2
Dec 2011

Amend 5
Aug 2011

9.2.5 Foundation support and damp proofing

1) *Masonry veneer* shall be supported by one, or a combination of the following:
   a) Concrete of masonry foundation *wall*
   b) Thickened slab edge footing
   c) Concrete or masonry lower storey *wall*.
2) The level of the concrete slab above ground shall comply with Figure 65.
3) The top of a foundation wall or concrete slab shall be stepped down, so that the surface supporting the veneer is 50 mm or more below the surface supporting the timber *framing*.
4) Provide a *damp-proof course* to the stepped rebates supporting *masonry veneer* adjacent to all habitable spaces and garages attached to habitable spaces. This includes stepped rebates in foundations, or on top of concrete or concrete masonry *walls* supporting veneers. Damp-proofing material shall be as outlined in Table 23 and be either:
   a) For rebates lower than ground floor level:
      i) two coats of bituminous liquid, or
      ii) 1.0 mm butyl rubber or bituminous sheet, or
      iii) 0.25 mm polythene or polyethylene *damp-proof membrane*.
   b) For rebates above ground floor level:
      i) 1.0 mm butyl rubber or bituminous sheet, or
      ii) 0.25 mm polythene or polyethylene *damp-proof membrane.*
5) Lap joints in *flashings* minimum of 150 mm.
6) Dimension rebates to accommodate the required cavity width in Paragraph 9.2.6 and the thickness of the veneer so that the veneer is supported within the tolerances outlined in Figures 73D and E.

Amend 5 Aug 2011

9.2.6 Cavities

Paragraphs 9.1.8.2(a), 9.1.8.5, and 9.1.9.3 shall apply to *masonry veneer* cavities.

a) The clear width of cavity between the *masonry veneer* and the exterior face of the *wall underlay* or bracing attaching to timber *framing* shall not be less than 40 mm or more than 75 mm wide measured at any part of the cavity.

COMMENT:
It is important to maintain the minimum cavity width of 40 mm after allowing for construction tolerances and thicknesses of *wall underlays* and sheet bracing.

b) Pipes and services shall not be placed in the cavity other than passing directly through the cavity to the exterior.
c) The cavity shall be drained and vented to outside at the bottom of wall panels, and above openings by open perpends that:
   i) are a minimum of 75 mm in height, by the width of the vertical mortar joint
   ii) at centres not exceeding 800 mm (where drainage/weep holes are less than 75 mm high, decrease spacing to give a ventilation area of 1000 mm^2/m wall length)
   iii) are fitted with vermin proofing where gaps greater than 13 mm exist.
d) The cavity shall be ventilated to the outside at the top of *walls* by either similar vents as at the bottom, or a continuous 5 mm minimum gap between the top course and soffit board, with a cover bead to outside that maintains a minimum 2 mm gap to masonry – refer to Figure 73E(l).
e) The cavity shall be vented under openings exceeding 2.4 metres wide through gaps in perpends positioned at 1/3 points along the opening except at opening ends. Where these vent openings are used, protect from water entry using cantilevered sill bricks, as shown in Figure 73C (f).
f) The cavity shall be sealed off from the floor and *roof* space.

Errata 2 Dec 2011

Errata 2 Dec 2011

Amend 5 Aug 2011

9.2.7.1 Wall ties and screws shall be determined by the *durability* zone outlined in NZS 3604 and as outlined in Table 18C.

Table 18C: Corrosion protection to masonry wall ties
Paragraph 9.2.7

	316, 316L, or 304 stainless steel	470 g/m² galvanising on mild steel
Zone B	Yes	Yes
Zone C	Yes	Yes
Zones D and E	Yes	-

Errata 2 Dec 2011

9.2.8 Control joints

9.2.8.1 Clay bricks

Control joints in clay brick *masonry veneer* are not required, unless specified by the brick manufacturer.

9.2.8.2 Concrete bricks

Longitudinal shrinkage stresses in concrete *masonry veneer* shall be controlled by providing vertical *control joints* at not more than 6 m centres.

Vertical control joints shall be located:

(a) Within 600 mm of T joints

(b) Within 600 mm of L shaped corners or by restricting the spacing to the next *control joint* to 3.2 m maximum

(c) At changes in *wall* height, exceeding 600 mm

(d) At changes in *wall* thickness.

Amend 5 Aug 2011

Control joints shall be formed as shown in Figure 73A and comprise:

a) A backer rod of compressible foam, and

b) Sealant in compliance with:

i) Type F, Class 20LM or 25LM of ISO 11600, or

ii) low modulus Type II Class A of Federal Specification TT-S-00230C.

9.2.9 Openings in masonry veneer

Openings with *masonry veneer* above shall be spanned by steel angle lintels.

Openings in *masonry veneer* for meter boxes less than 500 mm wide may be installed without lintel bars or head *flashings* provided the meter box is sealed to *wall underlay* with flashing tape to Paragraph 4.3.11.

Separate steel meter boxes from direct contact with *masonry veneer* or mortar with flashing tape to Paragraph 4.3.11.

Lintels shall:

a) Be protected against corrosion as in Table 18D and to exposure zones outlined in NZS 3604.

b) Have a minimum seating into adjacent veneer of:

i) 100 mm for spans up to, and including 2 m,

ii) 200 mm for spans over 2 m.

c) Be sized in accordance with Table 18E.

Table 18D: Corrosion protection to lintels
Paragraph 9.2.9, Table 18E

	316 or 316L or 304(2) stainless steel or **600 g/m² galvanising on mild steel plus duplex coating(1)**	**600 g/m² galvanising on mild steel(1)** or **300 g/m² galvanising on mild steel plus Duplex coating(1)**
Zone B	Yes	Yes
Zone C	Yes	Yes
Zone D	Yes	

1) To AS/NZS 2699.3
2) 304 stainless steel will exhibit greater levels of surface rusting than 316 stainless steel, especially where not exposed to rain washing.

Amend 5 Aug 2011

Table 18E: Masonry veneer lintel sizes (minimum)
Paragraph 9.2.9

Span of lintel (m) up to:	Maximum thickness of masonry veneer (mm)					
	70			90		
	Maximum height of veneer supported (mm)					
	350	**700**	**2000**	**350**	**700**	**2000**
0.800	60 x 60 x 6 L	60 x 60 x 6 L	60 x 60 x 6 L	60 x 80 x 6 L	60 x 80 x 6 L	80 x 80 x 6 L
2.000	60 x 60 x 6 L	60 x 60 x 6 L	60 x 60 x 6 L	60 x 80 x 6 L	60 x 80 x 6 L	80 x 80 x 6 L
2.500	60 x 60 x 6 L	80 x 80 x 6 L	80 x 80 x 6 L	80 x 80 x 6 L	80 x 80 x 6 L	80 x 80 x 6 L
3.000	80 x 80 x 6 L	80 x 80 x 6 L	125 x 75 x 6 L	80 x 80 x 6 L	80 x 80 x 8 L	90 x 90 x 10 L
3.500	80 x 80 x 6 L	80 x 80 x 6 L	125 x 75 x 6 L	80 x 80 x 8 L	90 x 90 x 10 L	125 x 75 x 10 L
4.000	80 x 80 x 8 L	125 x 75 x 6 L	125 x 75 x 10 L	80 x 80 x 10 L	125 x 75 x 6 L	150 x 90 x 10 L
4.500	125 x 75 x 6 L	125 x 75 x 10 L	_	125 x 75 x 6 L	125 x 75 x 10 L	_
4.800	125 x 75 x 6 L	125 x 75 x 10 L	_	125 x 75 x 6 L	125 x 75 x 10 L	_

Amend 5 Aug 2011

9.2.10 Windows and doors

Amend 5 Aug 2011

The openings in *wall framing* for windows and doors shall have *flexible flashing tape* applied, in accordance with Paragraph 9.1.5.

Air seals shall be provided in accordance with Paragraph 9.1.6.

Window *flashings* shall be installed in accordance with Paragraph 9.2.4 and Figures 73C and 73D(h).

Amend 5 Aug 2011

9.2.11 Secondary cladding

Where a secondary *cladding* is used with the *masonry veneer*, and is *direct fixed* to *framing* above windows or at gable ends, this shall be fully sealed on:

a) The face of the *cladding*,

b) All edges of the *cladding*, and

c) A 75 mm minimum perimeter strip on the rear of the *cladding*.

Amend 5 Aug 2011

9.3 Stucco

9.3.1 Limitations

This Acceptable Solution is limited to the following types of *stucco cladding*:

a) Solid plaster *cladding* with a non-rigid backing and a *drained cavity*, and

b) Solid plaster *cladding* with a rigid backing and a *drained cavity*. Refer to Figure 74

9.3.2 Structure

The timber *framing* of *external walls* supporting *stucco wall claddings* shall comply with NZS 3604 and NZS 4251. The *cladding system* shall be attached to the *wall framing*.

The *framing* for *buildings* using *stucco* exterior *cladding systems* shall be supported on a:

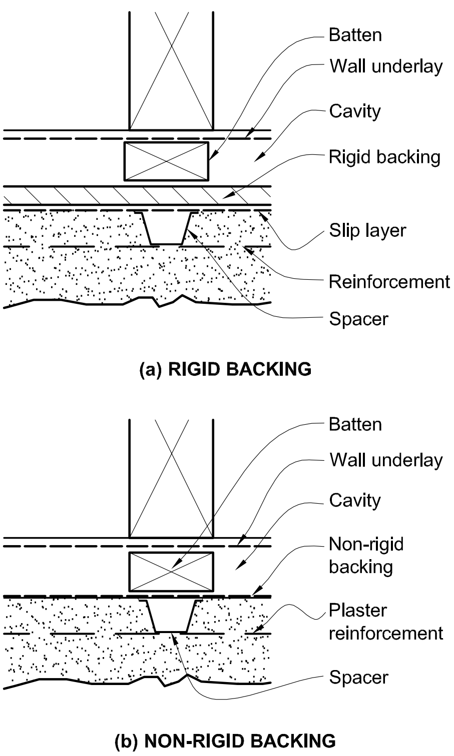
a) Concrete slab-on-ground, or

b) Continuous reinforced concrete foundation *wall*, or

c) Reinforced concrete masonry foundation *wall*.

Amend 5 Aug 2011

Figure 74: Types of stucco cladding
Paragraphs 9.3.1 and 9.3.3



Errata 2 Dec 2011

9.3.3 Stucco cladding system

All *stucco claddings* shall be used over a *drained cavity* as described in Paragraph 9.1.8, and shown in Figure 74.

9.3.3.1 All *stucco cladding* shall have *wall underlay* as specified in Table 23 and Paragraphs 9.1.5–9.1.7, and shall be*:* Amend 5 Aug 2011

a) Fixed to the *framing* as specified in Table 23, and

b) Provided as an overlay to rigid backings to provide a slip layer that permits the independent movement of plaster and backing.

9.3.3.2 Have plaster backing installed as in Paragraphs 9.3.5 and 9.3.6.

9.3.3.3 Have metal lath reinforcements for *stucco* plaster attached through the plaster backing as described in Table 24. Amend 5 Aug 2011

9.3.4 Installation

9.3.4.1 General

COMMENT:
Refer to Paragraph 1.5 for qualification of installers.

Amends 2 and 5

Activities that will cause impact or vibration during plaster application are not permitted until all plastering is completed and fully cured.

The materials, proportions, mixes, thickness, reinforcement materials and fixing, *control joints,* and application and curing of plaster shall comply with NZS 4251.

9.3.4.2 Movement control joints

Movement *control joints* shall be as required in NZS 4251.

Amend 5 Aug 2011

9.3.5 Non-rigid plaster backings

9.3.5.1 Installation of wall underlays

The *wall underlay* shall be in accordance with Table 23, and as described in Paragraphs 9.1.5–9.1.7.

Amend 5 Aug 2011

9.3.6 Rigid plaster backings

Rigid backings shall be made of either:

a) Plywood, or

b) Fibre cement sheet, and

Have slip layers to Paragraph 9.3.3 b). Amend 5 Aug 2011

Backing sheets shall be no more than 3 mm out of plane at the time of plastering.

9.3.6.1 Plywood backing

Plywood shall be:

a) Selected from Table 6 of NZS 4251, Amend 5 Aug 2011

b) H3 treated as per AS/NZS 2269, and Amend 2 Jul 2005

c) Fixed as specified in Clause 4.2.4.4.2 of NZS 4251, except that nails shall:

i) be 2.8 mm in diameter, and
ii) penetrate *framing* by 35 mm minimum. Amend 5 Aug 2011

9.3.6.2 Fibre cement sheet backing

Fibre cement shall:

a) Comply with AS/NZS 2908: Part 2,

b) Be a minimum of 4.5 mm thick,

c) Span no more than 600 mm centres between *cavity battens*, and

d) Be fixed as specified in Clause 4.2.4.5.2 of NZS 4251, except that nails shall:

i) be 2.8 mm in diameter, and
ii) penetrate *framing* by 35 mm minimum. Amend 5 Aug 2011

COMMENT:
When the sheathing is used as bracing, the nailing patterns are subject to *specific design*, and the use of tested and rated systems. Amend 2 Jul 2005

9.3.7 Finishes

All *stucco* surfaces shall be sealed by applying a minimum of a 2-coat latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730. Amend 2 Jul 2005

COMMENT:
Stucco cladding systems cannot be assumed to be completely weatherproof.

It is necessary to ensure that corrosive salts are not carried into the plaster by moisture, causing corrosion of the reinforcing and fixings.

9.3.8 Bottom of stucco

The bottom of *stucco* wall *cladding* shall be in accordance with Paragraph 9.1.3, and as shown in Figure 75.

9.3.9 Parapets and enclosed balustrades

Parapets shall be in accordance with Paragraph 6.0.

Enclosed balustrades shall be in accordance with Paragraph 7.4.

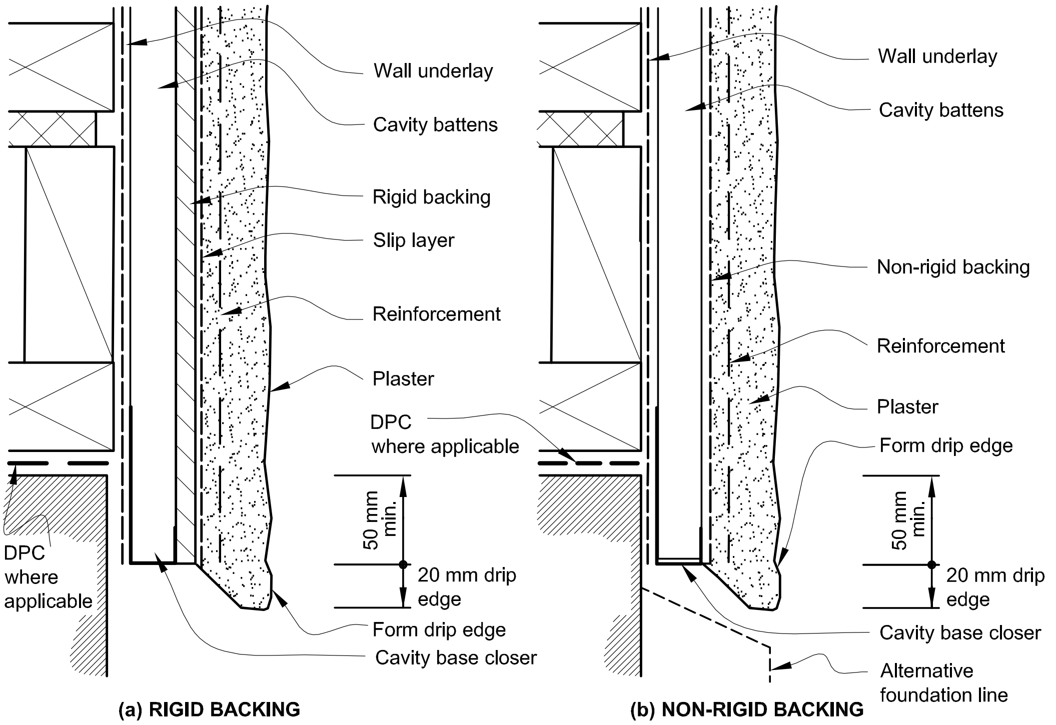
Parapets and *enclosed balustrades* for *stucco cladding* shall be capped with metal, butyl or *EPDM membrane*, complying with the requirements of Paragraph 4.0. Amend 5 Aug 2011

9.3.10 Windows and doors

Windows and doors shall comply with Paragraph 9.1.10, as shown in Figure 76.

Figure 75: Bottom of stucco cladding
Paragraph 9.3.8

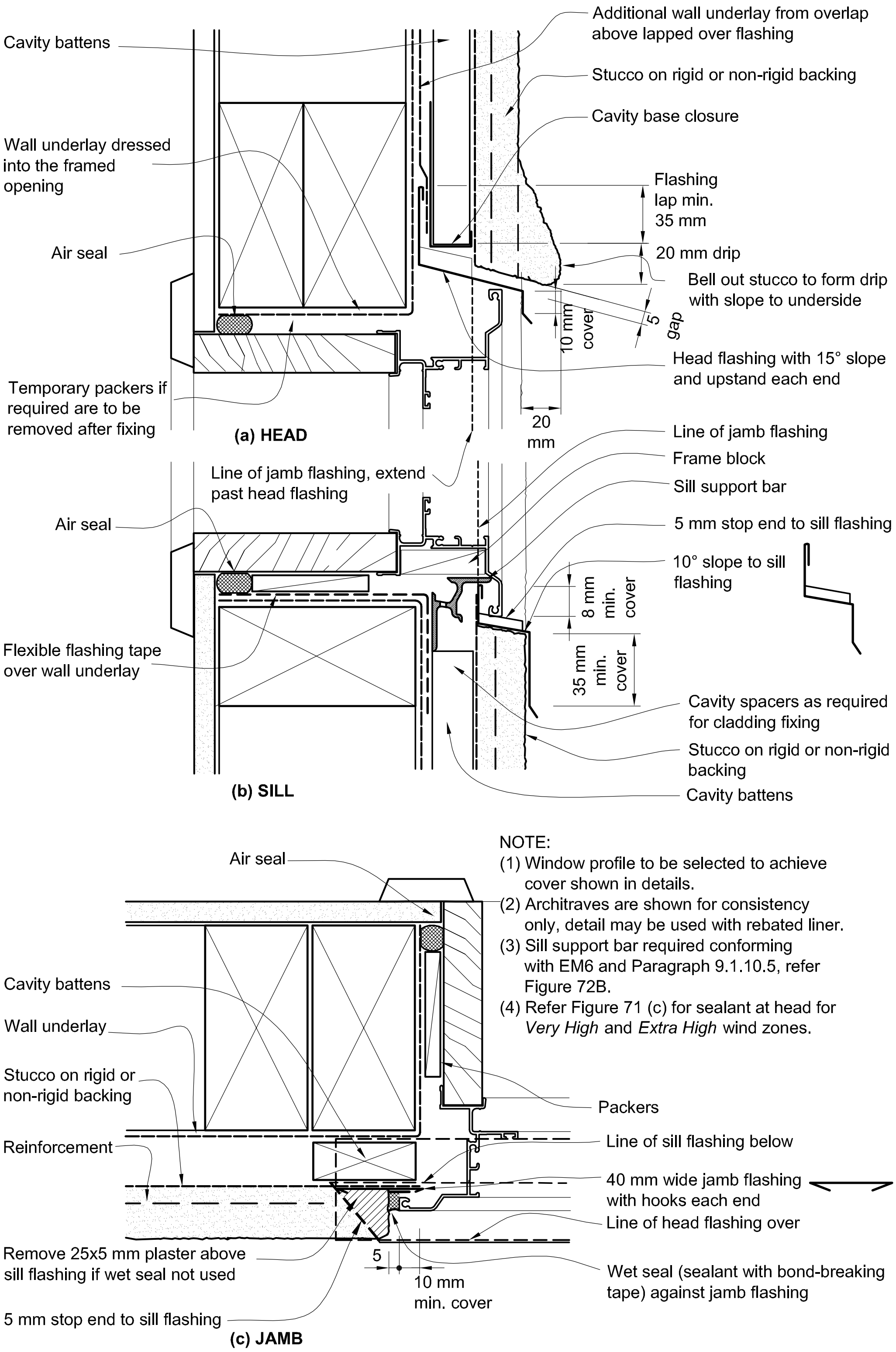
NOTE: 6 mm offset of *framing* to foundation is not necessary where *drained cavities* are used.



Amend 2 Jul 2005

Amend 5 Aug 2011

Figure 76: Windows and doors in stucco cladding
Paragraph 9.3.10, Figure 72B



NOTE:
(1) Window profile to be selected to achieve cover shown in details.
(2) Architraves are shown for consistency only, detail may be used with rebated liner.
(3) Sill support bar required conforming with EM6 and Paragraph 9.1.10.5, refer Figure 72B.
(4) Refer Figure 71 (c) for sealant at head for *Very High* and *Extra High* wind zones.

Amend 5
Aug 2011

9.4 Timber Weatherboards

Amend 5 Aug 2011

Timber weatherboard *claddings* shall be either *direct fixed* to *framing* over a *wall underlay* or fixed over a *drained cavity* as described in Paragraph 9.1.8.

Based on the *risk score* for an *external wall* calculated as per Paragraph 3.1, the weatherboard *cladding* may require the inclusion of a *drained cavity*.

9.4.1 Limitations

9.4.1.1 Weatherboard profiles

This Acceptable Solution is limited to the following types of timber weatherboards:

a) Horizontal bevel-back,

b) Horizontal rebated bevel-back,

c) Horizontal rusticated,

d) Vertical shiplap, and

e) Vertical board and batten.

Profiles shall be as given in NZS 3617 or BRANZ Bulletin 411.

9.4.1.2 Vertical weatherboards

This Acceptable Solution is limited to the use of *direct fixed* vertical weatherboards in risk categories as shown in Table 3.

COMMENT:
Vertical weatherboards are not used over cavities because of the need for horizontal battens, which if solid would interfere with a *drained cavity*.

Amend 5 Aug 2011

Vertical weatherboards are therefore limited to low risk applications.

9.4.1.3 Horizontal weatherboards

Horizontal weatherboards shall be either *direct fixed* or fixed over a *drained cavity*, according to the risk categories as shown in Table 3.

9.4.2 Materials

Timber weatherboard *cladding* shall include the following features:

Amend 5 Aug 2011

a) *Wall underlay* complying with Table 23 and Paragraphs 9.1.5–9.1.7, and

b) Timber selection and treatment of weatherboards in accordance with NZS 3602.

9.4.3 Installation

Amend 5 Aug 2011

A *building underlay* complying with Table 23 shall be installed behind:

a) All *direct fixed* timber weatherboards, or

b) *Cavity battens* for timber weatherboards installed over a *drained cavity*.

COMMENT:
Refer to Paragraph 1.5 for qualification of installers.

Amend 5 Aug 2011

9.4.3.1 Fixings

Fixings shall comply with Tables 20 and 24.

Amend 2 Jul 2005

Timber weatherboards shall be drilled for nailing at all joints and ends. All cut ends of painted weatherboards shall be primed.

9.4.4 Horizontal weatherboards

9.4.4.1 Horizontal laps

Laps shall be:

a) 32 mm for non-rebated bevel-back boards, or

b) 25 mm horizontal lap for rebated bevel-back and rusticated boards, with a minimum gap of 2 mm at the overlap between boards.

9.4.4.2 Joints

Joints shall be made only over supports and have:

a) Corrosion-resistant soakers fitted, complying with Paragraph 4.3.2 to Paragraph 4.3.8, or

Amend 5 Aug 2011

b) Scarf or splay joints.

9.4.4.3 Fixings

Amend 5 Aug 2011

Boards shall be fixed through the *wall underlay* to the *framing* in accordance with Table 24.

9.4.4.4 External corners

External corners shall be weatherproofed by one of the following methods:

a) For rusticated and bevel-back weatherboards, corner boxes with:
   i) scribers for bevel-back weatherboards, as shown in Figure 78, or
   ii) plugs or scribers for rusticated weatherboards, as shown in Figure 78,

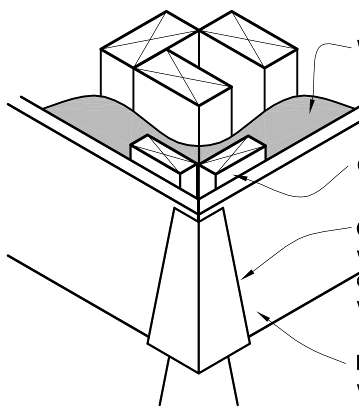
b) For bevel-back weatherboards:
   i) mitred joints with back *flashing* as shown in Figure 78, or
   ii) mitred joints with corrosion-resistant soakers – refer to Paragraphs 4.3.2 to 4.3.6 and Figure 77.

Amend 5 Aug 2011

Figure 77: Corner soakers for bevel-back weatherboards
Paragraph 9.4.4.4

Amend 2 Jul 2005

NOTE: Soaker corner for *direct fixed* weatherboards is similar to Figure 88.



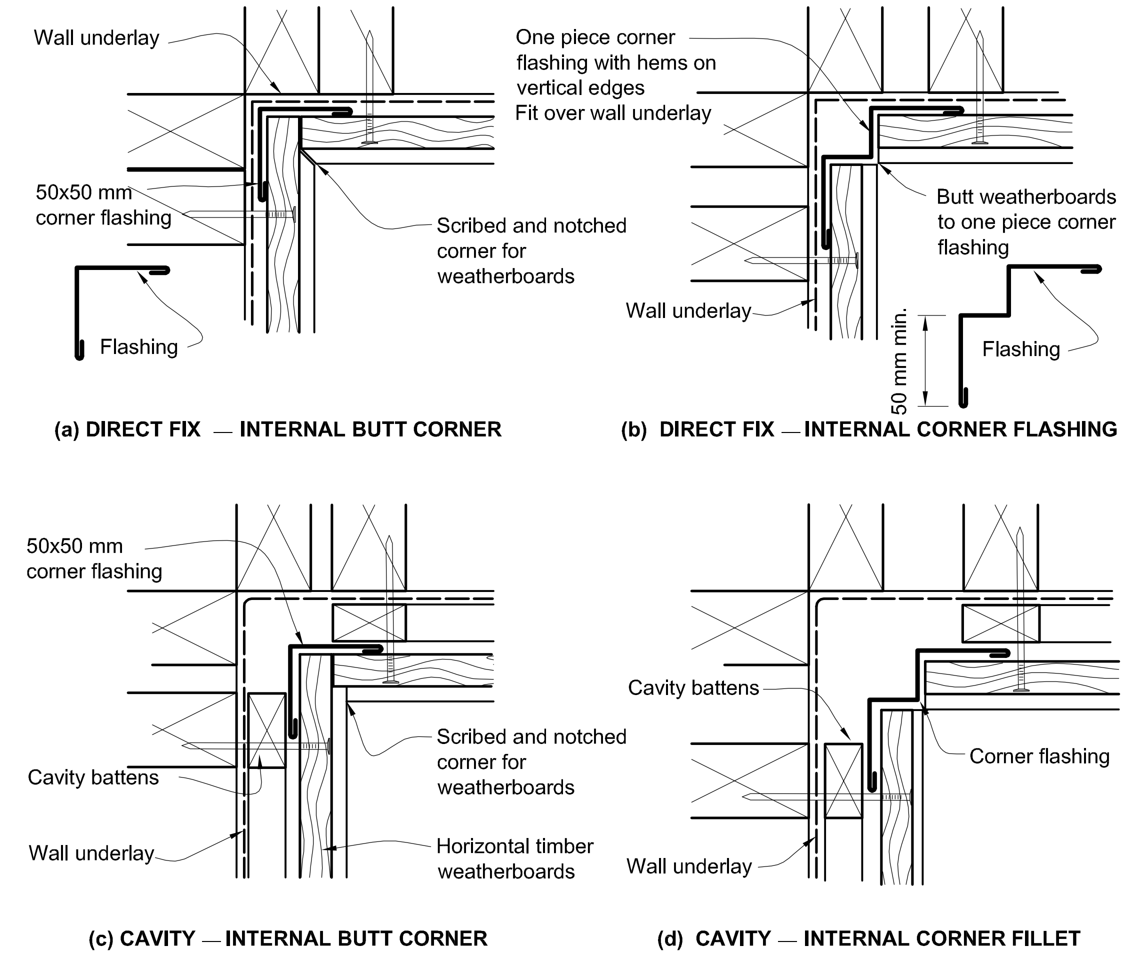
Amend 2 Jul 2005

Amend 5 Aug 2011

9.4.4.5 Internal corners

Internal corners shall be made *weathertight* as shown in Figure 79. A corrosion-resistant *flashing* shall be fitted behind weatherboards at all internal corners as shown in Figure 79. Amend 5 Aug 2011

Figure 79: Internal corners for horizontal or vertical weatherboards
Paragraph 9.4.4.5



Amend 5 Aug 2011

9.4.5 Vertical weatherboards

Vertical shiplap and board and batten weatherboards shall be in continuous lengths over a *storey* height.

9.4.5.1 Laps

a) Vertical shiplap weatherboards shall be fitted with a minimum gap of 2 mm at the overlap between boards.

b) Board and batten weatherboards shall:
   i) be fitted with a 5 mm to 8 mm gap between boards, and
   ii) have weather grooves to boards and battens aligned.

9.4.5.2 Fixings

Vertical weatherboards shall be fixed to *dwangs* at 480 mm maximum centres in accordance with Table 24. Amend 5 Aug 2011

9.4.5.3 Corners

a) External corners

External corners shall be weatherproofed by the use of corner facings as shown in Figure 80.

b) Internal corners

A corrosion-resistant corner *flashing*, as per Table 7 and Figure 79, shall be fitted behind the weatherboards at all internal corners. Amend 5 Aug 2011

Amend 5 Aug 2011

9.4.6 Windows and doors in direct fixed weatherboards

Amend 5 Aug 2011

Window and door details for:

a) *Direct fixed* bevel-back weatherboards are shown in Figure 81,

b) *Direct fixed* rusticated weatherboards are shown in Figure 82,

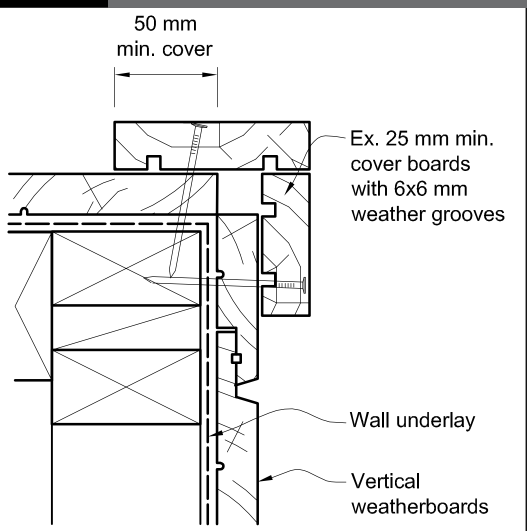
c) Vertical shiplap weatherboards are shown in Figure 83,

d) Vertical board and batten weatherboards are shown in Figure 84.

Amend 5 Aug 2011

Door sill details are as shown in Figure 17D.

Figure 80: External corners for vertical weatherboards
Paragraph 9.4.5.3



NOTE: Corner battens shall be sized to provide 50 mm minimum cover over *cladding*.

Amend 5 Aug 2011

9.4.7 Windows and doors in cavity walls

Window and door details for bevel-back weatherboards on a *drained cavity* shall be as shown in Figure 85. Amend 5 Aug 2011

Window and door details for rusticated weatherboards on a *drained cavity* are shown in Figure 86. Amend 5 Aug 2011

Door sill details are as shown in Figure 17C. Amend 5 Aug 2011

COMMENT:

The junctions around windows are critical, and it is important that responsibility is taken for the *weathertightness* of the window as installed within exterior walls.

Care should be taken to ensure that this responsibility is clearly defined and assigned. One way is to clearly specify that the window manufacturer shall be responsible for the supply and installation of *flashings* and frames into openings.

9.4.8 Parapets and enclosed balustrades

Parapets shall be in accordance with Paragraph 6.0.

Enclosed balustrades shall be in accordance with Paragraph 7.4.

9.4.9 Finishes

Where a protective finish is required by NZS 3602, all timber surfaces, including end grain and laps, shall be sealed by priming.

Two coats of exterior grade paint shall be applied, after priming, to all exposed surfaces. Paint systems shall comply with any of Parts 7, 8, 9 or 10 of AS 3730.

COMMENT:

Amend 5 Aug 2011

The minimum *durability* period for protective coatings is 5 years. Improvement in *durability* and stability of weatherboards can be achieved by priming all surfaces including backs of boards.

Manufacturers of coatings which have a proven performance in use may be able to show compliance with *NZBC* B2 Durability as detailed in B2/VM1 as an alternative to compliance with AS 3730.

With tangentially-sawn weatherboards, particularly painted or stained in dark colours, cupping is possible. Providing additional fixings may help restrain the board, but will usually result in splitting of the boards.

9.5 Fibre Cement Weatherboards

Fibre cement weatherboard *claddings* shall be either *direct fixed* to *framing* over a *wall underlay*, or fixed over a *drained cavity* as described in Paragraph 9.1.8. Amend 5 Aug 2011

Based on the *risk score* for an *external wall*, calculated as per Paragraph 3.1, the fibre cement weatherboard *cladding* may require the inclusion of a *drained cavity*.

9.5.1 Limitations

This Acceptable Solution is limited to flat fibre cement weatherboards, with a minimum thickness of 7.5 mm.

9.5.2 Material performance

Fibre cement weatherboards shall comply with AS/NZS 2908: Part 2.

9.5.3 Installation

A *wall underlay*, as specified in Table 23 and Paragraphs 9.1.5–9.1.7, shall be installed behind fibre cement weatherboard *claddings*. Amend 5 Aug 2011

COMMENT:

Refer to Paragraph 1.5 for qualification of installers. Amend 5 Aug 2011

9.5.3.1 Fixings

Fibre cement weatherboards shall be fixed through the *wall underlay* to the *framing* at maximum 600 mm centres as per Table 24. Amend 5 Aug 2011

9.5.3.2 Laps and joints

Horizontal laps shall be a minimum of 30 mm.

Joints shall be:

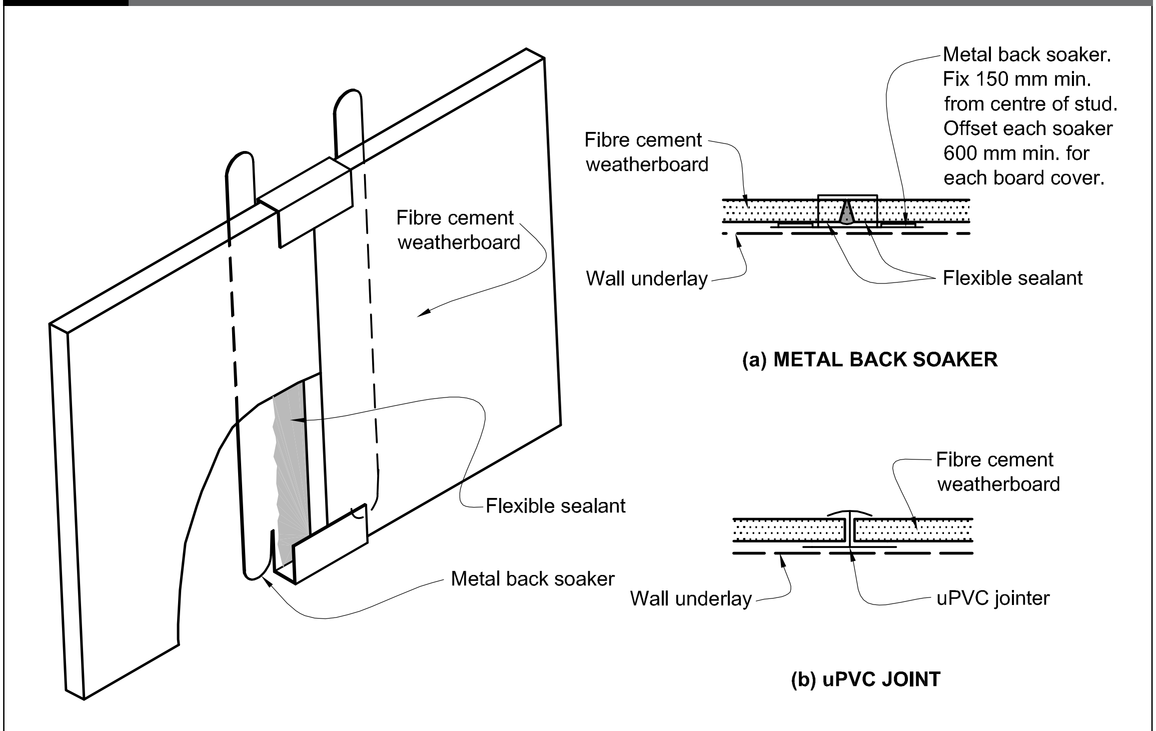
a) Positioned between *studs*,

b) Staggered at a minimum of 600 mm from joints in the adjacent boards, and

c) Weatherproofed by:
   i) uPVC H jointers as shown in Figure 87, or
   ii) hidden soakers as shown in Figure 87, with sealant used between ends of boards complying with:
      a. Type F, Class 20LM or 25LM of ISO 11600, or
      b. low modulus Type II Class A of Federal Specification TT-S-00230C.

Figure 87: Joints in fibre cement weatherboards
Paragraph 9.5.3.2

Amend 5 Aug 2011



Amend 2 Jul 2005

9.5.3.3 External corners

External corners shall be weatherproofed as shown in Figure 88 by:

a) The use of corrosion-resistant soakers complying with Paragraph 4.2.2 to Paragraph 4.3.6, or

b) Facings with weathergrooves.

Amend 5 Aug 2011

9.5.3.4 Internal corners

Internal corners shall be weatherproofed by metal corner *flashings* as shown in Figure 89. Amend 5 Aug 2011

9.5.4 Windows and doors

Windows and doors shall be installed in accordance with Paragraph 9.1.10. Amend 5 Aug 2011

9.5.4.1 Windows and doors – direct fixed

For *direct fixed* fibre cement weatherboards, windows and doors shall be detailed as shown in Figure 90 and Figure 17D. Amend 5 Aug 2011

9.5.4.2 Windows – on cavity

For fibre cement weatherboards fixed over a *drained cavity*, windows and doors shall be detailed as shown in Figure 91 and Figure 17C. Amend 5 Aug 2011

9.5.5 Parapets and enclosed balustrades

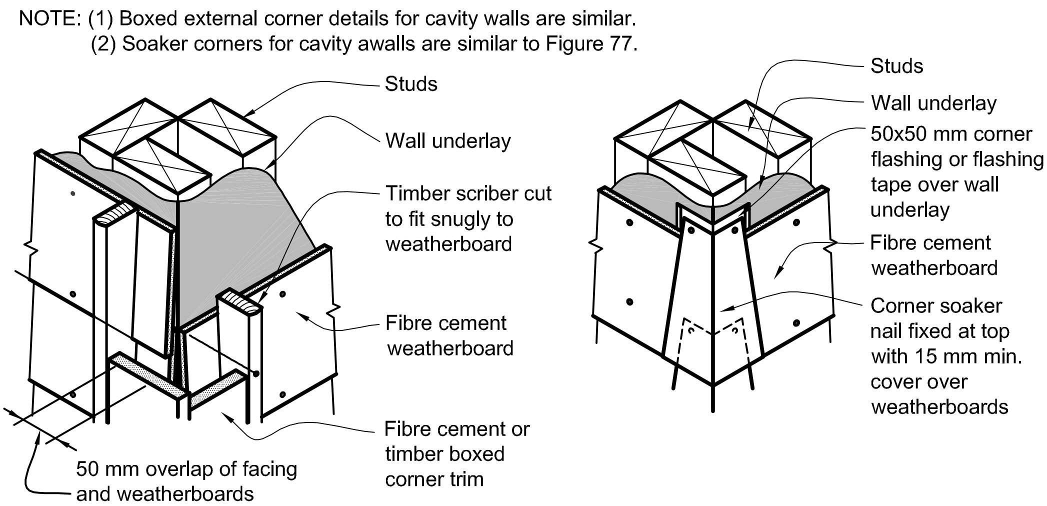
Parapets shall be in accordance with Paragraph 6.0.

Enclosed balustrades shall be in accordance with Paragraph 7.4.

9.5.6 Protective coating

The exposed faces, including top edges at sills and all bottom edges, of horizontal fibre cement weatherboards shall be finished with a minimum of a 2-coat latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730. Amend 2 Jul 2005

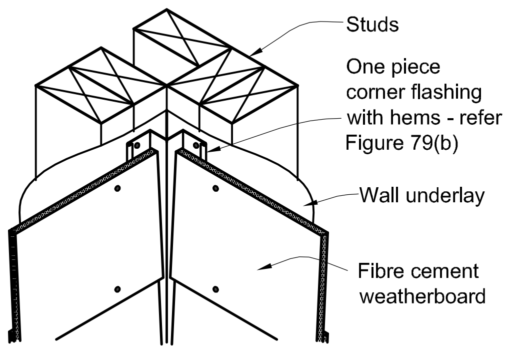
Figure 88: External corners in fibre cement weatherboards
Paragraph 9.5.3.3



Amend 2 Jul 2005
Amend 2 Jul 2005
Amend 5 Aug 2011

Figure 89: Aluminium corners in fibre cement weatherboards
Paragraph 9.5.3.4

NOTE: Corner details for cavity walls are similar.



Amend 5
Aug 2011

Amend 2 Jul 2005

9.6 Profiled Metal Wall Cladding

Horizontal profiled metal wall *cladding* shall be fixed over a *drained cavity* as described in Paragraph 9.1.8.

Vertical profiled metal wall *cladding* shall be *direct fixed* to *framing* over a *roof underlay*.

Refer to Table 3: Suitable *wall claddings*.

9.6.1 Limitations

This Acceptable Solution is limited to corrugated or *trapezoidal* metal wall *cladding* with the profiles, as shown in Figure 38, and applied as outlined in Table 3.

Amend 2 Jul 2005 Amend 5 Aug 2011

9.6.2 General

Amend 2 Jul 2005

COMMENT:
Refer to Paragraph 1.5 for qualification of installers.

Amends 2 and 5

9.6.3 Materials

9.6.3.1 Choice of metal

The metal *cladding* shall be selected according to the exposure conditions in Table 20 as defined in:

a) NZS 3604, or

b) AS/NZS 2728.

Amend 5 Aug 2011

Amend 5 Aug 2011

COMMENT:
The exposure zone in which a *building* is located can affect the *durability* of *flashings*.

Exposure zones are defined in NZS 3604, based on the likely exposure to wind-driven sea-salt. Corrosion due to geothermal or corrosive industrial atmospheres, as defined in NZS 3604, requires *specific design*.

Exposure zones are based on AS/NZS 2728.
AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand.

Amend 5 Aug 2011

9.6.3.2 Steel

Materials for the manufacture of profiled steel *cladding* shall:

a) Have a *BMT* of 0.4 mm minimum,

b) Be grade G550, or G300 for curved and crimped cladding

c) Be selected for corrosion protection according to the intended exposure zone as shown in Table 20.

Amend 2 Jul 2005

Amend 2 Jul 2005

Amend 2 Jul 2005

Amend 5 Aug 2011

9.6.3.3 Aluminium

Aluminium for the manufacture of profiled aluminium wall *cladding* shall comply with AS/NZS 1734, and be:

a) A *base metal thickness (BMT)* of a minimum of 0.7 mm,

b) Minimum 5000 series.

Amend 2 Jul 2005

For pre-painted aluminium, a factory-applied finish complying with AS/NZS 2728 shall be applied.

9.6.4 Maintenance

Refer to Paragraph 2.5.

Amend 5 Aug 2011

Amend 5 Aug 2011

9.6.5 Profiles

Profiles covered in this Acceptable Solution are:

a) Corrugated – curved with a minimum crest height of 16.5 mm minimum, and

Amend 2 Jul 2005 Amend 5 Aug 2011

b) *Trapezoidal* – symmetrical and asymmetrical with a minimum crest height of 19 mm.

For details of these profiles, refer to Figure 38.

9.6.6 Fixing

Amend 5 Aug 2011

The *cladding* shall be screw-fixed through the troughs and battens, where applicable, into the *framing*. Fixings shall:

a) Be minimum 12-gauge hexagonal head, self-drilling wood screws,

b) Penetrate the *framing* by a minimum of 30 mm,

Amend 2 Jul 2005

c) Be minimum Class 4 to AS 3566: Part 2, selected from Table 20,

Amend 5 Aug 2011 Amend 2 Jul 2005

e) Include neoprene (having a carbon black content of 15% or less by weight) or *EPDM* sealing washers as shown in Figure 39, and

f) Be used on the *cladding* at side laps and every second trough or, for *trapezoidal* where the rib centres exceed 150 mm, at side laps and every trough:
   i) to *framing*, and
   ii) at all external and internal corners.

Amend 2 Jul 2005

9.6.7 Flashings

Flashings used with metal *wall cladding* shall be in accordance with Paragraph 4.0, and with the following requirements:

a) *Hooks* and *hems* shall be as shown in Figure 5,

b) Have joints formed with laps and sealant as shown in Figure 6,

Amend 2 Jul 2005

c) Where shown, sealant shall be neutral cure, complying with:
   i) Type F, Class 20LM or 25LM of ISO 11600, or
   ii) low modulus Type II Class A of Federal Specification TT-S-00230C,

d) Under-*flashings* shall be fixed to *framing* at 600 mm maximum centres.

Amend 2 Jul 2005

e) *Flashings* shall be fixed together at junctions at 50 mm maximum centres or to *cladding* at 900 mm centres with:

Amend 2 Jul 2005

   i) for galvanized steel, 4 mm diameter monel metal or stainless steel rivets, where compatible as per Table 21, or
   ii) for aluminium-zinc coated steel, 4 mm diameter aluminium rivets, or
   iii) for aluminium, 4 mm diameter aluminium rivets.

Amend 2 Jul 2005

9.6.8 Vertical profile – direct fixed

9.6.8.1 Installation

For *direct fixed* vertical profile, the *wall underlay* shall be in accordance with the properties listed for *roof underlay* in Table 23.

Amend 5 Aug 2011

For copper-based treated *framing* or *underlay* refer to Paragraph 9.6.9.2.

Amend 5 Aug 2011

COMMENT:

In *direct fixed* metal *cladding*, the *wall underlay* will be in contact with the back of the vertical profiled metal *cladding*. *Underlay* is needed to separate treated timber from the back of the metal to minimise the risk of *electrolytic corrosion*.

Amend 5 Aug 2011

9.6.9 Horizontal profiled metal on cavity

9.6.9.1 Installation

Amend 5 Aug 2011

A *wall underlay*, as specified in Table 23 and Paragraphs 9.1.5–9.1.7, shall be installed over the outside face of the *framing*.

9.6.9.2 Cavity battens

If the *cavity batten* contains copper (e.g. CCA, copper azole or ACQ), appropriate separation between the back of the *cladding* and the *cavity batten* shall be provided.

Examples of suitable separation are:

Amends 2 and 5

a) An additional layer of paper-based *underlay*, complying with Table 23, over *cavity battens*,

b) Strips of paper-based *underlay* complying with Table 23 on the face of *cavity battens*,

Amend 2 Jul 2005

c) Pre-priming *cavity battens*.

9.6.9.3 Corners

Corners shall be weatherproofed by using the *flashings* and details shown in Figure 96.

Horizontal profiled metal wall *cladding* shall be under-flashed using *butt flashings* which shall:

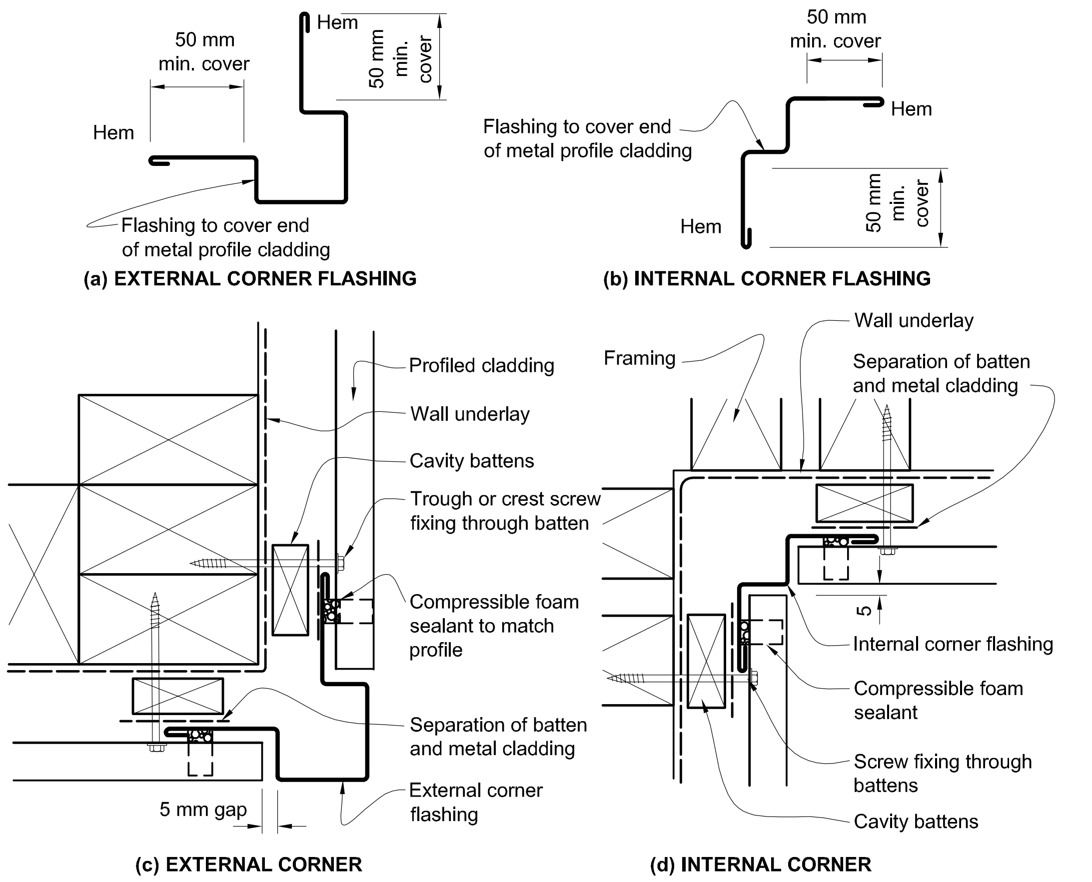
a) Be formed in one shaped piece,

b) Allow metal *cladding* to butt, with a separation of 5 mm, against sides of the exposed *flashing* corner, and

Amend 5 Aug 2011

c) Use profiled compressible foam to seal between the *flashing* underlap and underside of *cladding*.

Figure 96: Corner flashings for horizontal profiled metal
Paragraph 9.6.9.3



Amend 2 Jul 2005

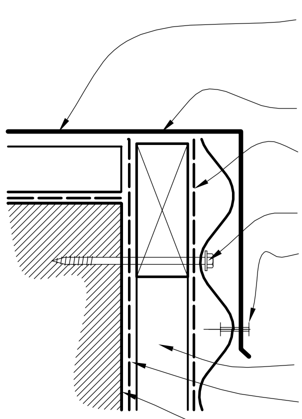
Amend 5 Aug 2011

9.6.9.4 Barges

Barge *flashings* shall be as shown in Figure 97.

Amend 2 Jul 2005

Figure 97: Barge for horizontal profiled metal
Paragraph 9.6.9.4



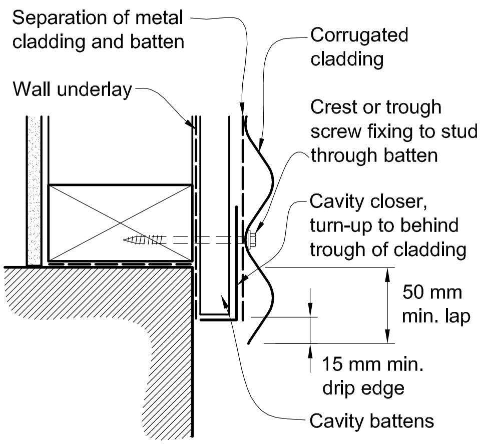
Amend 2 Jul 2005

Amend 5 Aug 2011

9.6.9.5 Bottom of cladding

The bottom edge of the *cladding* shall overlap the foundation *wall* as described in Paragraph 9.1.3 and as shown in Figure 98.

Figure 98: Bottom of cladding
Paragraph 9.6.9.5



NOTE: (1) 6mm offset of *framing* to foundation is not necessary where *drained cavities* are used.
(2) Refer 9.1.3 for ground clearances.

Amend 2 Jul 2005

Amend 5 Aug 2011

9.6.9.6 Horizontal profile: penetrations

All services penetrations through *claddings* shall be flashed and sealed. Pipe penetrations are shown in Figure 53.

The heads of larger penetrations shall be flashed in a similar fashion to Figure 69.

Amend 5 Aug 2011

9.6.9.7 Horizontal profile: windows and doors

Windows and doors shall be installed in accordance with Paragraph 9.1.10, and as shown in Figure 99 and Figure 100.

9.6.9.8 Parapets and balustrades

Refer to Figures 101 and 102 for horizontal and vertical profiled metal.

Amend 5 Aug 2011

Parapets shall be in accordance with Paragraph 6.0.

Enclosed balustrades shall comply with Paragraph 7.4.

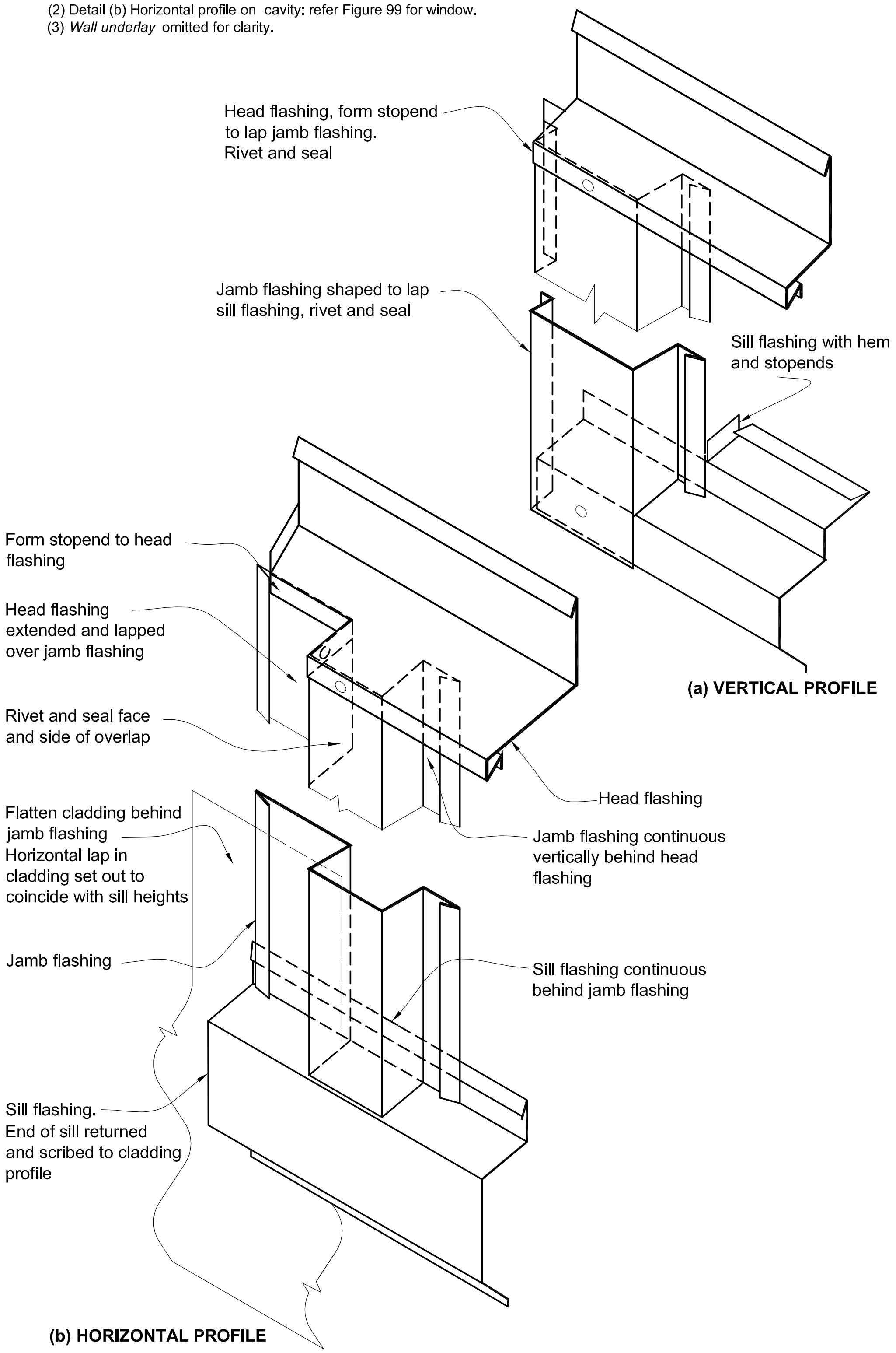
Amend 5 Aug 2011

COMMENT:
Side fixings of *handrails* or other attachments to *enclosed balustrades* or *parapets* will require *specific design* to demonstrate *weathertightness,* together with specific structural design for *stanchion* fixings.

Amend 2 Jul 2005

Figure 100: Window and door flashings for profiled metal
Paragraphs 9.6.8.6 and 9.6.9.7, Figures 95 and 99

NOTE: (1) Detail (a) *Direct fixed* vertical profile: refer Figure 95 for window.
(2) Detail (b) Horizontal profile on cavity: refer Figure 99 for window.
(3) *Wall underlay* omitted for clarity.

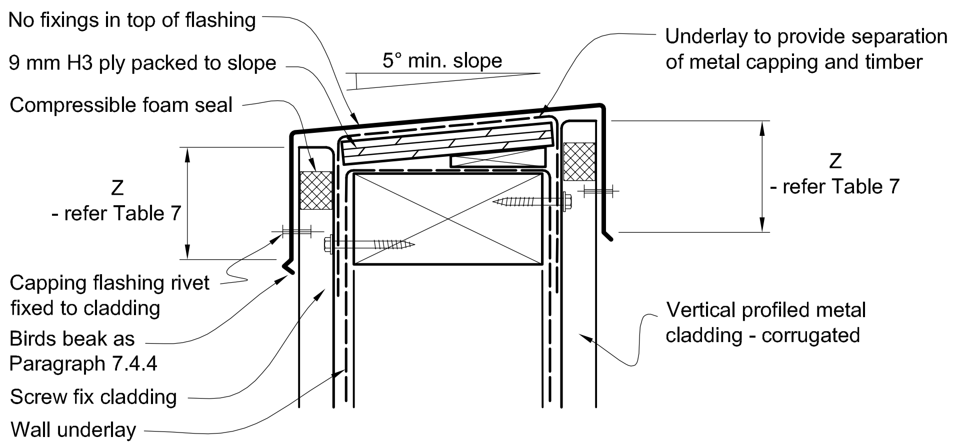


Amend 2
Jul 2005

Amend 5
Aug 2011

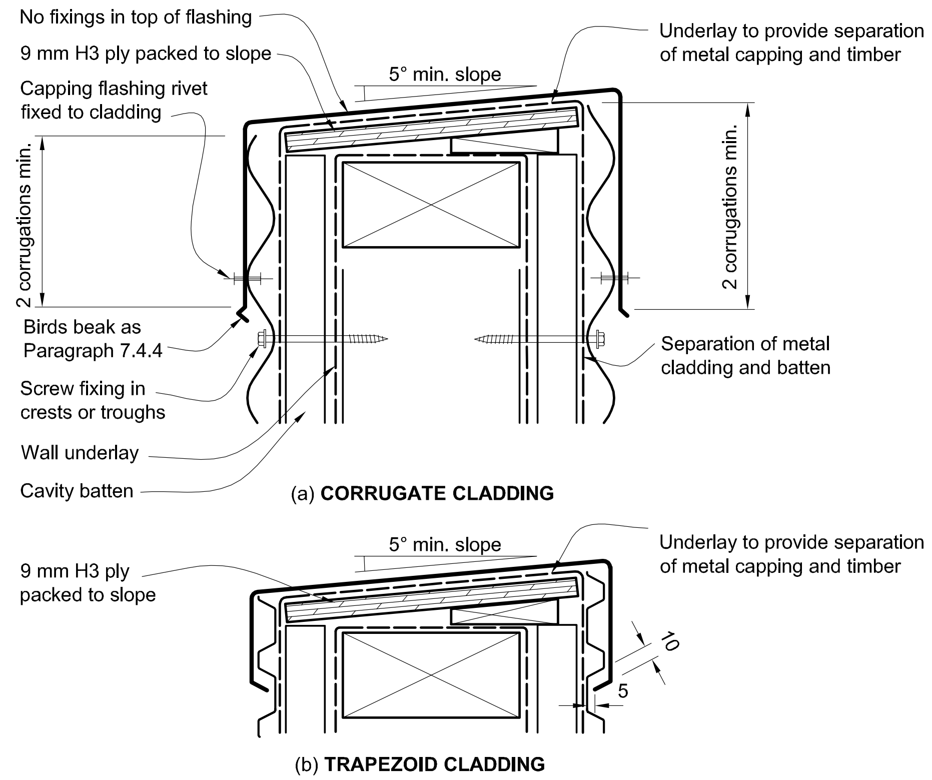
Amend 2
Jul 2005

Figure 101: Balustrade and parapet for vertical profiled metal
Paragraph 9.6.9.8



Amend 5
Aug 2011

Figure 102: Balustrade and parapet for horizontal profiled metal
Paragraph 9.6.9.8



Amend 5
Aug 2011

Figure 103 deleted

9.7 Fibre Cement Sheet

Fibre cement sheet *claddings* shall be either *direct fixed* to *framing* over a *wall underlay* or fixed over a *drained cavity* based on the *risk score* for an *external wall*, calculated as per Paragraph 3.1 and Table 3.

Amend 5 Aug 2011

9.7.1 Limitations

This Acceptable Solution is limited to the following types of fibre cement sheet *cladding systems*:

a) *Flush-finished* systems over a drained cavity using sheets of 7.5 mm minimum thickness, with

   i) fibre cement sheets manufactured with a rebated edge for this purpose,
   ii) if necessary for part sheets, rebated on site using a purpose-made tool, and
   iii) have all edges sealed,
   iv) joints, comprising a bedding compound and reinforcing tape, that are finished in accordance with Paragraph 9.7.4, or

Amend 10 Nov 2020

b) Jointed systems in accordance with Paragraph 9.7.3 using sheets of 6 mm minimum thickness with:

   i) purpose-made jointers,
   ii) timber battens over joints.

Amend 5 Aug 2011

Amend 2 Jul 2005

Amend 2 Jul 2005

Amend 5 Aug 2011

9.7.2 Material and installation – both systems

Fibre cement shall comply with AS/NZS 2908: Part 2.

9.7.2.1 Installation

Install sheets with:

a) Paint seals to all sheet edges and cut edges, including 100 mm across back face from each edge

b) A *wall underlay*, as specified in Table 23 and Paragraphs 9.1.5–9.1.7, installed behind fibre cement sheet *claddings*

c) Fixings as required in Table 24, installed through the *wall underlay* into the *wall framing*

d) All sheet joints located over solid *framing*.

COMMENT:

Refer to Paragraph 1.5 for qualification of installers.

Edge sealing can be improved by application of a second seal coating.

It is recommended that the applicator of the *flush-finished* jointing and coating be trained and approved by the supplier of the jointing and finish system.

9.7.3 Jointed systems

Jointed systems shall have:

a) Vertical joints with either:

   i) uPVC jointers – Figure 104A
   ii) timber battens – Figure 105.

Amend 10 Nov 2020

b) Internal corners:

   i) uPVC jointers – Figure 104B
   ii) timber battens – Figure 104B.

c) External corners

   i) timber battens – Figure 105.

d) Horizontal joints with either:

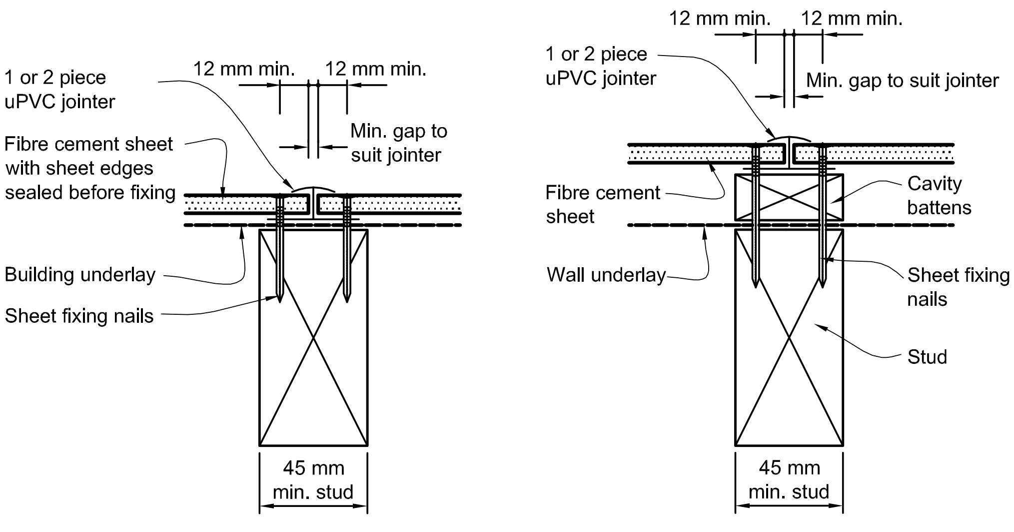
   i) 'Z' *flashings*, to Figure 107 for Direct fixed claddings
   ii) 'Z' *flashings* to Figure 108 for cavity fixed systems.

Flashings shall be either, uPVC, aluminium, stainless steel, or copper to Paragraph 4.3.

Timber battens shall comply with NZS 3602.

Amend 5 Aug 2011

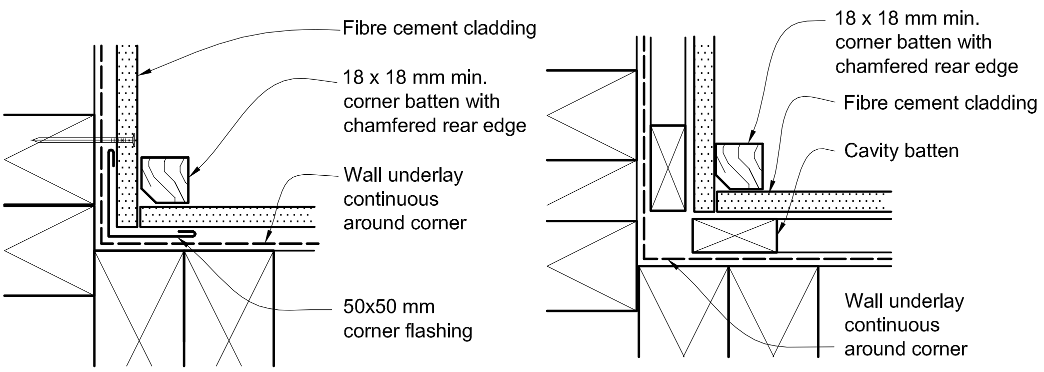
Figure 104A: Vertical uPVC joints for fibre cement sheet
Paragraph 9.7.3



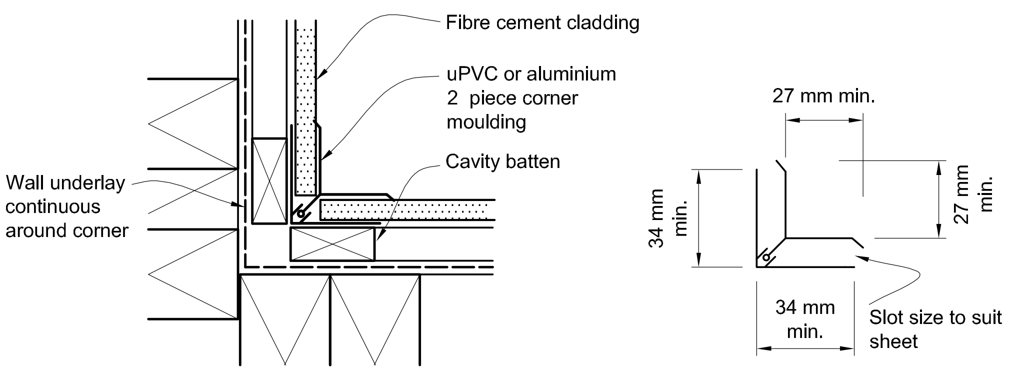
(a) DIRECT FIX (b) CAVITY

Amend 5
Aug 2011

Figure 104B: Internal corners for fibre cement sheet
Paragraph 9.7.3



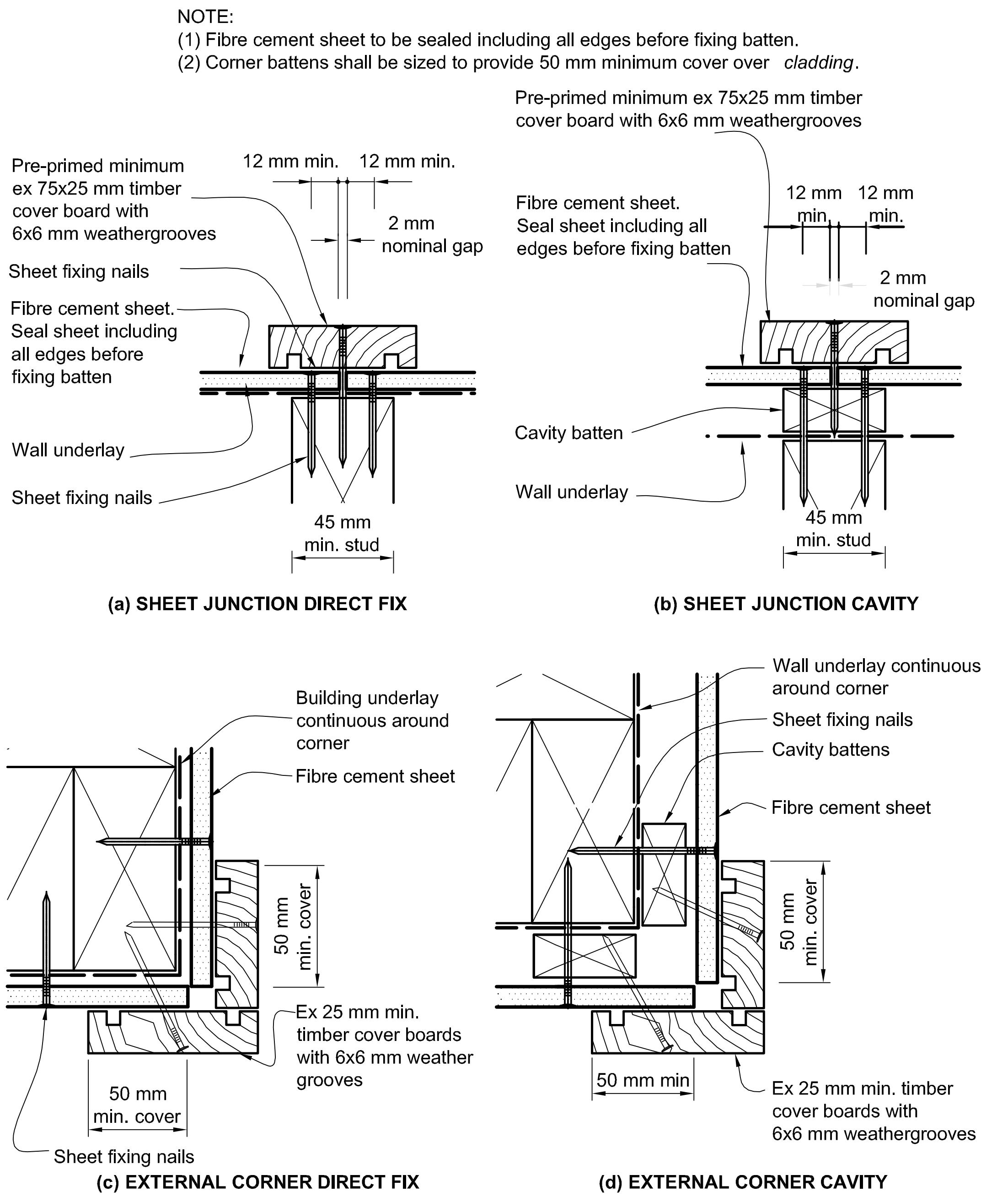
(a) DIRECT FIX (b) CAVITY



(c) CORNER MOULDING - CAVITY OR DIRECT FIX (d) CORNER MOULDING PROFILE

Amend 5
Aug 2011

Figure 105: Vertical timber batten joints for fibre cement sheet
Paragraph 9.7.3



(a) SHEET JUNCTION DIRECT FIX

(b) SHEET JUNCTION CAVITY

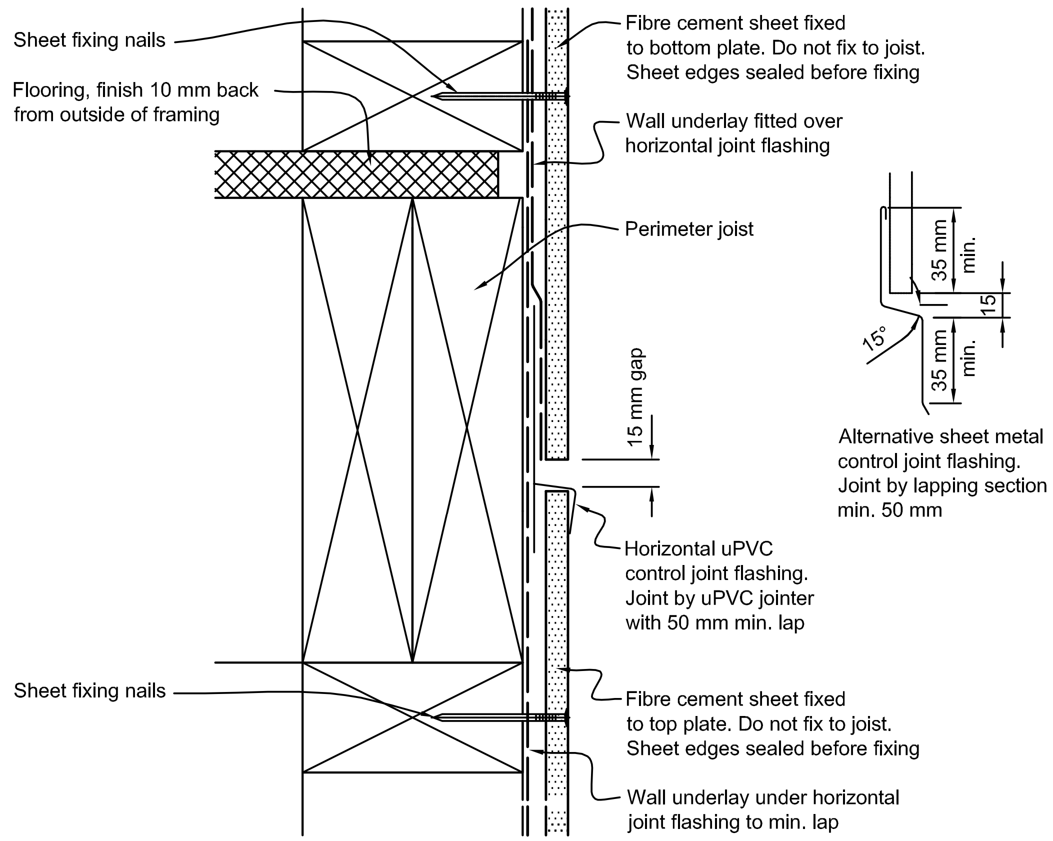
(c) EXTERNAL CORNER DIRECT FIX

(d) EXTERNAL CORNER CAVITY

Amend 5
Aug 2011

Figure 106 deleted

Figure 107: **Horizontal joints for direct fixed fibre cement**
Paragraph 9.7.3



Amend 5
Aug 2011

Figure 109 deleted

9.7.4.1 Control joints

Vertical *control joints* shall be located as shown in Table 19, and:

a) May occur at the edge of window or door openings,

b) Shall extend the full height of the *wall*, including where there is a horizontal joint and a vertical *control joint* on the *wall* – refer to Figure 111, and

c) May be staggered across horizontal *control joints*.

Table 19: Control joints for flush-finished fibre cement
Paragraph 9.7.4.1, Figure 111

Vertical control joints	Horizontal control joints
5400 mm centres max. (6000 mm allowed on *walls* that finish at an exterior corner)	5400 mm centres max. (on *dwangs* between full-height, continuous *studs*)
All internal corners	All floor joist locations

NOTE: Non-*flush-finished* joints are *control joints*.

9.7.4.2 Finishes

Finish colour shall have a reflectance of 40% or more, as outlined in Paragraph 2.4.

9.7.5 Soffit details

Soffits shall be detailed as shown in Figure 114 for *flush-finished* and Figure 8A for jointed.

9.7.6 Windows and doors

Windows and doors shall be installed in accordance with Paragraph 9.1.10 and:

a) *Direct fixed* windows and doors shall be detailed as per Figure 115

b) Windows and doors on cavity shall be detailed as per Figure 116.

9.7.7 Parapets and enclosed balustrades

Parapets shall comply with Paragraph 6.0.

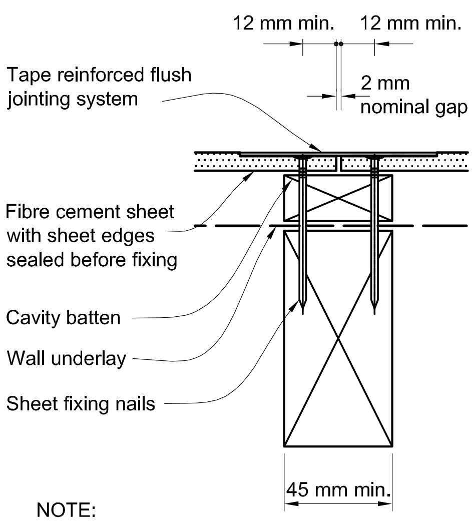
Enclosed balustrades shall comply with Paragraph 7.4.

Balustrade cappings may include:

a) Metal, butyl or *EPDM* to Paragraph 6.3, or,

b) *Flush-finished* fibre cement to Paragraph 9.7.7.1 and Figure 117.

Figure 110: Flush-finished joints for fibre cement sheet
Paragraph 9.7.4



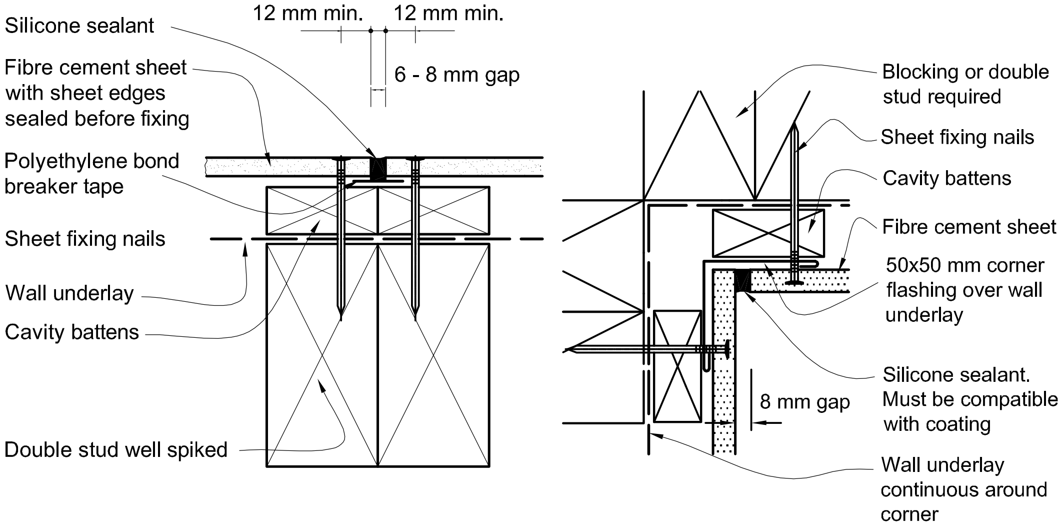
NOTE:
Fibre cement sheet used for this joint must be designed with recessed edge (site produced recesses to compatible sheets are permissible).

Amend 5 Aug 2011

Amend 5 Aug 2011

Figure 111: Vertical movement control joint for flush-finished fibre cement sheet
Paragraph 9.7.4.1

NOTE:
(1) Fibre cement sheet to be sealed including all edges before fixing batten.
(2) Do not apply paint over sealant. If texture coated, use polyethylene bond breaker tape.



(a) SHEET JUNCTION CAVITY FIX

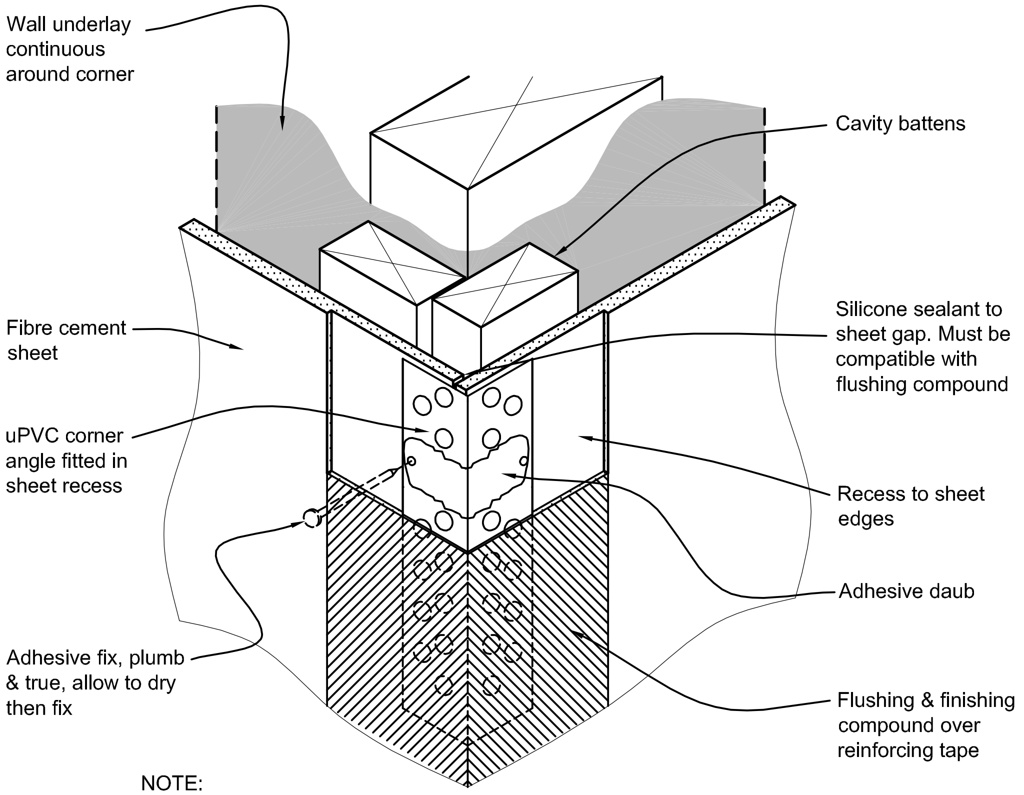
(b) INTERNAL CORNER CAVITY FIX

Amend 5
Aug 2011

Figure 112 deleted

Amend 2
Jul 2005

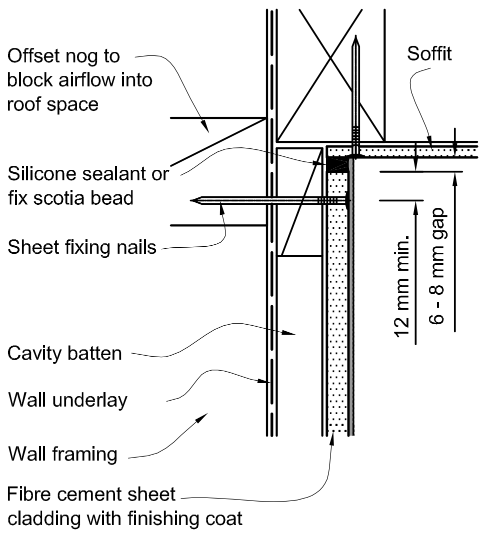
Figure 113: Flush-finished external corners for fibre cement sheet
Paragraph 9.7.4



NOTE:
(1) Fibre cement sheet used for this joint must be designed with recessed edge (site produced recesses to compatible sheets are permissible).
(2) Internal corners similar.

Amend 5
Aug 2011

Figure 114: Soffit for flush-finished fibre cement sheet
Paragraph 9.7.5



Amend 5
Aug 2011

9.7.7.1 Flush-finished topped balustrades

Amend 2 Jul 2005

Where the tops to *enclosed balustrades* are formed using *flush-finished* fibre cement, they shall have a minimum fall of 10° (1:6), and be wrapped as shown in Figure 117, with a *waterproofing membrane*, approved by the supplier of the jointing and finish system.
The *membrane* shall be fully protected by the coating and shall comply with the requirements of AS/NZS 4858 Table 8, Parts (a) to (e), except that bleach and detergent immersion set out in Appendix A1 shall not be required.

Amend 2 Jul 2005

Amend 5 Aug 2011

Amend 2 Jul 2005

Figure 117: Enclosed balustrade to wall for fibre cement sheet
Paragraphs 6.6 and 9.7.7.1

Errata 2 Dec 2011

NOTE: (1) Refer Figure 11 and Figure 12 for details of *framing* and bridge over cavity.
(2) Flush finish fibre cement balustrades only permitted with cavity construction - refer 9.1.8.

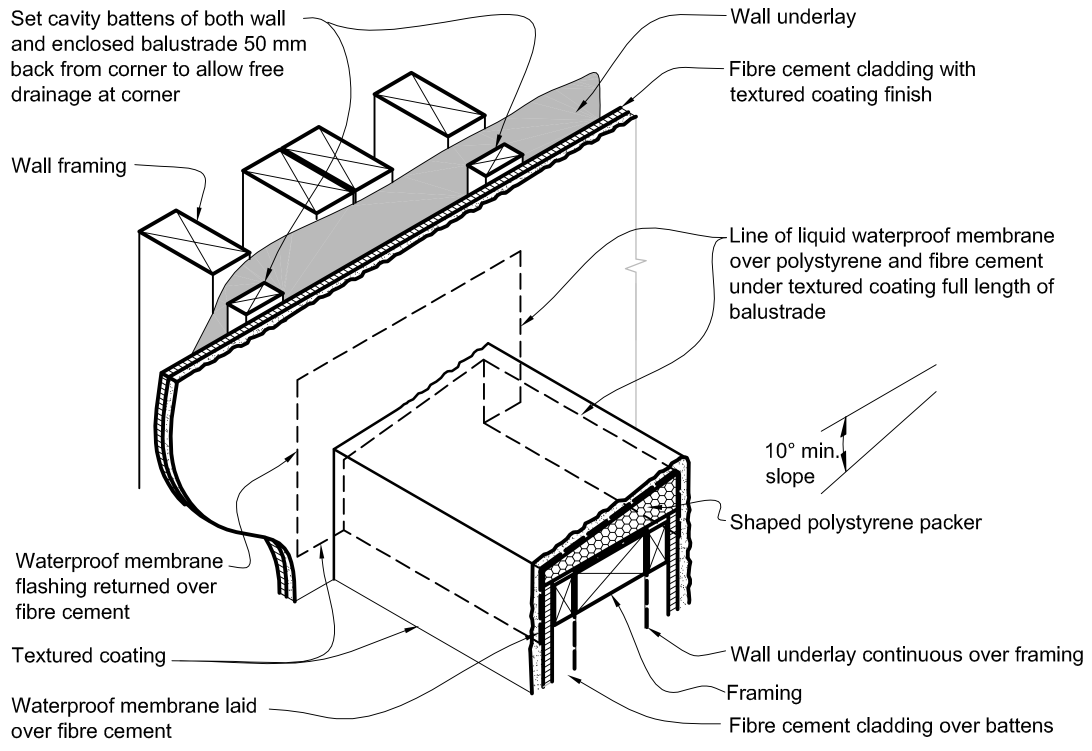


Figure 118 deleted

Amend 5 Aug 2011

9.7.8 Decorative attachments

Where decorative attachments are used, seal sheets prior to attachment of the decorative elements. The final weatherproofing system shall be applied over decorative elements and *wall cladding*. Horizontal decorative elements shall have top surfaces sloped to a minimum of 10° and drip mouldings to bottom edges.

Attachments shall not interfere with the functioning of critical joints such as *control joints.*

COMMENT:
Alternatively, a decorative moulding may be formed from the coating by using mesh and plaster.

Amend 5
Aug 2011

9.8 Plywood Sheet

Plywood-sheet *claddings* shall be either *direct fixed* to *framing* over a *wall underlay* or fixed over a *drained cavity* as per Paragraph 9.1.8. Amend 5 Aug 2011

Based on the *risk score* for an *external wall*, calculated as per Paragraph 3.1, the sheet *cladding* may require the inclusion of a *drained cavity*.

9.8.1 Limitations

This Acceptable Solution covers plywood panel *claddings* with vertical battened joints and flashed horizontal joints.

Figure 118 deleted

Amend 5 Aug 2011

9.8.2 Materials

Amend 5 Aug 2011

Batten-jointed panels shall have weather-grooved timber battens as shown in Figure 119.

Plywood panels shall be:

a) Manufactured to AS/NZS 2269, grade CD,

b) A minimum of 5 ply,

c) A minimum of 12 mm in thickness, and

d) Treated as required by NZS 3602.

9.8.3 Installation

A *wall underlay*, as specified in Table 23, shall be installed behind plywood sheet *claddings*.

COMMENT:
Refer to Paragraph 1.5 for qualification of installers.

Amend 5 Aug 2011

9.8.3.1 Fixings

Plywood sheets shall be fixed through the *wall underlay* into the *wall framing* with fixings as required in Table 24. Amend 5 Aug 2011

9.8.3.2 Joints

All joints shall: Errata 2 Dec 2011

a) Be made only over supports, and

b) If horizontal, incorporate a 10 mm expansion gap, and be fitted with a *flashing*, as shown in Figure 121, or

c) If vertical, have battened joints – refer to Figure 119. Amend 5 Aug 2011

Figure 119: Battened joints for plywood sheet
Paragraphs 9.8.2 and 9.8.3.2

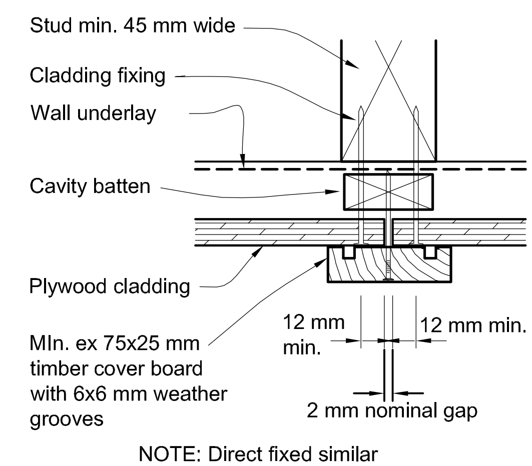
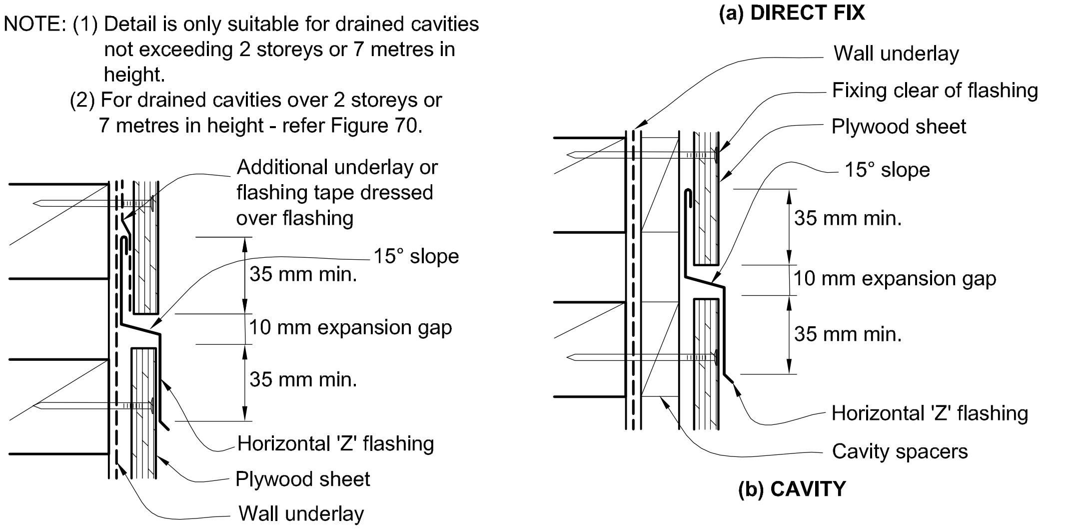


Figure 120 deleted

Amend 5 Aug 2011

Figure 121: Horizontal joints for plywood sheet
Paragraph 9.8.3.2



Amend 5 Aug 2011

9.8.4 Corners

9.8.4.1 External corners

Amend 5 Aug 2011

External corners shall be fitted with *flashings* or timber battens, as shown in Figure 122.

9.8.4.2 Internal corners

Internal corners shall be as shown in Figure 123 and have:

a) *Flashings* and timber battens for direct fix
b) Timber battens for cavity fix.

Amend 5 Aug 2011

9.8.5 Flashing material

Flashings shall be metal selected in accordance with Table 20 to Table 22 and Paragraph 4.3.

Amend 5 Aug 2011

9.8.6 Soffit details

Soffits shall be as shown in Figure 8A and Paragraph 5.3.

Amend 5 Aug 2011

9.8.7 Parapets and enclosed balustrades

Parapets and *enclosed balustrades* shall be capped with metal, butyl or *EPDM membrane. Cappings* shall comply with the requirements of Paragraph 4.0.

a) *Parapets* shall be in accordance with Paragraph 6.0
b) *Enclosed balustrades* shall be in accordance with Paragraph 7.4.

Amend 5 Aug 2011

9.8.8 Windows and doors

Windows and doors shall be installed in accordance with Paragraph 9.1.10.

9.8.8.1 Windows and doors: direct fixed

Amend 5 Aug 2011

Windows and doors shall be detailed as shown for fibre cement sheet *cladding* – refer to Figure 115.

9.8.8.2 Windows and doors: with cavity

Amend 5 Aug 2011

Windows and doors shall be detailed as shown for fibre cement sheet *cladding* – refer to Figure 116.

COMMENT:
The same principles of window installation apply to both fibre cement and plywood sheet *cladding*.

9.8.9 Finishes

A solution of 12.5% copper naphthenate in white spirits, or mineral turpentine, shall be brushed on to any edges cut after treatment.

Direct fixed plywood *cladding* used as bracing requires a minimum 50-year *durability*, and shall be treated to H3, painted on all edges and the outer face with a latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730.

Amend 5 Aug 2011

Amend 5 Aug 2011

9.9 EIFS

This paragraph covers polymer-modified cement-based plaster or polymer-based polystyrene-based plaster Exterior Insulation and Finish Systems *(EIFS)*.

EIFS cladding shall be fixed over a *drained cavity* as described in Paragraph 9.1.8.

Amend 5 Aug 2011

9.9.1 Limitations

This Acceptable Solution is limited to *EIFS cladding systems* that are:

a) Designed and tested as a total system, and

b) Not fixed:
   i) so as to form a horizontal surface,
   ii) as a replacement for roofing, or
   iii) in such a way as to allow water to pond.

9.9.2 General

Amend 2 Jul 2005

COMMENT:
Refer to Paragraph 1.5 for qualification of installers.

Amend 5 Aug 2011

9.9.3 Materials

EIFS cladding systems shall comprise the following parts:

a) A polystyrene sheet *cladding* material,

b) A polymer-modified cement-based plaster or a polymer-based plaster, reinforced with fibreglass mesh,

c) A polymer-modified cement or polymer-based finishing plaster, and a latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730,

d) A range of head, sill, jamb, corner and base mouldings suitable for exterior use, and

e) A flexible polymeric neutral cure sealant that:
   i) is approved by the *cladding system* supplier, and
   ii) complies with:
      a. Type F, Class 20LM or 25LM of ISO 11600, or
      b. low modulus Type II Class A of Federal Specification TT-S-00230C.

COMMENT:
This is the minimum standard, and extra elements deemed suitable by the system supplier should not be excluded on the basis of this Acceptable Solution.

9.9.3.1 Polystyrene sheet

Polystyrene sheet shall be a minimum of 40 mm thick and shall be either:

a) Expanded polystyrene (EPS) complying with AS 1366: Part 3, Class H or Class S, or

b) Extruded polystyrene (XPS) that complies with AS 1366: Part 4.

9.9.3.2 Fibreglass reinforcing mesh

Fibreglass reinforcing mesh shall be alkali-resistant fibreglass mesh, and shall:

a) Weigh no less than 150 grams per m^2,

b) Have an aperture size from 3 mm x 3 mm to 6 mm x 6 mm square, and

c) Comply with the requirements of EIMA 101.9 test No. 6.3 and ASTM E2098.

9.9.4 Installation

A *wall underlay*, as specified in Table 23 and Paragraphs 9.1.5–9.1.7, shall be fixed to the *framing*. Amend 5 Aug 2011

9.9.4.1 Fixings

Polystyrene sheets shall be fixed through the *cavity battens*, and *wall underlay* into the *wall framing* with fixings as required in Table 24. Amend 5 Aug 2011
Fixings shall:

a) Be spaced as shown in Table 24,

b) Penetrate the *framing* by 30 mm minimum,

c) Comply with AS/NZS 4680, and

d) Be either:
   i) hot-dipped galvanized springhead nails with a 22 mm top, or
   ii) hot-dipped galvanized flat head nails used in conjunction with a 22 mm minimum diameter plastic washer.

9.9.4.2 Joints

Amend 5 Aug 2011

Joints to plain-edged sheets shall be butt jointed over solid timber backing.

Rebated or tongued boards may be jointed away from solid timber backing, providing the joint is self-supporting at both edges.

Corner joints shall be butted together and fully supported along the length of the joint.

9.9.4.3 Movement control joints

Control joints shall always be located over solid timber backing. *Control joints* shall be as shown in Figure 124, and shall be provided:

a) On all walls over 20 metres long or over 7 metres high including gables, (Amend 5 Aug 2011)

COMMENT:
The system supplier may require *control joints* at closer spacings.

b) At abutments to different *cladding* types,

c) Where *cladding* covers different structural materials such as timber to concrete, and

d) Over a movement *control joint* in the underlying *framing*.

9.9.4.4 Fixing blocks

Amend 5 Aug 2011

H3.2 treated timber blocks shall be provided at appropriate locations for fixing all downpipe brackets, garden taps, and other outside fittings.

Amend 5 Aug 2011

The blocks shall be cut to suit the polystyrene thickness, and fixed to *framing* or *cavity battens*. Prior to applying the plaster basecoat, a patch shall be applied that:

a) Extends over the timber block face and overlaps the adjacent polystyrene by a minimum of 50 mm, and

b) Is suitable for the direct application of the base coat, and is either:

(i) a butyl-based *flexible flashing tape* that complies with Parts 3.2 and 4 of ICBO Acceptance Criteria AC148, or

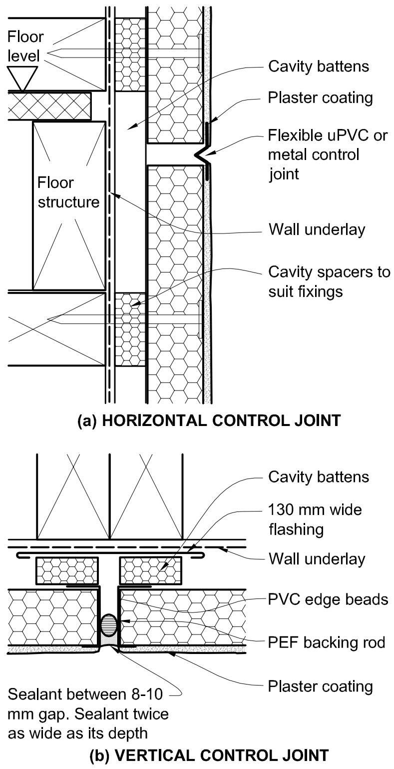
(ii) a *waterproofing membrane* that complies with the requirements of AS/NZS 4858 Table 8, Parts (a) to (e), except that bleach and detergent immersion set out in Appendix A1 shall not be required.

The design of fixing blocks for connecting items carrying substantial loads such as stringers for *decks* are outside the scope of this Acceptable Solution. These will require *specific design*. (Amend 2 Jul 2005)

Figure 124: Control joints for EIFS
Paragraph 9.9.4.3

Amend 10 Nov 2020
Amend 2 Jul 2005

NOTE:
(1) Detail (a) is for EIFS not exceeding *2 storeys* or 7m in height.
(2) For *EIFS* exceeding *2 storeys* or 7 m in height - refer Figure 70.



Amend 5 Aug 2011

Amend 5 Aug 2011

9.9.5 Battens

Cavity battens shall comply with Paragraph 9.1.8.4, installed as in Paragraph 9.1.8.

Amend 5 Aug 2011

COMMENT:
Cavity spacers must be short and sloped to prevent water being trapped by the battens and ventilation being restricted.

9.9.6 Coating

Suppliers of *EIFS cladding systems* shall demonstrate that their systems meet the tensile-adhesion performance requirements of ASTM E2134.

9.9.6.1 Reinforcing

The entire surface of the polystyrene sheet (including corners) must be continuously reinforced with alkali-resistant fibreglass reinforcing mesh as specified in Paragraph 9.9.3.2.

9.9.6.2 Reinforcing base coat

The reinforcing base coat shall have:

a) A base coat plaster at the greater of the system supplier's minimum recommended thickness or 3 mm thick, and be either:
   i) polymer-modified cement-based, or
   ii) polymer-based,

b) Reinforcing with an alkali-resistant fibreglass mesh (Paragraph 9.9.3.2), and

c) Cover to mesh by at least 1.5 mm plaster.

9.9.6.3 Finish coats

Finish colour shall have a reflectance of 40% or more, as outlined in Paragraph 2.4. Amend 5 Aug 2011

The finish shall comprise either:

a) One or more coats of polymer-modified cement-based plaster or polymer-based plaster, or

b) One or more coats of a pre-coloured polymer-modified cement-based plaster, or

c) A pre-coloured polymer-based plaster applied according to the conditions specified by the plaster manufacturer.

Where necessary to maintain *weather-tightness*, *EIFS* shall be finished with a latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730.

Polymer-modified cement-based plaster shall only be applied out of direct sunlight and when the temperature is between 5˚C and 30˚C, with the expectation that the temperature will be in that range for the following 24 hours.

9.9.6.4 Decorative mouldings

Decorative mouldings shall be formed from polystyrene, and shall be glued or mechanically fastened to ensure they remain securely attached to *EIFS cladding* or *framing*. Amend 5 Aug 2011

Where decorative mouldings are attached, the basecoat shall be applied before the moulding.

COMMENT:
Alternatively, a decorative moulding may be formed from the coating by using mesh and plaster.

9.9.7 EIFS/floor slab junction

The bottom of the *EIFS cladding* shall be as shown in Figure 125.

9.9.8 Pipes and service penetrations

All pipes and service penetrations through the *EIFS* shall be made weatherproof, by either:

a) A flange penetrating the *EIFS* as a sleeve and sealed into the *EIFS* system as shown in Figure 126, or

b) A face-fitted flange at *EIFS* surface, sealed with a neutral cure sealant complying with:
   i) Type F, Class 20LM or 25LM of ISO 11600, or
   ii) low modulus Type II Class A of Federal Specification TT-S-00230C.

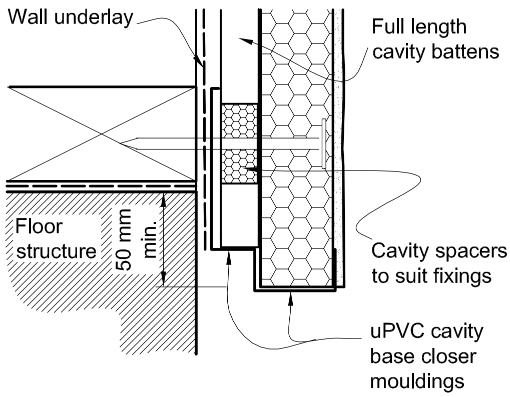
c) Pipe penetrations shall be installed to slope downwards to exterior. Refer to Figure 68 or 69.

Amend 5 Aug 2011

Where cables penetrate *cladding*, a sleeve or conduit shall be provided and sealed into the *EIFS* system. All wires that pass through a conduit shall be sealed into position inside the conduit.

Figure 125: Bottom of cladding for EIFS
Paragraph 9.9.7

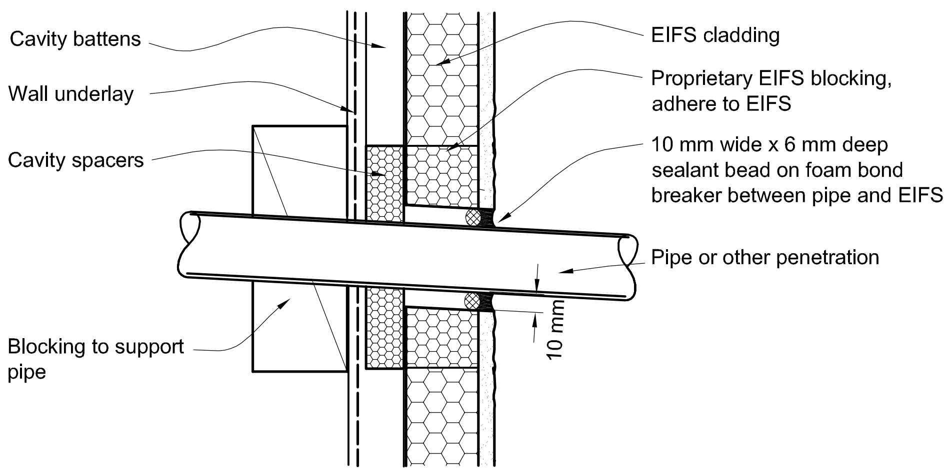
NOTE: (1) 6 mm offset of *framing* to foundation is not necessary where *drained cavities* are used.
(2) Refer 9.1.3 for ground clearances.



Amend 5 Aug 2011

Figure 126: Penetration for EIFS
Paragraph 9.9.8

NOTE: Refer Figure 68 for pipe sealing to wall underlay.



Amend 5 Aug 2011

9.9.9 Windows and doors

Windows and doors shall be installed in accordance with Paragraph 9.1.10, and shown in Figures 17C, 127 and 128.

Install uPVC three-way corner *flashings* at jamb/sill junctions as shown in Figure 127. Corner *flashings* shall be installed behind *EIFS* jamb and sill *flashings*, with flanges turned out over polystyrene backing sheets.

9.9.10 Parapets and enclosed balustrades

Parapets shall comply with Paragraph 6.0.

Enclosed balustrades shall comply with Paragraph 7.4.

9.9.10.1 Flush-finished balustrade top

Where the tops to *enclosed balustrades* are formed using *EIFS*, they shall have a minimum fall of 10° (1:6), and be wrapped as shown in Figure 129 and 130, with a liquid *waterproofing membrane* approved by the supplier. The *EIFS* system shall be fully protected by the coating, and shall comply with the requirements of AS/NZS 4858 Table 8, Parts (a) to (e), except that bleach and detergent immersion set out in Appendix A1 shall not be required.

Amend 2 Jul 2005

Amend 5 Aug 2011

9.9.10.2 Metal cappings

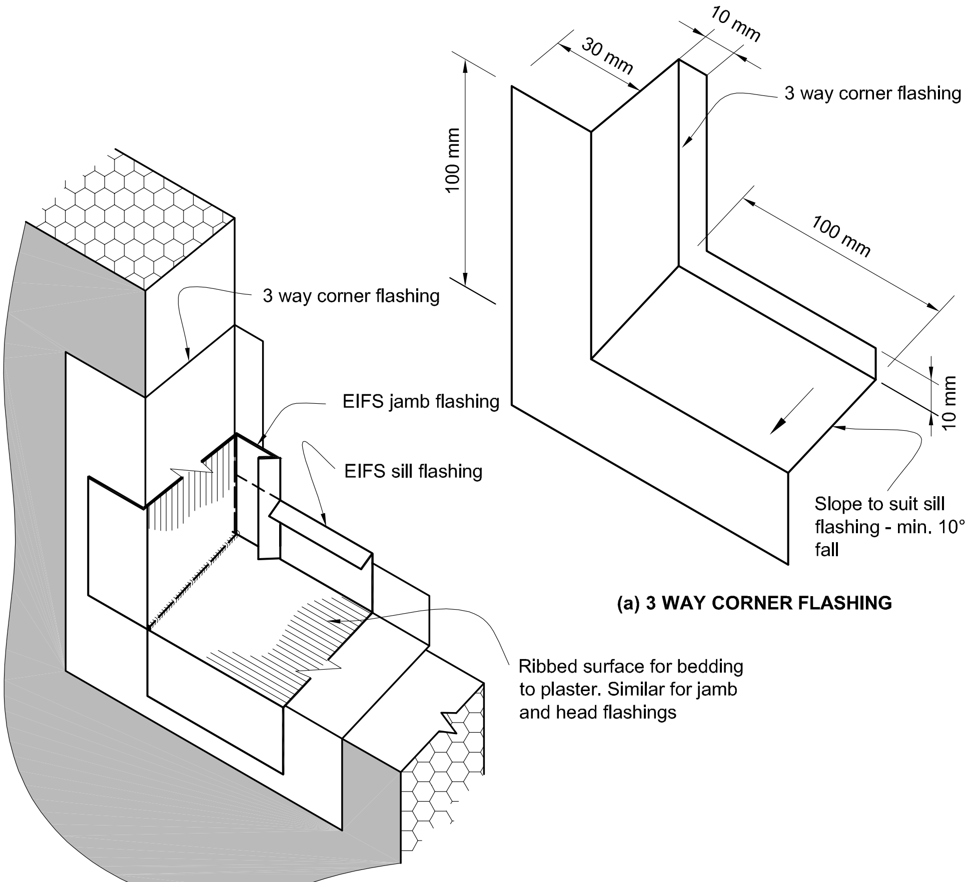
Metal *cappings* shall comply with the requirements of Paragraph 6.4, and shall be as shown in Figure 130.

Where a *parapet* or an *enclosed balustrade* meets *EIFS* wall *cladding*, a *saddle flashing* shall be used, as shown in Figure 11 and Figure 12.

Amend 10 Nov 2020

Amend 2 Jul 2005

Figure 127: Window and door corner flashing for EIFS
Paragraph 9.9.9



(b) 3 WAY CORNER FLASHING WITH
EIFS JAMB AND SILL FLASHING OVER

Amend 5
Aug 2011

10.0 Construction Moisture

Amend 5 Aug 2011

10.1 Moisture in materials

Moisture contained in the *building* structure at completion of *construction* shall not be permitted to damage the *building elements*.

Construction moisture includes the moisture contained in:

a) Timber products as a result of a treatment or manufacturing process,

Amend 5 Aug 2011

b) Green timber, and timber or other materials that have been exposed to the weather, and

c) Concrete, mortar or plaster that is not completely cured.

Amend 5 Aug 2011

10.2 Maximum acceptable moisture contents

The maximum moisture contents shall be:

a) For timber *framing* at the time of installing interior *linings*, the maximum acceptable moisture content shall be the lesser of:

i) 20% for insulated buildings, 24% for non-insulated buildings, or

ii) as specified in NZS 3602,

b) For timber weatherboards and exterior joinery, 20% at the time of painting,

c) For reconstituted wood products, 18% at all times, and

d) For concrete floors, sufficiently dry to give a relative humidity reading of less than 75% at the time of laying fixed floor coverings.

COMMENT:
Some manufacturers of timber or other wall or floor components may recommend lower moisture contents for their products.

It is advisable to use the manufacturer's moisture content requirements, if these are lower than those required by this paragraph.

10.3 Measuring moisture content

Amend 5 Aug 2011

10.3.1 Timber

Measurement shall be by the recommended procedure in the Scion (New Zealand Forest Research Institute) publication "Measurement of moisture content of Wood" using electrical resistance type moisture meters with insulated probes. Representative samplings of measurements shall be taken:

a) With meters calibrated to AS/NZS 1080.1 Appendix E

b) By inserting probes to at least 1/3 the depth of timber being measured, at a distance exceeding 200 mm from board ends

c) Using correction factors for timber species, temperature, and treatment type (outlined in Scion publication above).

COMMENT:
For convenience of site measurement, readings of moisture content can be compared against a 'control' *framing* sample of known acceptable moisture content. The comparative readings must be taken during the same test period, be of the same framing type, and using the same resistance moisture meter. This method of moisture testing may be appropriate for non-boron treated *framing*, or processed timber *framing*.

10.3.2 Concrete floors

Measurement shall be made in accordance with BRANZ Bulletin 330 Thin Flooring Materials using hygrometers calibrated to ASTM E 104 – 2002 Standard practice for maintaining constant relative humidity by means of aqueous solutions.

Amend 5 Aug 2011

Table 20: Material selection
This table shall be read in conjunction with Table 21 and Table 22 and Paragraph 4.0.
Refer relevant *cladding* and *flashings* paragraphs for material and coating specifications.
Paragraphs 2.2, 4.2.1, 4.3.3, 4.3.4, 4.3.8, 4.3.10, 8.2.3, 8.2.4, 8.3.4.2, 8.4.3.1, 8.4.3.2, 9.1.10.2, 9.6.3.1, 9.6.3.2, 9.6.6 and 9.8.5

Material	Exposure(1)(2)(4)(6) NOTE: Consider all walls as 'Sheltered' for steel based claddings(8)	Type	Acceptable Exposure Zones as per NZS 3604 – Section 4 (3)(4)(6): 15 years	50 years for hidden elements(2)(9)
CLADDINGS AND FLASHINGS				
Aluminium, zinc	Hidden(2)		B,C,D,E	B,C,D,E
	Exposed		B,C,D,E	
	Sheltered		B,C,D,E	
Copper, lead, or stainless steel	Hidden(2)		B,C,D,E	B,C,D, E
	Exposed		B,C,D,E	
	Sheltered		B,C,D,E	
Factory painted				
Aluminium-zinc-magnesium (combinations) coated or galvanised steel, to AS 1397 and AS/NZS 2728 with AM100, ZM274, and AZ150 minimum coatings	Hidden(9)	Type 4	B,C,D,E	B,C,D
	Hidden(9)	Type 6	B,C,D,E	B,C,D,E
	Exposed(8)	Type 4	B,C,D	
	Exposed(8)	Type 6	B,C,D,E	
	Sheltered	Type 4	B,C	
	Sheltered	Type 6	B,C,D	
Pressed metal tiles coated to minimum AZ150 or AM100 to AS 1397, AS/NZS 2728 or with post-form factory painting to cl 8.3.4.2.	Exposed	Type 6	B,C,D,E	
	Sheltered	Type 6	B,C,D	
Non-factory painted				
Aluminium-zinc-magnesium (combinations) coated steel, to AS 1397 with AZ150 or AM125 minimum coatings	Hidden(9)		B,C,D,E	B,C,D
	Exposed(8)		B,C	
	Sheltered		B	
Galvanised steel Z450 to AS 1397	Hidden(9)		B,C,D	B,C
	Exposed(8)		B,C	
	Sheltered		B	
Non-metallic				
Bituminous material, or uPVC	Hidden		B,C,D,E	B,C,D,E
	Exposed (uPVC only)		B,C,D,E	
	Sheltered (uPVC only)		B,C,D,E	
Butyl rubber	Hidden		B,C,D,E	B,C,D,E
	Exposed		B,C,D,E	
	Sheltered		B,C,D,E	
FIXINGS(7)				
Aluminium, bronze, and stainless steel (Types 304 and 316)(10)	Hidden		B,C,D,E	B,C,D,E
	Exposed		B,C,D,E	
	Sheltered		B,C,D,E	
Nails – Hot-dip galvanised steel to AS/NZS 4680	Hidden(5)(9)		B,C,D	B,C
	Exposed		B,C,	
	Sheltered		B	
Screws – galvanised steel, painted or unpainted, to AS 3566: Part 2	Hidden(5)(9)	Class 3	B,C,D,E(3)(4)	B,C,D,E
	Exposed	Class 4	B,C,D	
	Sheltered	Class 4	B,C	

Errata 2 Dec 2011
Amend 6 Feb 2014
Amend 6 Feb 2014
Amend 5 Aug 2011

Table 20: Material selection – continued

Note:

1) Refer to manufacturer's information for maintenance requirements in Exposed and Sheltered locations.
2) The term "hidden" means concealed behind another element such that no part is visible. Hidden elements require a 50 year *durability* under the *NZBC*. The term "exposed" means having surfaces exposed to rain washing. The term 'sheltered' means being visible, but not rain washed. For diagrammatic outline, refer NZS 3604 Figure 4.3(a). Exposed and sheltered elements require a 15 year *durability*. Where an element can be categorised as both 'sheltered' and 'exposed', the 'sheltered' condition will apply.
3) AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand, determined by exposure to wind-driven sea-spray. NZS 3604 references atmospheric classes B (Low), C (Medium) and D (High). E2/AS1 references atmospheric zones B,C,D,E. For the purposes of *cladding* selection, Zone E (Severe marine classified as breaking surf beach fronts) has been included. Designers must consult metal supplier's information for specific *durability* requirements of sites in Zone E.
4) The geographic limits of atmospheric classes in NZS 3604 and AS/NZS 2728 may vary. Table 20 uses the limits outlined in NZS 3604.
5) Includes fixings protected by putty and an exterior paint system of primer, undercoat and two top coats of paint.
6) Microclimates based on evidence from adjacent structures of corrosion caused by industrial or geothermal atmospheres are outside the scope of this Acceptable Solution.
7) Refer to Tables 21 and 22 for compatibility of fixings with metal *claddings*.
8) *Roof* only. Coated steel *wall claddings* must be considered as 'sheltered'.
9) Hidden steel coated elements in ventilated cavities in zones D and E (exposure to salt air) must be considered as 'sheltered'
10) The use of stainless steel fixings is not recommended by steel manufacturers for use with coated steel in severe marine and industrial environments, as they are considered to cause deterioration.

Amend 5 Aug 2011

Amend 5
Aug 2011

Table 21: Compatibility of materials in contact
This table shall be read in conjunction with Table 20 and Table 22.
Refer relevant *cladding* and *flashings* paragraphs for material and coating specifications.
Paragraphs 2.2, 4.2.2, 4.5.2, 8.2.4, 8.4.11, 8.4.11.1 and 9.6.7

Amend 6
Feb 2014

	Aluminium, anodised or mill-finish	Aluminium, coated (1)	Butyl rubber & EPDM	CCA-treated timber (2)	Cedar	Cement plaster (uncoated)	Ceramic tiles (cement grout)	Clay bricks (cement mortar)	Concrete old (unpainted)	Concrete green (unpainted)	Copper/brass	Glass	Glazed roof tiles	Lead (including lead-edged) unpainted	Plastics	Stainless steel	Steel, galvanised coil-coated	Steel, galvanized (unpainted)	Zinc	Zinc-aluminium-magneisum (combinations), coated (1)	Zinc-aluminium-magnesium (combinations), (unpainted)
Aluminium, anodised or mill-finish	✓	✓	✓	✘	✓	✘	✘	✘	✓	✘	✘	✓	✓	✘	✓	B	✓	✓	✓	✓	✓
Aluminium, coated (1)	✓	✓	✓	B	✓	✘	✘	✘	✓	✘	✘	✓	✓	B	✓	B	✓	✓	✓	✓	✓
Butyl rubber & EPDM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CCA-treated timber (2)	✘	B	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	B	✘	✘	B	✘
Cedar	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✘
Cement plaster (uncoated)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✓	✓	✓	✓	✓	✓	✘
Ceramic tiles (cement grout)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘
Clay bricks (cement mortar)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘
Concrete old (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Concrete green (unpainted)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✓	✓	✘	✘	✘	✘	✘
Copper/brass	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	B	✓	B	✘	✘	✘	✘	✘
Glass	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Glazed roof tiles	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lead (including lead-edged) unpainted	✘	B	✓	✓	✓	✘	✓	✓	✓	✘	B	✓	✓	✓	✓	B	B	B	B	B	✘
Plastics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stainless steel	B	B	✓	✓	✓	✓	✓	✓	✓	✓	B	✓	✓	B	✓	✓	B	✘	✘	B	B
Steel, galvanised coil-coated	✓	✓	✓	B	✓	✓	✓	✓	✓	✘	✘	✓	✓	B	✓	B	✓	✓	✓	✓	✓
Steel, galvanized (unpainted)	✓	✓	✓	✘	✘	✓	✓	✓	✓	✘	✘	✓	✓	B	✓	✘	✓	✓	✓	✓	✓
Zinc	✓	✓	✓	✘	✘	✓	✓	✓	✓	✘	✘	✓	✓	B	✓	✘	✓	✓	✓	✓	✓
Zinc-aluminium-magenesium (combinations), coated (1)	✓	✓	✓	B	✓	✓	✓	✓	✓	✘	✘	✓	✓	B	✓	B	✓	✓	✓	✓	✓
Zinc-aluminium-magnesium (combinations) (unpainted)	✓	✓	✓	✘	✘	✘	✘	✘	✓	✘	✘	✓	✓	✘	✓	B	✓	✓	✓	✓	✓

Amend 6
Feb 2014

LEGEND:
✓ Materials satisfactory in contact.
✘ Contact between materials is not permitted. Minimum gap of 5 mm is required to prevent moisture bridging.
B Avoid contact in sea-spray zone or corrosion zone D.

NOTES:
(1) Coated – includes factory-painted, coil-coated and powder-coated.
(2) Includes copper azole and copper quaternary salts.

Amend 2
Jul 2005

Amend 5 Aug 2011

Table 22: Compatibility of materials subject to run-off
This table shall be read in conjunction with Table 20 and Table 21.
Refer relevant *cladding* and *flashings* paragraphs for material and coating specifications.
Paragraphs 2.2, 4.2.2, 4.5.2, 8.2.4, 8.4.1 and 9.8.5

Amend 6 Feb 2014

Material that water flows onto / Material that water flows from	Aluminium, anodised or mill-finish	Aluminium, coated (1)	Butyl rubber & EPDM	CCA-treated timber (2)	Cedar	Cement plaster (uncoated)	Ceramic tiles (cement grout)	Clay bricks (cement mortar)	Concrete old (unpainted)	Concrete green (unpainted)	Copper/brass	Glass	Glazed roof tiles	Lead (including lead-edged) unpainted	Plastics	Stainless steel	Steel, galvanised coil-coated	Steel, galvanized (unpainted)	Zinc	Zinc-aluminium-magneisum (combinations), coated (1)	Zinc-aluminium-magnesium (combinations), (unpainted)
Aluminium, anodised or mill-finish	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Aluminium, coated (1)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✘
Butyl rubber & EDPM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✘
CCA-treated timber (2)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘	✘	✘
Cedar	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✘
Cement plaster (uncoated)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✘	✓	✓	✓	✘	✘	✓	✘
Ceramic tiles (cement grout)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✘	✘	✓	✘
Clay bricks (cement mortar)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✘	✘	✓	✘
Concrete old (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓
Concrete green (unpainted)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✘	✓	✓	✘	✘	✘	✘	✘
Copper/brass	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘	✘	✘
Glass	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Glazed roof tiles	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Lead (including lead-edged) unpainted	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘
Plastics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Stainless steel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Steel, galvanised coil-coated	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Steel, galvanized (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Zinc	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Zinc-aluminium-magenesium (combinations), coated (1)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Zinc-aluminium-magnesium (combinations) (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓

Amend 6 Feb 2014

LEGEND:
✓ Materials satisfactory with water run-off as indicated.
✘ Water run-off is not permitted as indicated.
A Etching or staining of glass may occur with run-off.

NOTES:

(1) Coated – includes factory-painted, coil-coated and powder-coated.

(2) Includes copper azole and copper quaternary salts.

Amend 2 Jul 2005

Errata 2 Dec 2011

Table 23: Properties of roof underlays and wall underlays
Paragraphs 6.2, 8.1.5, 8.2.3, 8.3.6, 8.4.7, 9.1.3.4, 9.1.4, 9.1.7.1, 9.1.7.2, 9.1.8.2, 9.2.4, 9.2.5, 9.3.3, 9.3.5.1, 9.4.2, 9.4.3, 9.5.3, 9.6.8.1, 9.6.9.1, 9.6.9.2, 9.7.2.1, 9.8.3 and 9.9.4

Errata 2 Dec 2011

Category	Application	Vapour resistance	Absorbency	Water resistance	pH of extract	Shrinkage	Mechanical
Roof (1) Underlay (Bitumen and fire-retardant paper-based products)(2)	All *roofs*	≤ 7 MN s/g ASTM E96 B.	NZS 2295: 2006 section 3				
Flexible Wall Underlay (Includes paper and synthetic underlays)	*Wall claddings* over a cavity(6) Flexible *underlays* over rigid *underlays* – refer Paragraph 9.1.7.2 *Direct fixed* absorbent *wall claddings*(4) (eg, timber, fibre cement etc)	NZS 2295: 2006 section 2 No minimum Absorbency requirement					
	Direct fixed non-absorbent *claddings*(3)	NZS 2295: 2006 section 2 Minimum Absorbency 100 g/m^2 tested to NZS 2295					
Rigid Wall Underlay (plywood(5) and fibre cement sheet)	*Wall claddings* over a cavity(6) *Direct fixed* absorbent *wall claddings* (eg, timber, fibre cement etc)	≤ 7 MN s/g ASTM E96 B.		≥ 20 mm NZS 2295			
	Direct fixed non-absorbent *claddings* (6)	≤ 7 MN s/g ASTM E96 B.	≥ 100 g/m^2 AS/NZS 4201: Part 6	≥ 20 mm AS/NZS 4201: part 4	≥ 6.0 and ≤ 9.0		
Air Barrier	Where no internal *linings*	≤ 7 MN s/g ASTM E96 B.	≥ 100 g/m^2 (7) NZS 2295	≥ 20 mm NZS 2295	≥ 6.0 and ≤ 9.0	≤ 0.5% NZS 2295	Edge tear strength NZS 2295 Air resistance BS 6538: Part 3: ≥ 0.1 MN s/m^3
DPC/DPM	All applications	≥ 90 MN s/g ASTM E96					

NOTE:
1) Metal *roofs* and *direct-fixed* metal *wall claddings* require paper-based *underlays*
2) Excluding synthetic *underlays*
3) Use paper based *underlays* where directly behind (in contact with) profiled metal *wall cladding*
4) Excludes profiled metal *wall cladding*
5) Plywood to be treated in accordance with NZS 3602
6) Bitumen based products shall not be used in direct contact with LOSP-treated plywood
7) Applies only to air barriers used with non-absorbent *claddings*.

Amend 5 Aug 2011

Amends 2 and 5

Amend 5 Aug 2011

Table 24: Fixing selection for wall claddings

Refer to NZS 3604 for fixing types where claddings act as structural bracing. Minimum fixing materials for non-structural claddings, shall be galvanised(1) steel for climate zones B,C and D (as outlined in NZS 3604). Where the cladding is a corrosive timber, such as western red cedar or redwood, or is treated with copper based ACQ or CuAz preservatives, use stainless steel(2)

COMMENT: Some manufacturers may require more durable fixings than those stated below or in NZS 3604 to maintain product warranties.

Paragraphs 9.4.4.3, 9.4.5.2, 9.5.3.1, 9.7.2.1, 9.8.3.1, 9.9.4.1, Table 18B

Joint	Length (mm) x diameter (mm) and type	Minimum framing penetration	Fixing pattern	Requirements
Cavity battens				
Battens to *framing*	NA	NA	NA	Battens will be fixed by the *cladding* fixings, which will penetrate the wall *framing*. Battens will therefore need only temporary fixing until the *cladding* is fixed.
Stucco plaster				
Rigid backing to *framing*	60 x 2.5 FH nail	35 mm	150 mm centres to sides and 300 mm centres in middle	
Metal lath to *framing*	40 x 2.5 FH nail or 40 x 2.8 FH nail	35 mm	150 mm centres	
Fibre cement weatherboards				
Weatherboard DIRECT FIXED	50 x 2.8 fibre cement nail	35 mm	Single fixing 20 mm above lower board, through both thicknesses	
Weatherboard OVER CAVITY	75 x 3.15 fibre cement nail	35 mm	as above	
Timber weatherboards: paint finish DIRECT FIXED				
Horizontal bevel-back	75 x 3.15 JH nail	35 mm	Single fixing 10 mm above top of lower board	
Horizontal rebated bevel-back	60 x 2.8 JH nail	35 mm	as above	
Horizontal rusticated	60 x 2.8 JH nail	35 mm	as above	
Vertical shiplap	60 x 2.8 JH nail	35 mm	Single fixing 10 mm from side lap (40 mm from edge of board)	*Dwangs* at maximum 480 mm centres.
Board and batten: board	60 x 2.8 JH nail	35 mm	Single fixing in centre or nails clenched over each side	as above
Board and batten: batten	75 x 3.15 JH nail	35 mm	Single fixing in centre of batten	as above
Timber weatherboards: paint finish OVER CAVITY				
Horizontal bevel-back	90 x 4.0 JH nail	35 mm	Single fixing 10 mm above top of lower board	
	75 x 3.15 annular grooved nail	25 mm	Single fixing 10 mm above top of lower board	
Horizontal rebated bevel-back	75 x 3.15 JH nail	35 mm	as above	

Amend 5 Aug 2011

Amend 2 Jul 2005

LEGEND:
RH rose head JH jolt head FH flat head

NOTE: Nail lengths are designed for minimum penetration of *framing*. If thickness of the batten or *cladding* is varied, length shall be adjusted accordingly.

Table 24: Fixing selection for wall claddings *(continued)*

Joint	Length (mm) x diameter (mm) and type	Minimum framing penetration	Fixing pattern	Requirements
Horizontal rusticated	75 x 3.15 JH nail	35 mm	Single fixing 10 mm above top of lower board	
Timber weatherboards: stained or bare finish DIRECT FIXED				
Horizontal bevel-back	65 x 3.2 RH annular grooved nail	30 mm	Single fixing 10 mm above top of lower board	
Horizontal rebated bevel-back	50 x 3.2 RH annular grooved nail	30 mm	as above	
Horizontal rusticated	50 x 3.2 RH annular grooved nail	30 mm	as above	
Vertical shiplap	50 x 3.2 RH annular grooved nail	30 mm	Single fixing 10 mm from side lap (40 mm from edge of board)	*Dwangs* at maximum 480 mm centres
Board and batten: board	60 x 3.2 RH annular grooved nail	30 mm	Single fixing in centre of board	as above
Board and batten: batten	75 x 3.2 RH annular grooved nail	30 mm	as above	as above
Timber weatherboards: stained or bare finish OVER CAVITY				
Horizontal bevel-back	85 x 3.2 RH annular grooved nail	30 mm	Single fixing 10 mm above top of lower board	
Horizontal rebated bevel-back	70 x 3.2 RH annular grooved nail	30 mm	as above	
Horizontal rusticated	70 x 3.2 RH annular grooved nail	30 mm	as above	
Vertical profiled metal: DIRECT FIXED				**Refer Paragraph 9.6.6**
Horizontal profiled metal: OVER CAVITY				**Refer Paragraph 9.6.6**
Plywood sheet: paint finish DIRECT FIXED				
Plywood to stud or batten	50 x 2.8 FH nail	30 mm	150 mm centres to sides, 300 mm centres in middle	
External cover batten	65 x 3.2 RH annular grooved nail	30 mm	300 mm centres in centre of batten	
Plywood sheet: paint finish OVER CAVITY				
Plywood	60 x 2.8 FH nail	30 mm	150 mm centres to sides, 300 mm centres in middle	
Cover batten	60 x 2.8 JH nail	To *cavity battens* only	300 mm centres in centre of batten	
Plywood sheet: stained or bare finish DIRECT FIXED				
Plywood to *stud* or batten	50 x 2.8 FH nail	30 mm	150 mm centres to sides, 300 mm centres in middle	
External cover batten	65 x 3.2 RH annular grooved nail	30 mm	300 mm centres in centre of batten	
LEGEND:				
RH rose head	JH jolt head	FH flat head		

NOTE: Nail lengths are designed for minimum penetration of *framing*. If thickness of the batten or *cladding* or *underlay* is varied, length shall be adjusted accordingly.

Amend 2 Jul 2005

Amend 5 Aug 2011

Amend 2 Jul 2005

Amend 5 Aug 2011

Amend 5 Aug 2011

Table 24: Fixing selection for wall claddings *(continued)*

Joint	Length (mm) x diameter (mm) and type	Minimum framing penetration	Fixing pattern	Requirements
Plywood sheet: stained or bare finish OVER CAVITY				
Plywood	65 x 3.2 FH nail	30 mm	150 mm centres to sides, 300 mm centres in middle	
External cover batten	65 x 3.2 RH annular grooved nail	To *cavity battens* only	300 mm centres in centre of batten	
Fibre cement sheet: jointed DIRECT FIXED				
Sheet	40 x 2.8 fibre cement nail	30 mm	150 mm centres to sides, 300 mm centres in middle	
External cover batten	65 x 3.15 JH nail	30 mm	Single fixing in centre of batten	
Fibre cement sheet: jointed OVER CAVITY				
Sheet	60 x 3.15 fibre cement nail	30 mm	150 mm centres to sides, 300 mm centres in middle	
External cover batten	65 x 3.15 JH nail	To *cavity battens* only	Single fixing in centre of batten	
Fibre cement sheet: flush-finish				
OVER CAVITY	60 x 3.15 fibre cement nail		as above	
EIFS				
40 mm polystyrene sheet OVER CAVITY	90 x 4.0 nail	30 mm	as above and with 40 mm plastic washers on external corner fixings	

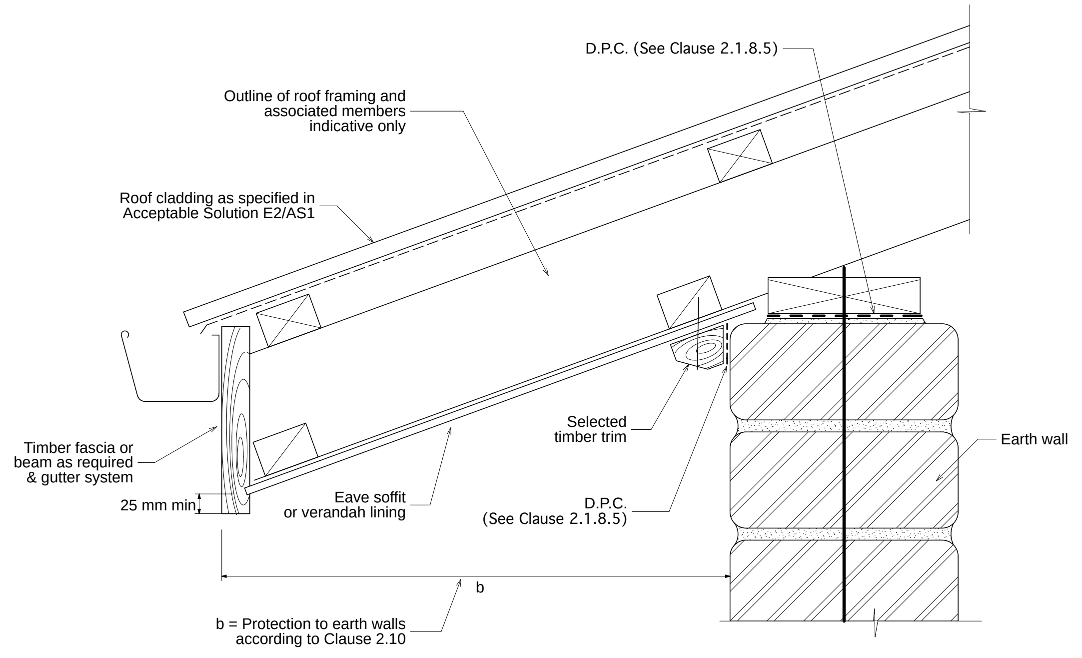
LEGEND:
RH rose head   JH jolt head   FH flat head

NOTE: 1. Galvanised nails shall be hot-dipped galvanised; galvanised screws shall be mechanically zinc plated in accordance with AS 3566 Class 4.

2. Stainless steel nails shall have annular grooves to provide similar withdrawal resistance to hot-dip galvanised nails.

Amend 5 Aug 2011
Amend 2 Jul 2005

Figure 5.11 **Soffit to wall junction**
B) Angled soffit



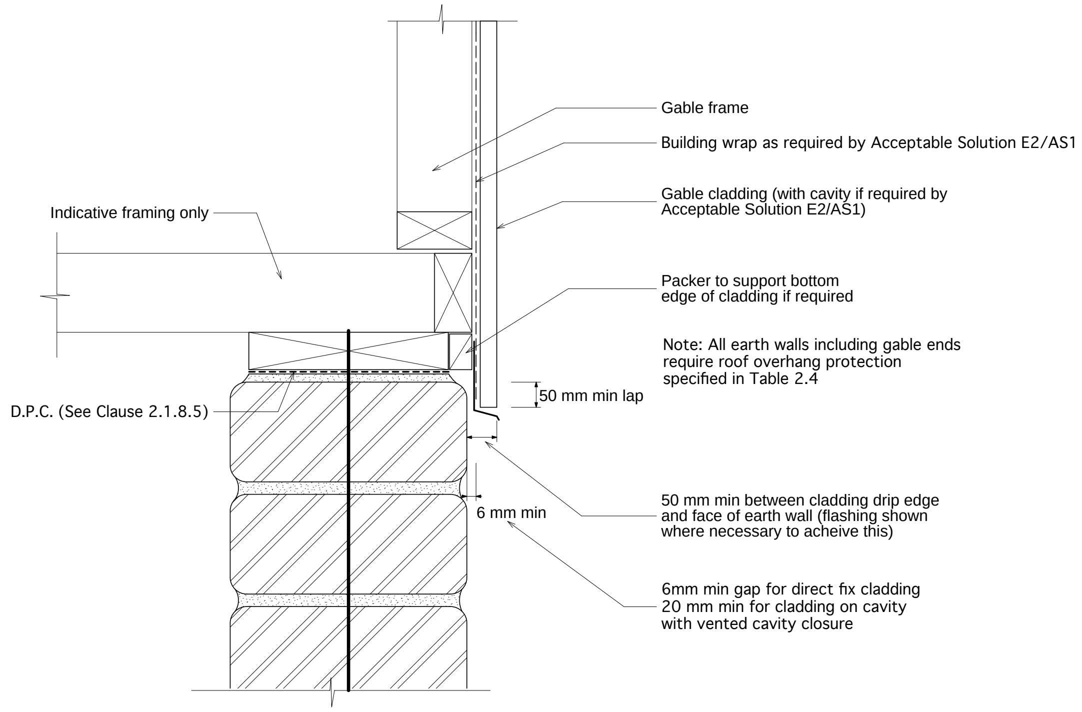
Note:
Roof framing constructed to NZS 3604

Clause 5.13 Add new Clause and Figure:

5.13 Timber-framed gable wall

The junction between timber-framed gable walls and earth walls must be constructed as shown in Figure 5.12.

Figure 5.12 Timber-framed gable to earth wall



Clause 9.2 Add the following new paragraph to end of Clause 9.2:

"Windows and doors with arched or sloping heads are outside the scope of this Standard".

Clause C9.2 Add the following new paragraph to end of commentary Clause C9.2:

Amend 5 Aug 2011

COMMENT:

Requirements for window and door joinery are not included in this Acceptable Solution. For more information, designers may refer to:

- NZS 3504: 1979 *Specification for aluminium windows*
- NZS 3610: 1979 *Specification for profiles of mouldings and joinery*
- NZS 3619: 1979 *Specification for timber windows.*

Figure 9.2 Replace Figure 9.2 with:

Figure 9.2 Head details
A) Timber joinery with timber-framed wall insert

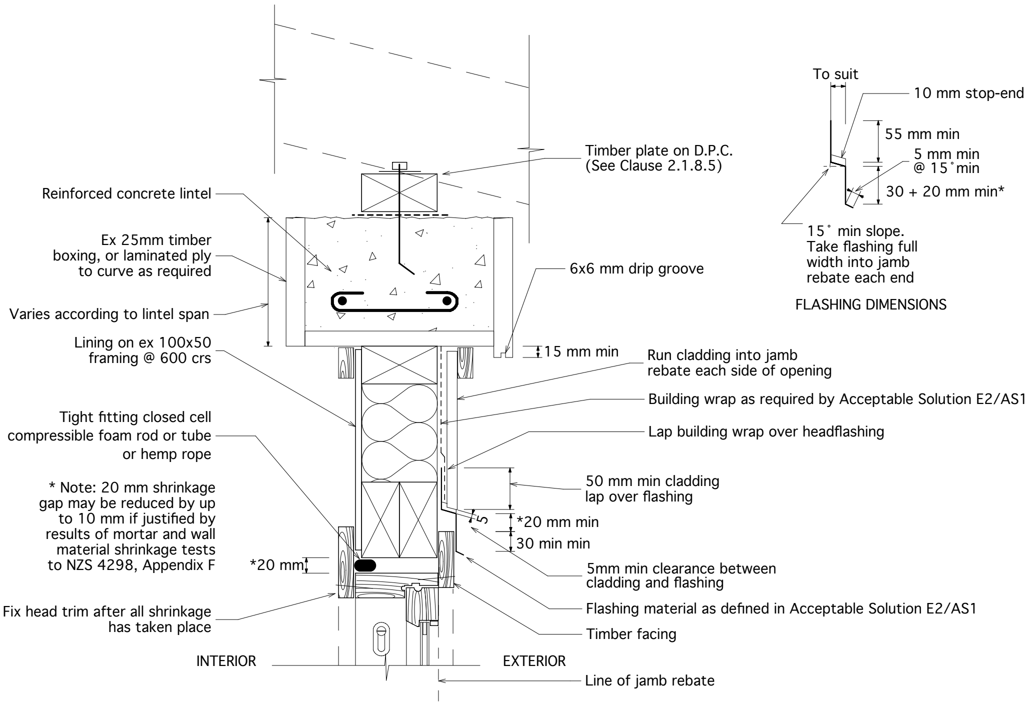


Figure 9.2 Head details
B) Aluminium joinery with timber-framed wall insert

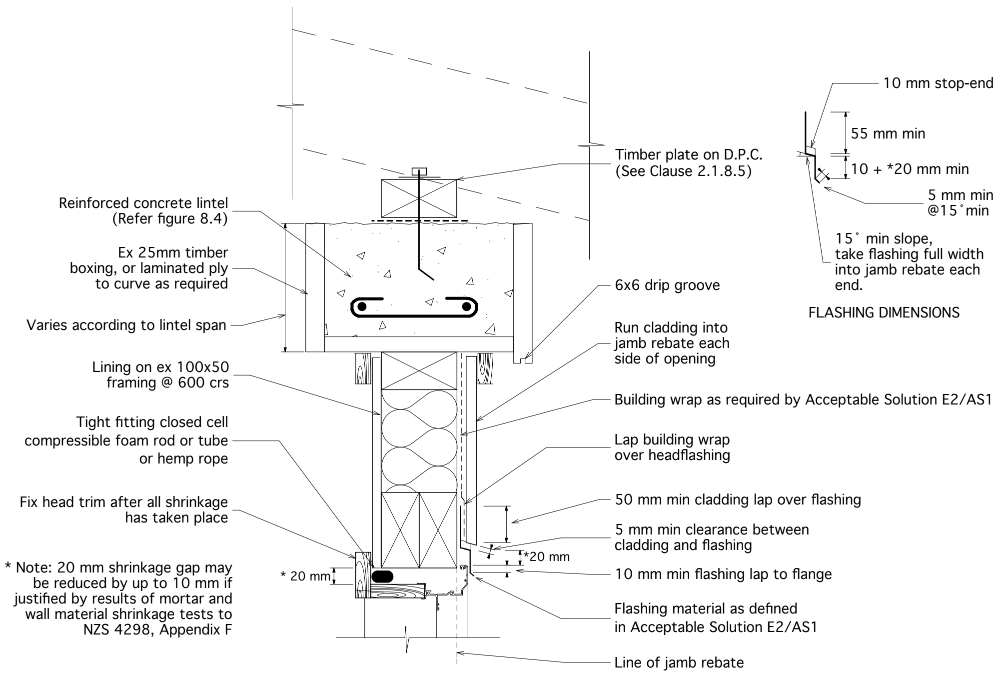


Figure 9.2 **Head details**
C) Timber joinery with timber lintel

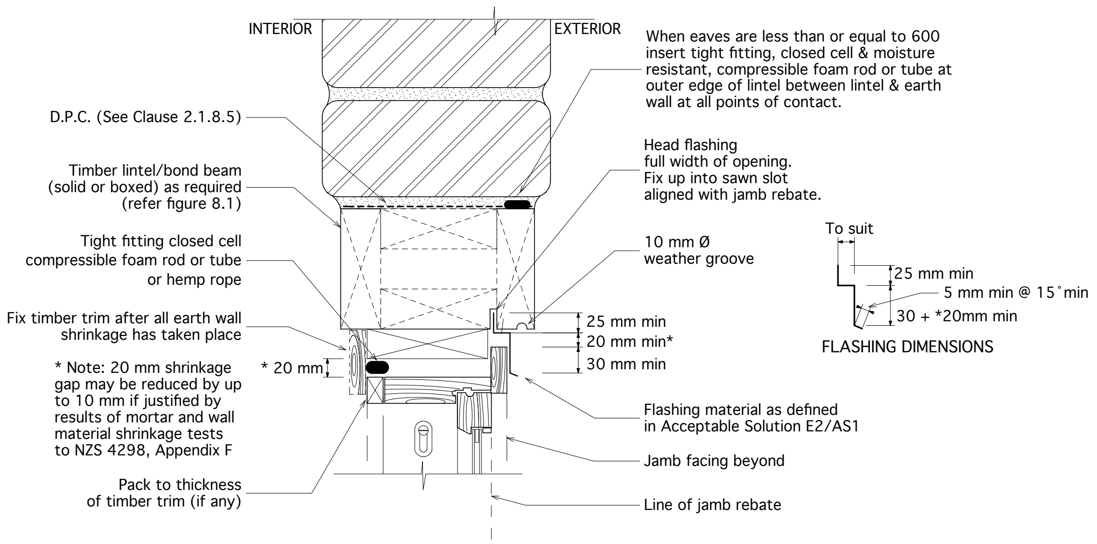


Figure 9.2 **Head details**
D) Aluminium joinery with timber lintel

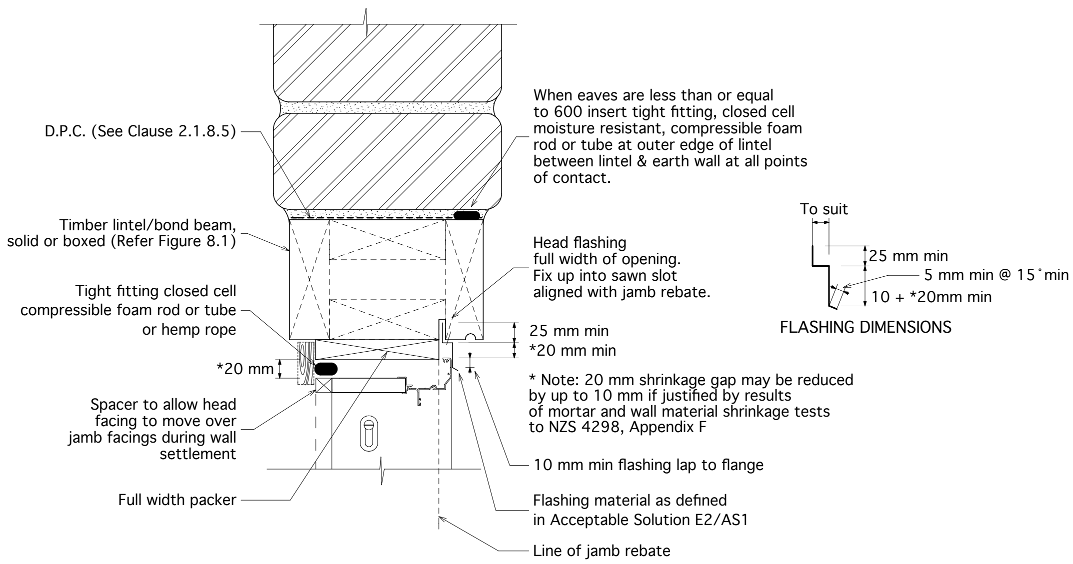


Figure 9.3 Replace Figure 9.3 with:

Figure 9.3 Jamb details
A) Timber joinery

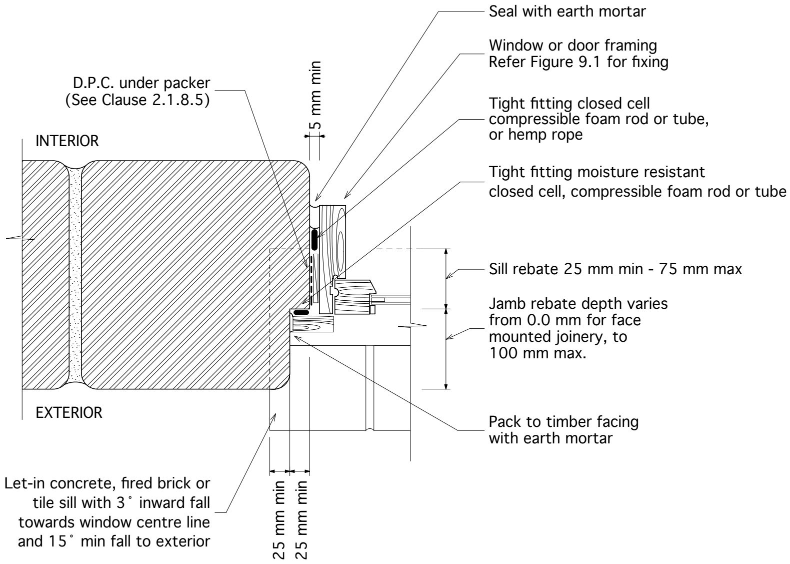


Figure 9.3 Jamb details
B) Aluminium joinery

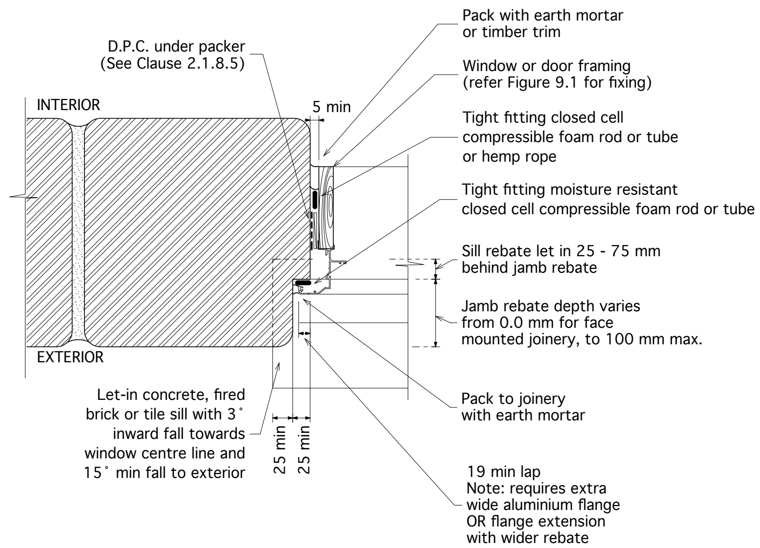


Figure 9.4 Replace Figure 9.4 with:

Figure 9.4 Sill details
A) Timber joinery with brick or tile sill

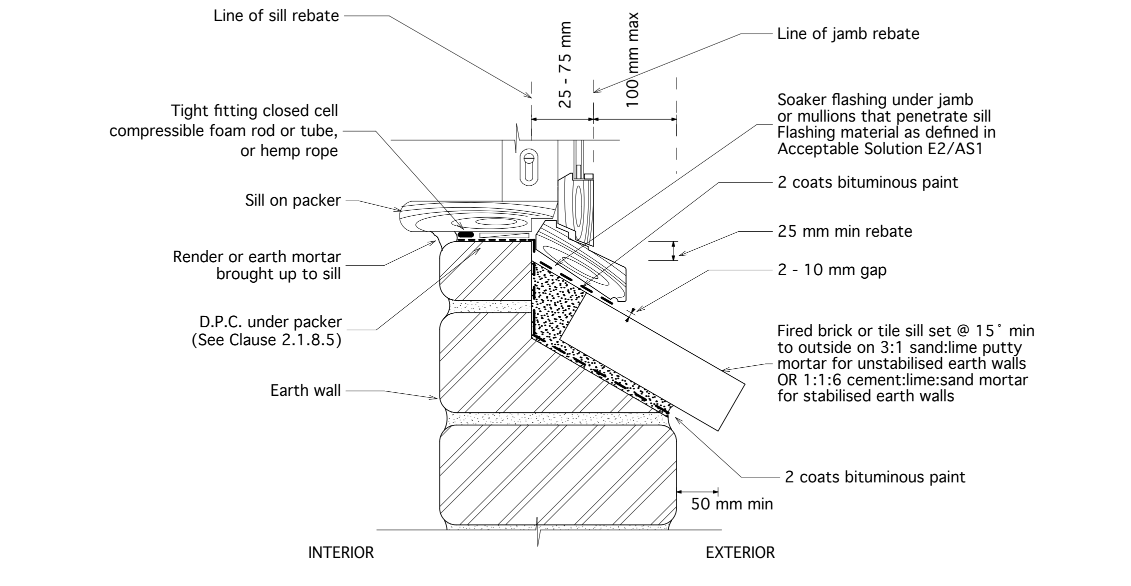


Figure 9.4 Sill details
B) Aluminium joinery with brick or tile sill

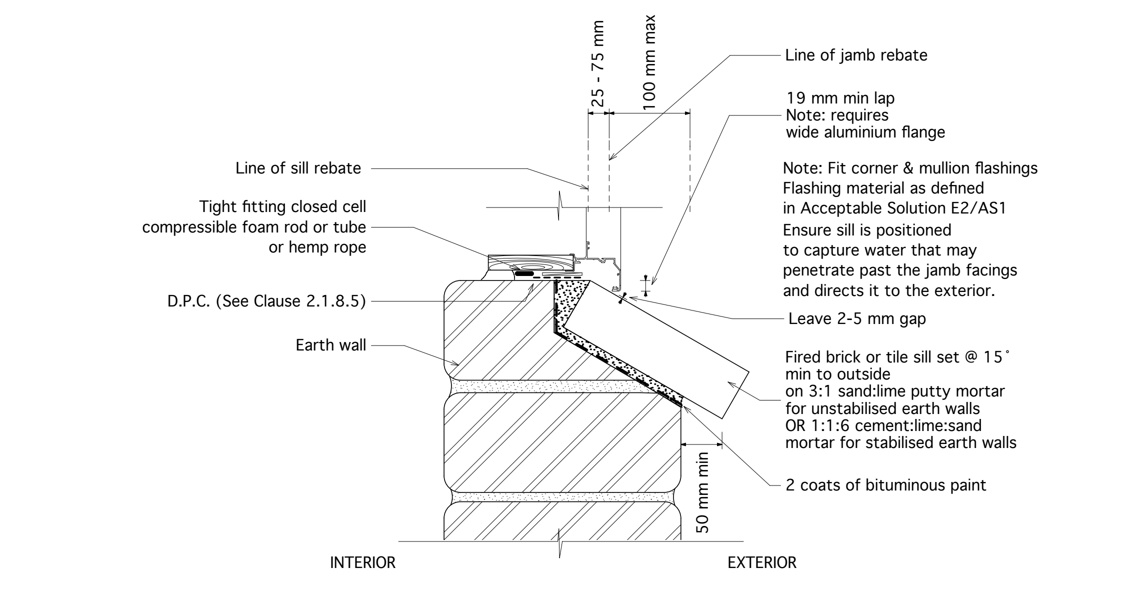


Figure 9.4 **Sill details**
C) Timber joinery with concrete sill

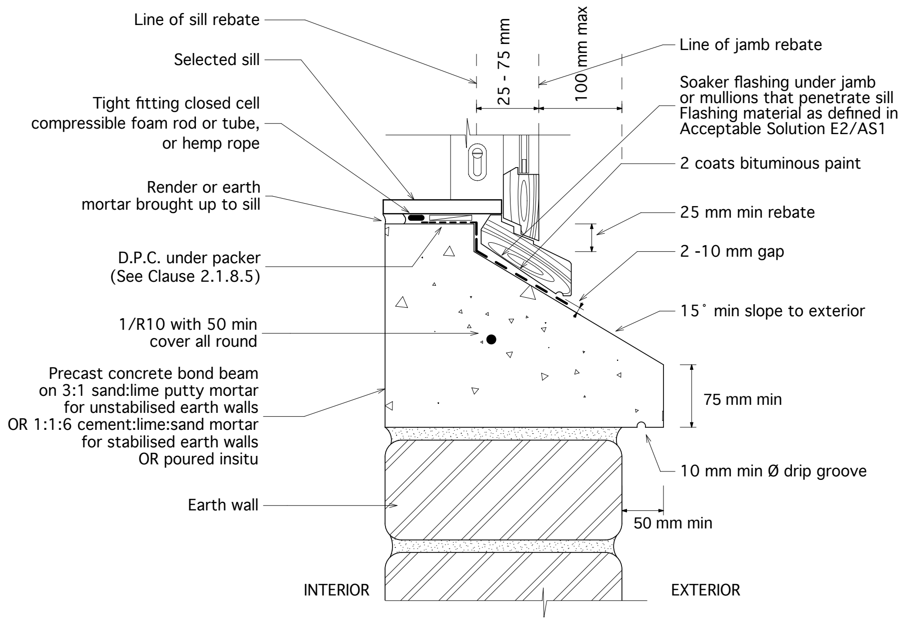
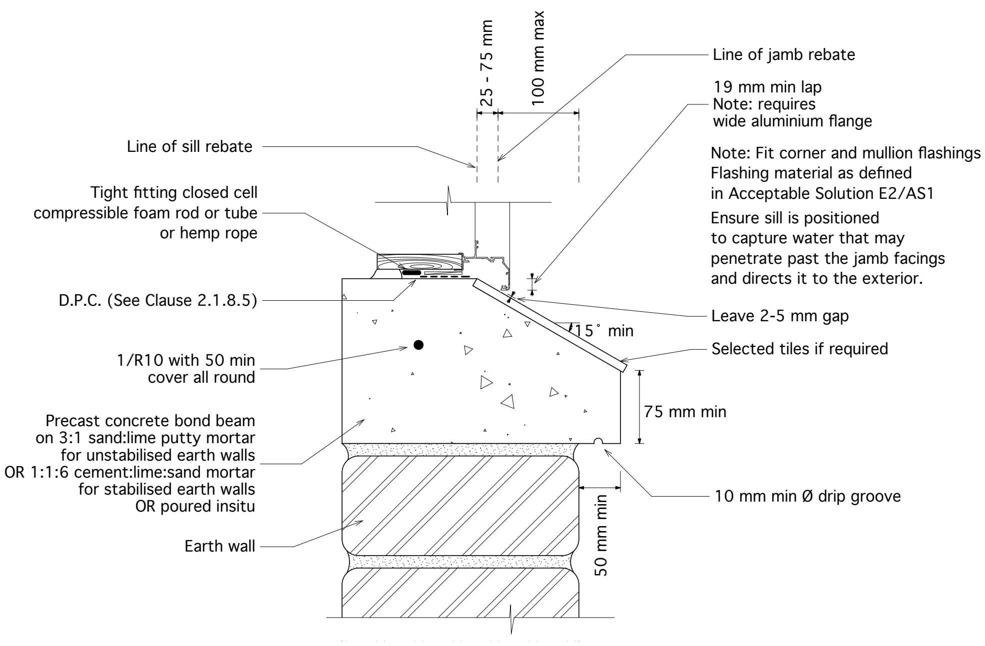


Figure 9.4 **Sill details**
D) Aluminium joinery with concrete sill



Clause 9.7 Add new Clause:

9.7 Penetrations

9.7.1
The upper surface of elements (e.g. pipes and meterboxes) that penetrate external walls must be sloped downwards to the exterior to direct moisture away from the wall and to discharge it clear of the wall surface.

Amend 5 Aug 2011

COMMENT:

C9.7.1
Penetrations should be located where they are sheltered from wind-driven rain – this may be achieved by positioning the penetration in a sheltered location or as high as practical under eaves on the wall.

9.7.2
Penetrations less than 200mm wide must meet the requirements of NZS 4298 Clause 2.1.12 and must be sealed all round with a tight-fitting moisture resistant compressible closed cell foam rod or tube that is finished 25 mm behind the wall surface, with the resulting gap filled with:

i) for unstabilised earth construction, a compatible unstabilised mortar

ii) for stabilised earth construction, a compatible stabilised mortar.

Amend 5 Aug 2011

COMMENT:

C9.7.2
Generally sealants do not adhere well to earthen surfaces with the possible exception of dense stabilised rammed earth or pressed earth brick.

9.7.3
Penetrations more than 200mm wide (e.g. meterboxes) must be anchored as required in Clause 9.1 and must meet the following requirements:

a) Where the depth of the penetration is more than 1/3 of the wall depth, the penetration must incorporate head, jamb and sill details similar to those required for windows.

b) Where the depth of the penetration is less than 1/3 of the wall depth, the penetration must be sealed all round with a compatible mortar as required by Clause 9.7.2.

Acceptable Solution E2/AS3

1.0 Concrete and Concrete Masonry Buildings

Errata 2 Dec 2011 Amend 5 Aug 2011

Concrete and concrete masonry construction with the scope of CCANZ CP 01, and that complies with CCANZ CP 01,will meet the performance criteria of *NZBC* E2.

Index E2/VM1 & AS1/AS2/AS3

Pages 193–204 INDEX deleted by Amendment 5

Acceptable Solution

E2 External Moisture

First Edition – effective 28 November 2019

Light steel framing weathertight solution for buildings up to 3 storeys or of 10m or less in height with a floor area not exceeding 300m².

E2/AS4 is a means of demonstrating the building envelope in a light steel framed construction will prevent the penetration of water to the extent required by clause E2 of the Building Code. Refer to supporting information for limitations.

SUPPORTING INFORMATION

Effective use

National Association of Steel Framed Housing (NASH) applies to buildings of certain height, forms of construction and structural behaviour. It also set by the NASH Standard Part 2. Building Consent Authorities should accept building consent applications from designers who can demonstrate that the particular building falls within those limitations.

Other Building Code clauses may be relevant including but not limited to:

- B1 Structure (for the cladding system as well as the building's primary structure)
- B2 Durability
- C1 – C6 Protection from fire
- E3 Internal moisture
- F2 Hazardous building materials
- G6 Airborne and impact sound
- H1 Energy efficiency.

Building Consent Authorities should accept building consent applications from designers who can demonstrate that the requirements of all relevant NZBC clauses have been integrated into the design proposal for an enclosure solution.

Construction quality assurance	E2/AS4 does not advise quality assurance or inspection procedures to be followed during construction. As with other building work, an applicant is to propose appropriate inspection procedures for the Building Consent Authorities to approve when issuing a building consent for an enclosure solution whose compliance is based on E2/AS4.

REFERENCES

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in this Acceptable Solution must be the editions, along with their specific amendments, listed below.

Publisher and document name/number	
National Association of Steel Framed Housing (NASH)	NASH Building envelope solution
National Association of Steel Framed Housing (NASH)	NASH Standard Part 2 Comments throughout the NASH document are for guidance purposes only and do not form part of the Acceptable Solution

CONTACT DETAILS PO Box 1473, Wellington 6140 | T 0800 242 243 | E info@building.govt.nz

BUILDING PERFORMANCE

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

New Zealand Government

Preface

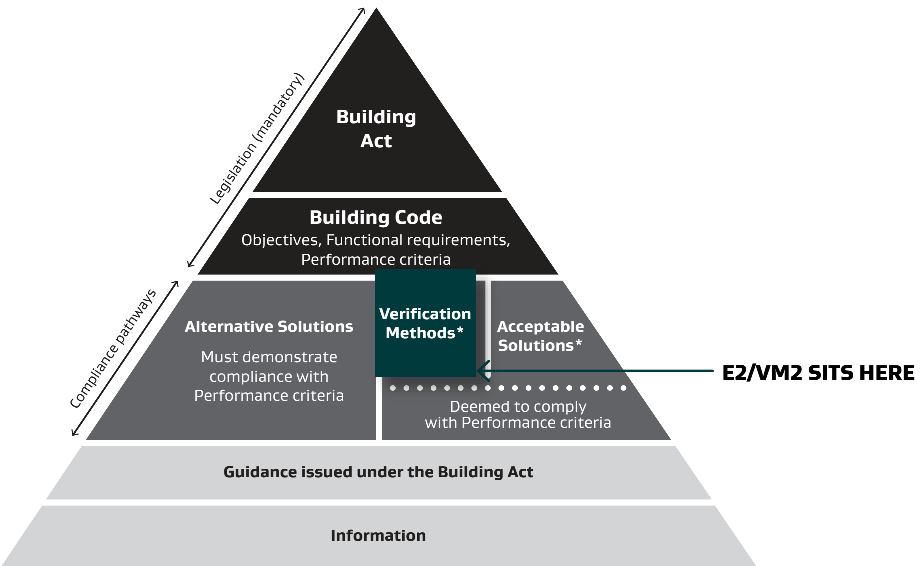
Document status

This document (E2/VM2) is a verification method issued under section 22 (1) of the Building Act 2004 and is effective on 29 November 2021. It does not apply to building consent applications submitted before 29 November 2021. The previous Verification Method E2/VM2 First Edition can be used to show compliance until 2 November 2022 and can be used for building consent applications submitted before 3 November 2022.

Building Code regulatory system

Each verification method outlines the provisions of the Building Code that it relates to. Complying with an acceptable solution or verification method is a way of complying with that part of the Building Code. Other options for establishing compliance are listed in section 19 of the Building Act.

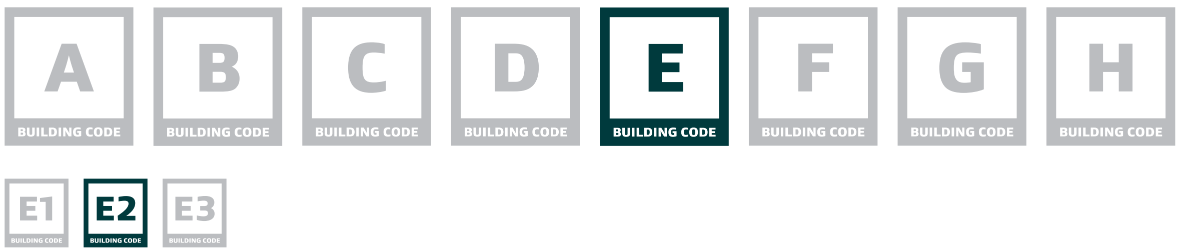
Schematic of the Building Code System



** may include cited standards and information*

A building design must take into account all parts of the Building Code. The Building Code is located in Schedule 1 of the Building Regulations 1992 and available online at www.legislation.govt.nz

The part of the Building Code that this verification method relates to is clause E Moisture and specifically E2 External moisture. Further information on the scope of this document is provided in Part 1. General.



Further information about the Building Code, the objectives, functional requirements and performance criteria provisions that it contains, and other acceptable solutions and verification methods are available at www.building.govt.nz

Main changes in this version

This is the second edition of E2/VM2. The main changes from the previous version are:

- The document layout has been revised to improve clarity with additional information on the document and its scope provided in Part 1. General.
- Reference to the BRANZ EM7 test method for evaluating cladding performance has been amended to the most recent version of the document (version 3) in Appendix A.
- The new edition allows cladding systems that have already demonstrated compliance under the previous edition to be used without retesting as stated in Part 2. Cladding systems.

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.building.govt.nz

Features of this document

- For the purposes of Building Code compliance, the standards and documents referenced in this verification method must be the editions, along with their specific amendments listed in Appendix A.
- Words in *italic* are defined at the end of this document in Appendix B.
- Hyperlinks are provided to cross-references within this document and to external websites and appear with a blue underline.
- Appendices to this verification method are part of, and have equal status to, the verification method. Text boxes headed 'COMMENT' occur throughout this document and are for guidance purposes only.

Contents

Part 1. General

1.1 Introduction

1.1.1 Scope of this document

1.1.1.1 E2/VM2 is a means of testing and demonstrating that a wall *cladding system* will prevent the penetration of water to the extent required by clause E2.3.2 of the Building Code.

1.1.1.2 E2/VM2 applies to buildings that fit within the scope of BRANZ EM7.

COMMENT: BRANZ EM7 applies to buildings of certain height, forms of construction and structural behaviour. It also has limitations on Inter-storey deflections and peak positive wind pressures on the *cladding system*. Building consent authorities should accept building consent applications from designers who can demonstrate that the building in the application falls within those limitations. BRANZ EM7 does not have any limits on the negative pressure on the *cladding system.*

1.1.2 Items outside the scope of this document

1.1.2.1 E2/VM2 does not demonstrate the water penetration resistance of window and exterior door units used with the wall *cladding system*.

COMMENT: E2/VM2 assesses the junctions of window and exterior door units with other elements of the *cladding system*, but not the units themselves. Instead it relies on the units having been manufactured to resist water penetration when subject to the relevant design parameters for the building.

Although there is currently no verification method or acceptable solution for the window and exterior door units for mid-rise buildings, window suppliers may be able to demonstrate, through testing, water penetration resistance of the windows when subject to:

› Peak positive and peak negative wind pressures acting on the window or exterior door unit (typically calculated in accordance with AS/NZS 1170.2 including all local pressure factors and internal pressures relevant to the location of the window on the building); and
› The maximum in-plane horizontal movement to which the window or exterior door could be subject.

1.1.2.2 E2/VM2 does not advise quality assurance or inspection procedures to be followed during construction.

COMMENT: As with other building work, a building consent authority should approve appropriate inspection procedures when issuing a building consent for *cladding systems* whose compliance is based on E2/VM2.

1.1.3 Compliance pathway

1.1.3.1 This verification method is one option that provides a means of establishing compliance with Building Code clause E2.3.2.

> COMMENT: Building Code clause E2.3.2 is reproduced below:
>
> E2.3.2 Roofs and exterior walls must prevent the penetration of water that could cause undue dampness, damage to building elements, or both.

1.1.3.2 Options for demonstrating compliance with the performance criteria of Building Code clause E2 External Moisture through the acceptable solutions and verification methods are summarised in Table 1.1.3.2. Compliance may also be demonstrated using an alternative solution.

> COMMENT: In addition to demonstrating that the requirements of this Verification Method are met, its users will need to identify how the building work addresses the following requirements of clause E2:
>
> - Requirements for roof *cladding systems,* including requirements for shedding water (E2.3.1) and water penetration (E2.3.2).
> - Requirements to address moisture absorbed or transmitted due to ground contact or proximity (E2.3.3).
> - Requirements to address the effects of moisture in subfloor spaces (E2.3.4).
> - Requirements to prevent moisture problems in concealed spaces (E2.3.5).
> - Requirements to address construction moisture (E2.3.6).
> - Requirements to make due allowances for consequences, uncertainties and variations (E2.3.7).

> COMMENT: Other Building Code clauses may be relevant to the cladding system in addition to clause E2, including clauses:
>
> - B1 Structure (for the *cladding system* as well as the building's primary structure)
> - B2 Durability
> - C1 – C6 Protection from fire
> - E3 Internal moisture
> - F2 Hazardous building materials
> - G6 Airborne and impact sound
> - H1 Energy efficiency
>
> Technical information provided by the suppliers of wall *cladding systems* should include information that explains how compliance can be achieved.
>
> Building Consent Authorities should accept building consent applications from designers who can demonstrate that the requirements of all relevant Building Code clauses have been integrated into the design proposal for a *cladding system.*

TABLE 1.1.3.2: Demonstrating compliance with E2 External Moisture through acceptable solutions and verification methods
Paragraph 1.1.3.2

Performance clause	Applies to	Relevant acceptable solutions and verification methods
E2.3.1 Shedding water	All roofs, except for buildings where external moisture is unlikely to cause significant impairment	For timber framed buildings up to 3 storeys, within specific limitations: E2/AS1. For single- and two-storey concrete roofs and decks with membranes, within specific limitations: E2/AS3. For light steel framed buildings up to 3 storeys, within specific limitations: E2/AS4.
E2.3.2 Penetration of water	All roofs and exterior walls, except for buildings where external moisture is unlikely to cause significant impairment	For wall *cladding systems* of timber framed buildings up to 3 storeys, within specific limitations: E2/VM1 Paragraph 1.0. For pitched roofing systems above a roof space, within specific limitations: E2/VM1 Paragraph 2.0. For wall *cladding systems* of buildings up to 25 m in height, within specific limitations: E2/VM2. For timber framed buildings up to 3 storeys, within specific limitations: E2/AS1. For earth building within specific limitations: E2/AS2. For single- and two-storey concrete and concrete masonry construction within specific limitations: E2/AS3. For light steel framed buildings up to 3 storeys, within specific limitations: E2/AS4.
E2.3.3 Ground contact or proximity	All walls, floors and structural elements in ground contact or proximity, except for buildings where external moisture is unlikely to cause significant impairment	For timber framed buildings up to 3 storeys, within specific limitations: E2/AS1. For earth building within specific limitations: E2/AS2. For single- and two-storey concrete and concrete masonry construction within specific limitations: E2/AS3. For light steel framed buildings up to 3 storeys, within specific limitations: E2/AS4.
E2.3.4 Suspended floors	All building elements susceptible to damage, except for buildings where external moisture is unlikely to cause significant impairment	For timber framed buildings up to 3 storeys, within specific limitations: E2/AS1. For earth building within specific limitations: E2/AS2. For single- and two-storey concrete and concrete masonry construction within specific limitations: E2/AS3. For light steel framed buildings up to 3 storeys, within specific limitations: E2/AS4.

General

Performance clause	Applies to	Relevant acceptable solutions and verification methods
E2.3.5 Concealed spaces and cavities	Building elements associated with concealed elements and cavities, except for buildings where external moisture is unlikely to cause significant impairment	For timber framed buildings up to 3 storeys, within specific limitations: E2/AS1. For earth building within specific limitations: E2/AS2. For single- and two-storey concrete and concrete masonry construction within specific limitations: E2/AS3. For light steel framed buildings up to 3 storeys, within specific limitations: E2/AS4.
E2.3.6 Construction moisture	All building elements, except for buildings where external moisture is unlikely to cause significant impairment	For timber framed buildings up to 3 storeys, within specific limitations: E2/AS1. For earth building within specific limitations: E2/AS2. For single- and two-storey concrete and concrete masonry construction within specific limitations: E2/AS3. For light steel framed buildings up to 3 storeys, within specific limitations: E2/AS4.
E2.3.7 Due allowances	All building elements. except for buildings where external moisture is unlikely to cause significant impairment	For timber framed buildings up to 3 storeys, within specific limitations: E2/AS1. For earth building within specific limitations: E2/AS2. For single- and two-storey concrete and concrete masonry construction within specific limitations: E2/AS3. For light steel framed buildings up to 3 storeys, within specific limitations: E2/AS4.

Part 2. Cladding systems

2.1 Test specifications

2.1.1 Demonstrating compliance

2.1.1.1 BRANZ EM7 is a means of demonstrating that a wall *cladding system* meets the performance requirements of Building Code clause E2.3.2.

> COMMENT: BRANZ EM7 prescribes a series of tests from AS/NZS 4284 with specific nominated values for the performance levels.

2.1.1.2 E2/VM2 testing must be carried out by a facility that has IANZ or equivalent accreditation for AS/NZS 4284 testing procedures.

2.1.2 Existing verification certificates

2.1.2.1 Wall *cladding systems* that meet the requirements of the previous version of E2/VM2, and for which the test certificate was issued during the period in which that version of E2/VM2 was in force, meet the performance requirements of Building Code clause E2.3.2.

2.1.2.2 Any verification certificates issued under E2/VM2 after 2 November 2022 must be under E2/VM2 Second Edition.

> COMMENT: Retesting is not required for wall *cladding systems* which have already passed testing in accordance with the previous version of E2/VM2.

Appendix A. References

For the purposes of Building Code compliance, the standards and documents referenced in this verification method must be the editions, along with their specific amendments, listed below.

Standards New Zealand		**Where quoted**
AS/NZS 4284: 2008	Testing of building facades	2.1.1.2

This standard can be accessed from www.standards.govt.nz

BRANZ		
BRANZ EM7 [version 3, June 2020]	Evaluation Method 7 – Performance of mid-rise cladding systems	1.1.1.2, 2.1.1.1

This document can be accessed from www.branz.co.nz

Appendix B. Definitions

Cladding	The exterior weather-resistant surface of a building. It includes any supporting substrate and, if applicable, surface treatment.
Cladding system	The outside or exterior weather-resistant surface of a building; including roof *cladding* and roof underlays, wall *cladding* and wall underlays, and cavity components, rooflights, windows, doors and all penetrations, flashings, seals, joints and junctions. This verification method requires the *cladding system* to include a drained cavity.

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 7), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 5 November 2020 and supersedes all previous versions of this document.

The previous version of this document (Amendment 6) will cease to have effect on 3 November 2021.

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.building.govt.nz

E3: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	September 1993	p. 7, 3.1.2	
Second edition	28 February 1998	Document revised – second edition issued	
Amendment 2	1 July 2001	p. 2, Document History, Status p. 9, Definitions	p. 14, 2.2.1
Amendment 3	14 October 2004	pp. 3 and 4 Code Clause	
Amendment 4	Effective from 10 October 2011 until 14 August 2014	p. 2, Document History, Status p. 7, References	p. 9, Definitions p. 13, E3/AS1 1.1.2
Amendment 5	14 February 2014 until 30 May 2017	p. 2A, Document History, Status p. 7, References	p. 9, Definitions p. 13, E3/AS1 1.1.4
Amendment 6	Effective from 1 January 2017 until 3 November 2021	p. 13 1.1.4	
Amendment 7	Effective from 5 November 2020	p. 5 Contents p. 7 References p. 10 Definitions	pp. 14–21 E3/AS12.0, 3.0, Figure 6 p. 22 Index
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

New Zealand Building Code Clause E3 Internal Moisture

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE–*continued*

Clause E3–INTERNAL MOISTURE

Provisions	Limits on application
OBJECTIVE	
E3.1 The objective of this provision is to– (Amend 3 Oct 2004)	
(a) Safeguard people against illness, injury, or loss of *amenity* that could result from the accumulation of internal moisture; and (Amend 3 Oct 2004)	
(b) Protect household units and other property from damage caused by free water from another household unit in the same building. (Amend 3 Oct 2004)	
FUNCTIONAL REQUIREMENT	
E3.2 *Buildings* must be constructed to avoid the likelihood of– (Amend 3 Oct 2004)	
(a) Fungal growth or the accumulation of *contaminants* on linings and other *building elements*; and	
(b) Free water overflow penetrating to an adjoining *household unit*; and	
(c) Damage to *building elements* being caused by the presence of moisture. (Amend 3 Oct 2004)	
PERFORMANCE	
E3.3.1 An *adequate* combination of *thermal resistance*, ventilation, and space temperature must be provided to all *habitable spaces*, bathrooms, laundries, and other spaces where moisture may be generated or may accumulate.	Performance E3.3.1 does not apply to *Communal Non-residential, Commercial, Industrial, Outbuildings* or *Ancillary buildings.* (Amend 3 Oct 2004)
E3.3.2 Freewater from accidental overflow from *sanitary fixtures* or *sanitary appliances* must be disposed of in a way that avoids loss of *amenity* or damage to *household units* or *other property*.	
E3.3.3 Floor surfaces of any space containing *sanitary fixtures* or *sanitary appliances* must be *impervious* and easily cleaned. (Amend 3 Oct 2004)	

FIRST SCHEDULE–*continued*

Provisions	Limits on application
E3.3.4 Wall surfaces adjacent to *sanitary fixtures* or *sanitary appliances* must be *impervious* and easily cleaned.	
E3.3.5 Surfaces of *building elements* likely to be splashed or become contaminated in the course of the *intended use* of the *building*, must be *impervious* and easily cleaned.	
E3.3.6 Surfaces of *building elements* likely to be splashed must be constructed in a way that prevents water splash from penetrating behind linings or into *concealed spaces*.	

Amend 3
Oct 2004

Contents

Amend 7 Nov 2020

References

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 5 Feb 2014

Amend 4 Oct 2011

Amend 5 Feb 2014

		Where quoted
Standards New Zealand		
NZS 4214: 2006	Methods of determining the total thermal resistance of parts of buildings	AS1 Definitions, 1.1.2
British Standards Institution		
BS EN 274:- Part 2: 2002	Waste fittings for sanitary appliances Test methods	AS1 2.0.2
Building Research Association of New Zealand		
BRANZ House Insulation Guide: 1995		AS1 1.1.3

Amend 4 Oct 2011

Amend 7 Nov 2020

Definitions

Amend 4 Oct 2011

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 5 Feb 2014

Adequate *Adequate* to achieve the objectives of the *building code*.

Amend 4 Oct 2011

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

Building element Any structural and non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.

Concealed space Any part of the space within a *building* that cannot be seen from an *occupied space*.

COMMENT:
This term includes any ceiling space, roof space, space under a raised floor (such as computer rooms, floors, or stages), plenums, spaces under a tiered floor, "left-over spaces" created when some structural element or the like has been covered in; small service or duct spaces within the volume of a *firecell* and the like, but not a protected shaft.

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

Fixture An article intended to remain permanently attached to and form part of a *building*.

Amend 2 July 2001

Floor waste An outlet located at the low point of a graded floor or in a level floor designed to receive accidental or intentional discharges.

Habitable space A space used for activities normally associated with domestic living, but excludes any bathroom, laundry, water-closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods.

Household unit

a) means any *building* or group of *buildings*, or part of a *building* or group of *buildings*, that is:

   i) used, or intended to be used, only or mainly for residential purposes; and

   ii) occupied, or intended to be occupied, exclusively as the home or residence of not more than one household; but

b) does not include a hostel, boarding house or other specialised accommodation.

Amend 4 Oct 2011

Impervious That which does not allow the passage of moisture.

Insulating material A material that has a thermal conductivity of less than 0.07 W/mK.

Intended use in relation to a *building*,—

(a) includes any or all of the following:

   (i) any reasonably foreseeable occasional use that is not incompatible with the *intended use*:

   (ii) normal maintenance:

   (iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but

(b) does not include any other maintenance and repairs or rebuilding.

Person with a disability means a *person* who has an impairment or a combination of impairments that limits the extent to which the *person* can engage in the activities, pursuits, and processes of everyday life, including, without limitation, any of the following:

Amend 2 Jul 2001

(a) a physical, sensory, neurological, or intellectual impairment:

(b) a mental illness.

Amend 4 Oct 2011

Plumbing system Pipes, joints and fittings laid above ground and used for the conveyance of *foul water* to the *foul water* drain, and includes vent pipes.

R-value The common abbreviation for describing the values of both *thermal resistance* and *total thermal resistance*.

Amend 7 Nov 2020

Sanitary appliance An appliance which is intended to be used for *sanitation*, but which is not a *sanitary fixture*. Included are machines for washing dishes and clothes

Sanitary fixture Any *fixture* which is intended to be used for *sanitation*.

Amend 7 Nov 2020

COMMENT:
Toilets, urinals, bidets, baths, showers, basins, sinks and tubs are examples of common *sanitary fixtures*.

Sanitation The term used to describe the activities of washing and/or excretion carried out in a manner or condition such that the effect on health is minimised, with regard to dirt and infection.

Thermal resistance The resistance to heat flow of a given component of a *building element*. It is equal to the temperature difference (°C) needed to produce unit heat flux (W/m^2) through unit area (m^2) under steady conditions. The units are $°Cm^2/W$.

Total thermal resistance The overall air-to-air *thermal resistance* across all components of a *building element* such as a wall, roof or floor. (This includes the surface resistances which may vary with environmental changes, e.g. temperature and humidity, but for most purposes can be regarded as having standard values as given in NZS 4214.)

Verification Method E3/VM1

No specific methods have been adopted for verifying compliance with the Performance of NZBC E3.

Acceptable Solution E3/AS1

1.0 Prevention of Fungal Growth

1.0.1 Fungal growth (mildew) is avoided by minimising internal condensation. Condensation is avoided or reduced by maintaining the correct balance between interior temperature and ventilation. Insulation assists in maintaining interior temperatures at a suitable level.

1.0.2 The New Zealand Building Code does not specify minimum heating requirements except for old people's homes and early childhood centres. Occupants will determine their own methods and levels of heating. Typically it is necessary and sufficient, for condensation control in winter, to keep interior temperatures 5°C to 7°C above exterior temperatures in a ventilated space.

1.1 Thermal resistance

1.1.1 *R-values* for walls, roofs and ceilings shall be no less than:

a) For light timber frame wall or other framed wall *constructions* with cavities, 1.5.

b) For single skin normal weight masonry based wall *construction* without a cavity, 0.6.

c) For solid timber wall systems no less than 60 mm thick, 0.6.

d) For roof or ceilings of any *construction*, 1.5.

1.1.2 *R-values* shall be determined using the methods in NZS 4214. Laboratory test samples shall be truly representative of the wall, roof or ceiling system, including any provision for reducing thermal bridging. Amend 4 Oct 2011

1.1.3 Materials and installation

The BRANZ House Insulation Guide provides examples of acceptable wall, roof and ceiling *constructions* to satisfy the requirements of Paragraph 1.1.1.

COMMENT:
The BRANZ House Insulation Guide gives *constructions* for a range of *R-values*. It is essential to choose the correct *R-values* from these shown in the tables in order to comply with this Acceptable Solution.

1.1.4 For the *construction* to be acceptable:

a) Building paper shall extend from the upper side of the top plate to the underside of the bearers or wall plates supporting the ground floor joists.

b) Deleted Amend 5 Feb 2014

c) There shall be no perimeter gaps between the *insulating material* and the framing members.

d) Where steel framing is used in Housing and Communical Residential building uses a thermal break with a minimum *R-value* of 0.25 m²°C/W shall be provided at the outside face of each steel framing member. Expanded polystyrene (EPS) strips, 10 mm thick provide an *R-value* of 0.25 m²°C/W. Other materials or methods may be used to provide the minimum *R-value* of 0.25 m²°C/W. Amend 5 Feb 2014

e) If foil insulation is used it must be placed on the lining side of studs, not the cladding side.

COMMENT:

1. Frame *construction* with 10 mm plaster board linings and a single layer of foil has an *R-value* of approximately 0.9 and does not satisfy Paragraph 1.1.1. Amend 5 Feb 2014
2. Surface condensation can be a problem where vapour barriers are needed for *buildings* enclosing very warm or wet areas such as spa pools, saunas and swimming pools, or *buildings* in a very cold environment such as ski lodges and mountain huts. These situations are not covered by this Acceptable Solution and require specific design.
3. Thermal breaks should be specifically designed for steel framed *buildings* that are not covered by Building Code Clause E3 Internal Moisture. That is where:
   i) the *building* use is not *Housing* or *Communal Residential*, and Amend 6 Jan 2017
   ii) the moisture load is greater than in Housing, and the building use has high occupant moisture load (eg, schools), and
   iii) there is a temperature differential from inside to outside that is sufficient to cause condensation on steel framing members. Amend 5 Feb 2014

1.1.5 Insulation for energy efficiency

Insulation satisfying the energy efficiency requirements of NZBC H1 cannot automatically be assumed to meet the *R-values* for internal moisture requirements of Paragraph 1.1.1.

COMMENT:
Insulation to prevent condensation relates to *thermal resistance* of the *building element* in question (e.g. wall or roof). Insulation for energy efficiency relates to the *building* as a whole, and the requirement can be met in different ways. It is possible, for example, to obtain sufficient energy efficiency in a *building* by heavily insulating the floor and ceiling with no insulation in the walls. This would not satisfy the requirement for this acceptable solution because there would not be sufficient insulation in the walls to minimise condensation.

1.2 Ventilation

1.2.1 Ventilation shall be provided naturally or mechanically to comply with G4/AS1.

1.3 Condensation control

1.3.1 In *buildings* classified as *Housing or Communal residential* which are not air conditioned, metal-framed windows with single glazing shall be *constructed* with a means of condensation disposal. An acceptable method is the provision of a condensation collection channel which, either discharges the water to the outside or is of sufficient capacity to hold the water, without overflowing, until it evaporates.

1.3.2 Condensation channels shall have closed ends and no openings which permit ponded water to contact *building elements* susceptible to moisture. Where provision is made for drainage to the outside, drainage outlets shall have the capacity to expel all condensed water and shall have means of preventing condensed water from being blown back by wind pressure.

1.3.3 Condensation channels and drainage outlets shall be able to be cleaned. The minimum clear dimensions of collection channels shall be 10 mm wide by 5 mm deep.

COMMENT:
1. Condensation can be reduced by good ventilation. Windows incorporating passive ventilators, particularly those with full perimeter ventilation, are effective in reducing condensation.
2. While a 10 mm condensation channel width is normally adequate to prevent overflowing, it is awkward to clean adequately. A more practical width is 20 mm.

2.0 Overflow

2.0.1 If a *sanitary fixture* is located where accidental overflow could damage an adjoining *household unit* or *other property*, then either:

a) Containment and *floor wastes* that meet the requirements of Paragraphs 2.1.1 and 2.2.1 shall be provided, or

b) The exemption for household kitchen sinks and laundry tubs with integrated overflows that meet Paragraph 2.0.2 shall apply.

2.0.2 Household kitchen sinks and laundry tubs that have an integrated overflow with a minimum flow rate of 0.25 l/s do not require additional overflow provision such as containment and a *floor waste* where:

a) The maximum flow rate from the inlet tap(s) is less than the flow rate of the integrated overflow for that sink or tub, or

b) The water supplies to the inlet tap(s) for that sink or tub are fitted with proprietary flow restrictors (such as cartridges) to limit the tap flow rate to less than the flow rate of the integrated overflow for the sink or tub.

Integrated overflows shall be tested and verified in accordance with BS EN 274 to determine their minimum flow rates.

COMMENT
Specifiers applying for building consents will need to demonstrate that integrated overflows have been tested and verified as meeting the minimum flow rate in accordance with BS EN 274. Manufacturers may be able to supply this information.

2.0.2.1 For multiple tubs or sinks installed in a kitchen or laundry and served by a single tap, either:

a) Each individual tub and sink shall have its own integrated overflow complying with Paragraph 2.0.2, or

b) A secondary tub or sink shall have a controlled overflow path into a main tub or sink which has an integrated overflow complying with Paragraph 2.0.2. Amend 7 Nov 2020

2.0.3 Containment and *floor wastes* are not required solely to account for the failure of a *sanitary appliance* component or hose, where the flexible discharge hose from the *sanitary appliance* can be directly connected into the *plumbing system* either by mechanical fastening to a fixture trap spigot, or by direct insertion into an open standpipe or a laundry tub waste hose connection port.

COMMENT:
This Acceptable Solution does not regard the failure of a component (e.g. a washer) or hose (e.g. burst hose) of a *sanitary appliance* as an accidental overflow.

Compliance of the spigot, open standpipe, or laundry tub waste hose connection port with NZBC Clause G13 Foul water is outside the scope of this Acceptable Solution.

Amend 7 Nov 2020

2.1 Containment

2.1.1 Containment provided to satisfy Paragraph 2.0.1 a) may be achieved by using *impervious* floor coverings which:

a) Are continuous and coved or joints sealed where they meet the wall (See Figure 1), and

b) Extend to the doorway and all walls of the room, or to at least 1.5 m from all *sanitary fixtures* and *sanitary appliances* in open-plan rooms.

Amend 7 Nov 2020

COMMENT
Additional protection to adjoining *household units* and *other property* may be provided by the use of construction details that provide more complete prevention of the passage of overflow water at doorways and open plan areas. However, doing so will exceed the requirements of this Acceptable Solution.

Amend 7 Nov 2020

2.2 Floor wastes

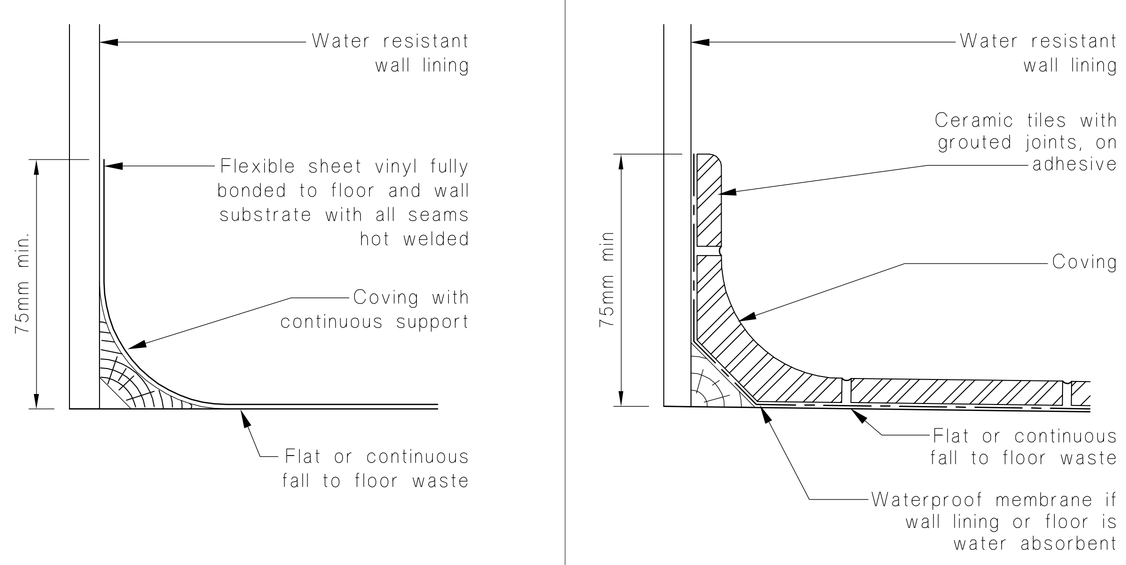
2.2.1 *Floor wastes* provided to satisfy Paragraph 2.0.1 b) shall comply with NZBC Clause G13. A graded floor is not essential in this situation.

Amend 2 Jul 2001

COMMENT
Acceptable Solutions G13/AS1 and G13/AS3 contain provisions for *floor wastes* that comply with NZBC Clause G13 Foul water.

Amend 7 Nov 2020

Figure 1: Floor Coverings at Wall Junctions
Paragraph 2.1.1



(a) Vinyl floor covering

(b) Ceramic tile covering

3.0 Watersplash

3.1 Lining materials

3.1.1 Floors

The following finishes to floors satisfy the performance for *impervious* and easily cleaned surfaces in spaces containing *sanitary fixtures* or *sanitary appliances*. In open plan spaces this surface shall extend at least 1.5 m from all *sanitary fixtures* and *sanitary appliances*:

COMMENT
The requirement for *impervious* and easily cleaned floor surfaces applies to spaces such as kitchens, bathrooms, laundries and toilet facilities. This requirement applies regardless of whether containment is required by Paragraph 2.0.

Amend 7 Nov 2020

a) Integrally waterproof sheet material (e.g. polyvinylchloride) with sealed joints and sealed or coved at edges where watersplash may occur.

Amend 7 Nov 2020

b) Ceramic or stone tiles having 6% maximum water absorption, waterproof grouted joints, and bedded with an adhesive specified by the tile manufacturer as being suitable for the tiles, substrate material and the environment of use. Edges of the tiled area where watersplash may occur must be sealed or coved, and tiles must be laid on a continuous impervious substrate or a membrane specified by the manufacturer as being suitable for the tiles, substrate material and the environment of use.

c) A slab-on-grade concrete floor having a steel trowel or polished finish, sealed at edges where watersplash may occur, when used in a domestic laundry within a garage, or in a *building* that contains only sanitary facilities.

COMMENT:
Other floor finishes may also be capable of satisfying the performance for *impervious* and easily cleaned, if installed in a manner that prevents gaps or cracks within the finish and at any parts of its perimeter that are exposed to watersplash, and/or if the surface is sealed with a suitable durable coating. However such other finishes are outside the scope of this Acceptable Solution.

Amend 7 Nov 2020

Water can penetrate behind or under floor finishes in situations where watersplash occurs regularly (such as around shower enclosures or the fronts of built-in baths), unless these edges are sealed or coved.

Domestic laundries in garages, and *buildings* containing only sanitary facilities, are spaces where the consequences of any small imperfections (such as microcracking) in the imperviousness of a concrete floor are minimal and compliance with NZBC Clause E3 Internal moisture can still be demonstrated.

Amend 7 Nov 2020

3.1.2 Walls

The following linings and finishes to walls satisfy the performance for *impervious* and easily cleaned surfaces in areas adjacent to *sanitary fixtures* or *sanitary appliances*, or otherwise likely to be splashed in the course of the *intended use* of the *building*:

Amend 7 Nov 2020

a) Integrally waterproof sheet material (e.g. polyvinylchloride) with sealed joints.

b) Ceramic or stone tiles having 6% maximum water absorption, waterproof grouted joints, and bedded with an adhesive specified by the tile manufacturer as being suitable for the tiles, substrate material and the environment of use.

c) Sheet linings finished with a semi-gloss or gloss coating or a hard-wearing low-sheen latex paint containing mould inhibitors.

Amend 7 Nov 2020

d) Water resistant sheet linings finished with decorative high pressure laminate or factory applied polyurethane or resin, and installed with *impervious* joints (see Figure 2).

COMMENT:
Other wall linings and finishes may also be capable of satisfying the performance for *impervious* and easily cleaned, if installed in a manner that prevents gaps or cracks within the finish and at any parts of its perimeter that are exposed to water splash, and/or if the surface is sealed with a suitable durable coating. However such other finishes are outside the scope of this Acceptable Solution.

Amend 7 Nov 2020

3.2 Joints

3.2.1 Joints between sanitary fixtures and impervious floor finishes

Where *sanitary fixtures* abut *impervious* floor finishes, the base of the fixture must be sealed to the *impervious* floor finish.

Amend 7 Nov 2020

3.2.2 Joints between fixtures and wall linings

Where baths, basins, tubs or sinks abut *impervious* linings, the joint between *fixture* and lining shall be sealed to prevent water penetration to *concealed spaces* or behind linings. (See Figures 3 (a) and (b).)

3.3 Showers and urinals

3.3.1 Showers

All shower spaces shall have *impervious* floors or floor finishes and *impervious* wall linings or wall finishes.

The *impervious* shower wall linings or wall finishes shall extend up the wall to the higher of 1800 mm above the shower floor, or 50 mm above the shower rose.

The top edge of *impervious* shower wall linings or wall finishes shall be sealed to the wall behind (or to the ceiling if full height) to prevent condensation penetrating behind the shower wall linings or wall finishes.

Penetrations in the shower wall for tapware, mixers, roses etc. shall be waterproofed with a proprietary flange system or with sealant (refer Figure 6), installed in a way that allows easy access when replacing washers, ceramic discs and o-rings.

COMMENT
Some tapware manufacturers have specific product installation requirements that are additional to the use of sealant around the tapware penetration.

3.3.1.1 Shower floor materials

Within shower enclosures, or within a 1500 mm horizontal radius from the shower rose where there is no shower enclosure such as a wall, screen, door or curtain (see Figure 5), one of the following materials or finishes to floors shall be used:

a) Plastic or stainless steel shower trays

b) Integrally waterproof sheet material (e.g. polyvinylchloride) with sealed joints, and coved at edges

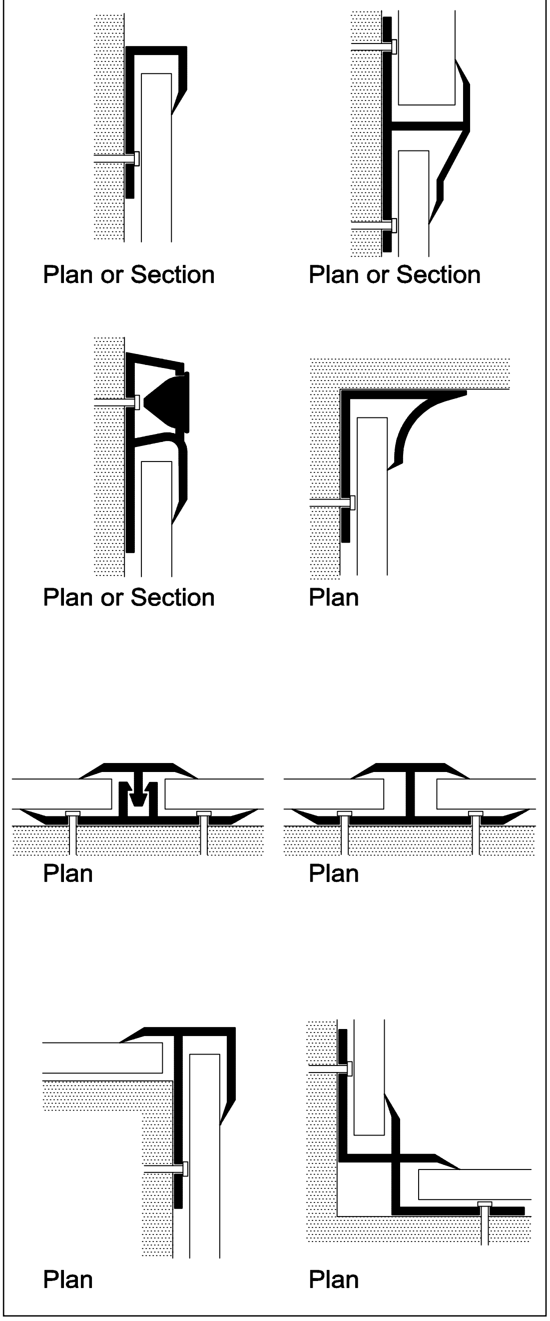
c) Ceramic or stone tiles having 6% maximum water absorption, waterproof grouted joints, and bedded with an adhesive specified by the tile manufacturer as being suitable for the tiles, substrate material and the environment of use. The shower must also have tiled walls (see Paragraph 3.3.1.2 c)), and tiles must be laid either:

Amend 7 Nov 2020

i) Within a shower tray specified by the manufacturer as being suitable for the tiles; or

Amend 7 Nov 2020

Figure 2: Wall Lining Joints
Paragraph 3.2.1



ii) On a membrane specified by the manufacturer as being suitable for the tiles, substrate material and the environment of use.

3.3.1.2 Shower wall lining and finish materials

Within shower enclosures or within a 1500 mm horizontal radius from the shower rose where there is no shower enclosure such as a wall, screen, door or curtain (see Figure 5), one of the following linings and finishes to walls shall be used:

a) Plastic shower wall liners, either as a single component without joints, or installed with waterproof joints

b) Integrally waterproof sheet material (e.g. polyvinylchloride) with sealed joints.

c) Ceramic or stone tiles having 6% maximum water absorption, waterproof grouted joints, and bedded with an adhesive specified by the tile manufacturer as being suitable for the tiles, substrate material and the environment of use. Tiles must be laid on a membrane specified by the manufacturer as being suitable for the tiles, substrate material and the environment of use.

d) Water resistant sheet linings finished with decorative high pressure laminate or factory applied polyurethane or resin, and installed with impervious joints (see Figure 2).

3.3.1.3 Showers over baths

For showers over baths, the bath rim must have a minimum height of 15 mm, and the shower wall lining shall lap over and be sealed to the rim of the bath. Either the bath rim must be recessed into the wall framing, or the shower lining must be packed out to suit the rim. A bath mould or flashing shall not be used for showers over baths.

COMMENT

Notches to recess the rim of a bath into the wall framing may require the use of over-sized framing members to ensure that the notches do not detrimentally affect structural performance of the wall.

Amend 7 Nov 2020

3.3.2 Shower enclosures

Shower floors and bases may be constructed with or without upstands, and where installed for use by *people with disabilities* shall have level thresholds.

3.3.2.1 When enclosures, such as walls, screens, doors or curtains are used they shall be continuous from floor level or top of upstand to 1800 mm minimum above floor level and not less than 50 mm above the shower rose. Amend 7 Nov 2020

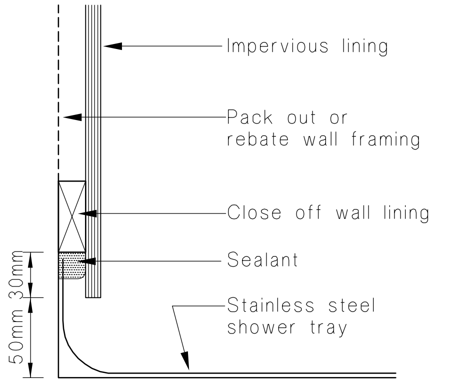
3.3.2.2 Where shower trays are used, the junction between tray and wall linings shall be constructed in accordance with Figure 4 (a) or (b). Amend 7 Nov 2020

3.3.2.3 Where the shower floor has no upstand or where a wall, screen, door or curtain is omitted, the floor shall have a fall of no less than 1:50 towards the *floor waste*. The fall shall apply to the floor area within a radius of 1500 mm taken from a point vertically below the shower rose, or from any wall within that radius. (See Figure 5.) Amend 7 Nov 2020

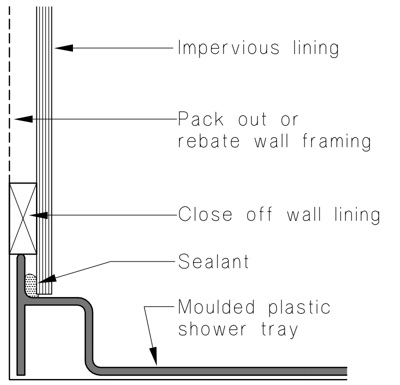
3.3.3 Urinals Amend 7 Nov 2020

Impervious wall shall extend horizontally at least 300 mm beyond each side of the urinal and vertically from floor level to a height of 1500 mm.

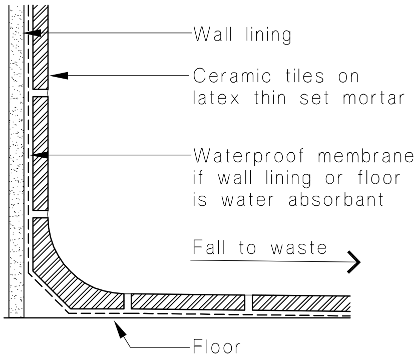
Figure 4: Shower Trays
Paragraphs 3.3.1 and 3.3.3



(a) Stainless steel shower tray

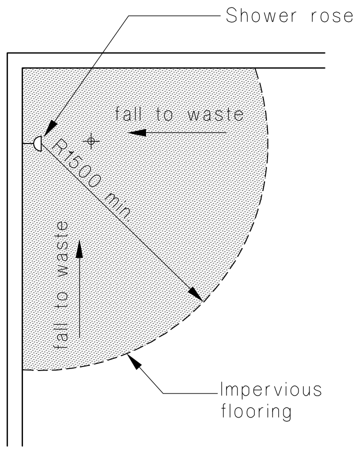


(b) Moulded plastic shower tray

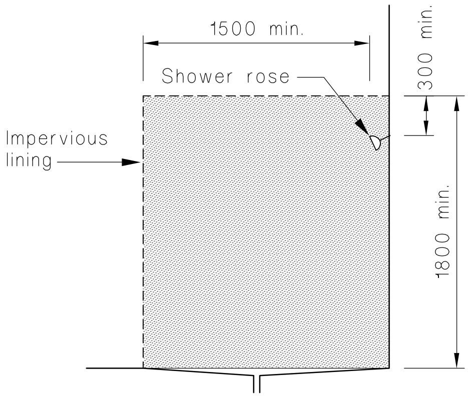


(c) Tiled shower tray

Figure 5: Wall and Floor Coverings to Unenclosed Showers
Paragraphs 3.3.1 and 3.3.5

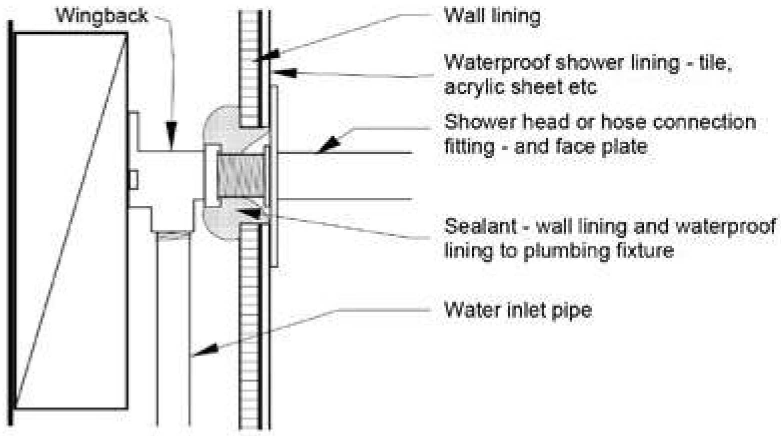


(a) Plan

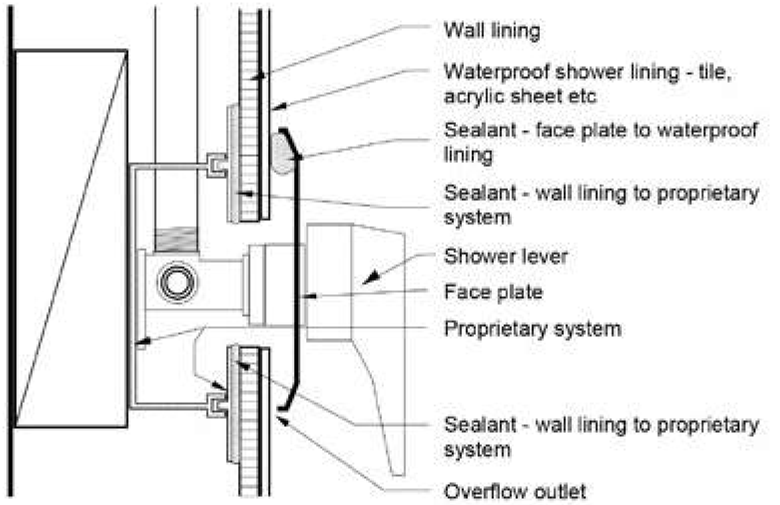


(b) Section

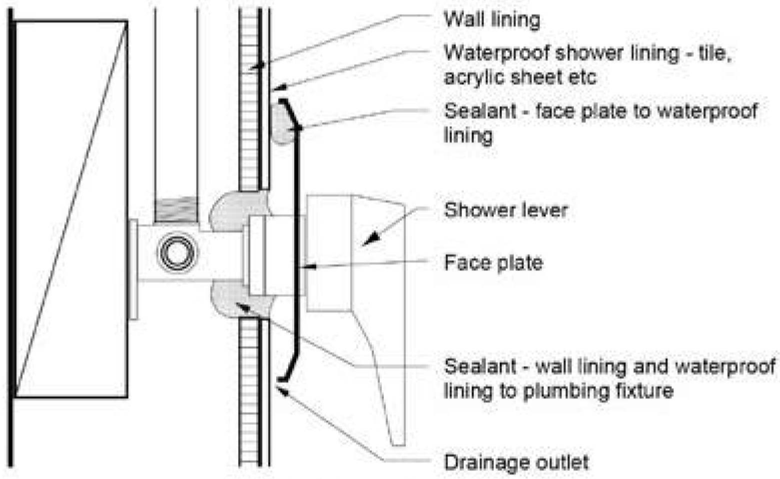
Figure 6: Examples for waterproofing through shower walls
Paragraph 3.3.1



(a) Shower head or flexible hose connection using sealant



(b) Shower mixer using proprietary system (example only)



(c) Shower mixer using sealant

Amend 7
Nov 2020

Index

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

E

MOISTURE

E3/AS2

Acceptable Solution

E3 Internal Moisture

First Edition – effective 5 November 2020

Internal Wet-area Membrane Systems

OVERVIEW (commentary only)

E3/AS2 references a code of practice for the selection, design and installation of internal wet-area membrane systems that help protect *buildings* from the effects of overflow and water splash when required as part of clauses E3.3.2 – E3.3.6 of the Building Code.

REQUIREMENTS

1.0 Internal Wet-area Membrane Systems

1.1 Building work involving internal wet-area membrane systems that are installed in accordance with sections 1 – 4 of the Waterproofing Membrane Association Incorporated (WMAI) Code of Practice for Internal Wet Area Membrane Systems (IWAM) as modified by Paragraph 2.0 of this Acceptable Solution will comply with New Zealand Building Code (NZBC) clauses E3.3.2 – E3.3.6, when the additional requirements described below are met:

NZBC Performance clause	Installation requirements additional to the IWAM Code of Practice
E3.3.2 Free water from accidental overflow from *sanitary fixtures* or *sanitary appliances* must be disposed of in a way that avoids loss of *amenity* or damage to *household units* or other *property*.	The building work involving internal wet-area membrane systems need only include a floor waste in locations where accidental overflow could damage an adjoining *household unit* or *other property*. Compliance of the floor waste with NZBC clause **G13 Foul water** is outside the scope of this Acceptable Solution.

NZBC Performance clause	Additional requirements additional to a membrane installed in accordance with the IWAM Code of Practice
E3.3.3 Floor surfaces of any space containing *sanitary fixtures* or *sanitary appliances* must be *impervious* and easily cleaned.	The building work involving internal wet-area membrane systems must be installed in conjunction with an over-surface finish that is easy to clean, to form the floor surfaces of spaces containing *sanitary fixtures* or *sanitary appliances.* Over-surface finishing work, such as tiling, is outside the scope of this Acceptable Solution.
E3.3.4 Wall surfaces adjacent to *sanitary fixtures* or *sanitary appliances* must be *impervious* and easily cleaned.	The building work involving internal wet-area membrane systems must be installed in conjunction with an over-surface finish that is easy to clean, to form the wall surfaces adjacent to *sanitary fixtures* or *sanitary appliances*. Over-surface finishing work, such as tiling, is outside the scope of this Acceptable Solution.
E3.3.5 Surfaces of *building elements* likely to be splashed or become contaminated in the course of the *intended us*e of the *building*, must be *impervious* and easily cleaned.	The building work involving internal wet-area membrane systems must be installed in conjunction with an over-surface finish that is easy to clean, to form the surfaces of *building elements* that are likely to be splashed or become contaminated in the course of the *intended use* of the *building*. Over-surface finishing work, such as tiling, is outside the scope of this Acceptable Solution.
E3.3.6 Surfaces of *building elements* likely to be splashed must be constructed in a way that prevents water splash from penetrating behind linings or into concealed spaces.	The building work involving internal wet-area membrane systems must form the surfaces of the *building elements* that are likely to be splashed. The construction of any surfaces that are likely to be splashed, but do not involve internal wet-area membranes, is outside the scope of this Acceptable Solution.

1.2 The IWAM Code of Practice may exceed the requirements of the NZBC in relation to:

a) The provision of floor wastes, where these are not located where accidental overflow could damage an adjoining household unit; and

b) The provision of overflows within plumbed cabinetry units; and

c) The installation of a waterproof membrane system behind *impervious* secondary shower linings (including showers over baths), and beneath and behind *impervious* sanitary fixtures which are sealed to adjacent walls and floors in a manner that prevents water penetrating behind linings and into concealed spaces; and

d) The height which a waterproof membrane system in a shower must extend above the shower rose.

1.3 Within the IWAM Code of Practice, text that is WMAI commentary is non-mandatory and does not form part of this Acceptable Solution. Such text is shown in italics on a grey background within the IWAM Code of Practice.

2.0 Modifications to the IWAM Code of Practice

2.1 Modification to IWAM Code of Practice Section 1.2.4.

Delete from Section 1.2.4 of the IWAM Code of Practice the commentary text that reads: "Both the Applicator (ie the company), and the Installer (ie the person or people) who carry out or supervise the work, must be certified by the Supplier. The Applicator should provide a Producer Statement – Construction (PS3) to verify that the installation of the waterproof membrane system complies with this Code of Practice and the approved building consent documents."

Also delete from Section 1.2.4 of the IWAM Code of Practice the statement "All waterproof membrane systems must be installed by or under the supervision of an installer certified by the supplier of the waterproof membrane system, working for a certified applicator".

SUPPORTING INFORMATION (commentary only)

The IWAM Code of Practice is available for free download from:

https://www.building.govt.nz/assets/Uploads/building-code-compliance/e-moisture/e3-internal-moisture/code-of-practice-for-internal-wet-area-membrane-systems-4th-edition-august-2020.pdf

Effective use	The IWAM is applicable to internal wet-area waterproof membrane systems, including their substrates, for bathrooms, kitchens and laundries within *buildings*. Facilities such as industrial processing areas (for instance a cowshed or an industrial food making facility), or the surrounds and changing facilities of internal swimming pools or spas, are outside the IWAM scope. Information on the types of locations where accidental overflow could damage an adjoining *household unit* or *other property* is available in E3/AS1 Paragraphs 2.0.2 – 2.0.3. Information on the height which a waterproof membrane system in a shower must extend above the shower rose is available in E3/AS1 Paragraph 3.3.1.
Demonstrating installation quality	The Building Consent Authority must be satisfied on reasonable grounds that the installation of a waterproof membrane system meets the requirements of the NZBC.
Avoiding problems	Internal wet-area membrane systems that will be installed in conjunction with specialist systems such as underfloor heating and sound insulation systems are outside the scope of this Acceptable Solution. Over-surface finishing work, such as tiling, is outside the scope of this Acceptable Solution. Where an over-surface finish must be easy to clean to enable compliance with NZBC clauses such as E3.3.2 – E3.3.5, compliance of that finish must demonstrated by other means.

SUPPORTING INFORMATION (commentary only)

Other requirements of clause E3

This Acceptable Solution cannot be used to demonstrate compliance with NZBC Performance clause E3.3.1, which is not addressed by the IWAM Code of Practice. Building designers using this Acceptable Solution to demonstrate compliance of building work involving internal wet-area membrane systems will separately need to demonstrate compliance with NZBC Performance clause E3.3.1:

NZBC Performance clause	Additional information
E3.3.1 An adequate combination of *thermal resistance*, ventilation, and space temperature must be provided to all *habitable spaces*, bathrooms, laundries, and other spaces where moisture may be generated or may accumulate. Performance E3.3.1 does not apply *to communal non-residential, commercial, industrial, outbuildings, or ancillary buildings*.	This NZBC Performance clause is outside the scope of this Acceptable Solution. Paragraphs 1.0 – 1.3.3 of Acceptable Solution E3/AS1 provide a means of demonstrating compliance with NZBC Performance clause E3.3.1.

REFERENCES AND DEFINITIONS

REFERENCES

For the purposes of NZBC compliance, the documents referenced in this Acceptable Solution must be the editions, along with their specific amendments, listed in this section.

Publisher and document name/number	
Waterproofing Membrane Association Inc.	Code of Practice for Internal Wet-area Membrane Systems August 2020

DEFINITIONS

Within this Acceptable Solution, words and terms that are italicised in the text have the meaning given in this section.

Term and definition	
Allotment	has the meaning ascribed to it by section 10 of the Building Act 2004
Amenity	means an attribute of a *building* which contributes to the health, physical independence, and well being of the *building's* users but which is not associated with disease or a specific illness
Building	has the meaning ascribed to it by sections 8 and 9 of the Building Act 2004
Building element	any structural or non-structural component and assembly incorporated into or associated with a *building*. Included are *fixtures*, services, drains, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports
Fixture	an article intended to remain permanently attached to and form part of a *building*

DEFINITIONS (CONTINUED)

Within this Acceptable Solution, words and terms that are italicised in the text have the meaning given in this section.

Household unit	means any *building* or group of *buildings*, or part of any *building* or group of *buildings*, used or intended to be used solely or principally for residential purposes and occupied or intended to be occupied exclusively as the home or residence of not more than one household; but does not include a hostel or boardinghouse or other specialised accommodation
Impervious	that which does not allow the passage of moisture
Intended use	intended use of a *building* includes— (a) any reasonably foreseeable occasional other use that is not incompatible with the *intended use*; and (b) normal maintenance; and (c) activities taken in response to fire or any other reasonably foreseeable emergency—but does not include any other maintenance and repairs or rebuilding
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
Sanitary appliance	an appliance which is intended to be used for *sanitation*, but which is not a *sanitary fixture*. Included are machines for washing dishes and clothes
Sanitary fixture	any *fixture* which is intended to be used for sanitation. Toilets, urinals, bidets, baths, showers, basins, sinks and tubs are examples of common *sanitary fixtures*.
Sanitation	the term used to describe the activities of washing and/or excretion carried out in a manner or condition such that the effect on health is minimised, with regard to dirt and infection

ISBN (ONLINE) 978-1-99-001944-9

CONTACT DETAILS PO Box 1473, Wellington 6140 | **T** 0800 242 243 | **E** info@building.govt.nz

Compliance Document for New Zealand Building Code Clause F1 Hazardous Agents on Site

Prepared by the Department of Building and Housing

This Compliance Document is prepared by the Department of Building and Housing. The Department of Building and Housing is a Government Department established under the State Sector Act 1988.

Enquiries about the content of this document should be directed to:

Department of Building and Housing
PO Box 10-729, Wellington.
Telephone 0800 242 243
Fax 04 494 0290
Email: info@dbh.govt.nz

Sales enquiries should be directed to:
Customer Services,
Victoria University Book Centre
PO Box 12-337, Wellington, New Zealand
Telephone 0800 370 370, (04) 463 5511
Fax (04) 463 5510
Email: dbh@vicbooks.co.nz
www.vicbooks.co.nz
ISBN 0-477-01606-5

Status of Compliance Documents

Compliance Documents are prepared by the Department of Building and Housing in accordance with section 22 of the Building Act 2004. A Compliance Document is for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Compliance Document will be treated as having complied with the provisions of the Building Code to which the Compliance Document relates. However, a Compliance Document is only one method of complying with the Building Code. There may be alternative ways to comply.

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

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

F1: Document History

	Date	Alterations
First published	July 1992	
Amendment 1	July 2001	p. 2, Document History, Status p. 9, Definitions

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

Document Status

The most recent version of this document, as detailed in the Document History, is approved by the Chief Executive of the Department of Building and Housing. It is effective from 1 July 2001 and supersedes all previous versions of this document.

People using this Compliance Document should check for amendments on a regular basis. The Department of Building and Housing may amend any part of any Compliance Document at any time. Up-to-date versions of Compliance Documents are available from www.dbh.govt.nz

New Zealand Building Code Clause F1 Hazardous Agents on Site

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE—*continued*

Clause F1—HAZARDOUS AGENTS ON SITE

Provisions	Limits on application
OBJECTIVE **F1.1** The objective of this provision is to safeguard people from injury or illness caused by *hazardous* agents or *contaminants* on a site	
FUNCTIONAL REQUIREMENT **F1.2** *Buildings* shall be constructed to avoid the likelihood of people within the *building* being adversely affected by *hazardous* agents or *contaminants* on the site.	
PERFORMANCE **F1.3.1** Sites shall be assessed to determine the presence and potential threat of any *hazardous* agents or *contaminants*. **F1.3.2** The likely effect of any *hazardous* agent or *contaminant* on people shall be determined taking account of: (a) The *intended use* of the *building*, (b) The nature, potency or toxicity of the *hazardous* agent or *contaminant*, and (c) The protection afforded by the *building* envelope and *building* systems.	

Contents

References

For the purposes of New Zealand Building Code Compliance, referenced documents shall be deemed to include any amendments issued prior to the date of the Approved Document as displayed at the foot of the page on which the references are listed.

		Where quoted
British Standards Institution		
BSDD 175: 1988	Code of practice for the identification of potentially contaminated land and its investigation	VM1 2.3.1, 2.3.2, 2.4.1
New Zealand Government Departments		
Department of Labour Workplace exposure standards and biological indices for NZ 1992		VM1 2.5.2
Australian and New Zealand Environment and Conservation Council		
Guidelines for assessment and management of contaminated sites 1992		VM1 1.0.1
United States Environmental Protection Agency		
USEPA SW 846: 1986	Test methods for evaluating solid waste	VM1 2.4.1
EPA/540/1 – 89/002: 1989	Risk assessment guidance for Superfund, Vol 1 Human health evaluation manual (Part A) Interim final. Prepared by USEPA Office of Emergency and Remedial Response	VM1 2.5.4
United States Public Health Service		
	Toxicological profiles on individual chemicals. Prepared by the Agency for Toxicological Substances and Disease Registry, in collaboration with the US Environmental Protection Agency	VM1 2.5.2 a)
World Health Organisation/Food and Agriculture Organisation		
Environmental Health Criteria 70		
	Principles for the safety assessment of food additives and contaminants in food, Geneva: 1987	VM1 2.5.2
	Evaluation of certain food additives and contaminants, Technical report series 776. Geneva: 1989	VM1 2.5.2
	IARC Monographs on the evaluation of carcinogenic risks to humans for individual chemicals, groups of chemicals, or processes. Published by the International Agency for Research on Cancer	VM1 2.5.2 c)
	"Environment health criteria" for various chemicals	VM1 2.5.2 b)

	Where quoted
Miscellaneous Publication	
Casarett and Doull's Toxicology. The basic science of poisons. 4th ed. Macmillan. New York 1991. Klassen CD, Amdur MO, Doull J (Eds)	VM1 2.5.3

Definitions

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

Building has the meaning ascribed to it by the Building Act 1991.

Contaminant has the meaning ascribed to it by the Resource Management Act 1991.

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

Hazardous Creating an unreasonable risk to people of bodily injury or deterioration of health.

Intended use of a *building* includes:

a) Any reasonably foreseeable occasional other use that is not incompatible with the *intended use*; and

b) Normal maintenance; and

c) Activities taken in response to *fire* or any other reasonably foreseeable emergency – but does not include any other maintenance and repairs or rebuilding.

Network utility operator means a person who:

a) Undertakes the distribution or transmission by pipeline of natural or manufactured gas, petroleum, or geothermal energy; or

Amend 1 Jul 2001

b) Is an electricity operator or electrical distributor as defined by section 2(1) of the Electricity Act 1992 for the purposes of any works defined by that Act; or

c) Undertakes the piped distribution of *potable* water for supply; or

d) Is the operator of a sewerage system or a stormwater drainage system.

Territorial authority has the meaning ascribed to it by section 2 of the Local Government Act 1974; and includes any organisation which is authorised to permit structures pursuant to section 12(1)(b) of the Resource Management Act 1991.

Verification Method F1/VM1

1.0 Introduction

1.0.1 This Verification Method is based on information derived from the Australian and New Zealand Environmental and Conservation Council "Guidelines for assessment and management of contaminated sites".

1.0.2 The presence of *hazardous* agents or *contaminants* on a *building* site shall be evaluated by:

a) Studying the site history,

b) Visually surveying the site, and

c) Where necessary, undertaking further investigation to:

  i) identify any *hazardous* agents or *hazardous contaminants*, and

  ii) evaluate the risk in relation to the proposed *building*.

1.0.3 Figures 1 and 2 outline the procedure to be followed in investigating and assessing a site.

2.0 Site Investigation

2.1 History and records

2.1.1 A study of the history including any previous use of the site shall be made. This study shall include information obtained from sources such as:

a) Aerial photographs,

b) The land title (which may indicate past uses of the land),

c) *Territorial authority* records (the *territorial authority* will supply information it holds, when an application is made for a project information memorandum),

d) Geological records,

e) Local landowners and adjacent occupiers, and

f) *Network utility operators* for sewers, gas, water, and electricity reticulation. (The information should include the presence of any abandoned pipes or lines.)

2.1.2 Table 1 shows the *contaminants* likely to result from some previous industrial uses of a site.

2.2 Preliminary investigation

2.2.1 The preliminary visual inspection shall include the observation of flora and fauna as well as a critical appraisal of the physical land features. Anything unusual, or any non-conformity in the features of the site should be accounted for, as it may indicate past uses or the presence of *hazardous* agents or *contaminants*. A *hazardous* agent could also be a naturally occurring feature of the land, for example geothermal activity. The inspection should include the identification of things such as:

a) Past development and uses,

b) Old rubbish tips, abandoned pits and quarries,

c) Mine workings and backfilling,

d) Polluted waterways, *drains*, ponds, or aquifers,

e) Areas of stunted or blighted growth, or of discoloured soil,

f) Unhealthy animal life and the presence of vermin, and

g) Possible *surface water* transport of *contaminants* from adjoining sites.

Figure 1: **Site Investigation**
Paragraph 1.0.3

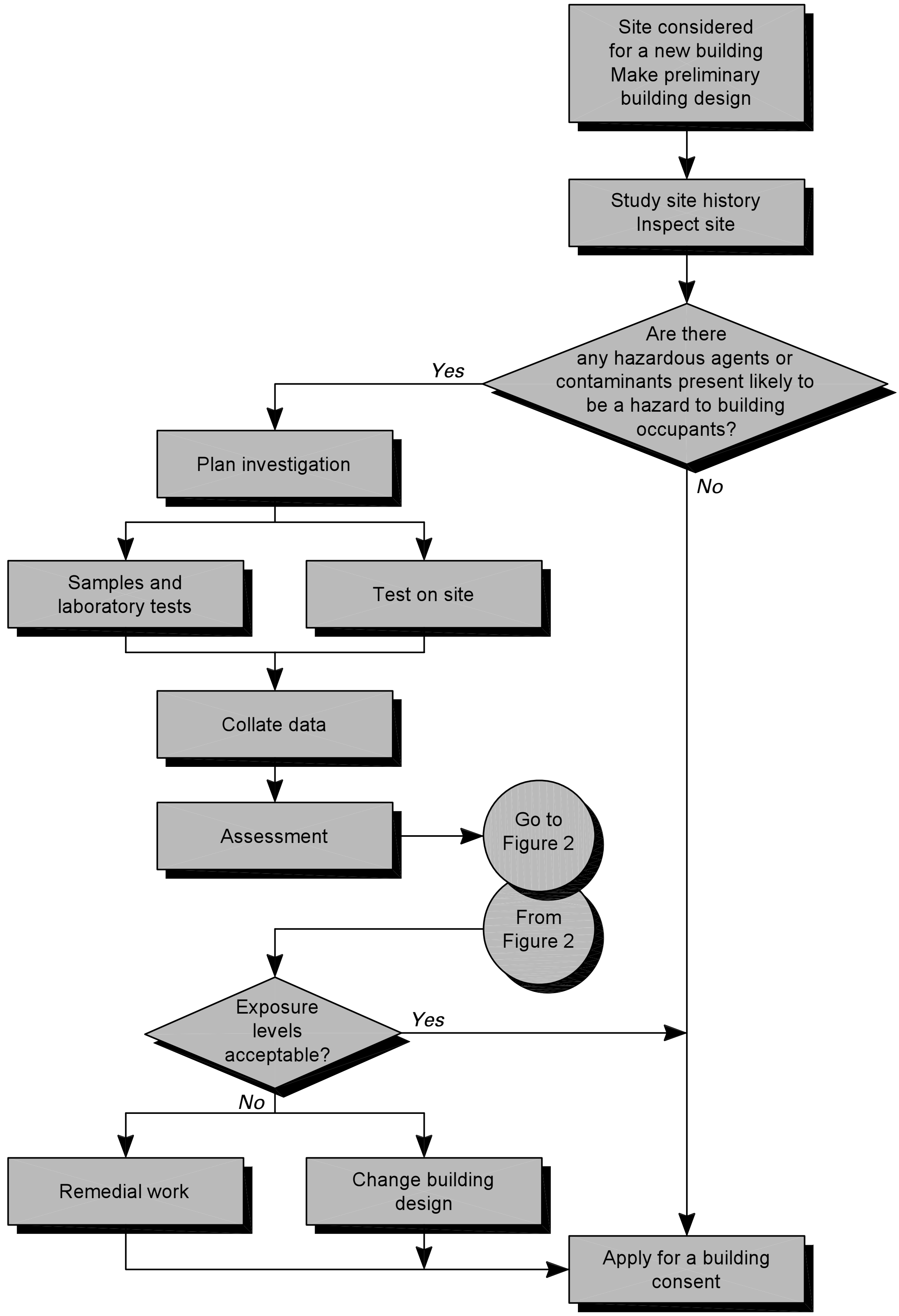


Table 1: Industries, Sites and Contaminants
Paragraph 2.1.2

IMPORTANT: This table should not be taken to mean that other types of site need not be investigated nor to mean that other *contaminants* are absent (see Note)

Industry	**Examples of sites likely to contain hazardous contaminants**	**Likely contaminants**
Chemicals	Acid/alkali works Dyeworks Fertilisers and pesticides Paint works Wood treatment plants	Acids; alkalis; asbestos; metals; solvents (e.g. toluene, benzene); phenols; specialised organic compounds
Petrochemicals	Oil refineries Tank farms Fuel storage depots Tar distilleries	Hydrocarbons; phenols; acids; alkalis and asbestos
Metals	Iron and steel works Foundries, smelters Electroplating, anodizing and galvanising works Engineering works Ship building/ship breaking Scrap reduction plants	Metals, especially iron, copper, nickel, chrome, zinc, cadmium and lead; asbestos
Energy	Gasworks Power stations Geothermal	Combustible substances (e.g. coal and coke dust); phenols; cyanides; sulphur compounds; asbestos
Transport	Garages, vehicle builders and maintenance workshops Railway depots	Combustible substances; hydrocarbons; asbestos
Mineral extraction Land restoration (including waste disposal sites)	Mines and spoil heaps Pits and quarries Filled sites	Metals (e.g. copper, zinc, lead); gases (e.g. methane); leachates
Water supply and treatment	Waterworks Sewage treatment plants	Metals (in sludges) Micro-organisms
Miscellaneous	Docks, wharfs and quays Tanneries Rubber works Military lands Paper and printing works	Acids; alkalis; metals; organic compounds; methane; toxic, flammable or explosive substances; micro-organisms

Note:

Common and widespread *contaminants* include hydrocarbons, polychlorinated biphenyls (PCBs), asbestos, sulphates and many metals used in paint pigments or coatings. These may be present on almost any site, and may range from barely detectable concentrations to relatively high levels.

2.2.2 Table 2 gives some site characteristics which may indicate the presence of *hazardous contaminants*.

2.2.3 Information derived from the study of the site history and the visual investigation shall be used to determine whether or not further detailed investigation is necessary. The *intended use* and method of *construction* of the proposed *building* shall be taken into account when this decision is made.

2.3 Detailed investigation

2.3.1 Sampling where contaminated soil is suspected shall generally be undertaken over the suspect area in a systematic manner, such as by using a uniform grid pattern. However judgemental sampling may be more appropriate where there is good reason to believe there is localised contamination. Samples shall also be taken from adjacent uncontaminated land of similar soil type to provide background reference levels. An acceptable procedure for carrying out sampling is given in BSDD 175 sections 5.4, 6.3, and 6.4.

2.3.2 Other *hazardous* agents or *contaminants*, such as liquids or gases, shall be sampled in a similar manner to contaminated soils or by testing on-site. BSDD 175 sections 5.4, 6.3, and 6.4 provide acceptable means of obtaining samples or testing for *hazardous* agents not directly contained in the soil.

2.4 Analysis

2.4.1 Analysis may be completed on site or, particularly for soil samples, may be done in a laboratory. BSDD 175 sections 8 and 9 give acceptable procedures for analysis and for producing a report summarising the results. An alternative acceptable laboratory procedure is given by USEPA SW 846.

2.5 Assessment

2.5.1 *Hazardous* agents or *contaminants* are most likely to be a danger to *building* occupants by being transported in an airborne state into the *building* through open windows and doors or the ventilation system. Contaminated soil particles may also be carried into a *building* in this manner. Actual concentrations of *contaminants* that are *hazardous* to *building* occupants are likely to be different from concentrations that are *hazardous* to people in closer contact with the soil or with liquids at ground level on the site.

Table 2: Site Characteristics and Possible Hazardous Contaminants
Paragraph 2.2.2

Signs of possible contamination	Possible contaminant
a) Vegetation (absence, poor or unnatural growth)	Metals, metal compounds, organic compounds, gases
b) Surface material (unusual colours and contours may indicate wastes and residues)	Metals, metal compounds, oily and tarry wastes, asbestos (loose), other fibres, organic compounds, including phenols, potentially combustible material including coal and coke dust, refuse and waste
c) Fumes and odours (may indicate organic chemicals at very low concentrations)	Flammable, explosive and asphyxiating gases including methane and hydrogen sulphide, corrosive liquids, faecal, animal and vegetable matter (biologically active)

Note:
Other signs of contamination may exist. Adjacent land should be used for comparison.

2.5.2 The concentrations of substances from the site that reach people in the *building* shall be considered in terms of foreseeable ingress or exposure pathways. Provisional Tolerable Weekly Intakes (PTWI) or Acceptable Daily Intakes (ADI) shall be those determined by the World Health Organisation/Food and Agriculture Organisation (WHO 1987, WHO 1989). Workplace exposure standards shall be those adopted by the Occupational Safety and Health division of the New Zealand Department of Labour. Reference texts for toxicological data shall be:

a) Toxicological profiles for individual chemicals prepared by the Agency for Toxicological Substances and Disease Registry (US Public Health Service) in collaboration with the US Environmental Protection Agency.

b) 'Environmental Health Criteria' for individual chemicals published by the World Health Organisation.

c) IARC Monographs on the evaluation of carcinogenic risks to humans for individual chemicals, groups of chemicals, or processes, published by the International Agency for Research on Cancer, World Health Organisation.

2.5.3 Where information is unavailable in these texts, secondary texts may be consulted including:

'Casarett and Doull's Toxicology. The basic science of poisons'.

2.5.4 The reference text for risk assessment shall be: USEPA, Office of Emergency and Remedial Response. Risk assessment guidance for Superfund, Vol 1. Human health evaluation manual (Part A) Interim final.

2.5.5 Some potentially *hazardous* agents such as asbestos fibres require action at very low concentration levels.

2.5.6 Some substances may not in themselves present a hazard but may be dangerous in combination with others, or may produce an explosion or fire when ignited, (e.g. fine dusts, volatile oils, tar, sulphur, methane gas). These possible effects shall also be considered.

2.6 Remedial work

2.6.1 In some cases remedial work to reduce concentrations of harmful substances in a *building* may be a more practical solution, and additionally may make the site suitable for a wider range of *building* types.

2.6.2 Remedial action can involve one or more of the following activities:

a) Excavation of contaminated soil for disposal to a place acceptable to the *territorial authority.*

b) Isolation of the contaminated soil by covering it with a calculated thickness of clean inert fill or hard cover.

c) Chemical, biological or physical treatment to destroy, remove, or immobilise the *contaminant* or agent.

d) Mixing the contaminated soil with clean soil in order to reduce the maximum concentrations of *contaminants* to a level that is not *hazardous* to *building* occupants.

2.6.3 Some of the more commonly found *contaminants* and examples of remedial action are given in Table 3.

2.7 Hazards to building elements

2.7.1 Some substances occurring naturally in the soil may cause degradation of *building* materials. This could lead to structural failure or provide opportunities for contamination within the *building*. Sulphates, for example, are known to attack concrete and some other naturally occurring chemicals can attack buried water or gas pipes. Such hazards shall be assessed at each site and appropriate preventive measures taken.

Table 3: Examples of Remedial Action for Common Contaminants
Paragraph 2.6.3

Contaminant	Hazard	Remedial action
Gases, solids and liquids	i) Gases which can affect the occupants of *buildings* include methane and carbon dioxide. ii) Solids and liquids such as hydrocarbons, solvents, phenols, inert refuse containing gypsum and domestic and industrial wastes may react to produce noxious fumes. Other chemicals may only react in the presence of acid or alkaline ground water, liquors or leachates. Acids may react with limestone, chalk and other carbonate rocks. Disturbance of the ground may activate these reactions or release the gases they produce.	i) Remove *contaminants* where practicable, and ii) Limited excavation, filling and sealing, and iii) Sealing service entries, and iv) Eliminating voids (including voids due to the settlement of any filling) where possible, and v) Sealing or effectively ventilating at high and low level voids which cannot be eliminated.
Combustible materials	Combustible materials may be already burning and smoulder or flame when broken into or may if they are not already burning, be ignited. They may produce gases which, if inhaled, could affect the occupants of the *building*. They may also produce gases which carry the risk of explosion and fire or direct damage to the building or loss of support to the foundations in the long term.	i) Where the material is known to have ignited, removal, partial excavation and filling. This action carries with it the risk of aggravating the severity of the *fire*, and ii) Where gases are being produced (whether or not the material has also ignited) remedial action similar to those described for Gases above.
Radioactive materials	Radioactive materials may be in enclosed containers or loose.	i) Where the container is intact, removal, and; ii) Where there is no container or it is not intact, excavation of all contaminated ground.
Materials attacking the building fabric	Materials, whether or not they are *contaminants* in their own right, may react with materials normally used for *buildings* and their services.	i) Removing the ground *contaminant* particularly where it is localised, and ii) Specifying *building* materials such as sulphate resisting cements which are sufficiently resistant to the ground *contaminant*, and iii) Protecting the *building* materials with, for example, bituminous or plastic membranes.

Note:
This table is intended as a preliminary guide only. Actual solutions are likely to be more complex and specific to the site.

Acceptable Solution F1/AS1

1.0 No specific acceptable solution has been adopted for complying with the Performance of NZBC F1.

Index F1/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellingto 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 3), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 1 January 2017 and supersedes all previous versions of this document.

The previous version of this document (Amendment 2) will cease to have effect on 30 May 2017.

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.building.govt.nz

F2: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	19 August 1994	pp. i and ii, Document History p. v, Contents p. vi, References	p. 3, 1.1, 1.1.1, 1.2, 1.2.1, 1.3 to 1.4.3 deleted p. 4, 1.4.4 deleted p. 5, Index
Reprinted incorporating Amendment 1	July 1996		
Amendment 2	1 December 2000 until 30 May 2017	p. ii, Document History p. vi, References	p. 3, 1.2.1
Amendment 3	Effective 1 January 2017	p. 5 Contents p. 7 References p. 9 Definitions	p. 13 AS1 1.0, 2.0 p. 15 Index

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

New Zealand Building Code Clause F2 Hazardous Building Materials

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE—*continued*

Clause F2—HAZARDOUS BUILDING MATERIALS

Provisions	Limits on application
OBJECTIVE	
F2.1 The objective of this provision is to safeguard people from injury and illness caused by exposure to *hazardous building* materials.	
FUNCTIONAL REQUIREMENT	
F2.2 *Building* materials which are potentially *hazardous*, shall be used in ways that avoid undue risk to people.	
PERFORMANCE	
F2.3.1 The quantities of gas, liquid, radiation or solid particles emitted by materials used in the *construction* of *buildings*, shall not give rise to harmful concentrations at the surface of the material where the material is exposed, or in the atmosphere of any space.	
F2.3.2 Transparent panels capable of being mistaken for an unimpeded path of travel shall be marked to make them visible.	Performance F2.3.2 does not apply to *Housing*
F2.3.3 Glass or other brittle materials with which people are likely to come into contact shall: (a) If broken on impact, break in a way which is unlikely to cause injury, or (b) Resist a reasonably foreseeable impact without breaking, or (c) Be protected from impact.	

Contents

Amend 3 Jan 2017

Amend 1 Aug 1994

References

For the purposes of New Zealand Building Code compliance, the New Zealand and other Standards, and other documents referred to in this Acceptable Solution (primary reference documents) shall be the editions, along with their specific amendments, listed below. Where the primary reference documents refer to other Standards or other documents (secondary reference documents), which in turn may also refer to other Standards or other documents, and so on (lower order reference documents), then the applicable version of these secondary and lower order reference documents shall be the version in effect at the date this Acceptable Solution was published.

Amend 3 Jan 2017

		Where quoted
Standards New Zealand		
NZS 4223:-	Glazing in buildings	AS1 1.1.1
Part 3: 2016	Human impact safety requirements	
	Amendment 1	

Amends 1 and 2

Amend 3 Jan 2017

Amend 1 Aug 1994

Definitions

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

Asbestos means the asbestiform varieties of mineral silicates belonging to the serpentine or amphibole groups of rock-forming minerals, including the following:

(a) actinolite asbestos:

(b) grunerite (or amosite) asbestos (brown):

(c) anthophyllite asbestos:

(d) chrysotile asbestos (white):

(e) crocidolite asbestos (blue):

(f) tremolite asbestos:

(g) a mixture that contains 1 or more of the minerals referred to in paragraphs (a) to (f).

Building has the meaning ascribed to it by Sections 8 and 9 of the Building Act 2004.

Construct in relation to a building, includes to design, build, erect, prefabricate, and relocate the building.

Amend 3 Jan 2017

Hazardous Creating an unreasonable risk to people of bodily injury or deterioration of health.

Intended use , in relation to a building,–

(a) includes any or all of the following:

(i) any reasonably foreseeable occasional use that is not incompatible with the *intended use*:

(ii) normal maintenance:

(iii) activities undertaken in response to fire or any other reasonably foreseeable emergency; but

(b) does not include any other maintenance and repairs or rebuilding

Amend 3 Jan 2017

Safety glass means a glass so treated or combined with other materials as to reduce the likelihood of injury to persons when it is cracked or broken.

Verification Method F2/VM1

No specific test methods have been adopted for verifying compliance with the Performance of NZBC F2.

Acceptable Solution F2/AS1

1.0 Glazing

1.1 Human impact safety

1.1.1 Glazing likely to be subject to human impact shall comply with NZS 4223: Part 3.

Amend 1 Aug 1994

COMMENT:

1. NZS 4223: Part 3: 2016 now requires manifestation for shopfronts whereas previously they were exempt.

   Transoms or rails with a face width not less than 20 mm and with their centreline between 800 mm and 1200 mm from the finished floor level can provide manifestation.
2. F4/AS1 Paragraph 2.1 gives safety from falling requirements for opening windows where the possible fall through the opening is 1 m or more, measured from the adjacent floor level.
3. D1/AS1 in Figure 6 shows where open windows could be a dangerous projection..

Amend 2 Dec 2000

Amend 2 Dec 2000

Amend 3 Jan 2017

Amends 1 and 2

2.0 Asbestos

COMMENT:

New building materials can be expected to be free of asbestos but many *buildings* constructed before the 1990s do include materials that contain asbestos. Therefore, for *alterations* to older *buildings*, Clause F1 'Hazardous Agents on Site' may be relevant because an existing *building* can be considered as part of a site.

The handling of asbestos-containing materials is covered by the Health and Safety at Work (Asbestos) Regulations 2016. These Regulations require the Licensing of asbestos removalists and asbestos assessors.

Refer to the WorkSafe New Zealand website http://www.business.govt.nz/worksafe/information-guidance/guidance-by-hazard-type/asbestos/working-with-asbestos

Amend 3 Jan 2017

Index F2/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Compliance Document for New Zealand Building Code Clause F3 Hazardous Substances and Processes – Second Edition

Prepared by the Department of Building and Housing

This Compliance Document is prepared by the Department of Building and Housing. The Department of Building and Housing is a Government Department established under the State Sector Act 1988.

Enquiries about the content of this document should be directed to:

Department of Building and Housing
PO Box 10-729, Wellington.
Telephone 0800 242 243
Fax 04 494 0290
Email: info@dbh.govt.nz

Sales enquiries should be directed to:
Customer Services,
Victoria University Book Centre
PO Box 12-337, Wellington, New Zealand
Telephone 0800 370 370, (04) 463 5511
Fax (04) 463 5510
Email: dbh@vicbooks.co.nz
www.vicbooks.co.nz
ISBN 0-477-01606-5

Status of Compliance Documents

Compliance Documents are prepared by the Department of Building and Housing in accordance with section 22 of the Building Act 2004. A Compliance Document is for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Compliance Document will be treated as having complied with the provisions of the Building Code to which the Compliance Document relates. However, a Compliance Document is only one method of complying with the Building Code. There may be alternative ways to comply.

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

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

F3: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	1 July 2001	p. 2, Document History, Status p. 7, References p. 9, Definitions	p. 14, 1.3.2 p. 15, 3.6.1 b) p. 21, 4.7.6
Second edition	22 March 2007	Document revised – second edition issued.	
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

Document Status

The most recent version of this document, as detailed in the Document History, is approved by the Chief Executive of the Department of Building and Housing. It is effective from 22 March 2007 and supersedes all previous versions of this document.

People using this Compliance Document should check for amendments on a regular basis. The Department of Building and Housing may amend any part of any Compliance Document at any time. Up-to-date versions of Compliance Documents are available from www.dbh.govt.nz

New Zealand Building Code Clause F3 Hazardous Substances and Processes

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE—*continued*

Clause F3—HAZARDOUS SUBSTANCES AND PROCESSES

Provisions	Limits on application
OBJECTIVE	
F3.1 The objective of this provision is to safeguard people from injury or illness, and *other property* from damage, caused by *hazardous substances* or processes in *buildings*.	
FUNCTIONAL REQUIREMENT	
F3.2 *Buildings* where *hazardous substances* are stored and *hazardous* processes undertaken, shall be constructed to provide *adequate* protection to people and to *other property*.	
PERFORMANCE	
F3.3 Spaces in *buildings* where *hazardous substances* are stored, handled or used, or where *hazardous* processes are undertaken, shall be located and constructed to protect people, and *other property*, under both normal and reasonably foreseeable abnormal conditions, and shall be provided with:	
(a) Means of restricting unauthorised access,	
(b) Means of preventing *hazardous substances*, or other materials unacceptable to the *network utility operator*, from entering *sewers* or public *drains*,	
(c) Means of allowing the harmless release of pressure where there is a significant risk of explosion occurring,	
(d) Protected ignition sources where flammable or explosive goods are stored,	
(e) Means of rendering harmless by ventilation, containment, dilution, or chemical or biological action, any radioactive, toxic or flammable vapours, gases or materials which may escape from pipes, vessels or containers.	

FIRST SCHEDULE—*continued*

Provisions	Limits on application
(f) Impervious, easily cleaned surface finishes on *building elements* likely to be splashed or become contaminated in the course of the *intended use* of the *building*, and (g) Signs as required by Clause F8 "Signs".	

Contents

References

For the purposes of New Zealand Building Code compliance, the acceptable New Zealand and other Standards, and other documents referred to in this Compliance Document (primary reference documents) shall be the editions, along with their specific amendments, listed below. Where the primary reference documents refer to other Standards or other documents (secondary reference documents), which in turn may also refer to other Standards or other documents, and so on (lower order reference documents), then the applicable version of these secondary and lower order reference documents shall be the version in effect at the date this Compliance Document was published.

	Where quoted
New Zealand Legislation	
Hazardous Substances and New Organisms Act 1996	VM1 1.0.1
Hazardous Substances (Classification) Regulations 2001	VM1 2.0.1
Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001	VM1 2.0.2, 3.1.1, 3.4.1
Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004	VM1 2.0.2, 3.2.1
Hazardous Substances (Emergency Management) Regulations 2001	VM1 3.3.1

Definitions

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

Construct in relation to a *building*, includes to design, build, erect, prefabricate, and relocate the *building*.

Escape height The height between the floor level in the *firecell* being considered and the floor level of the required *final exit* which is the greatest vertical distance above or below that *firecell*.

COMMENT:

1. It is necessary only to use the greatest height to the exits required for the *firecell* being considered, even though the *building* may have other *final exits* at lower or higher levels.
2. Where the *firecell* contains *intermediate floors*, or upper floors within *household units* the *escape height* shall be measured from the floor having the greatest vertical separation from the *final exit*.

Escape route A continuous unobstructed route from any *occupied space* in a *building* to a *final exit* to enable occupants to reach a *safe place*, and shall comprise one or more of the following *open paths*, *protected paths* and *safe paths*.

COMMENT:

Doors are not obstructions in an *escape route* provided they comply with C/AS1 Part 3 and D1/AS1.

Firecell Any space including a group of contiguous spaces on the same or different levels within a *building*, which is enclosed by any combination of *fire separations*, *external walls*, roofs, and floors.

COMMENT:

Floors, in this context includes ground floors, and those in which the underside is exposed to the external environment (e.g. when cantilevered). Note also that internal floors between *firecells* are *fire separations*.

Hazardous substance has the meaning given in the Hazardous Substances and New Organisms Act 1996.

Purpose group The classification of spaces within a *building* according to the activity for which the spaces are used.

Verification Method F3/VM1

1.0 Other legislation

1.0.1 The storage and use of *hazardous substances* is subject to the Hazardous Substances and New Organisms Act 1996 and Regulations, 'Gazette' notices and Group Standards issued under that Act. *Buildings* used for the storage or use of *hazardous substances* therefore must comply with that legislation as well as the Building Code.

1.0.2 The Hazardous Substances and New Organisms Act 1996 (HSNO Act) states in section 142(6):

> Any controls prescribed under any other Act for any hazardous substance shall not contravene the provisions of regulations made under sections 75 and 76 [for the control of hazardous substances] of this Act unless–
>
> (a) There is provision in that other Act that expressly provides that controls made under that other Act for specified purposes may contravene the provisions of regulations made under this Act; and
>
> (b) The controls are made for the purposes provided for in that Act.

1.0.3 There are no provisions in the Building Act for the Building Code to contravene any controls made under the HSNO Act.

2.0 Scope

2.0.1 This document covers substances defined as Class 2 (flammable gases), Class 3.1 (flammable liquids), Class 4 (flammable solids) and Class 5 (Oxidising substances and organic peroxides) under the Hazardous Substances (Classification) Regulations 2001. Low flashpoint diesel (low flash domestic heating oil and alpine diesel) shall be deemed to have a flammable classification of 3.1D.

2.0.2 This document is a Verification Method for the construction of *buildings* where Classes 2, 3.1, 4 and 5 *hazardous substances* are stored in excess of the quantities given in:

Table 4 of Schedule 3 for classes 2, 3 and 4

Table 1 of Schedule 4 for class 5

Table 2 of Schedule 4 for class 5

Table 1 of Schedule 5 for class 5

of the Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001 or in accordance with the provisions of Schedule 10 of the Hazardous Substances (Dangerous Goods and Toxic Substances) Transfer Notice 2004.

(Refer to www.legislation.co.nz and the 'Gazette', March 2004 No. 35, www.gazette.govt.nz for this legislation.)

3.0 Referenced legislation

3.0.1 Construction in compliance with the following documents shall be deemed as providing compliance with Clause F3.3 (a) to (e) of the Building Code.

3.1 Control of ignition and control of adverse effects of ignition for Classes 1 to 5

3.1.1 Parts 1 and 2 and 4 to 6 and Schedules 3, 4 and 5 of the Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001. (Refer to www.legislation.co.nz)

3.2 Methods of construction and isolation distances for Classes 2 and 3.1 only

3.2.1 Parts 1 to 4 of Schedule 10 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004. (Refer to the 'Gazette', March 2004 No. 35, www.gazette.govt.nz)

3.2.2 Note that paragraph 32 of Schedule 10 states:

> A separation distance from an area of high intensity land use calculated under Part 2 or Part 3 must not be calculated beyond the boundary of the property at which the relevant hazardous substance is present unless the person in charge of any property beyond that boundary agrees that the separation distance may be calculated to include the property of which the person is in charge.

3.3 Secondary containment systems (bunding)

3.3.1 Regulations 35 to 41 and Schedule 4 of the Hazardous Substances (Emergency Management) Regulations 2001. (Refer to www.legislation.co.nz)

3.4 Security

3.4.1 Regulation 56 for Classes 2, 3 and 4 of the Hazardous Substances (Classes 1 to 5 Controls) Regulations in the specified quantities. Regulations 89, 107 and 123 for Classes 5.1.1 and 5.1.2 of the Hazardous Substances (Classes 1 to 5 Controls) Regulations. (Refer to www.legislation.co.nz)

COMMENT

1. Means of egress may be in accordance with C/AS1: Part 3 provided that:
   - the *firecells* are considered as WF *purpose group*
   - *firecells* having a floor area greater than 50 m^2 have at least two *escape routes*
   - *firecells* having an *escape height* of more than 3 m have at least two *escape routes*.
2. Note the requirement for the establishment of a *hazardous substance* location under the Hazardous Substances (Classes 1 to 5 Controls) Regulations.
3. A container for a *hazardous substance*, including stationary containers or tanks, is a defined term in the Hazardous Substances and New Organisms Act. Containers for *hazardous substances* are not *buildings* for the purposes of the Building Act.

Index F3/VM1

All references to Verification Methods are preceded by **VM**.

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

**MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT**
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 2), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 1 January 2017 and supersedes all previous versions of this document.

The previous version of this document (Amendment 1) will cease to have effect on 30 May 2017.

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.building.govt.nz

F4: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	September 1993	p. 3, 1.2.1	p. 4, 2.0.1
Amendment 2	19 August 1994	pp. i and ii, Document History p. 3, 1.1.1, 1.2.1	p. 3, Table 1, Table 2 p. 5, Index
Reprinted incorporating Amendments 1 and 2	March 1995		
Amendment 3	1 December 1995	p. ii, Document History p. iii, F4.3.3	p. iv, F4.3.4 f) and g), F4.3.5 a)
Second edition	28 February 1998	Document revised – second edition issued	
Amendment 4	6 January 2002	p. 3, Code Clause F4	
Reprinted incorporating Amendment 4	September 2003		
Third edition	Published March 2007 Effective from 24 September 2007	Document revised – third edition issued	
Amendment 1	Effective from 21 June 2007 until 30 May 2017	p. 4, Building Code Clause F4	
Amendment 2	Effective 1 January 2017	pp. 5–5 Code Clause F4 p. 7 References p. 9 Definitions p. 13 F4/AS1 Table 1	p. 17 F4/AS1 1.2.2, 1.2.3 p. 18 F4/AS1 Figure 6 p. 19 1.2.6, 1.2.7, 2.1, 2.1.1, 2.1.3, 2.1.4

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

New Zealand Building Code Clause F4 Safety from Falling

The mandatory provisions for building work are contained in the New Zealand Building Code (NZBC), which comprises the First Schedule to the Building Regulations 1992. The relevant NZBC Clause for Safety from Falling is F4.

FIRST SCHEDULE–*continued*

Clause F4–SAFETY FROM FALLING

Provisions	Limits on application
OBJECTIVE **F4.1** The objective of this provision is to safeguard people from injury caused by falling.	
FUNCTIONAL REQUIREMENT **F4.2** *Buildings* shall be constructed to reduce the likelihood of accidental fall.	
PERFORMANCE **F4.3.1** Where people could fall 1 metre or more from an opening in the external envelope or floor of a *building*, or from a sudden change of level within or associated with a *building*, a barrier shall be provided.	Performance F4.3.1 shall not apply where such a barrier would be incompatible with the *intended use* of an area, or to temporary barriers on *construction* sites where the possible fall is less than 3 metres or to *buildings* providing pedestrian access in remote locations where the route served presents similar natural hazards.
F4.3.2 Roofs with permanent access shall have barriers provided.	
Amend 2 Jan 2017	
F4.3.4 Barriers shall: (a) Be continuous and extend for the full extent of the hazard, (b) Be of appropriate height, (c) Be constructed with *adequate* rigidity, (d) Be of *adequate* strength to withstand the foreseeable impact of people and, where appropriate, the static pressure of people pressing against them. (e) Be constructed to prevent people from falling through them, and	

FIRST SCHEDULE–*continued*

Provisions	
Amend 2 Jan 2017 (g) Restrict the passage of children under 6 years of age when provided to guard a change of level in areas likely to be frequented by them.	
Amend 1 Jun 2007 (h) Be constructed so that they are not readily able to be used as seats.	**Performance F4.3.4(h) does not apply to *Housing*.**

Amend 2 Jan 2017

Contents

References

For the purposes of New Zealand Building Code compliance, the acceptable New Zealand and other Standards, and other documents referred to in these Acceptable Solutions and Verification Methods (primary reference documents) shall be the editions, along with their specific amendments, listed below. Where the primary reference documents refer to other Standards or other documents (secondary reference documents), which in turn may also refer to other Standards or other documents, and so on (lower order reference documents), then the applicable version of these secondary and lower order reference documents shall be the version in effect at the date these Acceptable Solutions and Verification Methods were published.

Amend 2 Jan 2017

Amend 2 Jan 2017

Where quoted

Amend 2 Jan 2017

Definitions

Amend 2 Jan 2017

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

Balustrade The infill parts of a barrier (typically between floor and top rail).

Building has the meaning ascribed 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.

Handrail A rail to provide support to, or assist with the movement of, a person.

Household unit

a) means any *building* or group of *buildings*, or part of a *building* or group of *buildings*, that is:

i) used, or intended to be used, only or mainly for residential purposes; and

ii) occupied, or intended to be occupied, exclusively as the home or residence of not more than one household; but

b) does not include a hostel, boarding house or other specialised accommodation.

Intended use in relation to a *building*:

a) includes any or all of the following:

i) Any reasonably foreseeable occasional other use that is not incompatible with the *intended use*; and

ii) Normal maintenance; and

iii) Activities taken in response to *fire* or any other reasonably foreseeable emergency

b) but does not include any other maintenance and repairs or rebuilding.

Nosing The rounded projecting edge of a stair tread.

Pitch line The line joining the leading edge or *nosings* (if any) of successive stair treads within a single flight of stairs.

Theatre A place of assembly intended for the production and viewing of performing arts, and consisting of an auditorium and stage with provision for raising and suspending stage scenery above and clear of the working area.

Verification Method F4/VM1

No specific test methods have been adopted for verifying compliance with the Performance of NZBC F4.

Acceptable Solution F4/AS1

1.0 Barriers in Buildings

1.1 Barrier heights

1.1.1 Minimum barrier heights are given in Table 1.

COMMENT:
Refer to NZBC Clause D1 for *handrails* on stairs. *Handrails* can be constructed as an integral part of a barrier.

1.2 Barrier construction

1.2.1 In housing and other areas likely to be frequented by children under 6 years of age:

a) Figures 1-4 show acceptable barrier constructions

b) Openings anywhere over the full height of the barrier shall be such a size that a 100 mm diameter sphere cannot pass through them, and

c) The triangular opening formed by the riser, tread, and bottom rail of the barrier on a stair shall be of such a size that a 150 mm diameter sphere cannot pass through it (see Figure 4).

COMMENT:

1. *Buildings* classified as housing are always likely to be frequented by children under 6 years of age. However, 'Likely to be frequented' in regard to other *buildings* means something more than that children under 6 will be present from time to time. There should be an expectation that small children will be present on a regular basis (see Determination No. 2001/9 on www.dbh.govt.nz). Different parts of a *building* may have different barrier requirements, such as shopping malls where children under 6 are likely to frequent the public areas, but not the areas used for food preparation or the handling of stock.
2. The Clause F4.3.4(g) requirement that barriers restrict the passage of children under 6 years of age does not mean that all children under 6 must be unable to climb them. The Acceptable Solutions given here will prevent almost all children up to the age of 3 years from climbing. They can also be used as a guide for alternative designs.
3. Barriers with full height vertical members are the hardest for children to climb. Horizontal or near horizontal rails can easily be climbed by 2 year olds if the rails extend the full height of a barrier, even if the barrier includes a 200 mm wide top rail or if it slopes inwards at 15°.

Table 1: Minimum Barrier Heights
Paragraph 1.1.1, Figures 1-5

Building type	Location	Barrier height (mm) (Note 1)
Detached dwellings and within *household units* of multi-unit dwellings	Stairs and ramps and their intermediate landings	900
	Balconies and decks, and edges of internal floors or mezzanine floors	1000
All other *buildings*, and common areas of multi-unit dwellings	Stairs or ramps	900
	Barriers within 530 mm of the front of fixed seating	800
	All other locations	1100

Note:

1. Heights are measured vertically from finished floor level (ignoring carpet or vinyl, or similar thickness coverings) on floors, landings and ramps. On stairs the height is measured vertically from the *pitch line* or stair *nosings*.
2. A landing is a platform with the sole function of providing access.
3. Clause F4.3.1 has a limit on its application that may exclude the need for barriers in certain locations such as working wharves and loading docks.
4. An 800 mm high barrier in front of fixed seating would be appropriate in cinemas, *theatres*, and stadiums.
5. Where a *handrail* is mounted on top of a stairway barrier it may transition up to a height of 1100 mm on the intermediate landings.

Amend 2 Jan 2017

Amend 2 Jan 2017

1.2.2 In areas used exclusively for emergency or maintenance purposes in *buildings*, and in other *buildings* not frequented by children, barriers may have openings with maximum dimensions of either:

a) 300 mm horizontally between vertical *balustrade* members, or

b) 460 mm vertically between longitudinal rails.

COMMENT:
Where permanent access to roofs is provided only for the maintenance of building services the need for a barrier and its construction will depend on the roof slope and the proximity of the roof edge.

1.2.3 Figure 5 shows acceptable methods for constructing parapet and rail barriers so that they are not readily able to be used as seats, as required by Clause F4.3.4(h) for buildings other than housing.

COMMENT:
This requirement is particularly applicable to crowd situations such as cinemas, stadiums and bars.

Amend 2 Jan 2017

1.2.4 Where the height of fall from the deck on a house is less than 1 m, a fixed seat may be constructed on the deck as shown in Figure 6(a). Where the height of fall from the deck is more than 1 m, a fixed seat shall be constructed as in Figure 6(b).

1.2.5 When a barrier is provided on a retaining wall, it shall comply with Paragraphs 1.1 and 1.2.

COMMENT:
NZBC Clause F4.2 refers to the 'likelihood' of accidental fall. Not all retaining walls are in a location where people are likely to fall from them. Therefore, the need for a barrier (and the type of barrier) on a particular retaining wall can be judged in terms of the likelihood of people being present at the top of that wall (see Determination No. 99/012 on www.dbh.govt.nz)

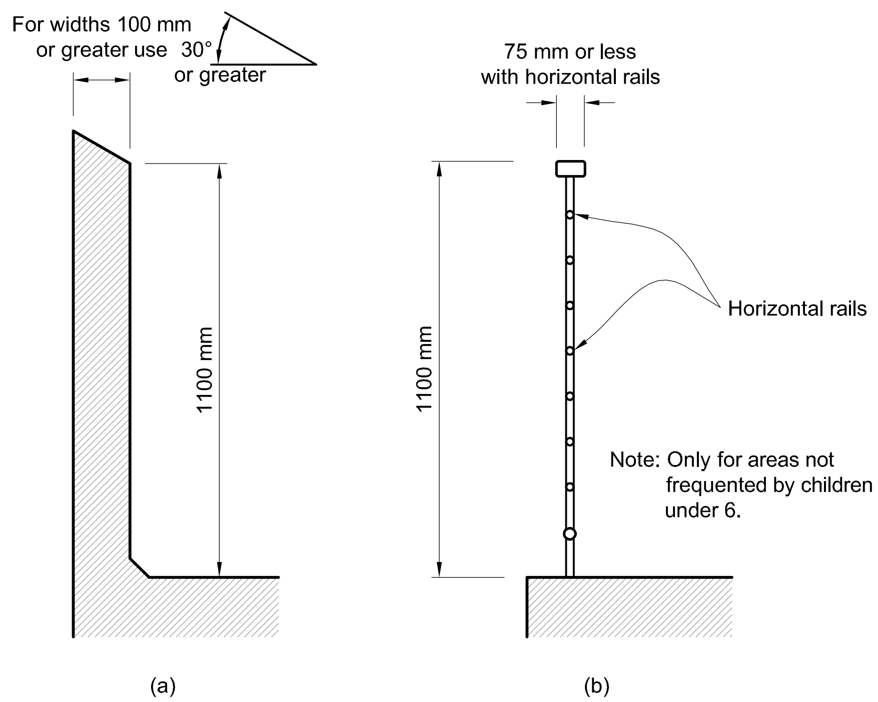
1.2.6 Construction site barriers shall have:

a) one or more intermediate horizontal rails in addition to the top rail and a maximum vertical opening between rails of 460 mm, or

b) a top rail at a height of 1000 mm and a toeboard that extends at least 225 mm above the platform, and

c) barrier rails at a maximum distance of 200 mm horizontally from the platform edge.

Figure 5: Parapet and rail barriers
Paragraph 1.2.3



Scaffolding cross-bracing between standards with a single lift may be used as a top rail for construction site barriers provided:

a) The braces cross at a height of between 1000 mm and 1100 mm above the platform, and

b) The platform is decked to within 200 mm of a vertical plane through the cross-bracing.

COMMENT:
See Worksafe guidance for working at any height.

Amend 2
Jan 2017

2.0 Opening windows

2.1 Paragraphs 2.1.1 to 2.1.4 apply where the possible height of fall from an open window is more than 1000 mm. The possible height of fall shall be measured from the inside floor level adjacent to the window.

Paragraphs 2.1.1(a) and 2.1.2(a) apply only when there are no projections or ledges below the opening that would assist a child in climbing.

COMMENT:
The height of the lower edge of the window opening above the floor usually determines the safety of the window for small children. However, the presence of a window seat or toilet pan means children can more easily gain access to the window opening.

If a fixed window seat is provided, the lower edge of the opening shall be measured from the seat.

Where a toilet pan or any other fixed feature is within 500 mm horizontally of a window, the lower edge of the opening shall be measured vertically from the pan or feature.

Amend 2
Jan 2017

2.1.1 In housing and areas of other *buildings* likely to be frequented by children under 6 years of age, a window with an opening width of less than 1000 mm shall have either:

a) the lower edge of the opening at least 760 mm above floor level, or

b) a restrictor fitted to limit the maximum opening so that a 100 mm diameter sphere cannot pass through it, or

c) a 760 mm high barrier protecting the opening of solid construction or with vertical members its full height.

COMMENT:
1. When a window opening width is less than 1000 mm a sill height of 760 mm is considered sufficient to protect older children and adults from falling through the opening. When the opening is wider than 1000 mm the opening needs to be treated in the same way if it were a balcony and the Table 1 barrier heights used, as in paragraph 2.1.2.

Amend 2
Jan 2017

2.1.2 In housing and areas of other *buildings* likely to be frequented by children under 6 years of age, a window with an opening width of more than 1000 mm shall have either:

a) the lower edge of the opening at a height above floor level as given for barriers in Table 1, or

b) a barrier of the same height protecting the opening complying with Paragraph 1.2.1.

2.1.3 In areas of *buildings* not likely to be frequented by children under 6 years of age, a window with an opening width of less than 1000 mm shall have either:

a) the lower edge of the opening at a height of at least 760 mm above floor level, or

b) a restrictor fitted to limit the maximum dimension of the opening in at least one direction to 460 mm, or

c) a 760 mm high barrier protecting the opening complying with Paragraph 1.2.2.

Amend 2
Jan 2017

2.1.4 In areas of *buildings* not likely to be frequented by children under 6 years of age, a window with an opening width of more than 1000 mm shall have either:

a) the lower edge of the opening at a height of at least 1100 mm above floor level, or

b) a 1100 mm high barrier protecting the opening complying with Paragraph 1.2.2, or

c) a restrictor fitted to limit the maximum dimension of the opening in at least one direction to 460 mm.

COMMENT:
Paragraphs 2.1.3 and 2.1.4 are not applicable to *housing,* see Table 1.

Amend 2
Jan 2017

Index F4/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Compliance Document for New Zealand Building Code Clause F5 Construction and Demolition Hazards

Prepared by the Department of Building and Housing

This Compliance Document is prepared by the Department of Building and Housing. The Department of Building and Housing is a Government Department established under the State Sector Act 1988.

Enquiries about the content of this document should be directed to:

Department of Building and Housing
PO Box 10-729, Wellington.
Telephone 0800 242 243
Fax 04 494 0290
Email: info@dbh.govt.nz

Sales enquiries should be directed to:
Customer Services,
Victoria University Book Centre
PO Box 12-337, Wellington, New Zealand
Telephone 0800 370 370, (04) 463 5511
Fax (04) 463 5510
Email: dbh@vicbooks.co.nz
www.vicbooks.co.nz
ISBN 0-477-01606-5

Status of Compliance Documents

Compliance Documents are prepared by the Department of Building and Housing in accordance with section 22 of the Building Act 2004. A Compliance Document is for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Compliance Document will be treated as having complied with the provisions of the Building Code to which the Compliance Document relates. However, a Compliance Document is only one method of complying with the Building Code. There may be alternative ways to comply.

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

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

F5: Document History

	Date	Alterations
First published	July 1992	
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.		

Document Status

The most recent version of this document, as detailed in the Document History, is approved by the Chief Executive of the Department of Building and Housing. It is effective from 1 July 1992 and supersedes all previous versions of this document.

People using this Compliance Document should check for amendments on a regular basis. The Department of Building and Housing may amend any part of any Compliance Document at any time. Up-to-date versions of Compliance Documents are available from www.dbh.govt.nz

New Zealand Building Code Clause F5 Construction and Demolition Hazards

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE–*continued*

Clause F5–CONSTRUCTION AND DEMOLITION HAZARDS

Provisions	Limits on application
OBJECTIVE **F5.1** The objective of this provision is to safeguard people from injury, and *other property* from damage, caused by *construction* or demolition site hazards. **FUNCTIONAL REQUIREMENT** **F5.2** *Construction* and demolition work on *buildings* shall be performed in a manner that avoids the likelihood of: (a) Objects falling onto people on or off the site, (b) Objects falling on property off the site, (c) Other hazards arising on the site affecting people off the site and *other property*, and (d) Unauthorised entry of children to hazards on the site. **PERFORMANCE** **F5.3.1** Suitable *construction* methods shall be used to avoid the likelihood of tools or materials falling onto places where people might be present. **F5.3.2** Where *construction* or demolition work presents a hazard in places to which the public has access, barriers shall be provided and shall: (a) Be of appropriate height and *construction* to prevent site hazards from harming traffic or passersby, (b) Be difficult to climb, (c) Have no openings other than those approved by the *territorial authority* for access and viewing, (d) Have no gates or doors which project beyond the site when opened,	

FIRST SCHEDULE–*continued*

Provisions	Limits on application
(e) Contain no projection that would be a hazard to traffic or people, and (f) Be clearly marked where the barrier itself may otherwise present a hazard to traffic or passersby. **F5.3.3** Where a *construction* or demolition site contains any hazard which might be expected to attract the unauthorised entry of children, the hazard shall be enclosed to restrict access by children. **F5.3.4** Suitable barriers shall be constructed to provide a safe route for people where lifting equipment creates a risk of accident from objects falling on a place of public access, or where a similar risk results from the height at which *construction* or demolition work is being carried out.	

Contents

References

For the purposes of New Zealand Building Code compliance, referenced documents shall be deemed to include any amendments issued prior to the date of the Approved Document as displayed at the foot of the page on which the references are listed.

There are no referenced documents.

Definitions

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

Building has the meaning ascribed to it by the Building Act 1991.

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

Gantry A structure covering a public way providing protection from both the side and overhead.

Hoarding A structure alongside a public way providing side protection but no overhead protection.

Verification Method F5/VM1

No specific test methods have been adopted for verifying compliance with the Performance of NZBC F5.

Acceptable Solution F5/AS1

1.0 Work-Site Barriers

1.0.1 The necessity for barriers will depend mainly on the site location. The need will be greater in areas with high levels of pedestrian traffic (i.e. in Central Business Districts), than in industrial or rural areas. Barriers are not necessary for domestic dwellings up to 2 storeys above ground level unless specific hazards exist.

COMMENT:
At all work-sites hazard evaluation will take account of:

1. Pedestrian counts adjacent to the site.
2. Car parking adjacent to the site.
3. Location of neighbouring *buildings*.
4. Presence of neighbouring work-sites or recreation areas.
5. Proximity to schools or early childhood centres.
6. Proximity to housing.
7. The depth of a water hazard.
8. The period of time for which ponded water will be present.
9. The accessibility and 'visibility' of the site.

1.0.2 If a work-site is not completely enclosed, and unauthorised entry by children is likely, it is acceptable for specific hazards to be fenced only when workers are absent from the immediate vicinity.

1.0.3 Where the potential hazard at a work-site makes a safety barrier necessary, a barrier complying with Table 1 is an acceptable solution.

1.1 Site fences and hoardings

1.1.1 Fences and *hoardings* shall extend at least 2.0 m in height from ground level on the side accessible to the public.

1.1.2 An acceptable fence may be constructed with galvanised chainlink netting having a maximum sized grid of 50 mm x 50 mm. Post spacing shall be a maximum of 2.5 m, and the gap between the bottom of the fence and ground no greater than 100 mm.

1.1.3 Any *hoarding* shall have continuous cladding in any of the following materials:

a) Close-butted timber with a thickness of at least 19 mm.

b) 6.0 mm thick exterior grade plywood on studs spaced at no greater than 600 mm centres.

c) 9.5 mm thick exterior grade plywood on studs spaced at no greater than 1000 mm centres.

d) Continuous metal cladding constructed with studs and rails spaced to provide strength and rigidity comparable with the *hoardings* in Paragraphs 1.1.3 a) to c).

Table 1: Barriers for Different Site Conditions
Paragraph 1.0.3

Horizontal distance of work from site boundary (D)	Height of work above site boundary (H)	Acceptable barrier
Less than 3.0 m	Any height	Gantry
Between 3.0 m and 15 m	H less than D H between D and 2D H greater than 2D	Linkmesh fence Hoarding Gantry
Greater than 15 m	Any height	Linkmesh fence

1.1.4 Viewing windows where used shall be screened with chainlink netting.

1.1.5 There shall be no gap between the lower edge of *hoardings* and the ground that would allow site-water run-off to flow onto a public footway.

1.2 Water hazard fences

1.2.1 The fence shall have a height above the outside ground level of at least 1.2 m if solid sheathed or 1.8 m if constructed of netting.

1.2.2 No fence shall have external horizontal members or projections which could provide a foothold that are spaced closer than 900 mm vertically.

1.2.3 The netting mesh size shall be no greater than 50 mm x 50 mm, and there shall be no openings through which a 100 mm diameter sphere can pass.

1.3 Gantries

1.3.1 A *gantry* shall protect a walkway with a vertical side wall and a horizontal overhead platform.

1.3.2 The side wall separating the work-site from the walkway shall comply with Paragraphs 1.1.1 and 1.1.3.

1.3.3 Two side walls shall be provided where a *gantry* is adjacent to a crane pick-up point (i.e. the *gantry* is clad on the sides in accordance with Paragraph 1.1.3).

1.3.4 The outside wall, if immediately adjacent to road traffic, shall be protected by a timber fender of no less than 300 mm x 75 mm, with its lower edge 500 mm above the road surface. An alternative fender may consist of two scaffold tubes spaced vertically at 250 mm centres, with the underside of the lower tube 500 mm above the road surface.

1.3.5 The overhead platform shall have at least 2.4 m clearance above the walkway surface and be constructed of either close-butted timber at least 50 mm thick, or of steel plate having a minimum thickness of 5 mm.

COMMENT:
Refer to NZBC B1 for design loadings for *gantries*.

1.3.6 The platform shall be sufficiently watertight to prevent water dripping on walkway users.

COMMENT:
The *territorial authority* may require *gantries* to be artificially lit.

1.4 Toeboards

1.4.1 Toeboards for preventing objects falling off storage or access platforms shall be at least as high as the materials stacked on the platform, and no less than 100 mm above the platform. The maximum gap between platform and toeboard shall not exceed 10 mm.

1.4.2 If however, stacked materials are otherwise restrained from falling (e.g. if long pieces of timber are held by the handrail posts), the minimum toeboard shall be satisfactory.

COMMENT:
Where toeboards are used as a means of compliance with NZBC F5.3.1, they are not a substitute for *gantries* or *hoardings* described in Paragraphs 1.1 and 1.3.

Index F5/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 4), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 1 January 2017 and supersedes all previous versions of this document.

The previous version of this document (Amendment 3) will cease to have effect on 30 May 2017.

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.building.govt.nz

F6: Document History			
	Date	**Alterations**	
First published	July 1992		
Amendment 1	1 December 1995	pp. i and ii, Document History p. iii, F6.3.1 p. v, Contents p. vi, References	p. 3, 1.2.1, 1.3 pp. 4 and 5, Table A1 p. 7, Index
Reprinted incorporating Amendment 1	July 1996		
Second edition	1 December 2000 Effective from 1 June 2001	Document revised – second edition issued	
Amendment 1	21 June 2007	Name of Compliance Document amended throughout pp. 3 and 4, new Building Code Clause F6	
Third Edition	18 October 2007	Document revised – Third edition issued	
Amendment 2	Effective from 10 October 2011 until 14 August 2014	p. 2, Document History, Status p.7, References	
Amendment 3	14 February 2014 until 030 May 2017	p. 2A, Document History, Status p.7, References	p. 9 Definitions p. 13, F6/AS1 1.2
Amendment 4	Effective 1 January 2017	p. 13 F6/AS1 1.2 pp. 16-17 F6/AS1 Appendix A p. 23 Index	
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

New Zealand Building Code Clause F6 Visibility in Escape Routes

The mandatory provisions for building work are contained in the New Zealand Building Code (NZBC), which comprises the First Schedule to the Building Regulations 1992. The relevant NZBC Clause for Visibility in Escape Routes is F6.

SR2007/124

Clause F6–Visibility in escape routes

Provisions	Limits on application
Objective	
F6.1 The objective of this provision is to help safeguard people from injury in *escape routes* during failure of the main lighting.	
Functional requirement	
F6.2 *Specified features* in *escape routes* must be made *reasonably visible* by lighting systems, other systems, or both, during failure of the main lighting.	Requirement F6.2 does not apply to *Detached Dwellings, household units* within *Multi-unit Dwellings*, *Outbuildings*, or *Ancillary buildings*.
Performance	
F6.3.1 *Specified features* in *escape routes* must, when the systems for visibility are at their design level, be *reasonably visible*.	Performance F6.3.1 does not apply to *specified features* in the initial 20 metres of an *escape route* if the risk of injury, or impediment to movement of people, due to the *specified features* not being visible is low (for example, because people are familiar with the *escape route*, the *escape route* is level, and people do not require assistance to escape).
F6.3.2 The systems for visibility must operate to the following percentages of their design levels within the following times after failure of the main lighting: (a) 80% in 0.5 seconds in locations (examples of which are given by performance F6.3.3) where there is a high risk of injury due to delay in operation of the systems for visibility; and (b) 10% in 0.5 seconds, and 80% in 30 seconds, in stairs and in locations that are unfamiliar to users; and (c) 10% in 20 seconds, and 80% in 60 seconds, in all other locations.	
F6.3.3 Examples of locations (referred to in performance F6.3.2(a)) where there is a high risk of injury due to delay in operation of the systems for visibility include:	

SR2007/124

Provisions	**Limits on application**
Performance–continued (a) areas where dangerous machinery is installed: (b) areas where hazardous processes take place: (c) clinical areas of hospitals: (d) prisons and other *buildings* in which people are detained: (e) any part of an *escape route* designed for use at any time by more than 250 people. **F6.3.4** The systems for visibility must operate continuously in *build -ings* or parts of buildings in the following risk groups for the following periods after failure of the main lighting: (a) *risk group A*, until restoration of the main lighting system: (b) *risk group B*, 90 minutes: (c) *risk group C*, 30 minutes. **F6.3.5** Despite performance F6.3.4, if a *building* or part of a *building* falls into both *risk group A* and *risk group B*, the systems for visibility must operate for whichever is the longer of the periods specified in performance F6.3.4(a) and (b). **F6.3.6** Signs to indicate escape routes must be provided as required by Clause F8 "Signs".	

Contents

References

Amend 3 Feb 2014

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 2 Oct 2011

Amend 3 Feb 2014

		Where quoted
Standards New Zealand		
NZS 4332: 1997	Non-domestic passenger and goods lifts	AS1 1.2 Comment
NZS 6104: 1981	Specification for emergency electricity supply in buildings	AS1 1.8.2
Standards Australia		
AS 2293:	Emergency evacuation lighting for buildings	
Part 1: 2005	System design, installation and operation *Amend: 1*	AS1 1.8.1, 1.8.2
Part 3: 2005	Emergency escape luminaires and exit signs *Amend: 1*	AS1 1.8.1
Standards – Australia/New Zealand		
AS/NZS 1680.1: 2006	Interior and workplace lighting: General principles and recommendations	AS1 1.4.1
AS/NZS 2293:-	Emergency evacuation lighting for buildings	
Part 2: 1995	Inspection and maintenance *Amends: 1, 2, 3*	AS1 1.8.3

Amend 3 Feb 2014 / Amend 2 Oct 2011 (AS 2293 Part 1); Amends 2 and 3; Amend 2 Oct 2011 / Amend 3 Feb 2014 (AS/NZS 2293 Part 2)

Definitions

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 3 Feb 2014

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

Building consent means a consent to carry out *building work* granted by a *building consent authority* under section 49 of the *Building Act 2004*.

Building height means the vertical distance between the floor of the lowest *final exit* from the *building*, and the highest occupied floor level containing or supporting any *purpose group* other than IE, IA or ID, or penthouses used to enclose *stairways*, lift shafts or machinery rooms located on or within the roof.

Classified use means a *classified use* listed in clause A1 of the *Building Code*.

Exitway means all parts of an *escape route* protected by *fire* or *smoke separations*, or by distance when exposed to open air, and terminating at a *final exit*.

Final exit The point at which an *escape route* terminates by giving direct access to a *safe place*.

COMMENT:
Final exits are commonly the external doors from a ground floor, but this applies only if such doors open directly onto a *safe place*. If a *safe place* can be reached only by passing down an alley, or across a bridge, then the *final exit* is not reached until the end of such an alley or bridge. *Final exits*, therefore, should be seen strictly as a point of arrival, rather than as any particular element of a *building*. They are determined entirely by the definition of *safe place*.

Illuminance means the luminous flux falling on to a unit area of surface.

Reasonably visible, in relation to a *specified feature*, and for the purposes of Clause F6, means that the *specified feature* is visible to a person who—

(a) is 10 metres from it, or the greatest distance from it that it is possible to go in the open space surrounding it, whichever is the lesser; and

(b) has sight that is not defective, or is corrected (for example, by an optical appliance).

Risk group A, for the purposes of performance F6.3.4 and performance F6.3.5, means *buildings*—

(a) whose occupants are required to remain in the *building* until the main lighting system is restored; or

(b) whose *evacuation time* is longer than 90 minutes.

Risk group B, for the purposes of performance F6.3.4 and performance F6.3.5, means *buildings*—

(a) whose *evacuation time* is 30 minutes or longer but not longer than 90 minutes; or

(b) whose occupant load is more than 1,000.

Risk group C, for the purposes of performance F6.3.4, means *buildings* not in *risk group A* or *risk group B*.

Safe place A place of safety in the vicinity of a *building*, from which people may safely disperse after escaping the effects of a *fire*. It may be a place such as a street, *open space*, public space, or an *adjacent building*.

Specified features, for the purposes of Clause F6, means the following:

(a) ***building elements*** that may act as obstructions:

(b) safety features required under clauses of the *Building Code* other than Clause F6 (for example, *handrails* required under Clause D1):

(c) changes in direction:

(d) stairs and ramps:

(e) escape doors:

(f) entries to a *safe place*.

Travel Distance The length of the *escape route* as a whole or the individual lengths of its parts, namely:

(a) *Open paths*;
(b) *Protected paths*; and
(c) *Safe paths*.

Verification Method F6/VM1

No specific test methods have been adopted for verifying compliance with the Performance of NZBC F6.

Acceptable Solution F6/AS1

Emergency Lighting Location, Illuminance and Installation

1.1 Scope

This Acceptable Solution applies to situations where emergency lighting is used as the sole means of meeting the performance requirements of Clause F6.

This Acceptable Solution does not apply to lighting that is essential to maintain safe working conditions.

COMMENT:

1. This Acceptable Solution is for illuminance-based emergency lighting systems only.
2. Examples of situations where lighting is essential to maintain safe working conditions include rotating machinery, operating theatres, and handling hazardous substances and organisms.
3. It should be noted that, irrespective of whether or not emergency lighting is required, the provision of signs must comply with Clause F8.

1.2 Location

Emergency lighting must be provided in all of the following:

(a) in all *exitways*,

(b) at every change of level in an *escape route*,

(c) in an *escape route* from the point where the initial *open path travel distance* exceeds 20 metres,

(d) in any *occupied space* designed for an *occupant load* of more than 250 people including all *escape routes* serving that space,

(e) in any part of an *escape route* designed to serve more than 250 people,

(f) in the *escape routes* of the *classified use* Community Care.

COMMENT:

1. To determine the *occupant load* of a floor refer to section 1.4 of C/AS1 through to C/AS6 as appropriate.
2. Paragraph 1.2 (b) applies to stairs, steps, ramps etc. A slope with a gradient steeper than 1 in 20 is considered a ramp for the purposes of this paragraph.
3. Paragraph 1.2 (c) recognises that people can find their way in darkness over relatively short distances to areas provided with acceptable visual conditions. Acceptable visual conditions can be provided either by an illuminated floor surface complying with Paragraphs 1.3.1 and 1.3.2 (a) or by directly visible illuminated areas complying with Paragraph 1.3.2 (b).
4. Examples of 20 metre travel distance measurement are given in Appendix D.
5. To reach a *safe place* the *escape route* may include an external portion. The requirements of this Acceptable Solution also apply to this external portion.
6. Lighting for emergency in lifts is contained in Acceptable Solution D2/AS1, which references NZS 4332.

Amend 4 Jan 2017

Amend 3 Feb 2014

1.3 Illuminance

1.3.1 Where required by Paragraph 1.2, emergency lighting must provide a direct *illuminance* of no less than:

(a) 1 lux in *exitways*, and

(b) 1 lux at every change in level in an *escape route*, and

(c) 0.2 lux everywhere else.

1.3.2 As an alternative to Paragraph 1.3.1, specific *escape routes* must be identified and provided with a direct *illuminance* of no less than:

(a) 1 lux in *exitways* and 1 lux throughout the route, or

(b) 10 lux across the width of the route with a uniformity ratio along the route of not greater than 100:1 (maximum to minimum) and 10 lux at changes of direction, changes of level and where the route enters an *exitway* or *final exit*.

1.3.3 For certain *buildings* or portions of *buildings* the *illuminance* specified in Paragraphs 1.3.1 and 1.3.2 may be insufficient. For locations such as noted in (a) to (d) below, Paragraphs 1.3.1 and 1.3.2 are therefore not applicable and the *illuminance* levels are to be determined by specific design:

(a) areas with dangerous machinery,

(b) areas containing hazardous processes,

(c) clinical areas of hospitals, and

(d) prisons and other places of detention.

1.4 Method of Measurement

1.4.1 *Illuminance* must be measured in accordance with Appendix B of AS/NZS 1680.1

1.4.2 Measurements must be made at floor level.

1.4.3 Measurements must not be made within 500 mm of vertical surfaces. Minimum *illuminance* will generally occur furthest from the luminaire(s) and at least four measurements shall be made around each luminaire on both axes. If the layout of luminaires is symmetrical, the number of measurements may be reduced.

1.4.4 Daylight or spill light from adjacent rooms must be excluded and the lamps switched on and allowed to stabilise prior to measurements being taken.

1.5 Start-up and Light Output

1.5.1 The emergency lighting system must initiate within the following times and provide:

(a) 80% of design *illuminance* level in 0.5 seconds in locations where there is a high risk of injury due to delay in operation of the emergency lighting, such as:

(i) areas with dangerous machinery,

(ii) areas containing hazardous processes,

(iii) clinical areas of hospitals,

(iv) prisons and other places of detention, and

(v) any part of an *escape route* designed for more than 250 people.

(b) 10% of design *illuminance* level in 0.5 seconds and 80% design *illuminance* level in 30 seconds in stairs or locations where the majority of the occupants/users are not familiar with the space, and

(c) 10 % of the design *illuminance* level in 20 seconds and 80% of the design *illuminance* level in 60 seconds in all other locations.

1.6 Duration

1.6.1 Emergency lighting must be maintained for the following durations:

(a) Continuously in *buildings* or parts of *buildings* where the occupants are required to remain in the *building* until the main lighting system is restored, or *buildings* that have an evacuation time of over 90 minutes,

(b) 90 minutes for *buildings* with an:

(i) *Escape height* over 150 metres, or

(ii) Evacuation time between 30 and 90 minutes, or

(iii) Occupant load over 1000

(c) 30 minutes for all other *buildings*.

1.7 Documentation

1.7.1 Where Paragraph 1.3.2 is used, the specific *escape routes* must be identified on the *building consent* drawings.

1.7.2 As part of the *building consent* application, the owner of the proposed emergency lighting system must submit documentation that provides:

(a) full technical justification of the design,

(b) the method of checking the *illuminance* of the completed design, and

(c) the method of checking ongoing compliance for the life of the *building*.

COMMENT:
Acceptable methods of checking the illumination of the completed installation include:

(a) *illuminance* measurements conforming with the method provided in Paragraph 1.4.1.

(b) site verification that the luminaire type and spacing comply with the computer-based design or the manufacturer's spacing tables submitted as part of the *building consent* application.

1.8 Installation, Maintenance and Equipment

1.8.1 An emergency lighting system must be installed in accordance with:

(a) AS 2293: Parts 1 and 3 as amended by Appendix B (F6/AS1), and

(b) NZBC Clause G9, Electricity.

Emergency lighting installations must be commissioned after the successful completion of tests to confirm automatic operation upon tripping or failure of the power supply to the normal lighting circuits and must include testing of any phase failure devices. Such tests must be repeated on the completion of any addition to, or alteration of, the installed system.

1.8.2 Not withstanding the requirements of Paragraph 1.8.1 (a) a generator installed and maintained in accordance with NZS 6104, as amended by Appendix C, is an acceptable emergency power supply to meet Section 3 of AS 2293: Part 1 providing the emergency lighting has priority as the initial load.

1.8.3 Inspection, maintenance and reporting procedures for central battery and single point systems shall be performed in accordance with AS/NZS 2293: Part 2.

COMMENT:
For Paragraph 1.8.2 the starting characteristics of generators make them unsuitable as initial power sources in situations where NZBC Performance Requirements F6.3.2(a) and (b) must be satisfied.

Appendix B – Modifications to AS 2293.1: 2005 and AS 2293.3: 2005

PART 1

Section 2 – System Performance, Arrangement and Control

2.3.1 General

Add Note after paragraph –

Note – Where generators are used as a means of electrical supply for the emergency lighting system the generator installation must comply with NZS 6104 as amended by Appendix C of F6/AS1.

2.3.3.1 Centrally supplied systems

Add after first paragraph –

"Where a generator is used as the means of providing emergency power it must start if any of the final sub-circuit sensors detect the loss of power to a final sub-circuit."

Section 3 – Emergency Lighting Power Sources

3.2.2 Fire Resistance – Delete

3.2.4.3 Maintenance of Fire Resistance – Delete

Section 5 – Design of Emergency Escape Luminaire Installations

5.2 Provision of Emergency Luminaires

Amend the first paragraph to read "Emergency luminaires must be installed throughout the designated area in accordance with New Zealand Building Code Clause F6". Delete last sentence of the first paragraph.

5.4.2.1 General

Delete (a)

5.4.2.3 Illuminance Calculations

Delete "…is not less than 0.2 lux" and add "…is as required by the New Zealand Building Code Clause F6".

Tables 5.1 to 5.5 inclusive – Delete tables.

Note – Spacing tables specifically designed to comply with the requirements of the New Zealand Building Code Clause F6 may be used to position emergency lighting luminaires in New Zealand.

5.6.1 General

Delete (a)

5.6.2 Direct Lighting (Spacing Rules)

– Delete clause

Note – Spacing tables specifically designed to comply with the requirements of the New Zealand Building Code Clause F6 may be used to position emergency lighting luminaires in New Zealand.

5.6.3 Direct Lighting (Illuminance Calculations)

Delete "not less than 1 lx." Replace with "as required by F6/AS1 Paragraph 1.3."

5.6.4 Indirect Lighting (Illuminance Calculations)

Delete "not less than 1 lx." Replace with "as required by F6/AS1 1.3."

Section 6 – Design of Exit Signs, Installation

6.2 Required Locations

Delete "…Building Code of Australia" and add "New Zealand Building Code Clause F6".

6.3 Use of Externally Illuminated Signs

Delete clause and add "Installation of external illuminated exit signs must comply with the requirements of New Zealand Building Code Clause F8". Retain the Note.

6.4 Sign Colours

Delete Clause 6.4.1, Areas of normal illumination and 6.4.2, Area of low illumination and refer to New Zealand Building Code Clause F8.

6.5 Choice of Images

Delete and refer to New Zealand Building Code Clause F8.

6.6 Size of Pictorial Element

Delete

6.7 Illumination

Delete "Building Code of Australia" and add "New Zealand Building Code Clauses F6 and F8…"

Section 7 – Installation of Electrical Wiring and Equipment for Centrally Supplied Systems

7.4 Protection of the Electrical Installation Against Fire

Delete

7.5 Segregation or Identification of Submains

Change the last sentence to read "Where emergency lighting submain conductors are of different voltages to the normal supply they must not be installed in the same conduit, duct or troughing." Retain second sentence.

Appendix A

Add: AS/NZS 1680.1: 2006 Interior and workplace lighting: General principles and recommendations

NZS 6104: 1981 Specification for emergency electricity supply in buildings

NZS 6742: 1971 Code of practice for emergency lighting in buildings

Appendix B – Delete

Appendix C – Delete figures C3, C4, C5, C6, C7 and C8

Appendix D – Delete

PART 3

Section 2 – General Requirements for Emergency Escape Luminaires

2.3 Illumination at switch on

2.3.1 Maximum delay Emergency luminaires must provide a light output as specified in F6/AS1 Paragraph 1.5.

Delete (a) and (b) and the sentence following.

Amend the beginning of Paragraph 3 to read "These requirements shall apply …."

Delete the Note.

Section 3 – General requirements for exit signs

Delete entire section.

Section 4 – Particular requirements for self-contained emergency luminaires and exit signs

Delete all references to Exit Signs – these are required to comply with New Zealand Building Code Clause F8.

4.8.3 Required indication

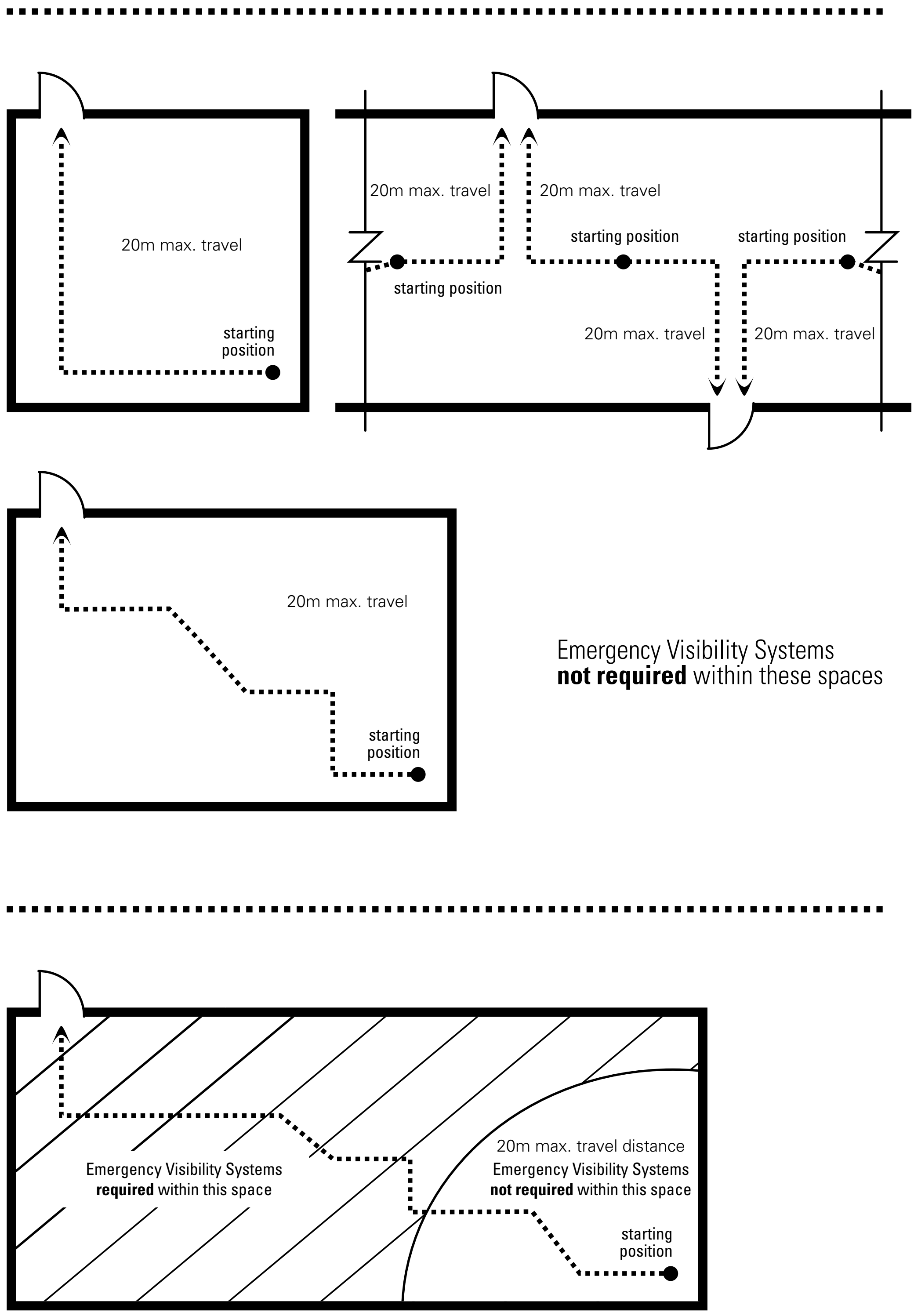
Paragraph after (c) change to read "Where a single indicator is used to provide all of the indications required by items (a) to (c), the following illuminated states shall have the meanings given:"

Appendix C Classification of emergency escape luminaires

Attention is drawn to the need to provide spacing tables that comply with the New Zealand requirements for the required illumination levels. The basic formulae and methods of deriving classifications and spacing tables remain the same. Clause 2.2 and Appendix C of this Standard may be used to formulate appropriate spacing tables for New Zealand requirements.

Appendix D – Measurement of escape route travel distance F6/AS1 1.2 (c)

Figure 1: Measurement of escape route travel distance
F6/AS1 1.2 (c)



Index F6/VM1 & AS1

References are to Paragraphs.

Compliance Document for New Zealand Building Code Clause F7 Warning Systems – Fourth Edition

Prepared by the Department of Building and Housing

This Compliance Document is prepared by the Department of Building and Housing. The Department of Building and Housing is a Government Department established under the State Sector Act 1988.

Enquiries about the content of this document should be directed to:

Department of
Building and Housing
Te Tari Kaupapa Whare

Department of Building and Housing
PO Box 10-729, Wellington.
Telephone 0800 242 243
Fax 04 494 0290
Email: info@dbh.govt.nz

ISBN: 978-0-478-38184-9 (print)
ISBN: 978-0-478-38185-6 (electronic)

Compliance Documents are available from www.dbh.govt.nz

New Zealand Government

Status of Compliance Documents

Compliance Documents are prepared by the Department of Building and Housing in accordance with section 22 of the Building Act 2004. A Compliance Document is for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Compliance Document will be treated as having complied with the provisions of the Building Code to which the Compliance Document relates. However, a Compliance Document is only one method of complying with the Building Code. There may be alternative ways to comply.

Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the status of Compliance Documents 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 Compliance Document.

F7: Document History

	Date	Alterations	
First published	July 1992		
Second edition incorporating Amendment 1	December 1993	p. v, Contents p. vi, References	p. vii, Definitions p. 3 to 8, Complete rewrite
Amendment 2	19 August 1994	pp. i and ii, Document History p. 4, 1.2.5, 1.3.3, 1.3.4, 1.4.3	p. 5, 1.4.4, 1.4.5, 1.5.4 p. 7 and 8, Index
Amendment 3	1 December 1995	p. ii, Document History p. vi, References p. 3, 1.1.1, 1.1.2, 1.1.3, 1.2.1, 1.2.2, 1.2.3	p. 4, 1.4.2 p. 5, 1.5.1 p. 6, 2.2.5 added
Reprinted incorporating Amendments 1, 2 and 3	April 1998		
Third edition	1 December 2000 Effective from 1 June 2001	Document revised – third edition issued	
Amendment 4	24 April 2003	p. 3, Code Clause p. 5, Contents p. 7, References	p. 13, 1.2.1 Type 1 pp. 17 and 18, 3.1-3.4 p. 20, Index
Reprinted incorporating Amendment 4	April 2004		
Amendment 5 4 July 2005	Effective 1 October 2005	pp. 1-2, Document History and Status pp. 7-8, References	pp. 9-10, Definitions pp. 13-14, F7/AS1
Amendment 6	Effective 1 November 2008	p. 2, Document History p. 5, Contents p. 7, References p. 9, Definitions p. 13, 1.2.1	p. 14, 1.2.5, 1.2.6, 1.2.8, 1.3.1 p. 15, 1.3.5, 1.3.6 p. 16, 2.1, 2.1.2 p. 17, 2.2.4 pp. 19-20, Index
Amendment 7	Effective 10 October 2011 until 10 April 2013	pp. 1-2, Document History and Status p. 3, Code Clause	p. 7, References p. 17, F7/AS1 3.2.2
Fourth edition	10 April 2012	Document revised – fourth edition issued	

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

Document Status

The most recent version of this document, as detailed in the Document History, is approved by the Chief Executive of the Department of Building and Housing. It is effective from 10 April 2012 and supersedes all previous versions of this document on 10 April 2013.

People using this Compliance Document should check for amendments on a regular basis. The Department of Building and Housing may amend any part of any Compliance Document at any time. Up-to-date versions of Compliance Documents are available from www.dbh.govt.nz

New Zealand Building Code Clause F7 Warning Systems

The mandatory provisions for building work are contained in the New Zealand Building Code (NZBC), which comprises the First Schedule to the Building Regulations 1992. The relevant NZBC Clause for Warning Systems is F7.

FIRST SCHEDULE–*continued*

Clause F7–WARNING SYSTEMS

Provisions	Limits on application
OBJECTIVE **F7.1** The objective of this provision is to safeguard people from injury or illness due to lack of awareness of an emergency.	
FUNCTIONAL REQUIREMENT **F7.2** *Buildings* shall be provided with appropriate means of warning people to escape to a *safe place* in an emergency.	
PERFORMANCE **F7.3.1** A means of warning must alert people to the emergency in *adequate* time for them to reach a *safe place*.	Performance F7.3 does not apply to *Outbuildings, backcountry huts* or *Ancillary buildings*.
F7.3.2 Appropriate means of detection and warning for fire must be provided within each *household unit*.	
F7.3.3 Appropriate means of warning for fire and other emergencies must be provided in *buildings* as necessary to satisfy the other performance requirements of this code.	

Contents

References

For the purposes of New Zealand Building Code compliance, the New Zealand and other Standards, and other documents referred to in this Compliance Document (primary reference documents) shall be the editions, along with their specific amendments, listed below. Where the primary reference documents refer to other Standards or other documents (secondary reference documents), which inturn may also refer to other Standards or other documents, and so on (lower order reference documents), then the applicable version of these secondary and lower order reference documents shall be the version in effect at the date this Compliance Document was published.

		Where quoted
Standards New Zealand		
NZS 4512: 2010	Fire alarm systems in buildings	AS1 1.1.1, 1.2.2, 1.2.3, 1.2.4, 1.2.6, 1.2.7, 1.3.1
NZS 4514: 2009	Interconnected smoke alarms for houses	AS1 3.3.1 c), 3.3.2, 3.4.1
NZS 4515: 2009	Fire sprinkler systems for life safety in sleeping occupancies (up to 2,000 m^2)	AS1 1.2.8
NZS 4541: 2007	Automatic fire sprinkler systems *Amend: 1*	AS1 1.2.8
Standards Australia		
AS 3786: 1993	Smoke alarms *Amends: 1, 2, 3, 4*	AS1 3.2.2
International Standards Organisation		
ISO 12239: 2003	Fire detection and fire alarm systems – smoke alarms	AS1 3.2.2
British Standards Institution		
BS EN 14604: 2005	Smoke alarm devices	AS1 3.2.2

Definitions

This is an abbreviated list of definitions for words or terms particularly relevant to this Compliance Document. The definitions for any other italicised words are specified in the New Zealand Building Code Handbook. See Acceptable Solutions and Verification Methods for Protection from Fire for the full list of fire safety definitions.

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

Exitway All parts of an *escape route* protected by *fire* or *smoke separations*, or by distance when exposed to open air, and terminating at a *final exit*.

Fire The state of combustion during which flammable materials burn producing heat, toxic gases, or smoke or flame or any combination of these.

Firecell Any space including a group of contiguous spaces on the same or different levels within a *building*, which is enclosed by any combination of *fire separations*, *external walls*, roofs, and floors.

Comment:
Floors, in this context, includes ground floors and those in which the underside is exposed to the external environment (eg, when cantilevered). Note also that internal floors between *firecells* are *fire separations*.

Household unit

a) means a *building* or group of *buildings*, or part of a *building* or group of *buildings*, that is—
   i) used, or intended to be used, only or mainly for residential purposes; and
   ii) occupied, or intended to be occupied, exclusively as the home or residence of not more than 1 household; but
b) does not include a hostel, boarding house or other specialised accommodation.

Occupant load The greatest number of people likely to occupy a particular space within a *building*. It is determined by:

a) dividing the total floor area by the m^2 per person (occupant density) for the activity being undertaken, or
b) for sleeping areas, counting the number of sleeping (or care) spaces, or
c) for fixed seating areas, counting the number of seats.

Comment:
See Paragraphs 1.4.5 (for fixed seating) and 1.4.6 (for sleeping areas) where appropriate.

Suite A *firecell* providing residential accommodation for the exclusive use of one *person* or of several people known to one another. It comprises one or more rooms for sleeping and may include spaces used for associated domestic activities such as hygiene and cooking.

Verification Method F7/VM1

No specific test methods have been adopted for verifying compliance with the Performance of NZBC F7.

Acceptable Solution F7/AS1

1.0 Installation and maintenance of fire alarm systems

1.1 Fire alarm systems

1.1.1 *Fire* alarm systems shall be designed, installed and maintained in accordance with NZS 4512 where appropriate and the specific requirements of this Acceptable Solution.

1.2 Descriptions of alarm aystems

1.2.1 The types of *fire* alarms to be provided in *buildings* shall be determined in accordance with Acceptable Solution C/AS1 to C/AS7. The following text provides specific details on each *fire* alarm system.

Type 1 – Domestic smoke alarm system

See Paragraph 3.0 – Domestic smoke alarms.

Type 2 – Manual fire alarm system

1.2.2 A single or multiple zone system with an alarm panel to provide defect warning, zone index diagram, and suitable for connection to the Fire Service. The system shall comply with NZS 4512.

Type 3 – Automatic fire alarm system activated by heat detectors and manual call points

1.2.3 A Type 3 system comprises a Type 2 system plus heat detectors and shall comply with NZS 4512.

Type 4 – Automatic fire alarm system activated by smoke detectors and manual call points

1.2.4 A Type 4 system comprises a Type 2 system plus smoke detectors and shall comply with NZS 4512.

Type 5 – Automatic fire alarm system with modified smoke detection and manual call points

1.2.5 Type 5 is a variation of the Type 4 and Type 7 alarm systems requiring part of the smoke detection component to comprise only a local alarm. The local alarm system, activated by the presence of smoke, shall have audible alerting devices to warn only the *firecell* occupants and the *building* management, where such management exists.

Comment:
Examples of management situations are motels, hotels or multi-unit residential accommodation in retirement villages.

The local alarm component of a Type 5 system:

a) Shall be restricted to single *firecells* containing sleeping accommodation, being *household units* or individual *suites* in *risk group* SM. The local alarm system shall not be extended to other areas such as *exitways* or common spaces. These shall retain a Type 4 smoke detection system, and

b) Shall have the facility to be silenced (muted) by a 'hush' switch located at a level readily able to be reached in accordance with Acceptable Solution D1/AS1. The hush switch shall mute the alarm for a time not exceeding 2 minutes, and

c) Shall be permitted only where an automatic *fire* detection and alarm system activated by heat detectors (part of the main alarm system) is also installed in sleeping *firecells* which do not already have an automatic *fire* sprinkler system.

Where a Type 5 system is installed, mechanical ventilation in accordance with Acceptable Solution G4/AS1 shall be provided in the kitchen area of the *household unit* or *suite*.

1.2.6 In *exitways* and common spaces the required Type 4 or Type 7 system shall not be modified. The system installation for Type 3 and Type 4 components shall comply with NZS 4512.

1.2.7 The system installation for the local smoke alarm component shall also comply with NZS 4512.

Type 6 – Automatic fire sprinkler system with manual call points

1.2.8 Type 6 system is a combined automatic *fire* sprinkler system and Type 2 alarm. Activation of the sprinklers shall automatically activate the audible alerting devices of the alarm system. Sprinkler installation shall comply with either NZS 4515 or NZS 4541, as modified by Appendix B of Acceptable Solutions C/AS1 to C/AS6.

Type 7 – Automatic fire sprinkler system with smoke detectors and manual call points

1.2.9 A Type 7 system is a combined Type 6 and Type 4 alarm system (including a Type 2 system). Sprinkler installation shall comply with the requirements of a Type 6 system.

Comment:
Smoke detectors are used to gain an earlier warning to life-threatening situations than may be achieved from the response of sprinklers, particularly where a smouldering *fire* does not produce enough heat in its early stages to activate a sprinkler head.

1.3 Location of heat and smoke detectors

1.3.1 Acceptable Solutions C/AS1 to C/AS7 specify which *fire* alarm system shall be installed in each *risk group*. Detectors shall be installed throughout the *firecells* of that *risk group* as required by NZS 4512.

1.3.2 Every space shall have at least one detector (heat, smoke or sprinkler).

2.0 Requirements of fire alarm systems

2.1 Alerting the Fire Service

2.1.1 Where an alarm system is required by Acceptable Solutions C/AS1 to C/AS7, there shall be available a means of communication with the Fire Service.

2.1.2 The means of communication shall be either:

a) A direct connection (approved by the Fire Service) between the alarm system and the Fire Service, or

b) A '111' telephone call to the Fire Service from a continuously attended telephone with outside line access serving all *buildings* connected to the alarm system, and having the main *fire* alarm panel or mimic panel visible to the switchboard operator. A warning device shall be provided to alert the operator of a *fire* alarm in any *building* on the site, or

c) Where Paragraph 2.2.3 applies, a telephone (or telephone system) that is available within the *building* and readily accessible at all times to enable '111' calls to be made to the Fire Service.

2.1.3 Telephone communication using the '111' call system (given in Paragraph 2.1.2 c)) may be used only where specifically permitted by Acceptable Solutions C/AS1 to C/AS7.

3.0 Domestic smoke alarms

3.1 Scope

3.1.1 Smoke alarms shall be installed in every *household unit* of *risk groups* SH and SM where a Type 4 or Type 7 alarm system is not required by Acceptable Solutions C/AS1 to C/AS7.

3.1.2 The other paragraphs of this Acceptable Solution do not apply to the installation of domestic smoke alarms. Paragraphs 3.1 to 3.4 stand alone and only detail the requirements for domestic smoke alarms within *household units*.

3.2 Type 1 – Domestic Smoke Alarm System

3.2.1 A Type 1 system is based on one or more domestic type smoke alarms with integral alerting devices. Coverage shall be limited to selected parts of a single *firecell*, subject to Paragraphs 3.3 and 3.4.

3.2.2 Smoke alarms shall be manufactured to at least one of: AS 3786, ISO 12239 or BS EN 14604.

3.2.3 The smoke alarms shall be either hard wired or battery powered and are not required to be interconnected. In addition, they shall provide a hush facility, being a button that silences the alarm for a minimum duration of 60 seconds.

Comment:
A hush facility is a button on the smoke alarm which silences the alarm for a limited time after activation. This allows the cause of a nuisance alarm to be cleared without having to remove the battery to silence the smoke alarm.

3.2.4 Smoke alarms shall have an alarm test facility easily reached by the *building* occupants. This facility may be located on the smoke alarms.

3.3 Location of smoke alarms

3.3.1 Smoke alarms shall be located as follows:

a) In multi-storey units, there shall be at least one smoke alarm on each level within the *household unit.*

b) On levels containing the sleeping spaces, the smoke alarms shall be located either:

   i) In every sleeping space, or

   ii) Within 3.0 m of every sleeping space door. In this case, the smoke alarms must be audible to sleeping occupants on the other side of the closed doors.

c) In all cases, so that the sound pressure level complies with that specified in NZS 4514.

Comment:
Smoke alarms also need to be located so that an alarm is given before the *escape route* from any bedroom becomes blocked by smoke. This includes those parts of *escape routes* on other floors. Although not required by this Acceptable Solution, the interconnection of individual smoke alarms should be considered if audibility is a problem.

3.3.2 Smoke alarms shall be installed on or near the ceiling. The placement shall be in accordance with NZS 4514.

Comment:
NZS 4514 gives instructions for the physical location of smoke alarms. Smoke alarms need to be situated on (or near) the ceiling for optimum detection of smoke in a *fire* situation. Following manufacturer's instructions is important to ensure smoke alarms are physically mounted correctly. This information is usually device specific.

3.4 Maintenance

3.4.1 Smoke alarms shall be maintained in accordance with the maintenance requirements of NZS 4514.

Index F7/VM1 & AS1

References are to the relevent paragraphs, figures or tables in **F7/VM1 & AS1** unless otherwise stated. References to Appendices are prefixed by the Appendix letter.

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington.
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 4), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 1 January 2017 and supersedes all previous versions of this document.

The previous version of this document (Amendment 3) will cease to have effect on 30 May 2017.

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.building.govt.nz

F8: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	Effective from September 1993 until 10 July 2012	p. v, Contents p. vi, References p. 4, Table 2 p. 11, 6.4.2 a)	p. 12, 6.4.3, Figures 11, 12, 13, 14, 6.5.1 p. 13, 6.6.3, 6.7.1, Figures 15, 16 pp. 15-16 Index
Second edition (Amendment 2)	Effective from 10 April 2012 until 14 August 2014	Document revised 2nd Edition issued	
Amendment 3	Effective 14 February 2014 until 30 May 2017	p. 2A, Document history, Status	p. 7 References p. 9 Definitions
Amendment 4	Effective 1 January 2017	p. 7 References p. 18 F8/AS1 4.5.1 p. 19 F8/AS1 4.5.4	p. 21 F8/AS1 5.4 p. 27 F8/AS1 Appendix A

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

New Zealand Building Code Clause F8 Signs

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

CLAUSE F8–SIGNS

Provision	Limits on application
OBJECTIVE	
F8.1 The objective of this provision is to: (a) safeguard people from injury or illness resulting from inadequate identification of *escape routes*, or of hazards within or about the *building*, (b) safeguard people from loss of *amenity* due to inadequate direction, and (c) ensure that *people with disabilities* are able to carry out normal activities and processes within *buildings*.	Objective F8.1(c) applies only to those *buildings* to which section 118 of the Building Act 2004 applies.
FUNCTIONAL REQUIREMENT	
F8.2 Signs must be provided in and about *buildings* to identify: (a) *escape routes*, (b) emergency-related safety features, (c) potential hazards, and (d) *accessible routes* and facilities for *people with disabilities*.	Requirement F8.2 does not apply to *detached dwellings*, or within *household units* in *multi-unit dwellings.*
PERFORMANCE	
F8.3.1 Signs must be *clearly visible* and readily understandable under all conditions of foreseeable use, including emergency conditions. **F8.3.2** Signs identifying potential hazards must be provided and located so that people encounter the signs before encountering the potential hazard. **F8.3.3** Signs to facilitate escape to a *place of safety* must be provided and (a) be located to identify the *escape routes*, and (b) continue to meet the performance requirements in clause F8.3.1 during failure of the main lighting for the period required by performance F6.3.4 and performance F6.3.5.	

CLAUSE F8–SIGNS (continued)

Provisions	Limits on application
F8.3.4 Signs must be provided and located to identify *accessible routes* and facilities provided for *people with disabilities*. **F8.3.5** *Accessible routes* must be identified with the International Symbol of Access.	

Contents

References

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

		Where quoted
Standards Australia		
AS 2293: 2005	Emergency escape lighting and exit signs for buildings	
Part 1:	System design, installation and operation	AS1 4.5.5
Part 3:	Emergency escape luminaires and exit signs *Amend: 1*	AS1 2.4, 4.5.3 a) i), 4.5.5, Appendix A
AS/NZS 2293.2: 1995	Emergency escape lighting and exit signs for buildings – Inspection and maintenance, incorporating Amendment No. 1, 2 and 3	AS1 4.5.5
NZS 4541:2013	Automatic fire sprinkler systems	AS1 5.4
British Standards Institution		
BS 5252: 1976	Framework for colour co-ordination for building purposes *Amend: 1*	AS1 Table 2
International Organization for Standardization		
ISO 3864: 2002	Safety colours and safety signs	
Part 1:	Design principles for safety signs in workplaces and public areas	AS1 2.4
ISO 7000: 2004	Graphic symbols for use on equipment	AS1 2.4
ISO 7010: 2003	Graphical symbols – safety colours and safety signs – Safety signs used in workplaces and public areas	AS1 2.4, 3.2.4
German Institute for Standardisation		
DIN 5381: 1985	Identification colours	AS1 Table 2
DIN 6164: 1980	DIN colour chart	
Part 2:	Specification of colour samples	AS1 Table 2
Chemical Industry Council Incorporated		
HSNO Code of Practice 2-1 09-04	Signage for premises storing hazardous substances and dangerous goods	AS1 2.4, 7.1
Royal New Zealand Foundation of the Blind		
Accessible Signage Guidelines: 2010		AS1 2.3

Amend 3 Feb 2014 (AS 2293 Part 3 Amend: 1); Amend 4 Jan 2017 (AS/NZS 2293.2 incorporating Amendment No. 1, 2 and 3); Amend 4 Jan 2017 (NZS 4541:2013)

Definitions

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 3 Feb 2014

Access route A continuous route that permits people and goods to move between the apron or *construction* edge of the *building* to spaces within a *building*, and between spaces within a *building*.

Accessible Having features to permit reasonable use by *people with disabilities*.

Accessible route An *access route* usable by a *people with disabilities*. It shall be a continuous route that can be negotiated unaided by a wheelchair user. The route shall extend from street *boundary* or car parking area to those spaces within the *building* required to be *accessible* to enable *people with disabilities* to carry out normal activities and processes within the *building*.

Active conductor Any conductor in which the electrical potential differs from that of a neutral conductor or earth.

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

Clearly visible for the purposes of Clause F8 and in relation to a sign means the nearest such sign is visible and readable at the maximum distance from which it needs to be viewed, to a person who either does not have a visual impairment, or uses corrective lenses.

Doorset A complete assembly comprising a door leaf or leaves including any glazed or solid panels adjacent to or over the leaves within the door frame including hardware or other inbuilt features; and a door frame, if any, with its fixing to the wall and, for a sliding door or tilting door, all guides and their respective fixings to the lintel, wall or sill.

Escape route A continuous unobstructed route from any *occupied space* in a *building* to a *final exit* to enable occupants to reach a *safe place*, and shall comprise one or more of the following: *open paths*, *smoke lobbies* and *safe paths*.

Comment:
Doors are not obstructions in an *escape route* provided they comply with C/AS1 and D1/AS1.

Exitway All parts of an *escape route* protected by *fire* or *smoke separations*, or by distance when exposed to open air, and terminating at a *final exit*.

Final exit The point at which an *escape route* terminates by giving direct access to a *safe place*.

Comment:
Final exits are commonly the external doors from a ground floor, but this applies only if such doors open directly onto a *safe place*. If a *safe place* can be reached only by passing down an alley, or across a bridge, then the *final exit* is not reached until the end of such an alley or bridge. *Final exits*, therefore, should be seen strictly as a point of arrival, rather than as any particular element of a *building*. They are determined entirely by the definition of *safe place*.

Fire door A *doorset*, single or multi-leaf, having a specific *fire resistance rating*, and in certain situations a smoke control capability, and forming part of a *fire separation*. The door, in the event of *fire*, if not already closed, will close automatically and be self latching.

Hold-open device A device which holds a *smoke control door* or *fire door* open during normal use, but is released by deactivating the device by an automatic *fire* detection system, allowing the door to close automatically under the action of a self-closing device.

Illuminance The luminous flux falling on to a unit area of surface (lumen/m^2).

Luminance The luminous intensity of a surface in a given direction per unit projected area (candela/m^2).

Occupant load The greatest number of people likely to occupy a particular space within a *building*. It is determined by:

a) dividing the total floor area by the m^2 per person (occupant density) for the activity being undertaken, or

b) for sleeping areas, counting the number of sleeping (or care) spaces, or

c) for fixed seating areas, counting the number of seats.

Open path That part of an *escape route* (including *dead ends*) within a *firecell* where occupants may be exposed to *fire* or smoke while making their escape.

People with disabilities People whose ability to use *buidlings* is affected by mental, physical, hearing or sight impairment.

Person with a disability Means a person who has an impairment or a combination of impairments that limits the extent to which the person can engage in activities, pursuits and processes of everyday life, including, without limitation, any of the following:

a) a physical, sensory, neurological, or intellectual impairment:

b) a mental illness.

Safe path That part of an *exitway* which is protected from the effects of *fire* by *fire separations*, *external walls*, or by distance when exposed to open air.

Safe place A place, outside of and in the vicinity of a single *building* unit, from which people may safely disperse after escaping the effects of a *fire*. It may be a place such as a street, *open space*, public space or an *adjacent building* unit.

Comment:
The Fire Safety and Evacuation of Buildings Regulations 2006 use the term '*place of safety*' and allow the *place of safety* to be within the *building* provided that it is protected with a sprinkler system.

Safety colour (green, red or yellow) A colour of specific properties to which a safety meaning is attributed.

Safety sign A particular type of sign which comprises a geometric form and a *safety colour*, together with a *safety symbol* or text (that is, words, letters, numbers or a combination of these) and gives a particular safety message.

Safety symbol means a graphic symbol used in a *safety sign*.

Smoke control door A *doorset* that complies with Appendix C, C6.1.2 of C/AS6.

Smoke lobby That portion of an *escape route* within a *firecell* that precedes a *safe path* or an *escape route* through an adjoining *building* which is protected from the effects of smoke by *smoke separations*.

Smoke separation Any *building element* able to prevent the passage of smoke between two spaces. *Smoke separations* shall:

a) Be a smoke barrier complying with BS EN 12101 Part 1, or

b) Consist of rigid *building elements* capable of resisting without collapse:

   i) a pressure of 0.1 kPa applied from either side, and

   ii) self weight plus the intended vertically applied live loads, and

c) Form an imperforate barrier to the spread of smoke, and

d) Be of *non-combustible construction*, or achieve a *FRR* of 10/10/-, except that non-*fire resisting glazing* may be used if it is toughened or laminated *safety glass*.

Comment:
The pressure requirement is to ensure rigidity and is not a smoke leakage requirement.

Walls and floors, whether *constructed* of sheet linings fixed to studs or joists, or of concrete, glazing, metal or fired clay, need only be inspected by someone experienced in *building construction* to judge whether the *construction* is tight enough to inhibit the passage of smoke.

Item d) is intended to ensure that the *smoke separation* will continue to perform as an effective barrier when exposed to *fire* or smoke for a short period during *fire* development.

There is no requirement for *smoke control doors* or other closures in *smoke separations* to meet the provisions of item d).

Stairway A series of steps or stairs with or without landings, including all necessary *handrails* and giving access between two different levels.

Acceptable Solution F8/AS1

1.0 Scope

This *Acceptable Solution* describes one way of meeting the requirements of NZBC Clause F8 for the design and provision of signage in and around *buildings*. Included are *safety signs*, exit signs, *fire* related safety feature signs, hazard signs, and signs for access and facilities for *people with disabilities*.

Signs are not required for detached dwellings, within *household units* in *multi-unit dwellings* or within hotel and motel *suites*.

Signs for *persons with disabilities* are only required in *buildings* to which section 118 of the *Building Act 2004* applies.

Comments in the grey boxes do not form part of the *Acceptable Solution*. These comments are included in the *Acceptable Solution* for guidance only.

2.0 Typography and pictograms

2.1 Language

Signs shall be one of the following:

a) A pictogram alone, or

b) English text with or without a pictogram, or

c) Māori text plus English text or a pictogram, or both, or

d) Any other language, including Braille, plus one of a), b) or c).

Where pictograms are used in combination with text, the text shall follow the pictogram.

> **Comment:**
> Text on signs illustrated in this *Acceptable Solution* is shown in English only.

2.2 Lettering

2.2.1 Lettering shall be vertical block type using full strokes.

2.2.2 The letter proportions shall be as set out in Table 1.

2.2.3 The thickness (d) of the letter shall be between 15% and 30% of the height (h) of the letter.

Suitable fonts are Helvetica, Univers, Frutiger, Sills Sans, Rotis Sans, Bookman, Arial and other fonts with at least equal readability.

2.2.4 Letter heights shall be as given in Paragraph 4.3.1 and Table 4.

2.2.5 Upper and lower case lettering may be used.

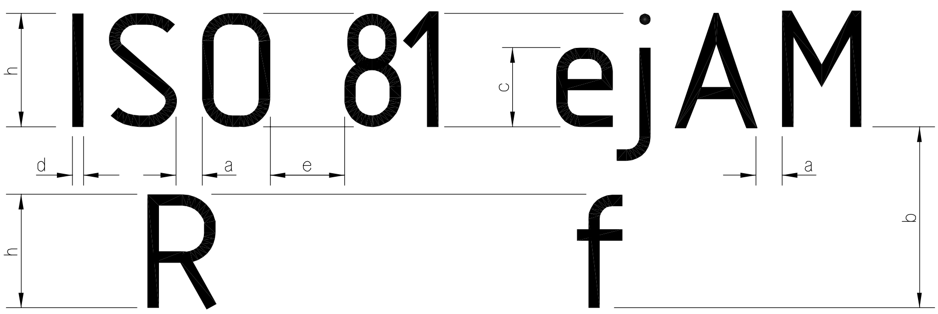
2.3 Braille

Braille shall be uncontracted Unified English Braille.

The 'Accessible Signage Guidelines', published by the Royal New Zealand Foundation of the Blind, provide information on the details of Braille signage (www.rnzfb.org.nz).

Table 1: Proportioning of lettering
Paragraph 2.2

Dimensions	Ratio	Examples of dimensions (mm)							
h	(10/10) *h*	10	20	25	40	50	75	100	125
c	(7/10) *h*	7	14	17.5	28	35	52.5	70	87.5
a	(2/10) *h*	2	4	5	8	10	15	20	25
b	(14/10) *h*	14	28	35	56	70	105	140	175
e	(6/10) *h*	6	12	15	24	30	45	60	75



2.4 Pictograms

Pictograms shall be as shown in ISO 3864.1, AS 2293.3, HSNO CoP 2-1 0904, ISO 7010 and ISO 7000 for the International Symbol of Access.

The height of the symbol in the pictogram shall be as given in Paragraph 4.3.2 and Table 5.

3.0 Safety signs

3.1 Safety colours

The colours for *safety signs* shall comply with one of the appropriate specifications listed in Table 2. Contrasting colours shall be as described in Table 3.

The use of *safety colours* must comply with Table 3.

Table 2 **Safety colours**
Paragraph 3.1

Safety colour	Specification reference Standard BS 5252 colour number	Specification reference DIN 5381 DIN 6164
Safety red	04 E 55	7.5 : 8.5 : 3
Safety yellow	08 E 51	2.5 : 6.5 : 1
Safety green	14 E 53	21.7 : 6.5 : 4
Safety blue	18 E 53	16.7 : 7.2 : 3.8

Table 3 **Safety colours and contrasting colours**
Paragraph 3.1

Safety colour	Meaning or purpose	Use	Contrasting colour if required	Safety symbol colour
Safety red	Stop Prohibition	Stop signs Prohibition signs Paragraph 3.2.1	White(1)	Black
Safety yellow	Caution, risk of danger	Indication of hazards (*fire*, explosion, radiation, chemical etc) Warning signs Paragraph 3.2.2	Black	Black
Safety green	Safe condition	Emergency exit signs Paragraphs 3.2.3 and 4.0	White(1)	White
Safety blue	Instruction	Escalators and moving walks Paragraph 7.5	White(1)	*Safety red* (cross)

1. For photoluminescent signs, substitute 'the natural colour of photoluminescent material' (pale yellow) for 'white'.

3.2 Sign layout

3.2.1 Prohibition signs

Prohibition and stop signs shall:

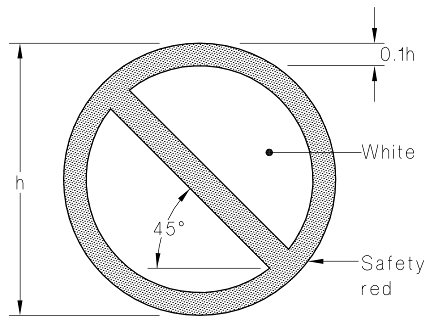
a) Be circular with a white background, a circular band and crossbar of *safety red*, and

b) Have a black *safety symbol* centrally placed on the background without obliterating the crossbar, and

c) Have the background colour displayed over no less than 33% of the sign face, and

d) Have the proportions given in Figure 1. (The *safety symbol* is omitted.)

Figure 1 Sign proportions for prohibition and stop signs
Paragraph 3.2.1



3.2.2 Caution signs

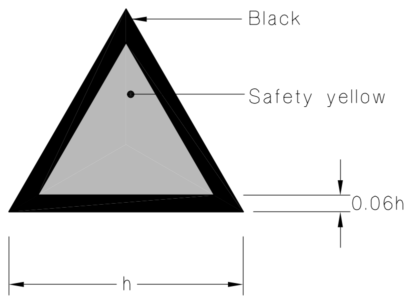
Caution signs shall:

a) Be of an equilateral triangle with a background of *safety yellow*, a black perimeter and have a black *safety symbol* or text located centrally on the background, and

b) Have the background colour displayed over no less than 50% of the sign face, and

c) Have the proportions given in Figure 2. (The *safety symbol* is omitted.)

Figure 2 Sign proportions for caution signs
Paragraph 3.2.2



3.2.3 Safe condition signs

Safe condition signs shall:

a) Be rectangular or square with a background of *safety green*, and a white *safety symbol* or text placed centrally on the background, and

b) Have the background displayed over 50% of the sign face.

Comment:
The choice of square or rectangular shape will generally relate to requirements of the *safety symbol* or text.

3.2.4 Acceptable safety signs

Acceptable safety signs are given in ISO 7010.

4.0 Exit signs

4.1 Sign locations

4.1.1 *Escape routes* shall be identified by exit signs which are *clearly visible* and shall be located:

a) At each point in the *open path* where a door giving access to a *final exit* or an *exitway* is not visible in normal use

b) To clearly indicate each door giving access to a *final exit* or an *exitway*, and

c) To clearly identify the route of travel through the *exitway*.

Comment:
The rapid identification of the nearest *escape routes* is particularly important in *buildings* such as shopping malls and supermarkets, where occupants tend automatically to escape via the familiar route used for entry.

4.1.2 Where exit signs are provided to identify a door on an *escape route*, the sign shall be positioned on the leaf at or above handle height, or on a vertical surface within 600 mm of the door. The sign shall be positioned where it is least likely to be obscured from view and where it cannot be obscured when the door is open.

4.2 Wording for exit signs

Where exit signs contain text they shall comply with Paragraphs 4.2.1 to 4.2.3.

4.2.1 Exit signs shall be *safety signs* complying with Tables 2 and 3 and shall display the word(s) '**Exit**' or '**Emergency Exit**' plus a direction arrow if necessary, to identify the *escape route*, or use another language plus English. (Refer to Paragraph 2.1.)

4.2.2 Where a direction arrow is incorporated as part of the exit sign, a clearance of at least 25 mm shall be provided between the word(s) and the arrow.

4.2.3 In addition the following signs shall be provided:

a) Where any door leads to an upper or lower level from an *exitway* and not to a *final exit*, that door shall be identified by a sign reading '**No Exit**'. (Refer to Paragraph 4.4.2.)

b) Where any door in a *safe path* is a *smoke control door* and that door leads to an alternative *exitway*, it shall be identified by signs on both sides reading '**Exit**'.

c) Where delayed action unlocking devices are fitted to an exit door, a sign describing the method of operation shall be installed adjacent to the door lock. The sign shall read 'There is a (x) second time delay on this door before it unlocks except when activated by the fire alarm'.

4.3 Sign details

4.3.1 Height of lettering

Sign lettering heights shall comply with Table 4, except that no lettering shall be less than 100 mm high on signs located in the following areas:

a) *Theatres*, cinemas and public halls

b) Shopping spaces that have an *occupant load* of more than 100 people.

Table 4 Height of lettering
Paragraph 4.3.1

Maximum viewing distance (m)	Minimum letter height 'h' (mm)
16	75
24	100
32	150

'h' is the letter height shown in Table 1.

For photoluminescent signs, the minimum height dimension shall be multiplied by 1.3 and the maximum viewing distance shall be 24 m.

For viewing distances greater than 32 m, the minimum letter height shall be determined in accordance with the following equation:

Minimum letter height, h, mm =
Maximum viewing distance, mm ÷ 210
and rounded up to the nearest 50 mm.

4.3.2 Pictogram elements including directional arrows

The minimum height of pictogram elements for exit signs shall be determined by the maximum viewing distance. The minimum element height shall be as given in Table 5.

Table 5 Pictogram height
Paragraph 4.3.2

Maximum viewing distance (m)	Minimum pictogram element height (mm)
16	100
24	150
32	200

Element height is as shown in Figures 1, 2 and 3.

For photoluminescent signs, the minimum height dimension shall be multiplied by 1.3 and the maximum viewing distance shall be 24 m.

For viewing distances greater than 32 m, the minimum element height shall be determined in accordance with the following equation:

Minimum element height, mm = Maximum viewing distance, mm ÷ 160 and rounded up to the nearest 50 mm.

4.3.3 Background

The background shall extend at least 15 mm beyond the words (and pictorial element if incorporated) displayed on the sign.

4.4 Colour

4.4.1 Except for photoluminescent signs and signs described in Paragraphs 4.4.2 and 4.4.3, the text and/or pictogram of an exit sign, and the direction arrow where incorporated, shall be white on a *safety green* background.

Text or pictograms in photoluminescent signs shall be in *safety green* and the rest of the sign shall be photoluminescent.

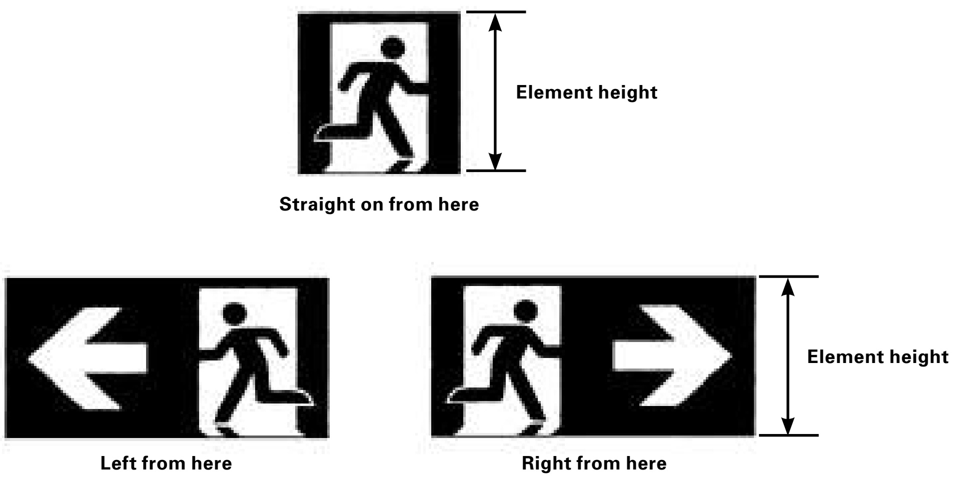
4.4.2 The sign described in Paragraph 4.2.3 a) (No Exit) shall comprise white text on a *safety red* background.

4.4.3 Where an exit sign is internally illuminated and normally viewed in low illuminance areas, such as in *theatres* and auditoriums, the text or pictogram of the sign and direction arrow, if any, may be *safety green* on a black (opaque) background. In the case of signs described in Paragraph 4.2.3 a), these may have text or a pictogram in *safety red* on a black (opaque) background.

4.5 Exit sign illumination

4.5.1 Exit signs in escape routes shall be illuminated in buildings required to have emergency lighting systems for providing visibility in escape routes as required by NZBC Clause F6. The sign illumination shall be by external or internal lighting, or the sign may be photoluminescent. Amend 4 Jan 2017

Figure 3 Formats and meanings of pictogram elements



The words under these pictograms indicate the meaning of the pictogram and are not part of the pictogram.
Arrows are aligned to reflect the direction to be followed.

4.5.2 Externally illuminated exit signs

Signs which rely for their visibility on illumination from an exterior source shall have:

a) An *illuminance* of no less than 200 lux provided at the face of the sign

b) A variation of *illuminance* of no greater than 3:1 across the face of the sign

c) Luminaires positioned so that the clarity of the sign message is not reduced at the required viewing positions by reflections on the sign face

d) The light source used to illuminate the sign not more than 1.5 m from the face of the sign, and

e) The light source screened from the view of people passing through the areas to avoid glare.

4.5.3 Internally illuminated exit signs

Signs which rely for their visibility on internal illumination shall comply with the following requirements:

a) For exit signs with a white text or pictogram and *safety green* background:

   i) the *luminance* of the background within 25 mm of the text or pictogram shall be no less than 8 cd/m^2 when measured in accordance with AS 2293: Part 3 Clause 3.4.2, and

   ii) the ratio of the *luminance* of the text to that of the background shall be no less than 4:1, and

   iii) the variation in *luminance* within the text and within the background shall be no more than 5:1.

b) For low *illuminance* area exit signs with a *safety green* legend and a black (opaque) background:

   i) the *luminance* of the text shall lie within the range 2cd/m^2 to 25 cd/m^2, and

   ii) the variation in *luminance* within the text shall be no more than 5:1.

Comment:
Internally illuminated signs are preferred to externally illuminated ones as they are self-contained units and are more easily seen in smoke conditions.

4.5.4 Photoluminescent signs

Photoluminescent signs shall, in the event of a power failure, continue to provide a minimum *luminance* of 30 mcd/m^2 for the duration prescribed in NZBC Clause F6 whenever the *building* is occupied.

Photoluminescent signs shall be maintained in a charged state such that in the event of an emergency when the *building* is occupied, the exit signs will be at full operational charge and will continue to operate at the prescribed level and for the prescribed time (refer to NZBC Clause F6). Illumination for charging the photoluminescent signage shall be not less than 100 lux and suitable for charging photoluminescent material.

Comment:
If a LED lamp is used for charging a photoluminescent sign, the colour temperature and distance between the lamp and the sign should be a key consideration. A colour temperature of 4000k or greater is generally sufficient to charge a photoluminescent material.

Amend 4 Jan 2017

Charging requirements and circuits and maintenance requirements shall be specified on the plans and specifications submitted for *building consent* application.

Amend 4 Jan 2017

4.5.5 Lighting supply

The lighting installation providing illumination to exit signs shall comply with NZBC Clause G9. Alternative supplies providing energy for the illumination of exit signs during interruption of the normal lighting supply shall comply with AS 2293: Parts 1 and 3 and AS/NZS 2293: Part 2 and maintain energy supply for the duration required by NZBC Clause F6.

For exit signs that are not continuously powered on (non-maintained), the emergency condition power supply shall be connected to both the loss of normal supply sensor and to the smoke detection circuit, if present, to ensure that the signs are provided with emergency power when either the normal power supply is tripped off or smoke activates the smoke detector circuit.

Where there are no hardwired smoke detectors installed, the exit sign shall be continuously powered (maintained).

> Comment:
> Often the normal power supply is not tripped until well after smoke development is significant and if non-maintained signs are not connected to the smoke detector circuit they may not be switched on.

5.0 Fire related safety features

5.1 Call points

Signs as shown in Figure 4 shall be provided on, or adjacent to, each call point. The method of operation and the appropriate emergency telephone number, including any outside line access number, shall be inserted in the spaces provided. The sign colours must be white and *safety red*.

Figure 4 **Call point sign**
Paragraph 5.1

5.2 Fire and smoke control doors

5.2.1 *Fire doors* and *smoke control doors* required by NZBC Clause C Protection from Fire shall have a sign fixed to both sides of the door leaf adjacent to the handle or push plate, stating '**Fire Door, keep closed**' or '**Smoke Control Door, keep closed**', except that door leaves fitted with *hold-open devices* shall have a sign stating only '**Fire Door**' or '**Smoke Control Door**'.

5.2.2 *Fire doors* and *smoke control doors* that have an automatic door closer shall have a sign fixed to the exposed side of the door stating '**Fire Door (automatic closing) do not obstruct**' or '**Smoke Control Door (automatic closing) do not obstruct**' as appropriate.

5.2.3 Safe condition signs on *fire doors* and *smoke control doors* shall measure no less than 90 mm x 50 mm and shall be in white letters no less than 8 mm high on a *safety green* background. (Refer to Paragraph 3.2.3.)

5.3 Lifts

A sign shall be provided on, or adjacent to, each landing call button plate with letters at least 8 mm high reading 'In the event of fire use the stairs'. Signs shall be *safety red* on a white background.

5.4 Sprinklered buildings

a) Warning signs shall be provided to indicate the maximum height at which goods may be stacked in accordance with the *building consent*.

b) Signs shall be positioned so that the bottom of the sign is at the highest level to which storage is permitted.

c) Signs shall be visible from 90% of all locations within aisles.

d) The sign shall comprise

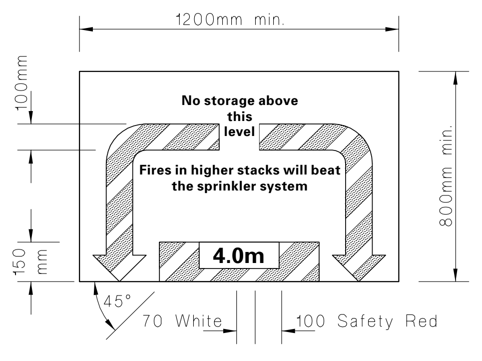
i) lettering, arrows and 45°lines in *safety red* on a white background and be sized as shown in Figure 5, or

ii) storage height limitation indicators described in section 408.2.1 of NZS 4541.

Amend 4 Jan 2017

Comment:
The height limitation of 4.0 m shown in Figure 5 is an example only.

Figure 5 **Storage height signs**
Paragraph 5.4



5.5 Signage in stairwells

a) Stairs shall be provided with signs to identify the floor level. The sign shall be *clearly visible* from each floor level landing.

b) Where fire hydrants are located in spaces containing a *stairway*, stair doors which give access to those hydrants shall be identified. This requirement applies only to those doors located on floors to which Fire Service personnel have direct access from the street and where more than one stair leads away from those floors. Signs shall be as shown in Figure 6.

c) Where fire hydrants are located in spaces containing scissor stairs, the *stairway* doors at each level providing direct access from the street for Fire Service personnel shall display a sign indicating the floor level location of hydrants which can be accessed from that particular door. Signs shall be as shown in Figure 7.

Comment:
In Figure 7, replace (xxxx) with 'odd' or 'even' as appropriate.

d) Signs required by this paragraph shall have lettering of no less than 25 mm in height. Signs required by sub-paragraphs (b) and (c) above shall comprise white lettering on a *safety red* background.

Figure 6 **Sign for door to stair with fire hydrants**
Paragraph 5.5 b)

Fire Hydrant this stair

Figure 7 **Sign for door to scissor stairs with fire hydrants**
Paragraph 5.5 c)

Fire Hydrant this stair
Outlets on (xxxx) levels

6.0 Access and facilities for people with disabilities

6.1 Signs shall be provided to identify facilities provided specifically for *people with disabilities*. Such facilities are:

a) *Accessible* car parks

b) *Accessible* entrances

c) *Accessible routes* through the *building*

d) *Accessible* services available in the *building.*

6.2 All signs, except as required by Paragraph 6.3, shall:

a) Display the International Symbol of Access, include the direction of travel (if appropriate) and name of, or symbol for, the facility as shown in Figure 8

b) Use lettering and symbols in a colour that contrasts clearly with the sign background

c) Use the proportional layout of the International Symbol of Access as shown in Figure 9

d) Be positioned consistently throughout the *building* between 1400 mm and 1700 mm above floor level

e) For carparks, be ground marked with the International Symbol of Access and may have additional signage positioned as in d) above.

Figure 8 **Example of sign indicating facilities and direction**
Paragraph 6.2 a)

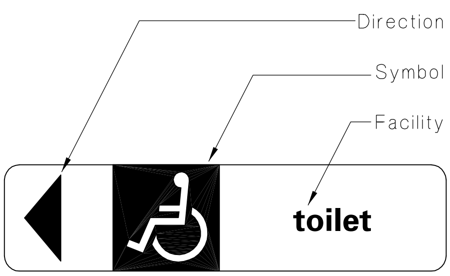
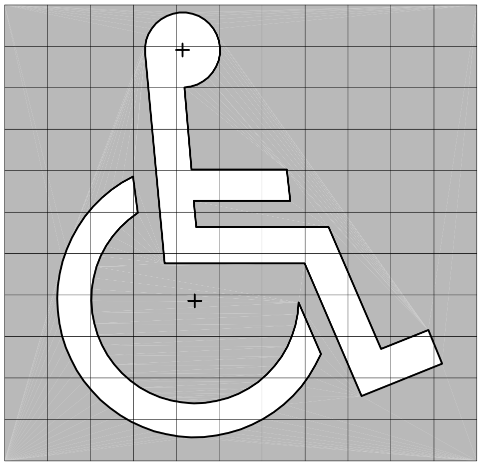
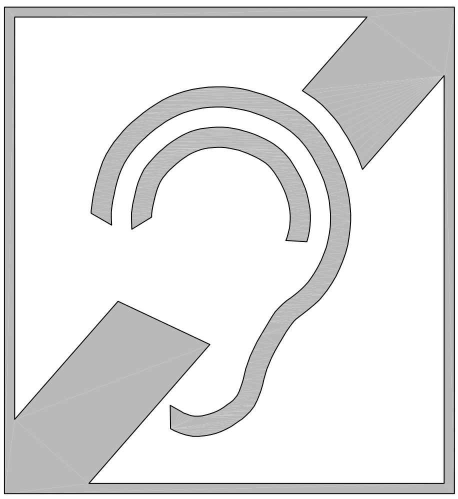


Figure 9 **International Symbol of Access**
Paragraph 6.2 c)



6.3 Where an assistive listening system is installed, a sign displaying the international symbol for deafness, as shown in Figure 10, shall be provided within 600 mm of the door(s) to the room in which the assistive listening system or device is located, and shall comply with Paragraph 6.2 b) and d).

Figure 10 **International symbol for deafness**
Paragraph 6.3



7.0 Hazards

7.1 Hazardous substances and processes

Signs for hazardous substances and processes shall comply with HSNO CoP 2-1 09-04 which identifies *buildings* where such signage is required, what signage is to be provided and where the signage is to be located.

7.2 Electrical hazards

7.2.1 Bare *active conductors* that are exposed shall be identified by the sign described in Paragraph 7.2.2:

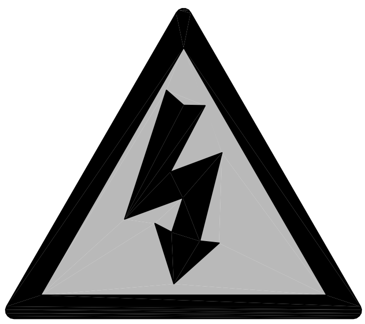
a) At each termination

b) At intervals of no more than 15 m, and

c) In each room through which they pass.

7.2.2 The caution *safety sign* shall comply with Figure 11 and Paragraph 3.2.2.

Figure 11 **Electrical hazard sign**
Paragraph 7.2.2



Danger live wires

The text is part of the sign.

7.3 Lifts

a) **Passenger lifts**
A sign shall be fitted to each lift car and display, in lettering at least 6 mm high, the lift's rated load in people and kilograms.

b) **Goods lifts**
A sign shall be fitted at each landing and display, in lettering at least 6 mm high, the rated load in kilograms.

Signs shall have *safety red* text on a white or stainless steel background.

Figure 12 **Machine room signs**
Paragraph 7.4.1

DANGER

Entry of unauthorised persons prohibited

7.4 Machine rooms

7.4.1 The sign shown in Figure 12 shall be provided adjacent to the door of every machine room.

7.4.2 The word 'DANGER' shall be printed in 50 mm high letters and the remainder of the notice in letters at least 25 mm high. The text shall be *safety red* on a white background.

7.4.3 The sign shall be placed where it is not obscured when the door is open.

7.5 Escalators and moving walks

7.5.1 Signs shall be displayed at the entrance to escalators and moving walks.

7.5.2 If the signs comprise words only, they shall contain the following instructions, where appropriate, in letters at least 8 mm high:

a) Small children must be held firmly by adults

b) Hold the handrail

c) Stand facing the direction of travel

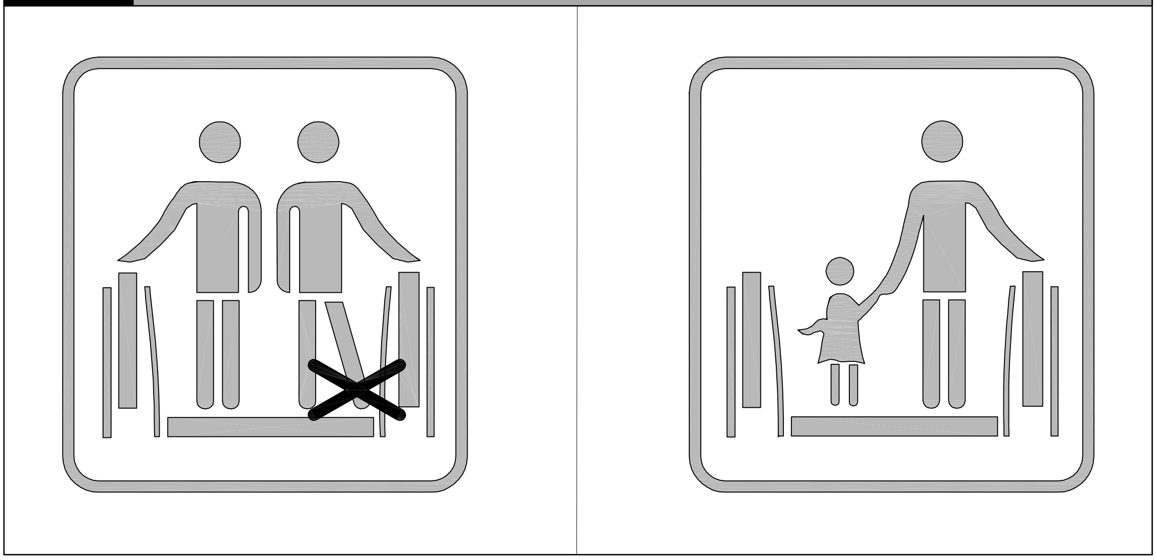
d) Keep feet away from sides.

Text shall contrast the background in accordance with Paragraph 6.2 b).

Signs shall have a minimum size of 80 mm x 80 mm.

7.5.3 If pictorgram are used, they shall be as shown in Figure 13 with a minimum size of 80 mm x 80 mm, of colour *safety blue* on a white background with the cross (X) in *safety red*.

Figure 13 **Signs for escalators and moving walks**
Paragraph 7.5.3



7.5.4 Signs identifying emergency stop buttons shall have a minimum size of 80 mm x 80 mm, be *safety red* and be marked with the inscription 'STOP' in white.

7.6 Water supplies

Outlets of non-potable water shall be identified as not suitable for drinking by using the prohibition *safety sign* shown in Figure 14. The pictogram shall be a minimum of 100 mm high and located adjacent to the outlet in a position that will not be obscured when the outlet is used.

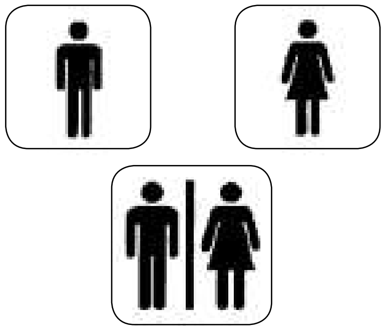
Figure 14 **Non-potable water signs**
Paragraph 7.6

8.0 Sanitary facilities

8.1 All facilities for personal hygiene shall be identified by a sign indicating location and whether for male, female, unisex or *accessible* use. Pictograms depicting whether for male, female or both shall be as shown in Figure 15. These shall be used in accordance with Paragraph 2.4. *Accessible* facilities shall be identified with the International Symbol for Access shown in Figure 9.

Comment:
Figure 8 shows a sign indicating an *accessible route* and direction to an *accessible* toilet.

Figure 15 **Santiary facilities signs**
Paragraph 8.1



Appendix A

Amendments to AS 2293.3: 2005

1.5 Electromagnetic Compatibility

Replace sentence with:

'Electromagnetic compatibility (EMC) requirements are specified by Radio Spectrum Management, Ministry of Business Innovation & Employment.'

Amend 4 Jan 2017

Index F8/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT
HIKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment (MBIE)

Hikina Whakatutuki Lifting to make successful

MBIE develops and delivers policy, services, advice and regulation to support economic growth and the prosperity and wellbeing of New Zealanders.

MBIE combines the former Ministries of Economic Development, Science and Innovation, and the Departments of Labour and Building and Housing.

Enquiries about the content of this document should be directed to:

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington.
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Status of Acceptable Solutions

Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with an Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Acceptable Solution relates. However, using an Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the status of 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.

Document Status

The most recent version of this document, as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 27 April 2017.

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 Acceptable Solution at any time. Up-to-date versions of Acceptable Solutions are available from www.building.govt.nz

Document History

Status	Date	Alterations
First Edition	27 April 2017	

Background

Until 1 January 2017, the safety of young children around swimming pools and some other pools was subject to the Fencing of Swimming Pools Act 1987. However, the fencing of pools was building work and was therefore subject to the New Zealand Building Code. Clause F4 'Safety from Falling' of the Building Code contained specific performance requirements for pool barriers and the Schedule to the Fencing of Swimming Pools Act was referenced as a means of compliance with Clause F4.

The Building (Pools) Amendment Act 2016, which was passed in October 2016, revoked the Fencing of Swimming Pools Act and incorporated child safety provisions for residential swimming pools into the Building Act 2004. It also added a new clause to the Building Code: Clause F9 'Means of Restricting Access to Residential Pools'. Residential pools that are subject to child safety provisions are defined in Section 7 of the Building Act. Refer also to the Definitions section of this document.

Most building work requires a building consent and the construction of a residential pool barrier is building work. Building work not requiring a building consent is listed in Schedule 1 of the Building Act. Clause 21A of Schedule 1 now includes:

> **Installation of a safety cover as a means of restricting access to a small heated pool that is a residential pool**

The Building Act 2004 can be seen at:

www.legislation.govt.nz/act/public/2004/0072/latest/whole.html

The provisions of the Building Act that apply to residential pools constructed, erected or installed before 1 January 2017 are contained in section 450B.

Clause F9 of the Building Code relates directly to section 162C(1) of the Building Act which requires all residential pools to have a pool barrier to restrict access by unsupervised children under 5 years of age. Section 162C(1) applies to pools constructed prior to 1 January 2017 as well as to pools constructed after that date in compliance with Clause F9. Barriers need to be maintained so that they continue to be effective.

Clause F9—Means of restricting access to residential pools

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

CLAUSE F9—MEANS OF RESTRICTING ACCESS TO RESIDENTIAL POOLS

Provisions	Limits on application
OBJECTIVE	
F9.1 The objective of this provision is to prevent injury or death to young children involving *residential pools*.	
FUNCTIONAL REQUIREMENT	
F9.2 *Residential pools* with a maximum depth of water of 400 mm or more that are filled or partly filled with water must have means of restricting access that prevents unsupervised access by a child under 5 years of age.	
PERFORMANCE	
F9.3.1 *Residential pools* must have or be provided with physical barriers that restrict access to the *pool* or the *immediate pool area* by unsupervised young children (ie, under 5 years of age).	In the case of a *small heated pool*, the means of restricting access referred to in Performance F9.3.1 need only restrict access to the *pool* when the *pool* is not in use.
F9.3.2 Barriers must either— (a) surround the *pool* (and may enclose the whole or part of the *immediate pool area*); or (b) in the case of a *small heated pool*, cover the *pool* itself.	Performance F9.3.2(b) applies only to those *small heated pools* where the top surface of every wall of the *pool* is at all points not less than 760 mm above the adjacent floor or ground and the walls of the *pool* inhibit climbing.
F9.3.3 A barrier surrounding a *pool* must have no permanent objects or projections on the outside that could assist children in negotiating the barrier. Any gates must— (a) open away from the *pool*; and (b) not be able to be readily opened by children; and (c) automatically return to the closed position after use.	
F9.3.4 Where a *building* forms all or part of an *immediate pool area* barrier,— (a) doors between the *building* and the *immediate pool area* must not be able to be readily opened by children, and must either— (i) emit an audible warning when the door is open; or (ii) close automatically after use:	

Schedule 1 clause F9: inserted, on 1 January 2017, by section 20 of the Building (Pools) Amendment Act 2016 (2016 No 71).

Clause F9—Means of restricting access to residential pools (continued)

CLAUSE F9—MEANS OF RESTRICTING ACCESS TO RESIDENTIAL POOLS (continued)

Provisions	Limits on application
(b) windows opening from a building into the *immediate pool area* must be constructed or positioned to restrict the passage of children. **F9.3.5** Where a cover is provided as a barrier to a *small heated pool*, it must— (a) restrict the entry of children when closed; and (b) be able to withstand a reasonably foreseeable load; and (c) be able to be readily returned to the closed position; and (d) have signage indicating its child safety features.	

Contents

References

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in these Acceptable Solutions (primary reference documents) must be the editions, along with their specific amendments, listed below. Where these primary reference documents cite other Standards or documents (secondary citations), which in turn may also cite other Standards or documents, and so on (lower-order citations), then the version that is cited must be used, or if no specific version is cited then the version that is current when the citing document is published must be used.

	Where quoted
Ministry of Business, Innovation and Employment	
Acceptable Solution F4/AS1 Safety from falling; third edition, amendment 1	AS1 2.5.1
Acceptable Solution F8/AS1 Signs; second edition, amendment 3	AS1 4.2.2, AS2 2.5
Standards New Zealand	
NZS 8500:2006 Safety barriers and fences around swimming pools, spas and hot tubs	AS1 2.4.1

Definitions

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

Abode or place of abode	a) Means any place used predominantly as a place of residence or *abode*, including any appurtenances belonging to or enjoyed with the place; and b) Includes – i) a hotel, motel, inn, hostel, or boarding house: ii) a convalescent home, nursing home, or hospice: iii) a rest home or retirement village: iv) a camping ground: v) any similar place.
Building	Has the meaning ascribed to it by sections 8 and 9 of the Building Act 2004.
Household unit	(a) Means a *building* or group of *buildings*, or part of a *building* or group of *buildings*, that is— (i) used, or intended to be used, only or mainly for residential purposes; and (ii) occupied, or intended to be occupied, exclusively as the home or residence of not more than 1 household; but (b) Does not include a hostel, boarding house, or other specialised accommodation.
Immediate pool area	Means the land in or on which the *pool* is situated and so much of the surrounding area as is used for activities carried out in relation to or involving the *pool*.
Pool	a) Means - i) any excavation or structure of a kind normally used for swimming, paddling, or bathing; or ii) any product (other than an ordinary home bath) that is designed or modified to be used for swimming, wading, paddling, or bathing; but b) Does not include an artificial lake.
Residential pool	Means a *pool* that is - a) in a place of *abode*; or b) in or on land that also contains an *abode*; or c) in or on land that is adjacent to other land that contains an *abode* if the *pool* is used in conjunction with that other land or *abode*.
Small heated pool	Means a heated *pool* (such as a spa *pool* or hot tub) that - a) has a water surface area of 5 m^2 or less; and b) is designed for therapeutic or recreational use.

F9/AS1 Residential Pool Barriers

1.0 Scope

This Acceptable Solution provides a means for restricting the unsupervised access of children under 5 years of age to *residential pools*. It describes acceptable methods of *construction* for barriers surrounding *pools* as well as the *construction* and operation of doors, gates and windows that provide access to an *immediate pool area*.

2.0 Barriers surrounding the immediate pool area

2.1 Pool barriers

2.1.1 A *pool* barrier can be a fence but may also take other forms of *construction*, such as a concrete block wall. The wall of a house or other *building* may form part of the barrier to an *immediate pool area* or may enclose the whole *immediate pool area* (such as with an indoor *pool*).

Comment:
Activities that may be carried out in the immediate pool area are those that involve the pool or are in relation to it. However, an activity may also be carried out independently of the use of the pool. For example, a barbeque and outdoor furniture could be located in the immediate pool area but not a clothes line or vegetable garden.

The use of the immediate pool area as a means of accessing the house from the property boundary or to gain access to other parts of the property from the house would in most cases conflict with the definition of immediate pool area.

2.1.2 *Pool* barriers not on a property boundary shall have a height of not less than 1200 mm from the finished floor or ground level outside the *pool* barrier.

2.1.3 *Pool* barriers shall not be angled more than 15° from vertical and may only slope away from the *pool*. Any rails, rods or wires forming a part of a *pool* barrier that are not themselves vertical shall be at least 900 mm apart vertically to restrict climbing. There shall be no openings in the *pool* barrier that a 100 mm diameter sphere could pass through.

2.1.4 Figure 1 shows acceptable ways of constructing *pool* barriers that are not on a property boundary.

2.1.5 Steel wire mesh with square openings may be used as an alternative to the solid panel shown in (e) in Figure 1 provided the openings do not have a side dimension greater than 13 mm. Panels with steel wire mesh having openings measuring between 13 mm and 35 mm on a side shall be not less than 1800 mm high but may have a gap at the base of not more than 100 mm.

2.1.6 There shall be no ground features or objects outside a *pool* barrier within 1200 mm of the top of the barrier that would assist a child in climbing. Figure 2 gives acceptable methods for evaluating this requirement.

2.1.7 Any projections or indentions on the outside face of a *pool* barrier shall not have a horizontal projection from the face of the *pool* barrier greater than 10 mm unless they are at least 900 mm apart vertically.

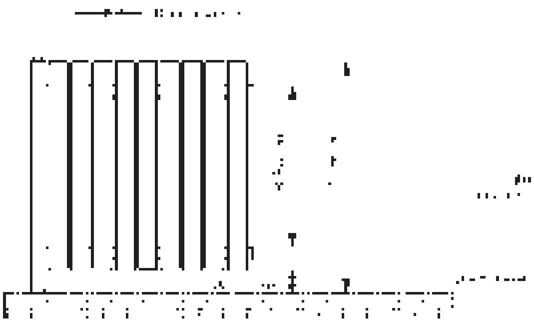
2.2 Pool barrier on a property boundary

2.2.1 If a *pool* barrier is located on a property boundary, it shall:

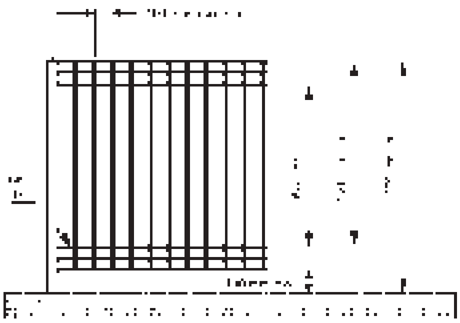
a) Be not less than 1800 mm high, measured from the ground level on the *pool* side, and
b) Have no openings that a 100 mm diameter sphere could pass through, and
c) Be located not less than 1000 mm horizontally from the water's edge, and
d) Have a 900 mm high zone on the *pool* side of the barrier that begins not more than 150 mm from the top and is constructed as specified in Paragraphs 2.1.3 and 2.1.7, to restrict climbing by children.

Comment:
Should a child gain access to the top of the barrier from the outside, this construction method will prevent them from climbing down into the pool area.

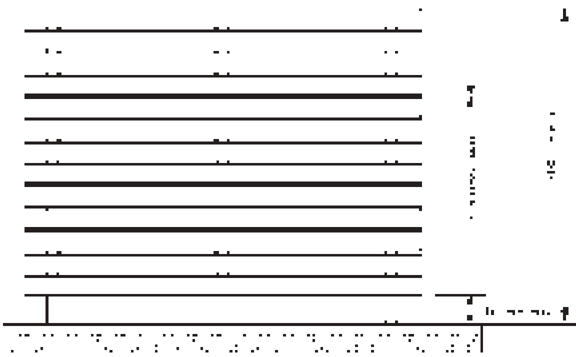
Figure 1: Acceptable pool barriers
Paragraphs 2.1.4, 2.1.5



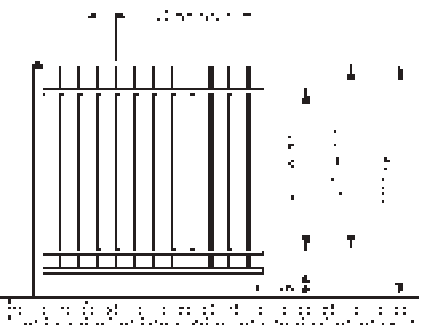
(a) Rails inside, but with uprights spaced not more than 10 mm apart.



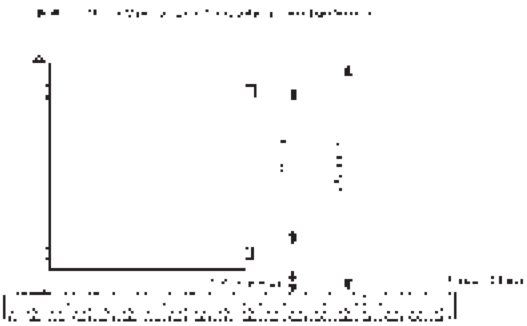
(b) Rails on outside, but with uprights spaced not more than 100 mm apart.



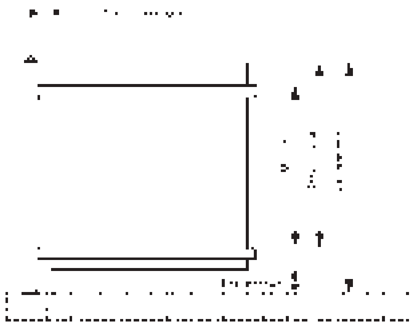
(c) Horizontal fencing with spacing of not more than 10 mm.



(d) Fencing with several horizontal members, such as welded construction.

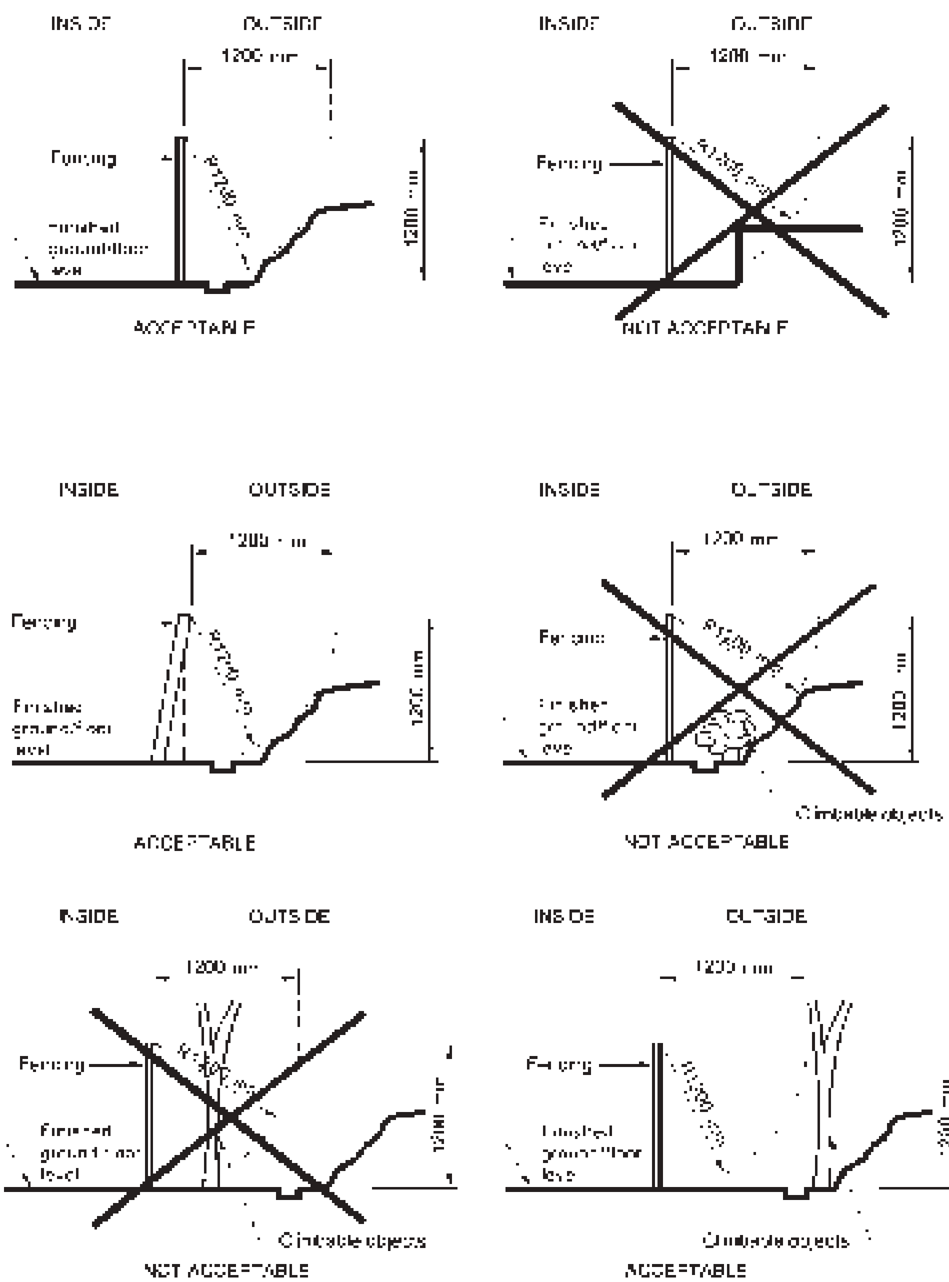


(e) Solid panel type barrier.



(f) Solid panel type barrier with rails on outside.

Figure 2: **Determining pool barrier height**
Paragraph 2.1.6



2.3 Pool wall as a barrier

2.3.1 The outside face of a *pool* wall is an acceptable barrier if it is no less than 1200 mm high and complies with Paragraphs 2.1.6 and 2.1.7. Any ladder or other means of providing access to the *pool* shall have an enclosing barrier and gate complying with 2.1 and 3.1.

Comment:
When the top of a pool wall is 1000 mm or more from the surrounding ground, Clause F4 'Safety from Falling' of the Building Code may apply if there is a potential hazard from falling over or off the top of the wall. Determinations 2010/085 and 2010/097 are applicable to this situation. See: www.building.govt.nz/determinations-view-past-determinations

2.4 Strength of pool barriers

2.4.1 NZS 8500 Appendices C, D, E & F are acceptable methods for assessing the strength of *pool* barriers.

Comment:
Wind force may be greater than the force specified in these Appendices, depending on the method of construction. Refer to B1/VM1 for design wind loads.

2.5 Balconies projecting into the immediate pool area

2.5.1 When the floor of a balcony is more than 2400 mm vertically above the *immediate pool area,* a barrier complying with Clause F4 may be used instead of a Clause F9 barrier provided that there are be no projections within 1200 mm below the top of it (such as a wall or landscaping feature) that could assist a child to climb down.

3.0 Gates in pool barriers

3.1 Gate construction

3.1.1 A gate in a *pool* barrier shall:

a) Be hinged, and

b) Be at least 1200 mm high, and

c) Comply with Paragraphs 2.1.2 to 2.1.7 above, and

d) Open away from the *pool*, and

e) Swing clear of any obstruction that might hold it open, and

f) Have a self-closing device that will return the gate to the closed and latched position from any position with a stationary start, and

g) Have hinges arranged such that when the gate is lifted up or pulled down:

   i) the latching device will not release, and

   ii) the gate will not come off its hinges, and

   iii) the ground clearance under the gate will not allow the passage of a 100 mm diameter sphere.

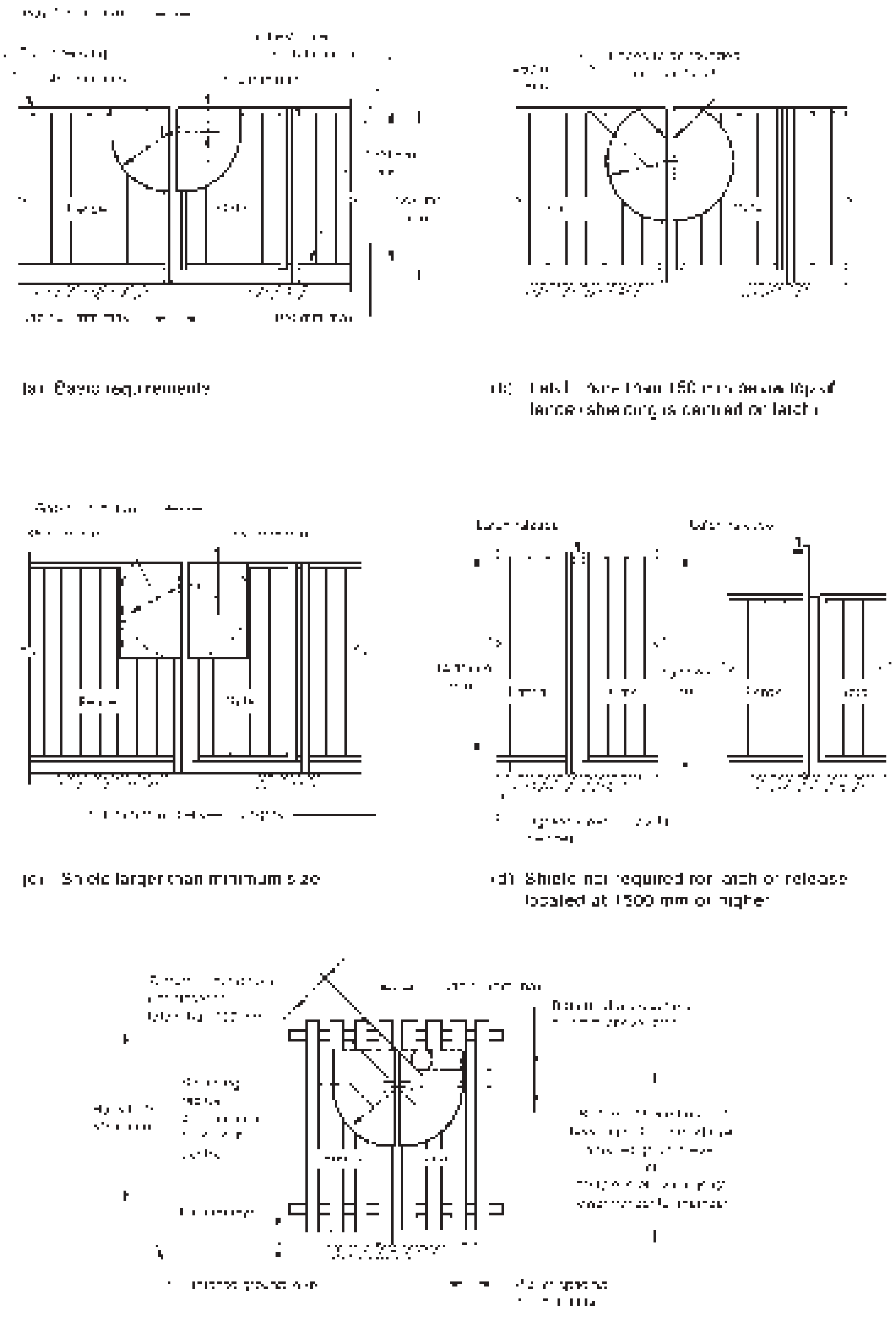
3.1.2 A latch on a gate in *pool* barrier shall:

a) Automatically operate on the closing of the gate such that a manual operation is required to release it, and

b) Be positioned so that it cannot be reached by a child from outside the *pool* area. Figure 3 gives acceptable means of preventing a child reaching the latch, and

c) Not be capable of being released from outside the *pool* area by the insertion of a thin implement through any gaps.

Figure 3: Acceptable means of protecting a latch as viewed from the pool side
Paragraph 3.1.2



(a) Basic requirements

(b) Latch more than 150 mm below top of fence (shielding is centred on latch)

(c) Shield larger than minimum size

(d) Shield not required for latch or release located at 1500 mm or higher

(e) Hand hole provided in fence or gate

4.0 Building wall forming the pool barrier

4.1 Windows in the building wall

4.1.1 Where there is an window that can open above and within 2400 mm vertically of the *immediate pool area* the window shall have either:

a) The lower edge of the opening no less than 1000 mm above the floor inside the *building* with no projections underneath of more than 10 mm, or

b) A restrictor limiting the size of the opening such that a 100 mm diameter sphere cannot pass through, or

c) A permanently fixed screen over the opening that a 100 mm diameter sphere cannot pass through.

4.2 Doors in the building wall

4.2.1 Doors in a *building* wall that provide access into the *immediate pool area* shall be single leaf doors that are not more than 1000 mm in width. These doors shall be side hinged or sliding.

4.2.2 Doors in a *building* wall providing access into the *immediate pool area* shall have:

a) Either a self-closing device or an audible alarm, and

b) A self-latching device that automatically operates on the closing of the door and that must be released manually, and

c) The release for the latching device located not less than 1500 mm above the inside floor, and

d) A sign which shall be:

i) fixed adjacent to the inside door handle at a height between 1200 mm and 1500 mm stating:

'SWIMMING POOL. CLOSE THE DOOR.', and

ii) composed of black letters of minimum height 5 mm complying with Paragraphs 2.2 and 3.2.2 of F8/AS1.

Comment:

a) Doors will usually require two-handed operation, one to release the high level latch and the other to operate the door handle lock set.

b) Doors described in Paragraphs 4.2.1 and 4.2.2 enable the barrier to the pool to remain effective except when the doors are briefly used for access.

c) Signs on pool doors are a requirement under Clause F8 'Signs', which does not apply to detached dwellings or to household units in multi-unit dwellings (such as apartment units). However, homeowners may choose to fit signs to their pool access doors as a reminder for visitors.

4.2.3 For hinged doors that open towards the pool, a self-closing device shall return the door to the closed and latched position from any position when the door is stationary. For all other doors, a self-closing device shall return the door to the closed and latched position when the door is stationary and 150 mm or further from the closed and latched position.

4.2.4 A door alarm shall:

a) Produce an alarm tone of $75dBAL_{10}$ when measured at a distance of 3000 mm that commences 7 seconds after the door's self-latching device is released, and

b) Automatically return to a state of readiness when the door is closed and latched, and

c) Have a low battery charge warning that may be visual or audible.

4.2.5 Door alarms may be provided with a deactivation switch placed not less than 1500 mm above floor level that silences the alarm for not more than 15 seconds.

Comment:

A deactivation switch can be useful when maintenance materials or pool furniture needs to be moved through a door.

F9/AS2 Covers for small heated pools

1.0 Scope

This Acceptable Solution applies to covers for *small heated pools* with a water surface area of 5 m² or less and with walls that are 760 mm above the adjacent floor or ground. To comply with this Acceptable Solution, a cover must be able to be readily returned to the closed position by an adult.

2.0 Small heated pools and covers

2.1 Pool walls

2.1.1 The top surface of the *pool* wall shall be at all points not less than 760 mm above the adjacent floor or ground and the *pool* wall shall be vertical or slope outwards at not more than 15° from vertical.

2.1.2 There shall be:

a) No external objects or projections within 760 mm of the top edge that could assist climbing. Figure 1 provides the acceptable methods for evaluating this requirement when 'R760' is substituted for 'R1200', and

b) No projections or indentations on the *pool* wall itself greater than 10 mm horizontally from the plane of the wall.

2.2 Strength of covers

2.2.1 Covers shall be capable of supporting a vertical point load of 200 N (20 kg) when imposed over an area of 120 mm diameter at the centre of the cover.

2.3 Top surface of cover

2.3.1 The top surface of a cover shall be *constructed* with a slope from the centre to the outside edges (to prevent water ponding on the cover).

2.4 Cover fastenings

2.4.1 Covers shall be held in place with straps fitted with lockable snap fasteners having a minimum width of 33 mm on their main body.

2.4.2 Fastenings using metal padlocks may be used instead of lockable snap fasteners.

Comment:
Security against unauthorised use by adults can be an issue with small heated pools in some locations so that padlocks can be a more practical means of securing a cover.

2.4.3 Hold-down straps and fasteners shall be capable of maintaining the cover in place so that there is no opening that a 100 mm sphere could pass through when a 100 N (10 kg) force is applied to the cover in any direction and at any location.

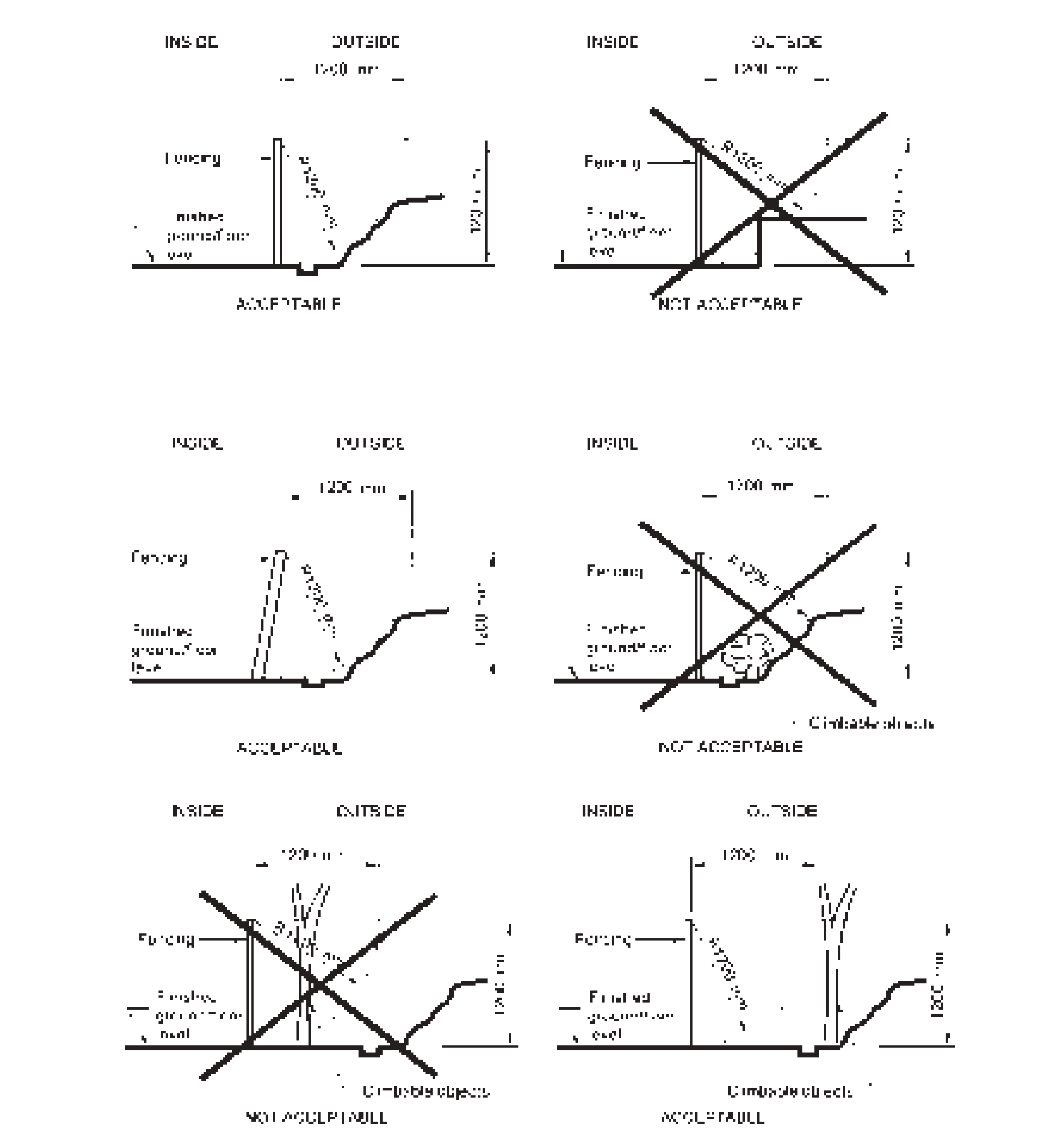
Comment:
Covers and fasteners need regular maintenance, particularly if exposed to UV light which affects straps and plastic fasteners.

2.5 Signage

2.5.1 Signs complying with Paragraphs 2.2 and 3.2.2 of F8/AS1 containing the text below with black letters not less than 5 mm in height shall be fixed on two opposite sides of the cover:

'**WARNING:** This spa pool cover must be kept locked except when under adult supervision'.

Figure 1: **Determining wall height of a small heated pool (Note: 'R760' is to be substituted for 'R1200')**
Paragraph 2.1.2



Index F9/AS1 & AS2

Compliance Document for New Zealand Building Code Clause G1 Personal Hygiene – Second Edition

Prepared by the Department of Building and Housing

This Compliance Document is prepared by the Department of Building and Housing. The Department of Building and Housing is a Government Department established under the State Sector Act 1988.

Enquiries about the content of this document should be directed to:

Department of Building and Housing
PO Box 10-729, Wellington.
Telephone 0800 242 243
Fax 04 494 0290
Email: info@dbh.govt.nz

Compliance Documents are available from www.dbh.govt.nz

Status of Compliance Documents

Compliance Documents are prepared by the Department of Building and Housing in accordance with section 22 of the Building Act 2004. A Compliance Document is for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Compliance Document will be treated as having complied with the provisions of the Building Code to which the Compliance Document relates. However, a Compliance Document is only one method of complying with the Building Code. There may be alternative ways to comply.

Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the status of Compliance Documents 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 Compliance Document.

G1: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	September 1993	pp. 5 and 6, Table 1	pp. 15 and 16, Index
Amendment 2	19 August 1994	pp. i and ii, Document History p. v, Contents p. 3, 1.1, 1.1.1, 1.2, 1.2.1 p. 12, 4.0, 4.2.1, 4.2.2	p. 13, 4.4, 4.4.1, 4.4.2, 4.4.3, Figure 10, Table 4 p.14, Figure 11 pp. 15 and 16, Index
Reprinted incorporating Amendments 1 and 2	October 1994		
Amendment 3	1 December 1995	p. vi, References	
Second edition	1 December 2000	Document revised – second edition issued	
Amendment 4	1 July 2001	p. 2, Document History, Status p. 7, References p. 9, Definitions p. 18, Figures 5 and 6	p. 19, Figures 7 and 8 p. 20, 4.2.7 and Figure 9 p. 21, 6.3.1 and Figure 10
Amendment 5	23 June 2007	p. 2, Document History, Status p. 5, Contents p. 7, References p. 9, Definitions p. 13, 1.1.1, 1.1.2	p. 14, 1.1.3, 1.1.4, 1.1.5, 1.1.6, 1.1.7, 1.1.8 p. 20, 6.1.1, p. 21, Figure 10 pp. 23–24, 26-27, Table 1 p. 28, Table 3
Erratum 1	11 July 2007	p. 2, Document History, Status	p. 22, Table 1
Amendment 6	10 October 2011	p. 2, Document History, Status pp. 3–4, Code Clause G1 p. 7, References	p. 15, G1/AS1 2.3.4 p. 16, G1/AS1 2.6.1

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

Document Status

The most recent version of this document, as detailed in the Document History, is approved by the Chief Executive of the Department of Building and Housing. It is effective from 10 October 2011 and supersedes all previous versions of this document.

People using this Compliance Document should check for amendments on a regular basis. The Department of Building and Housing may amend any part of any Compliance Document at any time. Up-to-date versions of Compliance Documents are available from www.dbh.govt.nz

New Zealand Building Code Clause G1 Personal Hygiene

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

Amend 6 Oct 2011

FIRST SCHEDULE—*continued*

Clause G1—PERSONAL HYGIENE

Provisions	Limits on application
OBJECTIVE	
G1.1 The objective of this provision is to:	
(a) Safeguard people from illness caused by infection or contamination,	
(b) Safeguard people from loss of *amenity* arising from the absence of appropriate personal hygiene facilities, and	
(c) Ensure *people with disabilities* are able to carry out normal activities and processes within *buildings*.	Objective G1.1(c) shall apply only to those *buildings* to which section 47A of the Act applies.
FUNCTIONAL REQUIREMENT	
G1.2 *Buildings* shall be provided with appropriate spaces and facilities for personal hygiene.	
PERFORMANCE	
G1.3.1 *Sanitary fixtures* shall be provided in sufficient number and be appropriate for the people who are intended to use them.	
G1.3.2 *Sanitary fixtures* shall be located, constructed and installed to:	
(a) Facilitate *sanitation*,	
(b) Avoid risk of food contamination,	
(c) Avoid harbouring dirt or germs,	
(d) Provide appropriate privacy,	
(e) Avoid affecting occupants of adjacent spaces from the presence of unpleasant odours, accumulation of offensive matter, or other source of annoyance,	
(f) Allow effective cleaning,	

Note: Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

Effective from 29 December 2000

54 *Building Regulations 1992* 1992/150

FIRST SCHEDULE—*continued*

Provisions	Limits on application
(g) Discharge to a plumbing and drainage system as required by Clause G13 "Foul Water" when water borne disposal is used, and	
(h) Provide a healthy safe disposal system when non-water-borne disposal is used.	
G1.3.3 Facilities for personal hygiene shall be provided in convenient locations.	
G1.3.4 Personal hygiene facilities provided for *people with disabilities* shall be *accessible*.	Performance G1.3.4 shall not apply to *Housing, Outbuildings, backcountry huts, Ancillary buildings*, and to *Industrial buildings* where no more than 10 people are employed.

Effective from 31 October 2008

Contents

References

Amend 6 Oct 2011

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in this Compliance Document (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 Compliance Document must be used.

		Where quoted
Standards New Zealand		
Amend 6 Oct 2011		
NZS 4121: 2001	Design for access and mobility – Buildings and associated facilities (Amend 4 Jul 2001)	AS1 4.2.7
Standards Australia		
AS 1976: 1992	Vitreous china used in sanitary appliances	AS1 2.6.1
AS 3588: 1996	Shower bases and shower modules (Amend 6 Oct 2011)	AS1 2.6.1
Standards Australia/New Zealand		
AS/NZS 1730: 1996	Washbasins	AS1 2.6.1
AS/NZS 2023: 1995	Baths for ablutionary purposes	AS1 2.6.1
British Standards Institution		
BS 3402: 1969	Specification for quality of vitreous china sanitary appliances (Amend 6 Oct 2011)	AS1 2.6.1

Definitions

Amend 5 Jun 2007

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

Access route A continuous route that permits people and goods to move between the apron or construction edge of the *building* to spaces within a *building*, and between spaces within a *building*.

Amend 5 Jun 2007

Accessible Having features to permit use by a *person with a disability.*

Amend 5 Jun 2007

Accessible route An access route usable by a *person with a disability*. It shall be a continuous route that can be negotiated unaided by a wheelchair user. The route shall extend from street boundary or car parking area to those spaces within the *building* required to be *accessible* to enable a *person with a disability* to carry out normal activities and processes within the *building*.

Amend 5 Jun 2007

Amend 5 Jun 2007

Building has the meaning ascribed to it by Sections 8 and 9 of the Building Act 2004.

Amend 5 Jun 2007

Fixture An article intended to remain permanently attached to and form part of a *building*.

Habitable space A space used for activities normally associated with domestic living, but excludes any bathroom, laundry, water-closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods.

Household unit

a) means any *building* or group of *buildings*, or part of a *building* or group of *buildings*, that is:

i) used, or intended to be used, only or mainly for residential purposes; and

ii) occupied, or intended to be occupied, exclusively as the home or residence of not more than one household; but

b) does not include a hostel, boarding house or other specialised accommodation.

Amend 5 Jun 2007

Impervious That which does not allow the passage of moisture.

Person with a disability means a *person* who has an impairment or a combination of impairments that limits the extent to which the person can engage in the activities, pursuits and processes of everyday life, including, without limitation, any of the following:

a) a physical, sensory, neurological, or

b) a mental illness.

Amend 5 Jun 2007

Privacy The situation of being withdrawn from view.

Privy A private room containing a receptacle (other than a WC) or an excavation for excreted liquid or solid human waste, and with a means of disposal or containment of the waste.

Sanitary fixture Any *fixture* which is intended to be used for *sanitation*.

Sanitation The term used to describe the activities of washing and/or excretion carried out in a manner or condition such that the effect on health is minimised, with regard to dirt and infection.

Soil fixture A ***sanitary fixture*** constructed to receive solid and/or liquid excreted human waste. It includes bedpan disposal units, slop sinks, urinals, water closet pans, and water-flushed sanitary towel disposal units.

Amend Jul 2001

Unisex facilities Facilities available for use by either sex.

COMMENT:
Unisex facilities may also be described as both gender facilities.

Verification Method G1/VM1

No specific test methods have been approved for verifying compliance with the performance of NZBC G1.

Acceptable Solution G1/AS1

1.0 Number and Type of Sanitary Fixtures

1.1 General

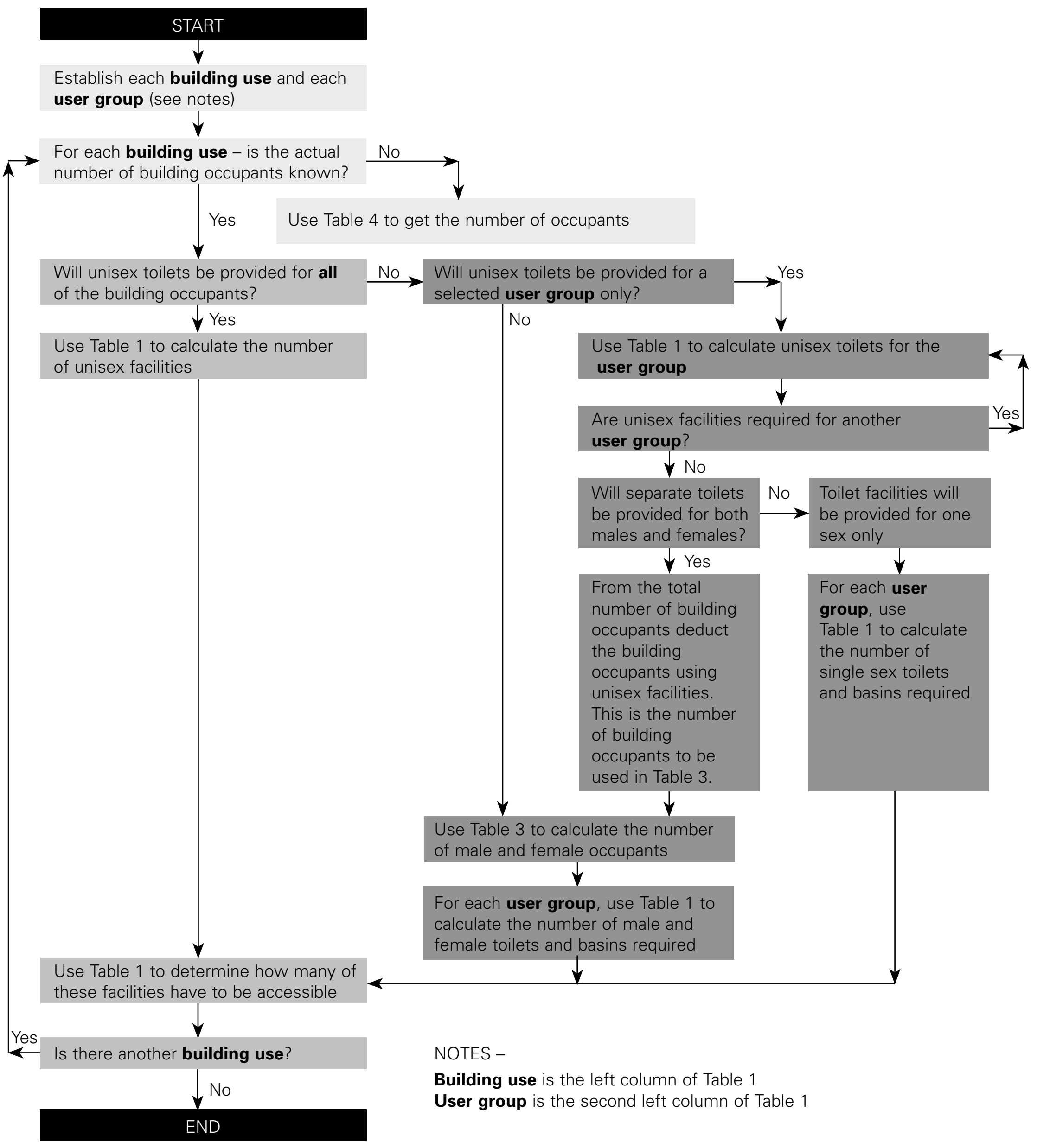
1.1.1 Sanitary facilities are required in occupied *buildings*.

Amend 5 Jun 2007 **1.1.2** WC pans and basins are required in any *building* where people:

a) live or are accommodated

COMMENT:
Examples may include, but are not necessarily limited to: a dwelling, holiday cottage, boarding house, attached dwelling, flat, multi-unit apartment, commune, marae, boarding house, hall of residence, holiday cabin, hostel, hotel, motel, nurses' home, retirement village, time-share accommodation, work camp, camping ground, hospital, old people's home, health camp, borstal, drug rehabilitation centre, old people's home where substantial care is extended, and a prison. Amend 5 Jun 2007

Figure 1: Method to Determine WC Pan, Urinal and Basin Numbers
Paragraph 1.1.1



NOTES –
Building use is the left column of Table 1
User group is the second left column of Table 1

or

b) work

COMMENT:
Examples may include, but are not necessarily limited to: staff facilities in all buildings.

or

c) eat food or drink on the premises

COMMENT:
Examples may include, but are not necessarily limited to: coffee bars, tea rooms, restaurants, bars and nightclubs.

or

d) assemble

COMMENT:
Examples may include, but are not necessarily limited to: a church, cinema, clubroom, hall, museum, public swimming pool, stadium, theatre, whare runanga, early childhood centre, college, day care institution, centre for handicapped people, kindergarten, school, university or transport terminal.

COMMENT:
People who purchase food or drink to take away and customers of commercial and industrial businesses are not required to be included when calculating the number of sanitary facilities to be provided.

1.1.3 Toilet facilities for males must contain WC pans and basins and may contain urinals.

1.1.4 Showers or baths are required for buildings where:

a) People live or are accommodated

b) People engage in active recreation

c) Children under the age of five are supervised or educated

d) People work in occupations where they get dirty and require showers before leaving work.

1.1.5 The number of *sanitary fixtures* for the uses in Paragraphs 1.1.2, 1.1.3 and 1.1.4 is calculated for:

a) WC pans, urinals and basins – use Figure 1, Table 1, Table 3 and Table 4.

Amend 5 Jun 2007 b) Baths and showers – use Table 2.

1.1.6 Provision of *sanitary fixtures* including those facilities for *persons with disabilities* are given in Tables 1 and 2.

1.1.7 Where separate facilities are provided, the male facility may include urinals. Amend 5 Jun 2007

1.1.8 Where *unisex facilities* are provided, they shall: Amend 5 Jun 2007

a) Be located in a self contained compartment offering full *privacy* by way of full height doors and walls,

b) Contain a WC pan, basin, sanitary towel disposal equipment (where required), but no urinal, and

c) Be located so that access is not via an area restricted to one sex.

1.2 Sanitary towel disposal

1.2.1 In *buildings*, other than housing and those used exclusively by preadolescents, sanitary facilities for females shall have provision for sanitary towel disposal by either:

a) Installing incinerators, macerators or similar disposal equipment, or

b) Providing space for a portable disposal system.

COMMENT:
Under the Health and Safety in Employment Regulations 1995, sanitary towel disposal equipment (either fixed or portable) must be provided in sanitary facilities used by females.

1.2.2 The location of sanitary towel disposal equipment shall not impede access for *people with disabilities* and shall be located:

a) Where separate female facilities are provided: within the facility to serve one or more toilet cubicles, or

b) Where *unisex facilities* are provided: in each toilet cubicle.

2.0 Fixture Construction and Installation

2.1 WC pans

2.1.1 A WC system shall be firmly fixed in place and have:

a) An *impervious*, easily cleaned surface finish (e.g. glazed earthenware or stainless steel),

b) Sufficient water trap volume to contain excreta from normal usage,

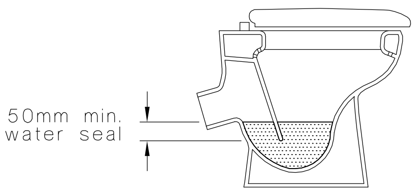
c) A minimum water seal depth of 50 mm (see Figure 2),

d) A pan which will not overflow during a single flush even if the outlet blocks,

e) A watertight flexible joint connecting the WC to a discharge pipe. The joint must be above floor level, and within the room containing the WC, and

f) A flushing apparatus capable of clearing all normal faecal matter from the pan in a single flush, and of delivering a full flush within 2 minutes of the previous usage.

Figure 2: WC Water Seal
Paragraph 2.1.1 c)



Section

2.2 Flushing systems

2.2.1 Flushing systems for *sanitary fixtures* shall use either cisterns or flushing valves.

2.2.2 Cisterns may be of the dual flush, 2 button type providing the choice of a full flush or a half flush.

2.2.3 Flushing valves shall have backflow prevention complying with G12/AS1, and a water supply capable of supplying several flushes in rapid succession. The capacity should be related to the nature and usage of the *building*.

2.3 Urinals

2.3.1 A urinal may be of the stall, continuous wall, trough or bowl type.

2.3.2 Any urinal shall have at its base a channel or trough of sufficient size to receive all fluids discharging into it. The channel shall drain to a trap at the lowest point where fluids shall enter a discharge pipe through a domed grate. The grate shall have openings with a total area at least that of the discharge pipe, and be securely fixed but removable for maintenance access (see Figure 3).

2.3.3 Wall hung bowl or trough urinals shall have the front lip height above the floor or step, no more than 600 mm for men and no more than 400 mm for boys. The back surface of the urinal must extend at least 450 mm above the front lip level.

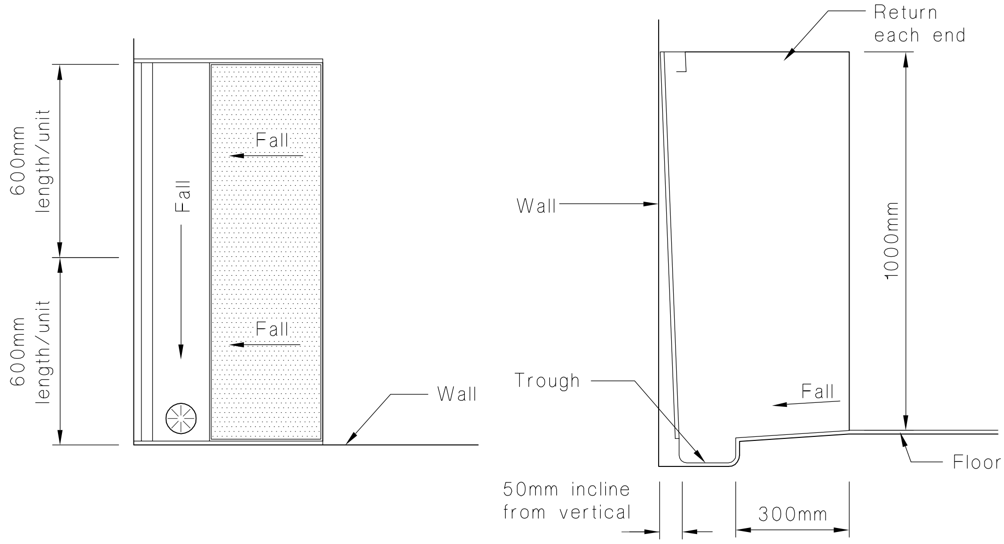
2.3.4 Urinals shall have *impervious*, easily cleaned surfaces (e.g. glazed ceramic ware or stainless steel). Stainless steel urinals are to be constructed of 1.2 mm minimum sheet thickness of grade 304 or when located in the outside air or a marine environment, the grade is to be 316. Amend 6 Oct 2011 Amend 6 Oct 2011

2.3.5 Urinal flushing apparatus shall clean the whole urinal surface and deliver a minimum of 2.5 litres of water per flush to each stall, bowl or 600 mm length of urinal wall.

2.3.6 A urinal flushing system shall have the cistern outlet at least 450 mm above the sparge pipe and comply with Table 5.

2.3.7 A flushing valve is also acceptable for urinals provided the water supply complies with Table 5 and backflow prevention complies with NZBC G12.

Figure 3: Continuous Wall Urinal
Paragraph 2.3.2



(a) Plan (b) Section

2.3.8 Manually operated flushing systems shall have the operating control located no more than 1.3 m above the floor.

2.4 Bidets

2.4.1 Bidets shall:

a) Be firmly fixed in place, and

b) Have an *impervious*, easily cleaned surface finish (e.g. glazed earthenware or stainless steel), and

c) Be either over-rim feed type or submersible spray type, and

d) Satisfy the provisions of NZBC G12 for backflow prevention.

2.5 Showers

2.5.1 Showers using either a shower tray or a level threshold shall satisfy the provisions of E3/AS1 Internal Moisture.

2.6 Acceptable standards

2.6.1 *Sanitary fixtures* construction shall comply with the relevant parts of the following standards:

AS 1976	Vitreous china used in sanitary appliances.
AS 3588	Shower bases and shower modules.
AS/NZS 2023	Baths for ablutionary purposes.
AS/NZS 1730	Washbasins.
BS 3402	Specification for quality of vitreous china sanitary appliances.

Amend 6 Oct 2011

Amend 6 Oct 2011

3.0 Location of Sanitary Fixtures

3.0.1 Other NZBC Clauses relevant to the installation of *sanitary fixtures* are:

E3 "Internal Moisture", for overflow and water splash requirements,

G4 "Ventilation",

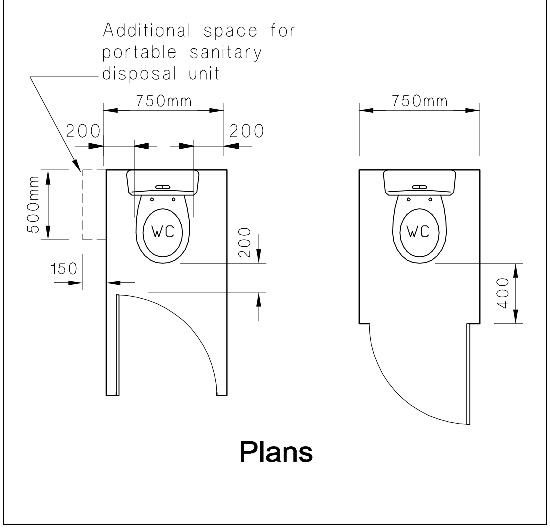
G12 "Water supplies", and

G13 "Foul water".

3.1 Space dimensions

3.1.1 Space containing *soil fixtures* shall be separated from *habitable spaces.* WC pans shall be located in spaces having dimensions of no less than those shown in Figure 4.

Figure 4: Space Dimensions for WC Pans
Paragraph 3.1.1



3.2 Access to food and work areas

3.2.1 In *household units*, at least one door shall be provided between a *soil fixture* and a kitchen or a place for food storage.

3.2.2 In *buildings* other than *household units*, no space containing a *soil fixture* shall open directly into:

a) A space used for the storage, preparation, sale or consumption of food, see Figure 10, or

b) An office or other work areas (as in factories), see Figure 10.

3.3 Basins

3.3.1 Basins shall be located in spaces containing a *soil fixture*, or in an immediately adjacent space. However, where only a single door is provided between the *soil fixture* space and a kitchen in *household units* (see Paragraph 3.2.1), a basin shall be provided within the *soil fixture* space.

COMMENT:

1. The essential requirement is the provision of a basin with cold water immediately available to users of *soil fixtures* particularly before handling food. While perhaps preferable, it is often not required or practical to supply hot water in some places such as roadside rest areas.
2. It is not acceptable for the kitchen sink to be used as a hand basin.

3.4 Communal sanitary fixtures

3.4.1 *Sanitary fixtures* may be located in *buildings* separate from other accommodation. The length of travel shall be convenient taking account of the type and usage of the *fixtures.*

3.4.2 In camping grounds *sanitary fixtures* shall be located no more than 75 metres from any caravan or campsite.

COMMENT:

This situation applies normally to institution *buildings*, motor camps, caravan parks, maraes, outdoor pursuits centres, schools and military bases, but may apply to a group of dwellings.

3.4.3 *Sanitary fixtures* for group dwellings shall be conveniently located for all occupants.

4.0 People with Disabilities

4.1 Access

4.1.1 *Sanitary fixtures* for *people with disabilities* shall be signposted as required by NZBC F8 "Signs" and located on an *accessible route* as required by NZBC D1 "Access Routes".

4.2 Number of facilities

4.2.1 Sanitary facilities for *people with disabilities* shall be provided in accordance with Tables 1 and 2. In large *buildings* having more than 300 occupants, where sanitary facilities are provided in groups in two or more locations, *accessible* facilities shall be included at each location for *buildings* having the following classified uses:

a) Communal non-residential – all *buildings* described as "assembly service", and

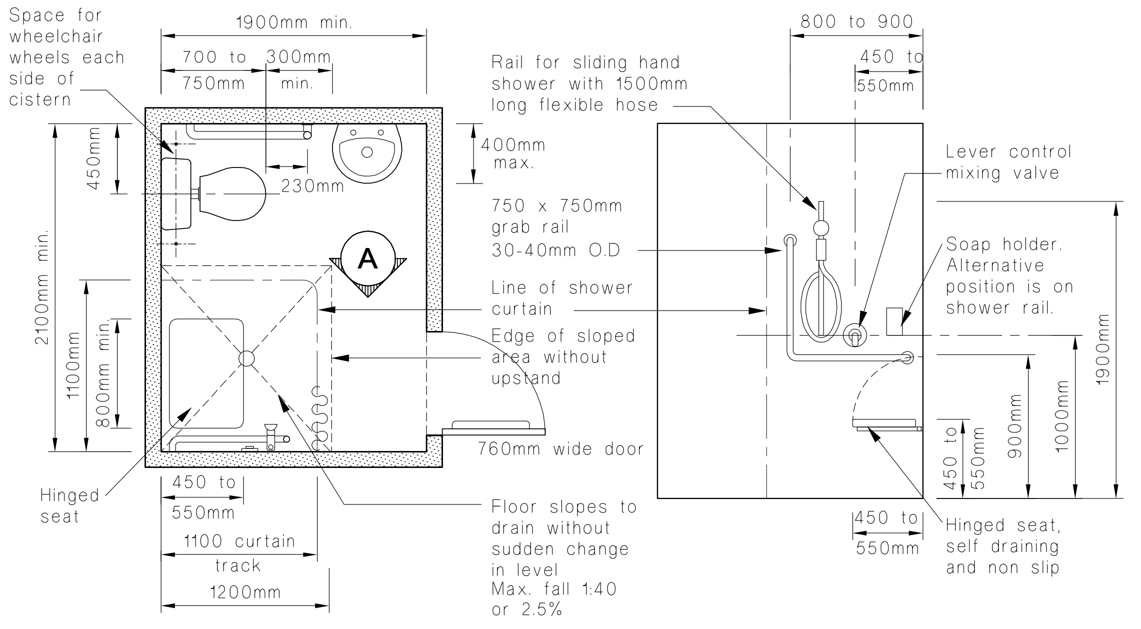
b) Commercial – those *buildings* that are amusement parks, shopping plazas, libraries and transport terminals.

COMMENT:

For example: a sports stadium may have groups of sanitary facilities conveniently distributed to service the seating arrangement for the users. It is essential that *people with disabilities* have the same access to facilities as other occupants.

4.2.2 *Fixtures* and spaces for *people with disabilities* shall comply with the relevant layouts shown in Figures 5, 6, 7, 8 and 9.

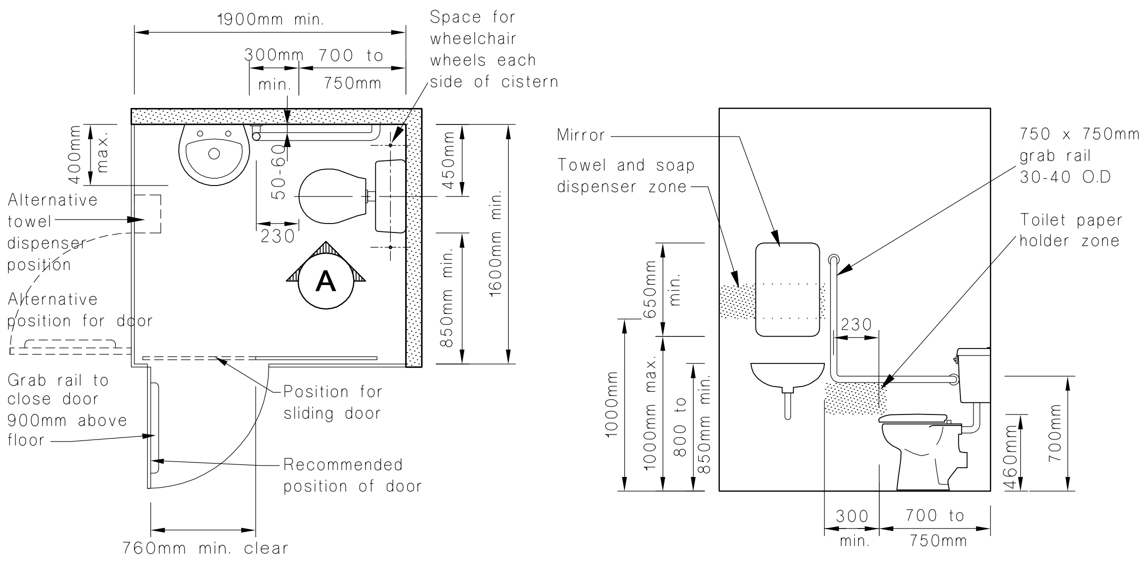
Figure 5: Accessible Toilet and Shower Compartment
Paragraph 4.2.2, Tables 1 and 2



(a) Plan (b) Elevation A

Amend 4 Jul 2001

Figure 6: Accessible Toilet Compartment
Paragraph 4.2.2 and Table 1

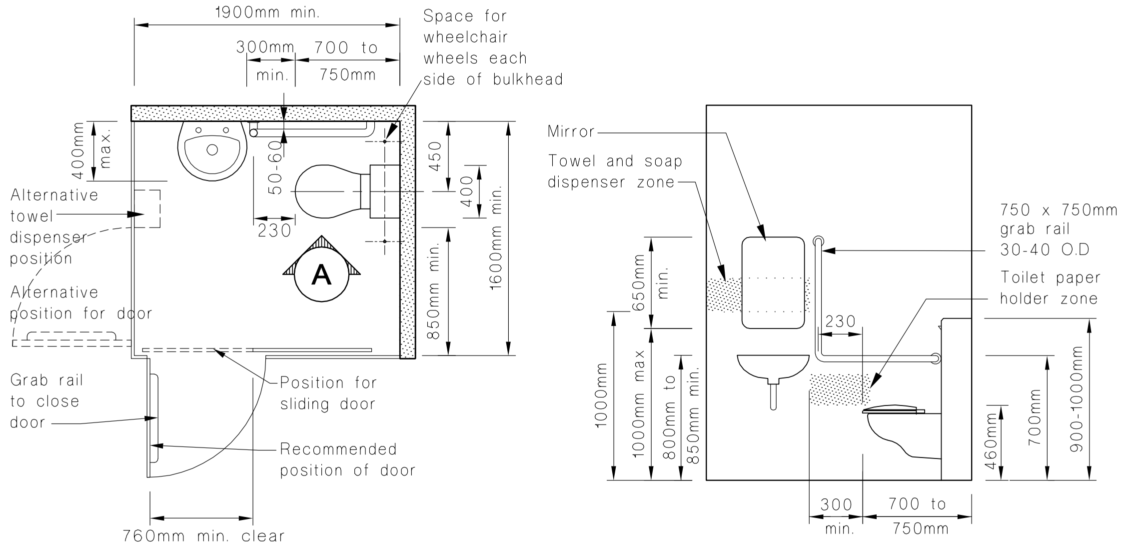


Plan Elevation A

Soap dispenser to be positioned in the zone over wash hand basin but not over taps.
Bottom of soap and towel dispensers between 1000 and 1200mm above floor level.

Amend 4 Jul 2001

Figure 7: Requirements for Accessible Wall Hung Pans
Paragraph 4.2.2, 4.2.8 and Table 1



Plan

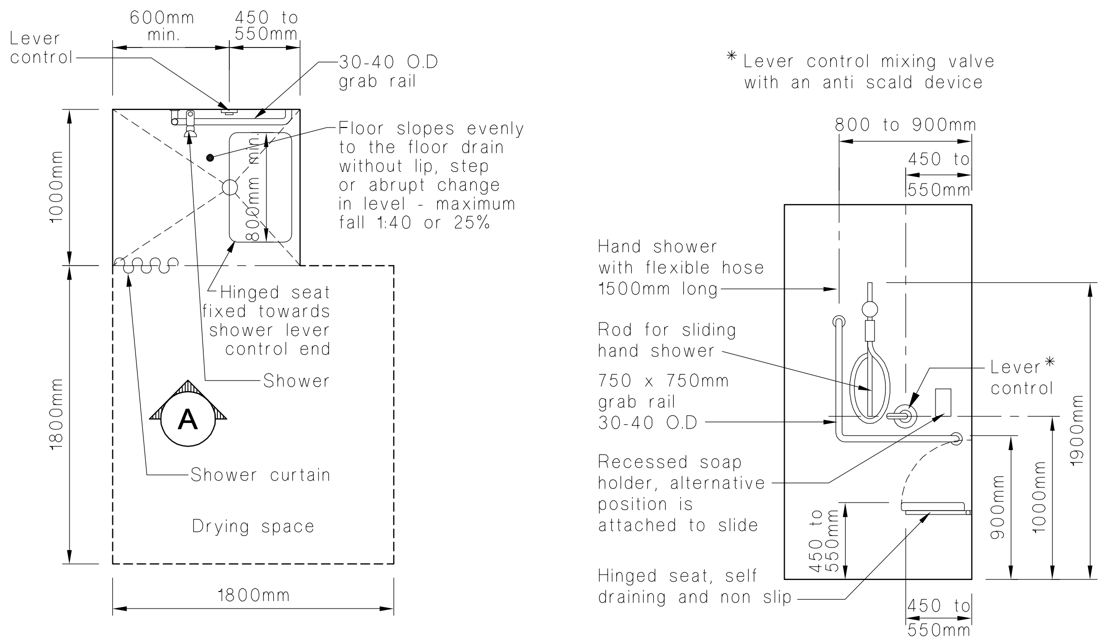
Elevation A

Soap dispenser to be positioned in the zone over wash hand basin but not over taps.
Bottom of soap and towel dispensers between 1000 and 1200mm above floor level.

Amend 4
Jul 2001

Figure 8: Accessible Shower Compartment
Paragraph 4.2.2 and Table 2

Note: Drying space to be fitted with a clothes hanging device positioned between 1400mm and 1500mm above finished floor level.

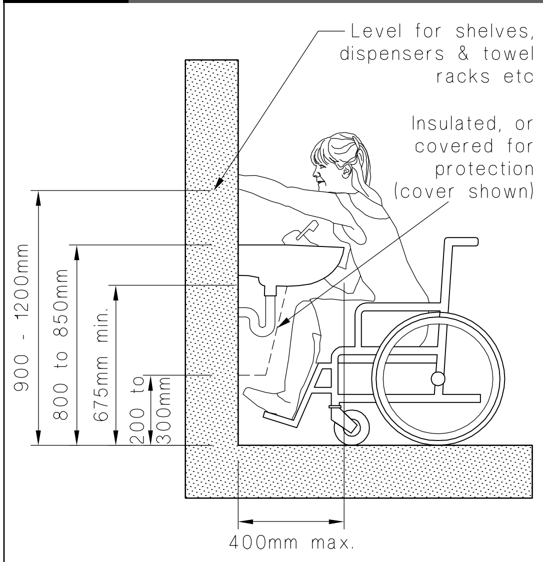


(a) Plan

(b) Elevation A

Amend 4
Jul 2001

Figure 9: Accessible Basin
Paragraph 4.2.2 and Table 1



Location of clearances

Amend 4 Jul 2001

4.2.3 For safety in an *accessible* shower compartment the shower slider rod, or the adjustable shower assembly integrated with the grab rail, shall be firmly fixed in place.

COMMENT:
Sliding rod assemblies are used by *people with disabilities* as a grab rail in an emergency and rods can come away in their hands leading to a fall.

4.2.4 *Accessible* showers shall have a level threshold.

4.2.5 If two or more toilet compartments are provided for wheelchair users, at least one shall have a pan of the opposite hand.

4.2.6 The WC flushing control shall be easily operable, positioned on the centre line or approach side of the WC pan, and no higher than 1200 mm above the finished floor level. Similarly, easily operable privacy bolts (to indicate whether the toilet is occupied) shall be located no more than 1200 mm above floor level.

4.2.7 NZS 4121 Section 10 is also an acceptable solution for *people with disabilities*. Amend 4 Jul 2001

4.2.8 Where there is a wall hung pan or a concealed cistern, full access is required each side of the WC pan, as detailed in Figure 7, to allow for wheel-over access. The wall in front of a concealed cistern shall extend no less than 1.0 m above floor level to provide back support, and fold-up lid shall be provided.

5.0 Non-flushing Sanitary Fixtures

5.0.1 *Soil fixtures* that are not water flushed, such as those using chemicals or biological treatment, shall be located where they will not cause a nuisance.

COMMENT:
1. "Nuisance" is a defined term under the Health Act 1956.
2. Some types of non-water borne toilets may require the provision of specific ventilation.

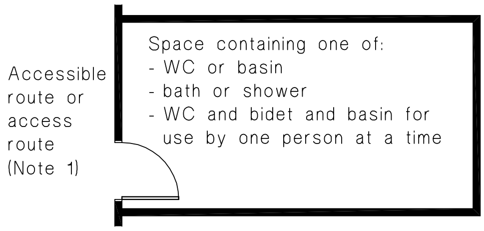
5.0.2 *Privies* are acceptable if located at least 3.0 m from any *building* having a classified use, other than outbuildings or ancillary buildings. Receptacles for excreta are to be constructed to exclude flies and be fitted with a hinged lid.

6.0 Privacy

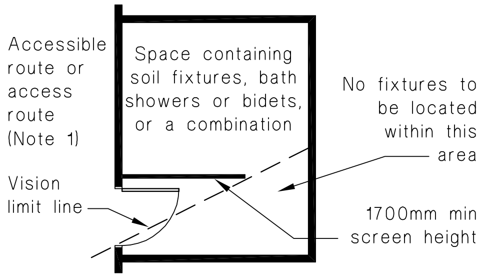
6.1 Line of sight

6.1.1 There shall be no direct line of sight between an *access route* or *accessible route* and a WC, urinal, bath, shower or bidet. See Figure 10 for acceptable layouts. Amend 5 Jun 2007

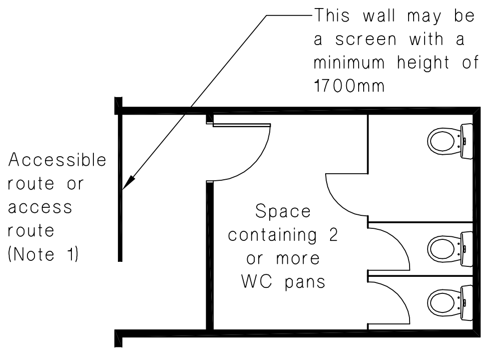
Figure 10: Visual Privacy for Sanitary Fixtures
Paragraphs 3.2.2 and 6.1.1



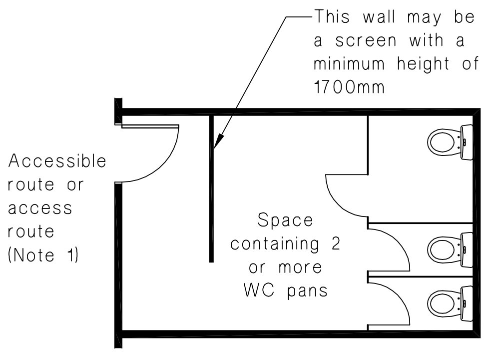
(a) Visual separation by door only



(b) Visual separation by screen



(c) Separation of WC pans



(d) Separation of WC pans

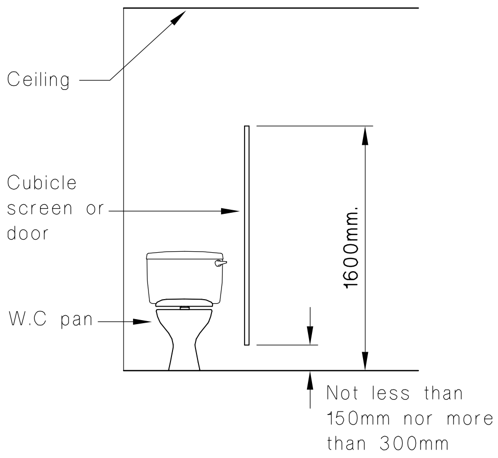
NOTE: (1) Accessible facilities have to be located on an accessible route.
(2) Dimensions for access and accessible routes have to comply with D1/AS1.

Amend 5 Jun 2007

6.2 Cubicles

6.2.1 Where a space contains more than one WC pan, each pan shall be enclosed in a separate cubicle. Screen walls and doors are acceptable with their upper edge at least 1600 mm above the floor, and their lower edge between 150 mm and 300 mm above the floor (see Figure 11).

Figure 11: Cubicle Screening for WCs
Paragraph 6.2.1



6.3 Lobbies

6.3.1 Lobbies between the space containing sanitary facilities and general public areas are not necessary to meet privacy and line of sight requirements, but if provided:

a) They shall be independent for each sex if the facilities are single sex or,

b) They shall be unisex for *unisex facilities*.

Amend 4 Jul 2001

Amend 5 Jun 2007

Table 1: Number of Sanitary Fixtures: WC Pans, Urinals and Basins
Paragraph 1.1

Housing (see Notes)

Building use	User group	Separate sex toilet facilities								Unisex toilet facilities	
		Combination of WC pans and urinals				WC pans only		Basins			
		WC pans		Urinals							
		Design Occ.	Number	Design Occ.	Number	Design Occ.	Number	Design Occ.	Number	Design Occ.	Number
Detached dwellings and multi-unit dwellings	**Occupants**					–	1	–	1		
Group dwelling Marae, commune	**Occupants**	Provide in accordance with Communal Residential: boardinghouse, hospitals, prisons, old people's homes.									

Communal Residential (see Notes)

Building use	User group	Separate sex toilet facilities								Unisex toilet facilities	
		Combination of WC pans and urinals				WC pans only		Basins			
		WC pans		Urinals							
		Design Occ.	Number	Design Occ.	Number	Design Occ.	Number	Design Occ.	Number	Design Occ.	Number
Community Service and Community Care Boardinghouses, hospitals, prisons, old people's homes	**Female occupants**					1 – 4 5 – 18	1 2	1 – 35 36 – 120	1 2	1	1
						>18	add 1 per 20	>120	add 1 per 90		
	Male occupants	1 – 2 3 – 9 10 – 30	1 2 3	1 – 50 51 – 160	1 2	1 – 2 3 – 9 10 – 19 20 – 30	1 2 3 4	1 – 20 21 – 70	1 2	2 - 7 8 – 14	2 3
		>30	add 1 per 10	>160	add 1 per 160	>30	add 1 per 10	>70	add 1 per 50		
	Occupants with disabilities. Note 6					1 – 100 101 – 300 >300	1 2 3	1 – 100 101-300 >300	1 2 3	>14	add 1 per 9
	Staff	Provide in accordance with Commercial: staff facilities.									

Erratum 1 Jul 2007

Amend 5 Jun 2007

Amend 5 Jun 2007

Table 1: Number of Sanitary Fixtures: WC Pans, Urinals and Basins *(Cont'd)*
Paragraph 1.1

Communal Non-residential (see Notes)

Building use	User group	Separate sex toilet facilities: Combination of WC pans and urinals: WC pans – Design Occ.	WC pans – Number	Urinals – Design Occ.	Urinals – Number	WC pans only – Design Occ.	WC pans only – Number	Basins – Design Occ.	Basins – Number	Unisex toilet facilities – Design Occ.	Unisex toilet facilities – Number
Camping Grounds Comment: See also Camping Grounds Regulations, which contain the allocation of 3.5 people per camp site for calculating the number of campers.	**Female occupants**					1 – 12 13 – 25 26 – 50 51 – 75 76 – 100	1 2 3 4 5	1 – 25 26 – 50	1 2	1	1
						>100	add 1 per 40	>50	add 1 per 50	2 – 12	2
	Male occupants	1 – 25 26 – 50 51 – 100	1 2 3	1 – 50 51 – 100	1 2	1 – 12 13 – 25 26 – 50 51 – 75 76 – 100	1 2 3 4 5	1 – 25 26 – 50	1 2	13 – 25 26 – 50 51 – 75 76 – 100	3 4 5 6
		>100	add 1 per 40	>100	add 1 per 50	>100	add 1 per 40	>50	add 1 per 50	>100	add 1 per 40
	People with disabilities. Note 6					1 – 100 101 – 300 >300	1 2 3	1 – 100 101 – 300 >300	1 2 3		
	Staff	Provide in accordance with Commercial: staff facilities.									
Assembly Service Churches, club rooms, assembly halls, stadiums, sports venues, grandstands	**Female patrons**					1 – 15 16 – 60 61 – 120 >120	1 2 3 add 1 per 70	1 – 60 61 – 200 201 – 350 >350	1 2 3 add 1 per 150	1 – 10	1
	Male patrons	1 – 50 51 – 250 251 – 500 501 – 800 >800	1 2 3 4 add 1 per 350	1 – 60 61 – 220 221 – 400 >400	1 2 3 add 1 per 190	1 – 25 26 – 110 111 – 200 >200	1 2 3 add 1 per 100	1 – 70 71 – 230 231 – 410 >410	1 2 3 add 1 per 190	11 – 40 >40	2 add 1 per 50
	Patrons with disabilities. Note 6					1 – 300 >300	1 2	1 – 300 >300	1 2		
Museums, art galleries (display areas)	**All patrons**	Provide in accordance with Commercial: amusement park, shopping plaza etc.									

Table 1: **Number of Sanitary Fixtures: WC Pans, Urinals and Basins *(Cont'd)***
Paragraph 1.1

Communal Non-residential (see Notes) - *Continued*

Building use	User group	Separate sex toilet facilities								Unisex toilet facilities	
		Combination of WC pans and urinals				WC pans only		Basins			
		WC pans		Urinals							
		Design Occ.	Number	Design Occ.	Number	Design Occ.	Number	Design Occ.	Number	Design Occ.	Number
Theatres, cinemas	**Female patrons**					1 – 10 11 – 50	1 2	1 – 80 81 – 250 251 – 430	1 2 3	1 – 5	1
						>50	add 1 per 60	>430	add 1 per 200	6 – 30	2
	Male patrons	1 – 15 16 – 80	1 2	1 – 80 81 – 290	1 2	1 – 10 11 – 60	1 2	1 – 65 66 – 220	1 2		
		>80	add 1 per 100	>290	add 1 per 230	>60	add 1 per 70	>220	add 1 per 170	>30	add 1 per 40
	Patrons with disabilities. Note 6					1 – 300 >300	1 2	1 – 300 >300	1 2		
	Staff	Provide in accordance with Commercial: staff facilities.									
Places of active recreation, swimming pools, squash courts, gymnasiums	**Female patrons**					1 – 10 11 – 60 61 – 120	1 2 3	1 – 70 71 – 230 231 – 400	1 2 3	1 – 5	1
						>120	add 1 per 70	>400	add 1 per 170	6 – 40	2
	Male patrons	1 – 25 26 – 130 131 – 270 >270	1 2 3 add 1 per 150	1 – 50 51 – 180 181 – 320 >320	1 2 3 add 1 per 150	1 – 20 21 – 80 81 – 150 >150	1 2 3 add 1 per 80	1 – 50 51 – 180 >180	1 2 add 1 per 140	>40	add 1 per 40
	Patrons with disabilities. Note 6					1 – 300 >300	1 2	1 – 300 >300	1 2		
Assembly Care Early childhood centres	**Students**							1 – 40 41 – 150 151 – 270	1 2 3	1 – 25 26 – 120 121 – 230 231 – 350	1 2 3 4
								>270	add 1 per 130	>350	add 1 per 150
Schools, universities	**Staff and students**	Provide in accordance with Commercial: staff facilities.									

Amend 5 Jun 2007

Amend 5 Jun 2007

Amend 5
Jun 2007

Table 1: Number of Sanitary Fixtures: WC Pans, Urinals and Basins *(Cont'd)*
Paragraph 1.1

Building use	User group	Commercial (see Notes)									
		Separate sex toilet facilities								Unisex toilet facilities	
		Combination of WC pans and urinals				WC pans only		Basins			
		WC pans		Urinals							
		Design Occ.	Number	Design Occ.	Number	Design Occ.	Number	Design Occ.	Number	Design Occ.	Number
Staff facilities for: offices, banks, shops, hotels, bars and any other building use * Refer Note 5	**Female staff**					1 – 10 11 – 50 51 – 90	1 2 3	1 – 70 71 – 250	1 2	1 - 5	1
						>90	add 1 per 60	>250	add 1 per 200		
	Male staff	1 – 10 11 – 60 61 – 120	1 2 3	1 – 150 151 – 550	1 2	1 – 10 11 – 50 51 – 110	1 2 3	1 – 70 71 – 250	1 2	6 - 30	2
		>120	add 1 per 80	>550	add 1 per 450	>110	add 1 per 70	>250	add 1 per 200	>30	add 1 per 40
	Staff with disabilities. Note 6					1 – 300 > 300	1 2	1 – 300 >300	1 2		
Amusement parks, shopping plaza, libraries, transport terminals * Refer Note 5	**Female patrons**					1 – 50 51 – 240 241 – 480 481 – 750	1 2 3 4	1 – 350 351 – 1150	1 2	1 – 35 36 – 165	1 2
						>750	add 1 per 250	>1150	add 1 per 850		
	Male patrons	1 – 50 51 – 250 251 – 500 501 – 800	1 2 3 4	1 – 500 501 – 1700	1 2	1 – 75 76 – 330 331 – 650	1 2 3	1 – 280 281 – 950	1 2	166 – 320	3
		>800	add 1 per 350	>1700	add 1 per 1400	>650	add 1 per 350	>950	add 1 per 700	>320	add 1 per 200
	Patrons with disabilities. Note 6					1 – 300 >300	1 2	1 – 300 >300	1 2		
Coffee bars, tea rooms, restaurants, bars, night clubs * Refer Note 5	**Female patrons**					1 – 15 16 – 90 91 – 170	1 2 3	1 – 120 121 – 380	1 2	1 – 5	1
						>170	add 1 per 100	>380	add 1 per 290	6 – 40	2
	Male patrons	1 – 15 16 – 80	1 2	1 – 100 101 – 340 341 – 600	1 2 3	1 – 15 16 – 65 66 – 135 136 – 200	1 2 3 4	1 – 70 71 – 250	1 2	41 – 80	3
		>80	add 1 per 100	>600	add 1 per 280	>200	add 1 per 80	>250	add 1 per 200	>80	add 1 per 50
	Patrons with disabilities. Note 6					1 – 300 >300	1 2	1 – 300 >300	1 2		

Table 1: Number of Sanitary Fixtures: WC Pans, Urinals and Basins *(Cont'd)*
Paragraph 1.1

Industrial (see Notes)

Building use	User group	Separate sex toilet facilities								Unisex toilet facilities	
		Combination of WC pans and urinals: WC pans		Combination of WC pans and urinals: Urinals		WC pans only		Basins			
		Design Occ.	Number	Design Occ.	Number	Design Occ.	Number	Design Occ.	Number	Design Occ.	Number
Factories, power stations, industrial plants	**Female staff**					1 – 10 11 – 50 51 – 90 >90	1 2 3 add 1 per 60	1 – 70 71 – 250 >250	1 2 add 1 per 200	1 – 5	1
	Male staff	1 – 10 11 – 60 61 – 120 >120	1 2 3 add 1 per 80	1 – 150 151 – 550 >550	1 2 add 1 per 450	1 – 10 11 – 50 51 – 110 >110	1 2 3 add 1 per 70	1 – 70 71 – 250 >250	1 2 add 1 per 200	6 – 30 >30	2 add 1 per 40
	Staff with disabilities. Note 6					1 – 300 >300	1 2	1 – 300 >300	1 2		

Note:

1. Design Occ: Design occupancy – the number of people in the user group.
2. Number: The number of *fixtures* or facilities required.
3. Greater than: > = greater than.
4. Urinals: 600 mm long stall urinal = 1 urinal.
5. Staff: Staff and patrons may share the same facilities. The number provided must be the total as required for staff plus those required for patrons.
   a) Where staff and patrons use separate toilet facilities:
   You should calculate the number of toilets for staff and add them to the number of toilets that you have calculated for patrons.
   b) Where staff and patrons share facilities:
   You should add the number of toilets you have calculated for staff to the number of toilets you have calculated for patrons like this:
   If the number of patrons is greater than the ">[30][1]" in the staff section of the table, you should use the "add 1 per >[40][1]" to calculate the number of toilets for staff and the number of toilets for patrons.
   [1] is based on unisex toilets for staff.
6. People with disabilities:
   a) See Paragraph 4.2.1 for situations where *accessible* facilities must be provided at all groups of toilets.
   b) For Industrial *buildings* – *accessible* facilities shall be provided where more than 10 people are employed.
   c) *Accessible* facilities need not be in addition to those required for other *building* occupants.
   d) See Figures 5, 6 and 7 for *accessible* toilet facility layouts.

COMMENT:

Example for separate toilet facilities: Using unisex facilities, 100 patrons at a coffee bar require 4 facilities. Using unisex facilities, 8 staff of a coffee bar require 2 facilities.

COMMENT:

Example for shared toilet facilities: Using unisex facilities, 100 patrons at a coffee bar require 4 facilities. Using unisex facilities, 8 staff of a coffee bar require 1 facility based on >30 add 1 per 40.

Amend 5
Jun 2007

Table 2: Number of Sanitary Fixtures, Baths and Showers
Paragraph 1.1

Building use	User group	Baths or showers Design Occ.	Baths or showers Number	Accessible showers
Housing				
Detached dwellings and multi-unit dwellings	Occupants	–	1	
Group Dwelling Marae, commune	Occupants	1 – 25 26 – 60 61 – 100 >100	1 2 3 add 1 per 50	
Communal Residential				
Community Service and Community Care Hospitals, old people's homes, community housing, specialist care facilities	Occupants	1 – 8 9 – 20 >20	1 2 add 1 per 10	*Accessible* showers to be provided in accordance with the needs of the occupants, patients or treatment within the institutions
Hotels, hostels, motels, prisons, boardinghouses	Occupants	1 – 8 9 – 20 >20	1 2 add 1 per 10	For each *accessible* unit: One *accessible* shower
Camping grounds, motor camps, caravan parks	Occupants	1 – 25 26 – 60 61 – 100 >100	1 2 3 add 1 per 50	*Accessible* showers provided on the scale of: 1 – 100 1 101 – 300 2 >300 3
Communal Non-residential				
Churches, club rooms, assembly halls, grandstands (seating areas), museums, art galleries (display areas)	Patrons Staff	–	0	Where showers are provided include at least one *accessible* shower compartment (see Figure 8)
Places of active recreation, swimming pools, squash courts, gymnasiums	Patrons Staff	1 – 30 >30	1 add 1 per 50	Where showers are provided include at least one *accessible* shower compartment (see Figure 8)
Early childhood centres	Children	–	1 bath	–
Schools, Universities – spaces other than those used for active recreation	Students Staff	–	0	Where showers are provided include at least one *accessible* shower compartment (see Figure 8)
Commercial				
Amusement parks, shopping plaza, libraries, transport terminals, coffee bars, tea rooms, restaurants, bars, night clubs, offices, banks. (Includes staff facilities for other building uses.)	Patrons Staff	–	0	Where showers are provided include at least one *accessible* shower compartment (see Figure 8)
Industrial				
Factory, power station, industrial plant (for those workers engaged in dirty occupations.)	Staff	1 – 7 8 – 16 >16	1 2 add 1 per 10	Where showers are provided one *accessible* shower is required when more than 10 people are employed (see Figure 8)

Table 3: Sanitary Facility Design Occupancy for Each Sex
Paragraph 1.1.1

Building Use	Multiplication factor (applies to the number of building occupants) Males	Females
Housing		
Group dwelling Marae, commune	0.60	0.60
Communal Residential		
Boarding house, hospital, prison and old people's home (see **Note 1**)	0.60	0.60
Camping ground	0.50	0.50
Communal Non-residential		
Assembly Service		
Church	0.50	0.60
Club room, assembly hall, stadium, sports venue, grand stand	0.80	0.60
Museum and art galleries (display areas only)	0.60	0.60
Theatre, cinema	0.60	0.70
Swimming pool	0.60	0.60
Assembly Care		
School (see **Note 1**), university	0.60	0.60
Commercial		
Shopping plaza	0.40	0.70
Library	0.60	0.60
Transport terminals	0.70	0.50
Amusement park, or other building where people are only present for about 1 hour and there is no interval	0.60	0.60
Coffee bar, tea rooms, restaurants, bars, night club	0.80	0.50
Office, banks (including staff facilities for shops, hotels, bars and any other building use)	1.00	0.65
Industrial		
Factory, power stations, industrial warehouse	1.00	0.65

Note:
1. Applies to *buildings* or parts of *buildings* used by both sexes, e.g. co-education schools.

Amend 5
Jun 2007

Table 4: Occupant Densities (adapted from C/AS1 Part 2)
Paragraph 1.1.1

Building use	Occupant density (Users/m^2) (see **Note 1**)
Communal Non-residential and Commercial	
Airports – baggage claim	0.5
Airports – concourses	0.1
Airports – waiting areas, check in	0.7
Area without seating or aisles	1.0
Art galleries, museums	0.25
Bar sitting areas	1.0
Bar standing area	2.0
Bleachers, pews or similar bench type seating	2.2 users per linear metre
Classrooms	0.5
Dance floors	1.7
Day care centres	0.25
Dining, beverage and cafeteria spaces	0.8
Exhibition areas, trade fairs	0.7
Fitness centres	0.2
Gymnasia	0.35
Indoor games areas/bowling alleys, etc.	0.1
Libraries – stack areas	0.1
Libraries – other areas	0.15
Lobbies and foyers	1.0
Mall areas used for assembly purposes	1.0
Reading or writing rooms and lounges	0.5
Restaurants, dining rooms and lounges	0.9
Shop spaces and pedestrian circulation areas including malls and arcades	0.3
Shop spaces for furniture, floor coverings, large appliances, building supplies and manchester	0.1
Showrooms	0.2
Space with fixed seating	as number of seats (see **Note 2**)
Space with loose seating	1.3
Spaces with loose seating and tables	0.9
Stadia and grandstands	1.8
Stages for theatrical performances	1.3
Standing space	2.6
Swimming pools (water surface area)	0.2
Swimming pool surrounds and seating	0.35
Teaching laboratories	0.2
Vocational training rooms in schools	0.1
Communal Residential	
Bedrooms Bunkrooms Detention quarters Dormitories, hostels Halls and wharenui Wards containing more than two beds	as number of beds (see **Note 2**)

Table 4: Occupant Densities *(Cont'd)*
Paragraph 1.1.1

Building use	Occupant density (Users/m²) (see **Note 1**)
Commercial and Industrial	
Aircraft hangars	0.02
Bulk storage (e.g. solid stacked)	0.01
Commercial laboratories, laundries	0.1
Computer rooms (not used as classrooms for training)	0.04
Factory space in which layout and normal use determines the number of people using it in working hours	as approved (see **Note 3**)
Heavy industry	0.03
Interview rooms	0.2
Kitchens	0.1
Manufacturing and process areas, staff rooms	0.1
Offices and staffrooms	0.1
Personal service facilities	0.2
Reception areas	0.1
Workrooms, workshops	0.2
Warehouse storage (e.g. racks and shelves)	0.03
Buildings and parts of buildings with intermittent use	(see **Note 4**)
Boiler rooms, plant rooms, service units and maintenance workshops	0.03
Parking buildings, garages	0.02
Exitways, enclosed corridors, lifts (no occupants counted)	0.0
Laundry and house keeping facilities	0.2
Storage	0.02
Toilets and subordinate spaces (no occupants counted)	0.0

Note:

1. The floor area to be used shall be the total building use floor area including that occupied by internal partitions and *fixtures*. The occupant densities in this table already allow for a proportion of floor area, appropriate to the activity, being occupied by furniture, partitions, *fixtures* and associated equipment.
2. For fixed seating and beds, the number of seats or beds is used instead of an occupant density (users per m²).
3. In such cases, the number of occupants must be specified when seeking a building consent. Future increase in numbers shall be treated as a change in use.
4. Spaces in *buildings* and parts of *buildings* with intermittent use are normally not included in the calculations for the number of occupants. It is assumed that the occupation is temporary and by people who would already have been included in the number of occupants of another space. The figures given in the table apply where people are specifically employed to perform the functions for which the spaces are provided.

Table 5: Urinal Flushing Systems
Paragraph 2.3.6

Number of urinals per cistern	Number of spreaders for wall urinals	Minimum capacity of flush pipe (litres)	Diameter of flush pipe (mm)	Diameter of sparge to spreaders (mm)
1	2	2.5	25	20
2	3	5.0	32	20
3	4	7.5	40	25
4 (see **Note 1**)	5	10.0	40	25

Note:

1. Up to 6 urinal stalls may be flushed by one cistern or flushing valve provided no more than 3 stalls are served by any branch from the flush pipe.

Index G1/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 3), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 1 January 2017 and supersedes all previous versions of this document.

The previous version of this document (Amendment 2) will cease to have effect on 30 May 2017.

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.building.govt.nz

G2: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	1 July 2001	p. 2, Document History, Status p. 9, Definitions	
Amendment 2	10 October 2011	p. 2, Document History, Status p. 3, Code Clause G2 p. 7, References	p. 9, Definitions p.13, G2/AS1 1.0.3 p.15, Index
Reprinted incorporating Amendments 1 and 2	10 October 2011 until 30 May 2017		
Amendment 3	Effective 1 January 2017	p. 5 Contents p. 7 References p. 9 Definitions	p. 13 G2/AS1 1.0.3, 1.2, Figure 1 p. 14 G2/AS1 Figure 2
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

New Zealand Building Code
Clause G2 Laundering

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE—*continued*

Clause G2—LAUNDERING

Provisions	Limits on application
OBJECTIVE	
G2.1 The objective of this provision is to ensure	
(a) *Adequate amenities* for people to do laundering, and	
(b) That *people with disabilities* are able to carry out normal activities and processes within *buildings*.	Objective G2.1(b) shall apply to those *buildings* to which section 47A of the Act applies.
FUNCTIONAL REQUIREMENT	
G2.2 *Buildings* shall be provided with *adequate* space and facilities for laundering.	Requirement G2.2 shall apply only to *Housing*, old people's homes, early childhood centres, camping grounds and work camps.
PERFORMANCE	
G2.3.1 Facilities shall have capacity for the *intended use*, and consist of *fixtures*, or space and services for appliances.	
G2.3.2 Space shall be *adequate* in size to provide for the installation and use of *fixtures* or appliances.	
G2.3.3 Space and facilities shall be provided within each accommodation unit or may be grouped elsewhere in a convenient location.	
G2.3.4 *Accessible* facilities shall be provided for *people with disabilities*.	Performance G2.3.4 shall apply only to camping grounds.

Note: Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

Effective from 29 December 2000

Contents

References

Amend 2 Oct 2011 Amend 3 Jan 2017

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in these Acceptable Solutions and Verification Methods (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 these Acceptable Solutions and Verification Methods must be used.

Amend 3 Jan 2017

	Where quoted
Standards New Zealand	
AS/NZS 1229: 2002 Laundry troughs and tubs	AS1 1.0.3

Amend 3 Jan 2017 Amend 2 Oct 2011

Definitions

Amends 2 and 3 This is an abbreviated list of definitions for words or terms particularly relevant to these Acceptable Solutions and Verification Methods. The definitions for any other italicised words may be found in the New Zealand Building Code Handbook.

Accessible Having features to permit use by *people with disabilities.*

Adequate *Adequate* to achieve the objectives of the *building code*.

Amenity An attribute of a *building* which contributes to the health, physical independence, and well being of the *building's* users but which is not associated with disease or a specific illness.

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

Discharge pipe Any pipe that is intended to convey discharge from *sanitary fixtures* or *sanitary appliances*.

Amend 2 Oct 2011

Fixture An article intended to remain permanently attached to and form part of a *building*.

Intended use in relation to a *building*,—

(a) includes any or all of the following:

- (i) any reasonably foreseeable occasional use that is not incompatible with the *intended use*:
- (ii) normal maintenance:
- (iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but

(b) does not include any other maintenance and repairs or rebuilding.

Person with a disability means a *person* who has an impairment or a combination of impairments that limits the extent to which the *person* can engage in the activities, pursuits, and processes of everyday life, including, without limitation, any of the following:

Amend 1 Jul 2001

- (a) a physical, sensory, neurological, or intellectual impairment:
- (b) a mental illness.

Amend 2 Oct 2011

Socket outlet An accessory fixed to a wall or ceiling and designed to accept a plug that extends the electrical supply to an appliance by means of a flexible cable.

Water seal The depth of water that can be retained in a *water trap.*

Water trap A fitting designed to retain a depth of water that prevents foul air and gases escaping from the *plumbing system* or *foul water drainage system* and entering a *building*. Amend 1 Jul 2001

Verification Method G2/VM1

No specific test methods have been adopted for verifying compliance with the Performance of NZBC G2.

Acceptable Solution G2/AS1

1.0 Laundering Facilities

1.0.1 Laundering facilities shall be provided with:

a) A laundry tub, or

b) Space and service connections for a washing machine.

1.0.2 A laundry tub shall:

a) Have a capacity to spill-level of no less than 35 litres, and

b) Be capable of fully containing a solid cylinder of 400 mm diameter and 200 mm depth.

COMMENT:
This provision allows for the filling or washing of containers such as buckets.

Amend 2 Oct 2011

1.0.3 Another Acceptable Solution

Amend 3 Jan 2017

Laundry tubs complying with AS/NZS 1229 are acceptable, but exceed the requirements given in Paragraph 1.0.2.

1.1 Service connections

1.1.1 A tub shall be provided with a cold water supply.

1.1.2 Space provided for a washing machine shall have a cold water supply, a *discharge pipe*, a *water trap*, and an adjacent 10 amp *socket outlet*.

1.1.3 Plumbing and drainage for waste water from the tub and washing machine *discharge pipe* shall be provided as required by NZBC G13 "Foul Water".

COMMENT:
NZBC G9 "Electricity", G12 "Water Supplies", and G13 "Foul Water" are also relevant to laundering facilities.

1.2 Minimum space

Amend 3 Jan 2017

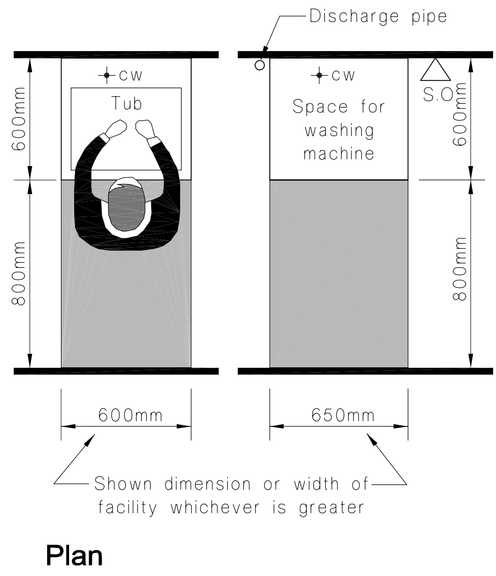
1.2.1 Laundry floor space shall be no less than shown in Figure 1.

1.2.2 Where laundry facilities are intended for *people with disabilities*, space to allow a turning circle of 1500 mm shall be provided in front of the laundry tub or washing machine, as shown in Figure 2.

COMMENT:
The washing machine space dimensions allow for a range of popular machines. Designers should check current models and increase the size if necessary.

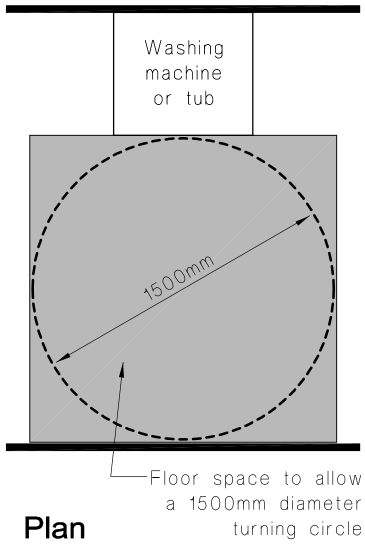
Figure 1: Minimum Dimensions for Laundries
Paragraph 1.2.1

Amend 3 Jan 2017



Amend 3
Jan 2017

Figure 2: **Minimum Dimensions for Laundries for People with Disabilities**
Paragraph 1.2.2



1.3 Number of facilities

1.3.1 Laundering facilities shall be provided according to the number of people being serviced. Acceptable provisions are shown in Table 1.

Table 1: **Provision of Laundering Facilities**
Paragraph 1.3.1

Defined use	Number required
Detached dwelling or separate *household unit* to accommodate no more than 2 people	Nil
Detached dwelling or separate *household unit* to accommodate 3 or more people, and early childhood centres	1
Group dwelling, old people's homes, and work camps	1 per 20 people
Multi-unit dwellings (common laundry space)	1 per 4 dwelling units
Camping grounds	1 per 70 people

Index G2/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington.
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 2), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 1 January 2017 and supersedes all previous versions of this document.

The previous version of this document (Amendment 1) will cease to have effect on 30 May 2017.

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.building.govt.nz

G3: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	Effective 1 July 2001 until 30 May 2017	p. 2, Document History, Status p. 9, Definitions	
Amendment 2	Effective 1 January 2017	p. 3 Building Code Clause G3 p. 7 Contents p. 9 References p. 11 Definitions	p. 15 Figure 1 p. 16 1.5.1, 1.5.2 p. 19 Index
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

New Zealand Building Code Clause G3 Food Preparation and Prevention of Contamination

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE–*continued*

Clause G3–FOOD PREPARATION AND PREVENTION OF CONTAMINATION

Provisions	Limits on application
OBJECTIVE	
G3.1 The objective of this provision is to:	
(a) Safeguard people from illness due to contamination,	
(b) Enable hygienic food preparation without loss of *amenity*, and	
(c) Ensure that *people with disabilities* are able to carry out normal activities and processes within *buildings*.	Objective G3.1(c) shall apply only to those *buildings* to which section 47A of the Act applies.
FUNCTIONAL REQUIREMENT	
G3.2.1 *Buildings* shall be provided with space and facilities for the hygienic storage, preparation and cooking of food, that are *adequate* for the *intended use* of the *building*.	Requirement G3.2.1 shall apply to *Housing*, work camps, old people's homes and early childhood centres, and where appropriate shall also apply to *Commercial* and *Industrial buildings* whose *intended uses* include the manufacture, preparation, packaging or storage of food.
G3.2.2 *Buildings* used for the storage, manufacture or processing of food, including animal products, shall be constructed to safeguard the contents from contamination.	
G3.2.3 *Buildings* used for the medical treatment of humans or animals, or the reception of dead bodies, shall be constructed to avoid the spread of contamination from the *building* contents.	
PERFORMANCE	
G3.3.1 Food preparation facilities shall be hygienic and include:	
(a) Space for a refrigerator, or a perishable food storage area capable of being cooled and protected from vermin and insects.	Performance G3.3.1 (a) and (b) shall apply to *Housing*, work camps, old people's homes, early childhood centres and *Commercial* or *Industrial buildings* whose *intended uses* include the handling of perishable food.

Note: Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

Effective 29 Dec 2000

FIRST SCHEDULE–*continued*

Provisions	Limits on application
(b) Means for food rinsing, utensil washing and waste water disposal.	
(c) Means for cooking food, and	Performance G3.3.1 (c) shall apply to *Housing*, work camps, old people's homes and early childhood centres.
(d) Space and a surface for food preparation.	Performance G3.3.1 (d) shall apply to *Housing*, work camps, old people's homes and early childhood centres.
G3.3.2 Spaces for food preparation and utensil washing shall have:	
(a) Interior linings and work surfaces shall be *impervious* and easily cleaned,	
(b) All *building elements* constructed with materials which are free from *hazardous substances* which could cause contamination to the *building* contents, and	Performance G3.3.2 (b) shall apply to *Housing*, work camps, old people's homes and early childhood centres, and where appropriate shall also apply to *Commercial* and *Industrial buildings* whose *intended uses* include the manufacture, preparation, packaging or storage of food.
(c) Exposed *building elements* located and shaped to avoid the accumulation of dirt.	Performance G3.3.2 (c) shall not apply to *Housing*.
G3.3.3 An *adequate* energy supply shall be provided, appropriately located for use by cooking and refrigeration appliances.	
G3.3.4 Space and facilities shall be provided within each *household unit*, or grouped elsewhere in a convenient location.	
G3.3.5 Where facilities are provided for *people with disabilities* they shall be *accessible*.	Performance G3.3.5 shall apply only to camping grounds and *accessible* accommodation units in *Communal Residential buildings*.

FIRST SCHEDULE–*continued*

Provisions	Limits on application
G3.3.6 Spaces in *buildings* shall be protected from the likelihood of contamination or vermin entering areas used for the storage, processing or preparation of food, and shall have a means of preventing contamination spreading from these areas to other spaces.	Performance G3.3.6 shall apply to *Commercial* or *Industrial buildings* whose *intended uses* include the handling of perishable food, the medical treatment of humans or animals, the slaughter of animals or the reception of dead bodies.

Contents

Amend 2
Jan 2017

References

Amend 2 Jan 2017

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in these Verification Methods and Acceptable Solutions (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 these Verification Methods and Acceptable Solutions must be used.

		Where quoted
Building Research Association of New Zealand		
BRANZ Technical Paper P36: 1983 W.R. Sharman	Food processing floors, a guide to design, materials and construction.	AS1 2.1.5
New Zealand Government Departments		
Ministry of Agriculture and Fisheries		
MQ1: 1988	Qual approvals manual	AS1 2.1.5

Definitions

This is an abbreviated list of definitions for words or terms particularly relevent to these Verification Methods and Acceptable Solutions. The definitions for any other italicised words may be found in the New Zealand Building Code Handbook.

Access route A continuous route that permits people and goods to move between the apron or construction edge of the *building* to spaces within a *building*, and between spaces within a *building*.

Amend 2 Jan 2017

Accessible Having features to permit use by *people with disabilities*.

Adequate *Adequate* to achieve the objectives of the *building code*.

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

Amend 2 Jan 2017

Contaminant has the meaning ascribed to it by the Resource Management Act 1991.

Hazardous Creating an unreasonable risk to people of bodily injury or deterioration of health.

Household unit–

(a) means a *building* or group of *buildings*, or part of a *building* or group of *buildings*, that is—

(i) used, or intended to be used, only or mainly for residential purposes; and

(ii) occupied, or intended to be occupied , exclusively as the home or residence of not more than 1 household; but

(b) does not include a hostel, boarding house, or other specialised accommodation.

Amend 2 Jan 2017

Impervious That which does not allow the passage of moisture.

Intended use, in relation to a *building*,—

(a) includes any or all of the following:

(i) any reasonably foreseeable occasional use that is not incompatible with the *intended use*:

(ii) normal maintenance:

(iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but

(b) does not include any other maintenance and repairs or rebuilding.

Amend 2 Jan 2017

Person with a disability means a person who has an impairment or a combination of impairments that limits the extent to which the person can engage in the activities, pursuits, and processes of everyday life, including, without limitation, any of the following:

(a) a physical, sensory, neurological, or intellectual impairment:

(b) a mental illness.

Amends 1 and 2

Acceptable Solution G3/AS1

1.0 Domestic Appliances and Facilities

1.0.1 This part of the acceptable solution applies only to *Housing*, work camps, old people's homes, and early childhood centres.

1.1 Sink and preparation surface

1.1.1 Utensil washing and food rinsing facilities shall have a sink with free draining surfaces with continuous falls to the outlet. The sink shall be capable of fully containing a solid cylinder of 300 mm diameter and 125 mm depth.

1.1.2 The food preparation surface shall have the minimum dimensions shown in Figure 1. A drainer integral with and draining to the sink is acceptable.

1.1.3 Food preparation surfaces shall be easily maintained in a hygienic condition. Stainless steel, decorative high pressure laminate, and tiles are examples of suitable materials for these surfaces.

1.1.4 Hot and cold water supply shall be provided to the sink as required by NZBC G12 "Water Supplies".

1.1.5 Plumbing and drainage for waste water from the sink shall be provided as required by NZBC G13 "Foul Water".

1.2 Cooker

1.2.1 A cooker with an oven and a hot plate, or a wall oven and a separate hob, shall be provided for cooking.

1.3 Perishable food store

1.3.1 The food store shall have a minimum capacity of:

0.5 m^3 for use by up to 2 people

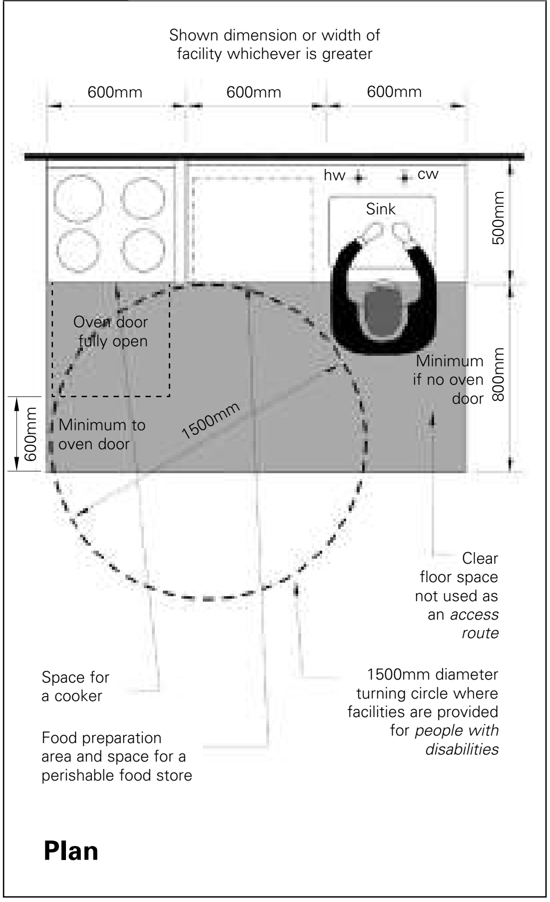
1.0 m^3 for use by 3 to 5 people

1.0 m^3 + 0.2 m^3 per additional person over 5 people

1.3.2 The food storage space shall provide for either refrigeration, or ventilation to the outside air.

Figure 1: Preparation Area and Minimum Clear Space
Paragraphs 1.1.2 and 1.5

Amend 2 Jan 2017



Amend 2 Jan 2017

1.3.3 Ventilation may be by mechanical or natural means. Where natural air flow is used, wall vents to the exterior shall be installed near both the top and bottom of the storage area.

1.3.4 Ventilation openings shall be fly and vermin proof.

1.4 Energy source

1.4.1 Where a *building* is connected to a reticulated energy source, cooking and refrigeration appliances shall be permanently connected to a gas supply, complying with NZBC G11, or provided with connections to electrical outlets complying with NZBC G9.

1.5 Minimum space

1.5.1 The minimum clear space, adjacent to the facilities, shall be as shown in Figure 1, and shall extend at least 800 mm on the operational side of the facility. If there is an oven door that protrudes into this clear space when open, there must be at least 600 mm clearance as shown. The minimum clear space shall not form part of any *access route*.

COMMENT:
Where an *access route* passes the operational side of the facilities (for example, a kitchen area that serves as a thoroughfare to provide access to other spaces or the exterior), more space will be required than the 800 mm minimum for where there is not an *access route*. This situation is not covered by this Acceptable Solution. The amount of space that is appropriate is likely to depend on factors such as the layout of the facilities, the frequency of use of the facilities and of the *access route*, and the familiarity of occupants with each other.

1.5.2 Where facilities are provided for *people with disabilities*:

a) space to allow a turning circle of 1500 mm shall be provided in front of those facilities as shown in Figure 1,

and

b) work surfaces shall be a maximum height of 900 mm above the floor.

COMMENT:
Guidance on the design of accessible kitchens is given at: https://www.building.govt.nz/building-code-compliance/g-services-and-facilities/g3-food-preparation-and-prevention-of-contamination/public-accommodation-access/

Amend 2
Jan 2017

1.6 Wall linings

Wall linings adjacent to appliances and facilities shall have surfaces that can be easily maintained in a hygienic condition. Stainless steel, decorative high pressure laminate, tiles, wallboards with painted or applied *impervious* coatings or films, are examples of suitable materials for these surfaces.

2.0 Commercial and Industrial Facilities

2.0.1 This part of the acceptable solution applies only to *Commercial* or *Industrial buildings*.

2.1 Interior linings for food processing areas

2.1.1 Walls of concrete, cement plaster, or concrete block shall be sealed with a synthetic coating which provides an *impervious*, easily cleaned surface.

COMMENT:
1. Particular care is required in selecting suitable surface finishes for food processing areas. Concrete floors in particular which have not been specially treated or protected, may suffer deterioration from chemical attack.
2. The interior surfaces of food processing areas should be light in colour. This makes the presence of dirt obvious and facilitates effective cleaning.
3. Food processing spaces include all spaces, or spaces immediately surrounding or supportive to the space, where animals are slaughtered or dressed, or where any food product is processed, conveyed, held, refrigerated or packed.

2.1.2 Porous materials such as wood and plasterboard are not acceptable ceilings or wall linings.

2.1.3 Exposed trusses, service ducts and similar *building elements* in food processing areas shall be completely enclosed with a material which is non-absorbent and easily cleaned.

2.1.4 Surface finishes shall be protected from likely impact and not be subject to chipping or flaking.

COMMENT:
Wherever practical it is advisable to use materials which do not require repainting.

2.1.5 Lining materials, surface coatings and sealants complying with MAF Qual Approvals Manual MQ1 for specific applications, are acceptable.

COMMENT:
BRANZ Technical Paper P36 is a useful reference document for food processing floors.

2.2 Interior linings in other areas

2.2.1 Examples of other types of *buildings* needing special attention, are factories where electroplating or the processing of lead products is carried out, and mortuaries.

2.2.2 Specific attention shall be given to protection from free water used for washing down premises, products or *building elements*, and from contaminating vapours or liquids which could form unhygienic or *hazardous* deposits on *building elements*.

2.2.3 The surfaces of floors, walls, ceilings and other *building elements*, as well as any joints in their *construction*, shall be *impervious* and easily cleaned. The following are acceptable surface materials:

a) Polyvinylchloride sheet

b) Ceramic tiles with waterproof grouted joints

c) Concrete with steel trowel finish.

COMMENT:
In the case of floors the requirement for a smooth surface must be balanced against the need to provide reasonable slip resistance for *building* users.

2.2.4 Wall/floor junctions which are coved, shall have any floor covering carried vertically to at least 75 mm above floor level.

2.2.5 *Construction* methods shall avoid ledges, recesses, cracks or other areas where moisture or *contaminants* could accumulate and be difficult to remove.

2.3 Wash-down areas

2.3.1 *Buildings* where wash-down is used for cleaning (e.g. abattoirs or dairy process areas), shall also be constructed to avoid the accumulation of water.

2.3.2 Horizontal ledges shall be sloped at no less than 45° to prevent accumulation of dirt and moisture. Stairs and walkways shall be graded towards drainage points.

2.3.3 Floors shall be graded to remove all effluent and water to a disposal system complying with NZBC G13 or G14.

2.3.4 Floors shall be self-draining and evenly graded to fall to *adequately* sized floor outlets or an open channel. In food processing areas slopes shall be no less than 1 in 60 for monolithic type floors, or 1 in 50 for tiled floors.

2.3.5 In equipment wash-down areas, floor gradients shall be no less than 1 in 25.

2.3.6 Where floor-drain outlets are used, they shall be installed so that each outlet serves a floor area of no more than:

a) 20 m^2 in dairy process areas,

b) 40 m^2 in other areas.

2.3.7 Open channels shall be spaced no more than 10 m apart, be deep enough to avoid overflowing, and have a gradient to their outlet of no less than 1 in 60.

Index G3/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Amend 2 Jan 2017

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Fourth Edition), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 27 June 2019 and supersedes all previous versions of this document.

The previous version of this document (Amendment 4) will cease to have effect on 31 October 2019.

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.building.govt.nz

G4: Document History

	Date	**Alterations**	
First published	July 1992		
Amendment 1	September 1993	p. 3, 1.1.2	
Reprinted incorporating Amendment 1	July 1994		
Second edition	28 February 1998	Document revised – second edition issued	
Amendment 1	23 June 2007	p. 2, Document History, Status p.5, Contents p.7, References	p.9, Definitions pp. 13–16 G4/AS1
Third edition	1 November 2008	Document revised – third edition issued	
Amendment 2	Effective from 10 October 2011 until 14 August 2014	p. 2, Document History, Status p.7, References	
Amendment 3	14 February 2014 until 30 May 2017	p. 7 References p. 9 Definitions pp. 13, 19–20 G4/AS1 1.1.3 2.3.1, 2.4.1, 3.0.1	pp. 21–23 Figures 2, 3 and 4
Amendment 4	Effective from 1 January 2017 to 31 October 2019	p. 7 References p. 11 G4/VM1 2.0.1	p. 20 G4/AS1 2.4.1, 3.0.1
Fourth Edition	Effective 27 June 2019		
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

New Zealand Building Code Clause G4 Ventilation

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992 and amended by the Building Amendment Regulations 1997.

FIRST SCHEDULE–*continued*

Clause G4–VENTILATION

Provisions	Limits on application
OBJECTIVE **G4.1** The objective of this provision is to safeguard people from illness or loss of *amenity* due to lack of fresh air.	
FUNCTIONAL REQUIREMENT **G4.2** Spaces within *buildings* shall be provided with *adequate* ventilation consistent with their maximum occupancy and their *intended* use.	
PERFORMANCE **G4.3.1** Spaces within *buildings* shall have means of ventilation with *outdoor air* that will provide an *adequate* number of air changes to maintain air purity.	
G4.3.2 Mechanical air-handling systems shall be *constructed* and maintained in a manner that prevents harmful bacteria, pathogens and allergens from multiplying within them.	
G4.3.3 *Buildings* shall have a means of collecting or otherwise removing the following products from the spaces in which they are generated: (a) Cooking fumes and odours, (b) Moisture from laundering, utensil washing, bathing and showering, (c) Odours from sanitary and waste storage spaces, (d) Gaseous by-products and excessive moisture from commercial or industrial processes, (e) Poisonous fumes and gases, (f) Flammable fumes and gases, (g) Airborne particles, (h) Bacteria, viruses or other pathogens, or (i) Products of combustion.	

FIRST SCHEDULE–*continued*

Provisions	Limits on application
G4.3.4 Contaminated air shall be disposed of in a way which avoids creating a nuisance or hazard to people and *other property*.	
G4.3.5 The quantities of air supplied for ventilation shall meet the additional demands of any fixed *combustion appliances*.	

Contents

References

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 the reference document must be used.

		Where quoted
Standards New Zealand		
AS/NZS 3666:–	Air-handling and water systems of buildings – Microbial control	
Part 1: 2011	Design, installation and commissioning	AS1 1.5.1 b)
Part 2: 2011	Operation and maintenance	AS1 1.5.1 b)
NZS 4303: 1990	Ventilation for acceptable indoor air quality	AS1 1.5.1 a) d)
AS/NZS 5601:-	Gas installations	AS1 2.3.1 b), 2.4.1 c), 3.0.1
Part 1: 2013	General installations *Amend: 1, 2*	
Standards Australia		
AS 1668:–	The use of mechanical ventilation and air-conditioning in buildings	
Part 2: 2002	Ventilation design for indoor-air contaminant control *Amends: 1, 2*	AS1 1.2.4, 1.5.1 a) c) i) ii) d) e), f), g),
New Zealand Government Departments		
Worksafe New Zealand, Workplace Exposure Standards and Biological Exposure Indices 10th Edition, November 2018		VM1 2.0.1
Chartered Institution of Building Services Engineers, London		
CIBSE Code Series A: 1996 Air distribution systems		VM1 1.0.1, AS1 1.5.1 h)

Definitions

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 Clause A2 Interpretation.

Adequate Adequate to achieve the objectives of the *Building Code*.

Atmospheric burner A burner system where all the air for combustion is induced by the inspirating effect of a gas injector and/or by natural draught in the combustion chamber without mechanical assistance.

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

Building element Any structural and non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, drains, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.

Chimney A non-combustible structure which encloses one or more *flues*, fireplaces or other heating appliances.

Common extract duct A mechanical ventilation duct that extracts from different *household units*, and may contain air, moisture and contaminant.

Construct In relation to a *building*, includes to design, build, erect, prefabricate and relocate the *building*.

Draught diverter A device, without moving parts, fitted in the *flue* of an appliance for isolating the combustion system from the effects of pressure changes in the secondary *flue*.

Equivalent aerodynamic area The area of an equivalent aerodynamically perfect orifice, and equals the penetration area required by the natural ventilation device multiplied by the discharge coefficient determined under test.

Fire separation Any *building element* which separates *firecells* or *firecells* and *safe paths*, and provides a specific *fire resistance rating*.

Fixture An article intended to remain permanently attached to and form part of a *building*.

Flue The passage through which the products of combustion are conveyed to the outside.

Forced or induced draught appliance An appliance where all or part of the air for combustion is provided by a fan or other mechanical device which is an integral part of the combustion system.

Habitable space A space used for activities normally associated with domestic living, but excludes any bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods.

Household unit

a) means any *building* or group of *buildings*, or part of a *building* or group of *buildings*, that is:

  i) used, or intended to be used, only or mainly for residential purposes; and

  ii) occupied, or intended to be occupied, exclusively as the home or residence of not more than one household; but

b) does not include a hostel, boarding house or other specialised accommodation.

Intended use in relation to a *building*:

a) includes any or all of the following:

  i) any reasonably foreseeable occasional other use that is not incompatible with the intended use; and

  ii) normal maintenance; and

  iii) activities taken in response to fire or any other reasonably foreseeable emergency

b) but does not include any other maintenance and repairs or rebuilding.

Natural draught The flow produced by the tendency of warmed gases to rise.

Net openable area is the area of windows or doors or other opening measured on the face dimensions of the openable *building element* concerned.

Occupied space Any space within a *building* in which a person will be present from time to time during the *intended use* of the *building*.

Outdoor air Air as typically comprising by volume:

i) oxygen 20.94%

ii) carbon dioxide 0.03%

iii) nitrogen and other inert gases 79.03%.

Permanent opening An opening which cannot be closed, this implies that doors, windows etc are NOT permanent openings, although door undercuts are.

Room-sealed appliance An appliance designed so that air for combustion neither enters from, nor combustion products enter into, the room in which the appliance is located.

Trickle ventilator A controllable ventilation opening through the external envelope to the outside to provide background ventilation.

Verification Method G4/VM1

1.0 Ventilation Rate

1.0.1 In ducted mechanical ventilation systems the air-flow rate (and consequently number of air changes), may be verified using the methods of measurement given in the CIBSE Code Series A, Appendix A3.1. For determining the volume of *outdoor air,* measurements shall be taken close to the *outdoor air* inlet.

2.0 Air Purity

2.0.1 The acceptability of indoor air purity for workplaces may be verified by demonstrating that contaminant levels do not exceed the limits recommended in "Workplace Exposure Standards and Biological Exposure Indices".

Acceptable Solution G4/AS1

1.0 Ventilation

1.1 Introduction

1.1.1 Ventilation of spaces within *buildings* is required to maintain air purity by a flow of *outdoor air* through the *building* envelope, with or without mechanical assistance.

COMMENT:
If activities or environmental conditions adjacent to external natural ventilation openings produce air pollution in any of the forms listed in NZBC G4.3.3, it may be necessary to relocate the openings or use mechanical ventilation.

1.1.2 Ventilation of spaces within *buildings* must be provided by natural ventilation (refer to Paragraphs 1.2 and 1.3), mechanical ventilation (refer to Paragraph 1.5), or a combination of mechanical and natural ventilation (refer to Paragraph 1.4).

1.1.3 *Buildings* containing Type 5 fire alarm systems must have mechanical extract ventilation installed in kitchens.

COMMENT:
Refer to Acceptable Solution F7/AS1 and Acceptable Solutions C/AS1– C/AS6 Appendix A for information on Type 5 fire alarms.

1.2 Natural ventilation – General

1.2.1 Where natural ventilation is available via adjacent spaces, specific ventilation is not required to small spaces such as hallways and lobbies in *household units*.

1.2.2 Natural ventilation of *occupied spaces* must be achieved by providing a *net openable area* of windows or other openings to the outside of no less than 5% of the floor area. The 5% floor area requirement does not apply to:

a) *occupied spaces* in Commercial and Industrial *buildings* where products listed in NZBC Clause G4.3.3 are generated (mechanical ventilation of these spaces is required), and

b) *household units* and accommodation units where there is only one external wall with opening windows (refer to Paragraph 1.3 for additional requirements if natural ventilation is used).

COMMENT:
1. The net openable area of windows or doors is measured on the face dimensions of the *building element* concerned.
2. Fixing in an open position of doors and windows used for ventilation is necessary to avoid injury or damage from sudden closure in the event of strong winds or other forces.
3. Keeping water from entering the *building* must be considered for compliance with NZBC Clause E2 External Moisture.

1.2.3 Openable *building elements* shall be constructed in a way that allows them to remain fixed in the open position as a means of ventilation during normal occupancy of the *building*.

1.2.4 Natural ventilation of car parks shall comply with the natural ventilation part of AS 1668.2 Section 7.

1.2.5 Spaces in *household units* and accommodation units that contain cooktops, showers and baths must have mechanical extract fans installed to remove moisture generated by these fixtures. Mechanical extract fans (including associated ducting) must have a flowrate not less than:

a) 25 L/s for showers and baths, and

b) 50 L/s for cooktops.

COMMENT:
Mechanical extract fans are intended to remove moisture from localised sources, and will not necessarily provide adequate ventilation for the whole *occupied space*.

Within this acceptable solution, natural ventilation (refer Paragraphs 1.2 and 1.3) on its own is not adequate to remove moisture generated from cooktops, showers and baths.

1.3 Natural ventilation of household units and accommodation units with one external wall

Scope

1.3.1 Paragraphs 1.3.2 to 1.3.5 specify the natural ventilation to both *household units* and accommodation units with only one external wall, such as those often found in apartments, hotels and motels.

Kitchens, bathrooms, toilets and laundries that do not have an external wall must be mechanically ventilated in accordance with Paragraphs 1.4 or 1.5.

Kitchens, bathrooms, toilets, laundries and habitable spaces that have an external wall

1.3.2 Kitchens, bathrooms, toilets, laundries and *habitable spaces* with an external wall must be ventilated to the outside by:

a) windows and/or other openings to the outside with a *net openable area* of no less than 5% of the floor area of the space, or

b) high level *trickle ventilators* located through the external wall or in *building elements* within the external wall (see Paragraph 1.3.5 for *trickle ventilators*), and

c) having a distance between the external wall and opposing wall of the space of less than 6 metres.

1.3.3 Spaces in *household units* and accommodation units that contain cooktops, showers and baths must have mechanical extract fans installed to remove moisture generated by these fixtures. Mechanical extract fans (including associated ducting) must have a flow rate not less than:

a) 25 L/s for showers and baths, and

b) 50 L/s for cooktops.

COMMENT:
Mechanical extract fans are intended to remove moisture from localised sources, and will not necessarily provide adequate ventilation for the whole *occupied space*.

Within this acceptable solution, natural ventilation on its own is not adequate to remove moisture generated from cooktops, showers and baths.

Habitable spaces ventilated via another habitable space

1.3.4 *Habitable spaces* without openings to the exterior must be ventilated via another *habitable space* by:

a) providing from the other *habitable space* to outside, openable windows and/or other openings of *net openable area* of no less than 5% of the combined floor area of the combined *habitable spaces*, and

b) providing high and low level *trickle ventilators* located on the external wall (see Paragraph 1.3.5 for *trickle ventilators*), sized according to the combined floor area, and

c) providing an area of *permanent opening* between the two spaces of no less than 5% of the combined floor area of the *habitable spaces*, and

d) having a combined distance of the *habitable spaces*, measured between the external wall and furthest opposing wall, of less than 6 metres.

COMMENT:
Habitable spaces must not be naturally ventilated via an adjacent space that is a bathroom, kitchen, toilet or laundry.

Trickle ventilators

1.3.5 *Trickle ventilators* are devices that have an opening to the outside. *Trickle ventilators* shall:

a) have an opening of no less than 2000 mm^2 *equivalent aerodynamic area*, and

b) be located to minimise draughts, and

c) be secured to keep pests and insects out, and

d) have acoustic attenuation, if required by NZBC G6 Airborne and Impact Sound, and

e) be controllable and closable in all conditioned spaces, and

f) be installed in *household units*, providing they do not contain mechanical supply ventilation, and

g) have the *equivalent aerodynamic area*, based on the number of occupants, for the space as given in Tables 1 and 2, and

Table 1: Number of occupants
Paragraph 1.3.5

Household unit accommodation unit type	Number of people
Studio	2
1 bedroom	2
2 bedroom	3
Greater than 2 bedrooms	Add 1 per bedroom

h) have, where high and low level *trickle ventilators* are required, the high and low level *trickle ventilators* of approximately the same *equivalent aerodynamic area* and separated by a minimum of 1 metre. High level *trickle ventilators* are located in the top half of the wall. Low level *trickle ventilators* are located in the bottom half of the wall.

COMMENT:
There are a range of *trickle ventilators*, sometime called background ventilators, on the market.

Table 2: Total required equivalent aerodynamic area per space (mm^2)
Paragraph 1.3.5

	Number of occupants				
Ventilator locations	**1**	**2**	**3**	**4**	**5**
High and low level	4000	8000	12,000	16,000	20,000
High level only	3000	6000	9000	12,000	15,000

1.4 Combined natural ventilation and mechanical ventilation

Scope

1.4.1 This section specifies the combined natural and mechanical ventilation requirements for both *household units* and accommodation units, with one external wall, such as those often found in apartments, hotels and motels.

Habitable spaces will be naturally ventilated, and kitchens, bathrooms, toilets and laundries will be ventilated by continuous or intermittent mechanical extract ventilation (refer to Paragraph 1.5).

Combined natural ventilation with continuous or intermittent mechanical ventilation

1.4.2 *Habitable spaces* with one external wall and a *permanent opening* to a kitchen, bathroom, toilet or laundry, within which a continuous or intermittent mechanical extract system is installed, must be ventilated by:

a) integrating high level *trickle ventilators*, located within the external wall or *building elements* that are integrated within the external wall (see Paragraph 1.3.5 for *trickle ventilators*), and

b) having a *net openable area* of windows and/or other openings to the outside of no less than 5% of the floor area, and

c) having the kitchen, bathroom, toilet, or laundry door undercut by 20 mm, and

d) having a maximum dimension between the external wall and the furthest internal opposing wall, when measured across the combined *habitable space* and the kitchen, bathroom, toilet, or laundry, of

i) less than 10 metres for continuous mechanical extract systems, or

ii) less than 6 metres for intermittent mechanical extract systems.

COMMENT:
If Paragraphs 1.4.2 d) i) & ii) both apply, then ventilation shall be achieved by complying with Paragraph 1.4.2 d) ii).

1.5 Mechanical ventilation

1.5.1 Mechanical ventilation systems must satisfy the following conditions:

a) **outdoor air supply** shall be designed and equipment installed to comply with NZS 4303, or AS 1668.2 (excluding Table A1 and Sections 3 and 7), and to provide outdoor air to *occupied spaces* at the flow rates given in NZS 4303 Table 2, and

b) **air-handling systems** shall be installed and maintained to the requirements of AS/NZS 3666.1 and AS/NZS 3666.2, and

c) **extract ventilation** shall:

i) be constructed so that any products listed in Clause G4.3.3 are removed, collected or diluted by ventilation rates and methods set out in AS 1668.2 Section 5

COMMENT:
Commercial kitchen extract ventilation is included in AS 1668.2 Section 5.

ii) where provided to remove moisture and other contaminants from kitchens, bathrooms, toilet spaces and laundries in *household units*, exhaust the air to the outside at flow rates given in AS 1668.2, Table B1, and

COMMENT:
Extract ventilation systems that pass through fire rated *building elements* must be designed to maintain the fire performance of the *building* – refer to NZBC Clauses C1-C6.

iii) exhaust air to the outside at a flowrate not less than 50 L/s, when intermittent mechanical extract ventilation is used to remove moisture and other contaminants from spaces in *household units* and accommodation units that contain cooktops.

d) **outdoor air intakes** shall be located to avoid contamination from any local source in accordance with AS 1668.2 Clause 4.3.1 and NZS 4303 Clause 5.5, and

e) **recirculated air systems** shall comply with AS 1668.2 Clause 4.5, and

f) **contaminated air discharge systems** shall discharge contaminated air in a way that complies with AS 1668.2 Clause 5.10, and

g) **filtration** shall comply with AS 1668.2 Clause 4.4, and

h) **commissioning** shall comply with CIBSE Code Series A.

Car park ventilation

1.5.2 Mechanical ventilation of car parks shall comply with the mechanical ventilation part of AS 1668.2 Section 7.

Positive and negative pressure

1.5.3 *Building* interiors ventilated by mechanical systems incorporating filtration shall, except where Paragraph 1.4.4 applies, be maintained at a positive pressure.

COMMENT:
Positive pressure allows good control of intake air filtration, whereas under negative pressure, unfiltered air may be drawn through gaps and openings in *building elements*.

1.5.4 Spaces in which mechanical ventilation is used to remove or collect contaminants shall be maintained at negative pressure relative to other spaces in the *building*.

COMMENT:
Negative pressure reduces the likelihood of contaminants being spread to other spaces.

2.0 Ventilation of Spaces Containing Gas-fuel Appliances

2.1 Natural ventilation

2.1.1 Natural ventilation systems for appliances burning gas fuel designed to operate under *natural draught* conditions shall:

a) Supply air under equal pressure conditions to the burners and to the *draught diverter* i.e. in the same room and as close as possible to the appliance, and

b) For non *room-sealed appliances* having a combined gas input exceeding 1 kW for each m^3 of the space in which they are installed, be provided with vents, in addition to the ventilation required by Paragraphs 1.1 and 1.2. The vents shall be sized and located according to Paragraphs 2.1.3 to 2.1.8.

2.1.2 Domestic gas cookers in non room-sealed spaces which are also used for sleeping, require permanent venting to the outside. The size of the vent shall be appropriate to the gas input to the cooker and shall be subject to specific design.

2.1.3 Vent sizes

Two permanent vent openings, one high level and one low level, shall be provided, each with a free ventilation area per kW of gas input (of all appliances in the space) of no less than:

a) 1200 mm^2 for spaces vented directly to the outside, and

b) 2300 mm^2 for spaces vented via adjacent spaces.

2.1.4 The vent opening areas given in Paragraph 2.1.3 may be halved for plant rooms and boiler rooms infrequently occupied by people.

2.1.5 Vent openings shall have vertical dimensions of no less than 50 mm, and no dimension of less than 6.0 mm in any other direction.

2.1.6 Low-level vents shall have their lower edge no more than 100 mm above floor level, and upper-level vents shall have their lower edge no less than 75 mm above the top of the draught diverter relief opening.

2.1.7 A louvred door is also an acceptable method of ventilation provided the bottom of the free area extends to not less than 100 mm above the floor, and the requisite high-level free area is available from the level of 75 mm above the *draught diverter* relief opening.

2.1.8 In plant room or boiler room installations, low- and high-level vents may be combined into a single opening, provided it reaches from floor to ceiling and has a total free area equivalent to that required for the two separate vents.

2.2 Mechanical ventilation

2.2.1 When mechanical ventilation is used, the system shall have either:

a) Mechanical supply with mechanical extraction, or

b) Mechanical supply with natural exhaust.

2.2.2 A mechanical ventilation system shall:

a) For each kW of gas consumption (of all appliances in the plant room) provide *outdoor air* at the rate of:

   i) 3.6 m^3/h for *forced or induced draught appliances*, and

   ii) 7.2 m^3/h for appliances with *atmospheric burners*, and

b) Remove exhaust air from the room either:

   i) mechanically at one third the inlet rate, or

   ii) naturally via high-level openings having a free ventilation area of no less than 600 mm^2 per kW of total gas consumption for all appliances in the room.

2.3 Flue construction

2.3.1 A *flue* system shall have:

a) The cross-sectional area of a *natural draught flue* system external to the appliances, no less than the cross-sectional area of the appliance outlet, or

b) The *flue* designed to comply with AS/NZS 5601.1, section 6.7 and Appendix H, and

c) If a *draught diverter* is not fitted:

   i) *flue* products discharged to the atmosphere only at the *flue* terminal, unless the discharge at other locations can be achieved without hazard to *persons*, property or appliance operation, and

   ii) a method of automatically shutting down the main burners of *forced or induced draught appliances*, should the normal free discharge of the *flue* be interrupted.

2.3.2 Draught diverters

Draught diverter installations shall discharge the total *flue* products including excess air and *draught diverter* dilution air, at the *flue* terminal without spillage from the skirt of the *draught diverter*.

2.4 Flue locations on dwellings

2.4.1 The location of a *flue* terminal on a dwelling shall have:

a) Outlets from *natural draught flues* or *chimneys*, positioned relative to surrounding *construction* to avoid wind causing down draughts in the *flue*,

b) *Flue* pipes which extend through the roof, terminated no closer than:

   i) 500 mm to the nearest part of any roof,

   ii) 2.0 m to the roof level of a flat roof intended for personal or public use, and

   iii) 500 mm above any parapet, and

c) *Flues* which terminate on the wall of a *building* located clear of inlets for outside air in accordance with the minimum clearances specified in AS/NZS 5601.1, section 6.9 and Figure 6.2.

3.0 Another Solution for Gas-fuel Appliances

3.0.1 AS/NZS 5601.1 Sections 1, 3, 4, 5 and 6 and Appendices A – M and O - R is an Acceptable Solution, but may exceed the performance criteria of NZBC G4.

Appendix 1 Typical apartment layouts and ventilation options

Figure 1: **Layout 1**
Table 3

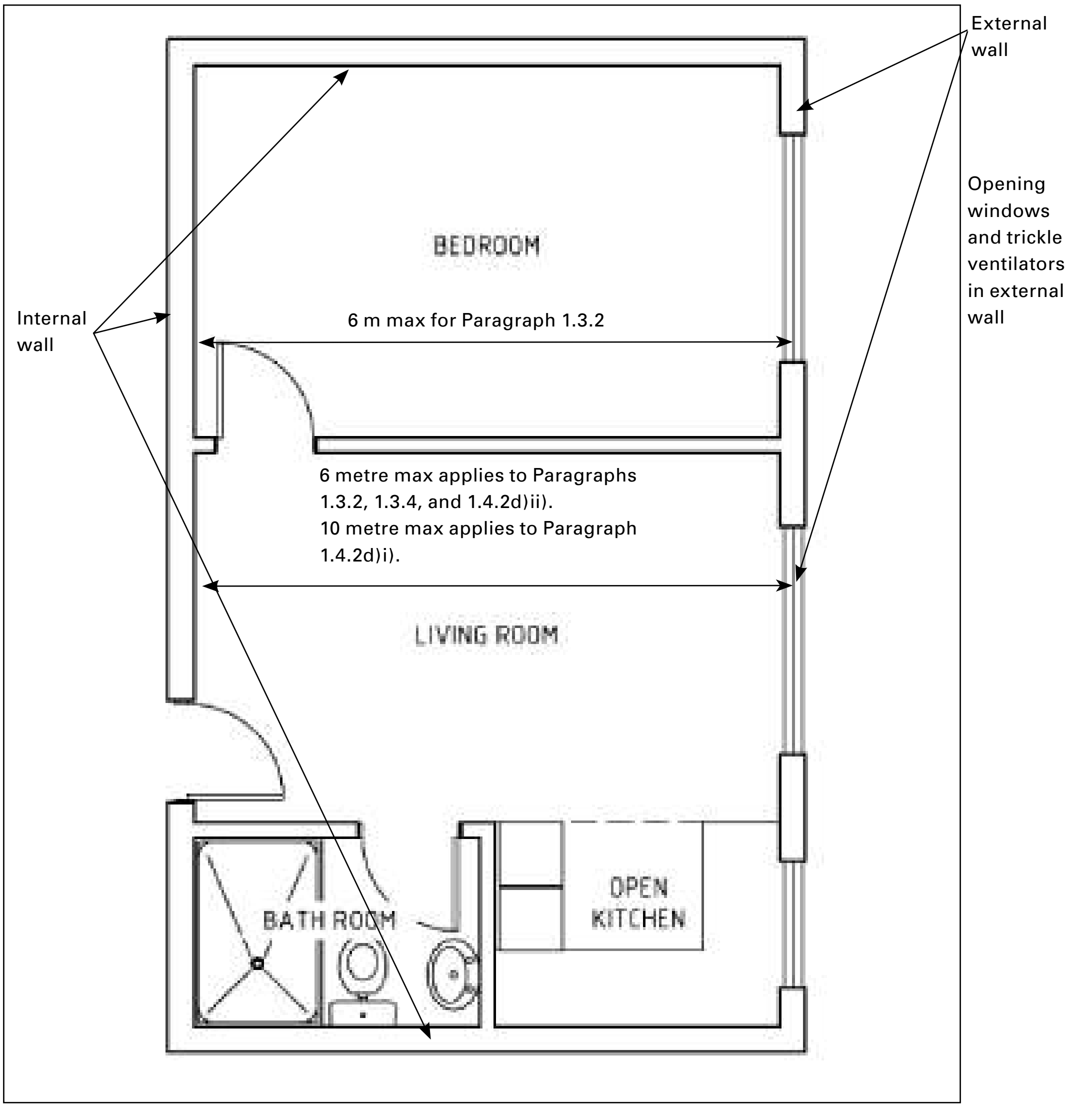


Table 3: **Ventilation options – Layout 1**
Figure 1

Room	Natural ventilation (Paragraph)	Mechanical ventilation (Paragraph)	Combined ventilation (Paragraph)
Bedroom	1.3.2	1.5	–
Living	1.3.2	1.5	1.4.2d) ii) (6 m max dist) or 1.4.2 d) i) (10 m max dist)
Kitchen	1.3.2 and 1.3.3	1.5	1.4.2d) ii) (6 m max dist) or 1.4.2 d) i) (10 m max dist)
Bathroom	1.3.3	1.5	1.4.2d) ii) (6 m max dist) or 1.4.2 d) i) (10 m max dist)

Figure 2: **Layout 2**
Table 4

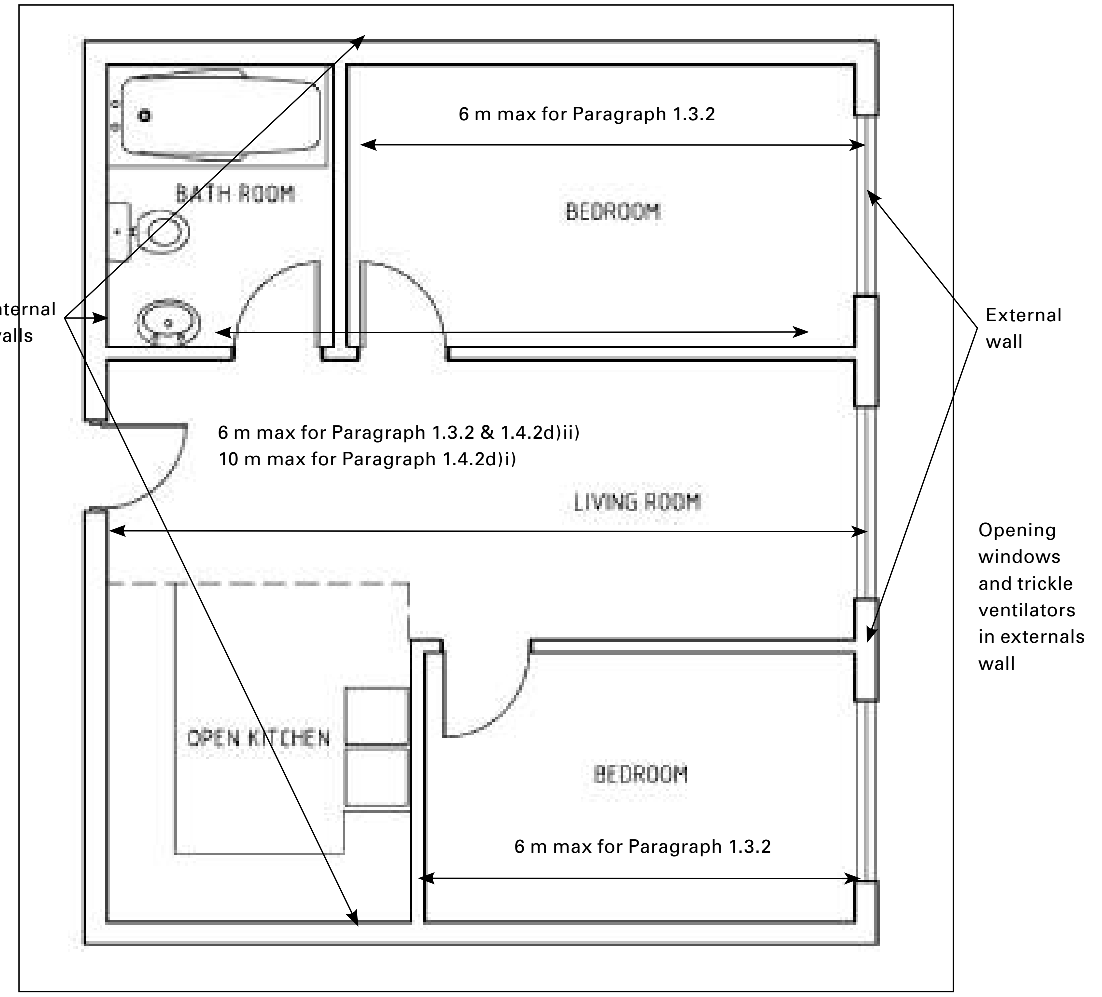


Table 4: **Ventilation options – Layout 2**
Figure 2

Room	Natural ventilation (Paragraph)	Mechanical ventilation (Paragraph)	Combined ventilation (Paragraph)
Bedrooms	1.3.2	1.5	–
Living	1.3.2	1.5	1.4.2d) ii) (6 m max dist) or 1.4.2 d) i) (10 m max dist))
Kitchen	-	1.5	1.4.2d) ii) (6 m max dist) or 1.4.2 d) i) (10 m max dist)
Bathroom	-	1.5	1.4.2d) ii) (6 m max dist) or 1.4.2 d) i) (10 m max dist)

Figure 3: **Layout 3**
Table 5

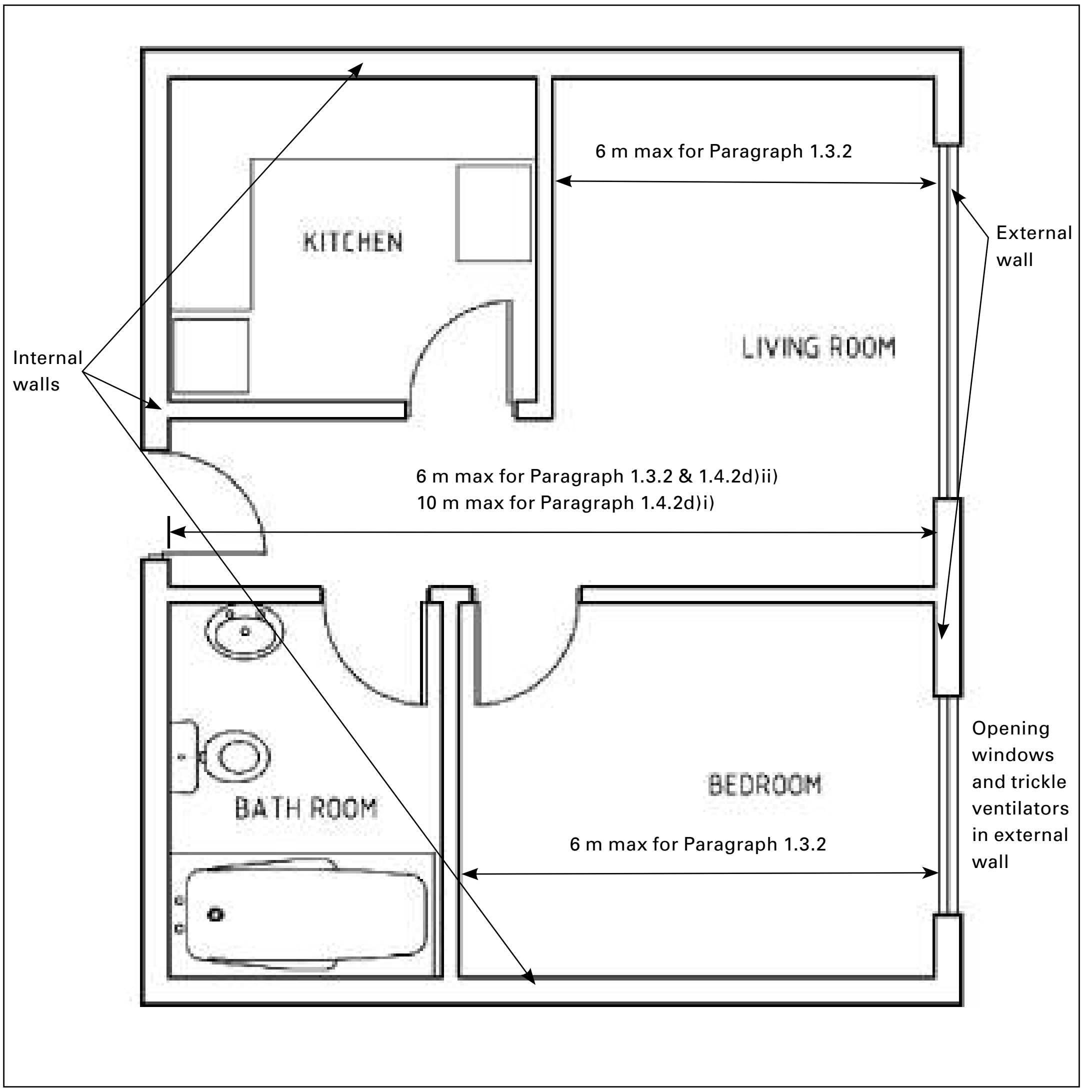


Table 5: **Ventilation options – Layout 3**
Figure 3

Room	Natural ventilation (Paragraph)	Mechanical ventilation (Paragraph)	Combined ventilation (Paragraph)
Bedrooms	1.3.2	1.5	–
Living	1.3.2	1.5	1.4.2d) ii) (6 m max dist) or 1.4.2 d) i) (10 m max dist)
Kitchen	-	1.5	1.4.2d) ii) (6 m max dist) or 1.4.2 d) i) (10 m max dist)
Bathroom	-	1.5	1.4.2d) ii) (6 m max dist) or 1.4.2 d) i) (10 m max dist)

Index G4/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Compliance Document for New Zealand Building Code Clause G5 Interior Environment

Prepared by the Department of Building and Housing

This Compliance Document is prepared by the Department of Building and Housing. The Department of Building and Housing is a Government Department established under the State Sector Act 1988.

Enquiries about the content of this document should be directed to:

Department of Building and Housing
Te Tari Kaupapa Whare

Department of Building and Housing
PO Box 10-729, Wellington.
Telephone 0800 242 243
Fax 04 494 0290
Email: info@dbh.govt.nz

Compliance Documents are available from www.dbh.govt.nz

New Zealand Government

Status of Compliance Documents

Compliance Documents are prepared by the Department of Building and Housing in accordance with section 22 of the Building Act 2004. A Compliance Document is for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Compliance Document will be treated as having complied with the provisions of the Building Code to which the Compliance Document relates. However, a Compliance Document is only one method of complying with the Building Code. There may be alternative ways to comply.

Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the status of Compliance Documents 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 Compliance Document.

G5: Document History

	Date	Alterations
First published	July 1992	
Amendment 1	1 July 2001	p. 2, Document History, Status p. 3, NZBC p. 7, References p. 9, Definitions
Amendment 2	10 October 2011	p. 2, Document History, Status p. 3, Code Clause G5 p. 7, References p. 9, Definitions

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

Document Status

The most recent version of this document, as detailed in the Document History, is approved by the Chief Executive of the Department of Building and Housing. It is effective from 10 October 2011 and supersedes all previous versions of this document.

People using this Compliance Document should check for amendments on a regular basis. The Department of Building and Housing may amend any part of any Compliance Document at any time. Up-to-date versions of Compliance Documents are available from www.dbh.govt.nz

New Zealand Building Code Clause G5 Interior Environment

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

Amend 1 Jul 2001
Amend 2 Oct 2011

FIRST SCHEDULE–*continued*

Clause G5–INTERIOR ENVIRONMENT

Provisions	Limits on application
OBJECTIVE **G5.1** The objective of this provision is to:	
(a) Safeguard people from illness caused by low air temperature,	
(b) Safeguard people from injury or loss of *amenity* caused by inadequate activity space,	
(c) Safeguard people from injury caused by unsafe installations, and	
(d) Ensure that *people with disabilities* are able to carry out normal activities and processes within *buildings*.	Objective G5.1(d) shall apply only to those *buildings* to which section 47A of the Act applies.
FUNCTIONAL REQUIREMENT **G5.2.1** *Buildings* shall be *constructed* to provide:	
(a) An *adequate*, controlled interior temperature,	Requirement G5.2.1 (a) shall apply only to *habitable spaces*, bathrooms and recreation rooms in old people's homes and early childhood centres.
(b) *Adequate* activity space for the intended use, and	Requirement G5.2.1 (b) shall apply only to old people's homes.
(c) *Accessible* spaces and facilities.	Requirement G5.2.1 (c) shall apply only to *Communal Residential*, *Communal Non-residential*, and *Commercial buildings*.
G5.2.2 Heating appliances in *buildings* shall be installed in a way that reduces the likelihood of injury.	
PERFORMANCE **G5.3.1** *Habitable spaces*, bathrooms and recreation rooms shall have the provision for maintaining the internal temperature at no less that 16ºC measured at 750 mm above floor level, while the space is *adequately* ventilated.	Performance G5.3.1 shall apply only to old people's homes and early childhood centres.

Note: Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

Effective from 29 December 2000

FIRST SCHEDULE–*continued*

Provisions	Limits on application
G5.3.2 Heating appliances, and any attached cables, pipes or other fittings shall be securely fixed in place.	Performance G5.3.2 shall apply only to old people's homes and early childhood centres.
G5.3.3 *Habitable spaces* shall have sufficient space for activity, furniture, and sanitary and mobility aids.	Performance G5.3.3 shall apply only to old people's homes.
G5.3.4 Where reception counters or desks are provided for public use, at least one counter or desk shall be *accessible*.	Performance G5.3.4 applies only to *Communal Residential*, *Communal Non-Residential*, and *Commercial buildings*.
G5.3.5 *Buildings* shall be provided with listening systems which enable enhanced hearing by people with hearing aids.	Performance G5.3.5 applies only to: (a) *Communal Non-residential* assembly spaces occupied by more than 250 people, and (b) Any theatre, cinema, or public hall, and (c) Assembly spaces in old people's homes occupied by more than 20 people.
G5.3.6 Enhanced listening systems shall be identified by signs complying the Clause F8 "Signs".	

Contents

References

Amend 1 Jul 2001

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in this Compliance Document (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 Compliance Document must be used.

Amend 2 Oct 2011

			Where quoted
	Standards Association of New Zealand		
Amend 1 Jul 2001	NZS 4121: 2001	Design for access and mobility – Buildings and associated facilities	AS1 3.0.1
Amend 2 Oct 2011	NZS 4214: 2006	Methods of determining the total thermal resistance of parts of buildings	Definitions

Definitions

Amend 2 Oct 2011

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

Accessible Having features to permit use by *people with disabilities.*

Adequate *Adequate* to achieve the objectives of the *building code.*

Amenity An attribute of a *building* which contributes to the health, physical independence, and well being of the *building's* users but which is not associated with disease or a specific illness.

Amend 2 Oct 2011

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

Building element Any structural and non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, drains, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.

Fixture An article intended to remain permanently attached to and form part of a ***building***.

Habitable space A space used for activities normally associated with domestic living, but excludes any bathroom, laundry, water-closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods.

Intended use in relation to a *building*,—

(a) includes any or all of the following:

(i) any reasonably foreseeable occasional use that is not incompatible with the *intended use*:

(ii) normal maintenance:

(iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but

(b) does not include any other maintenance and repairs or rebuilding.

Amend 2 Oct 2011

Person with a disability means a *person* who has an impairment or a combination of impairments that limits the extent to which the *person* can engage in the activities, pursuits, and processes of everyday life, including, without limitation, any of the following:

Amend 1 Jul 2001

(a) a physical, sensory, neurological, or intellectual impairment:

(b) a mental illness.

Amend 2 Oct 2011

R-value The common abbreviation for describing the values of both *thermal resistance* and *total thermal resistance.*

Thermal resistance The resistance to heat flow of a given component of a *building element.* It is equal to the temperature difference (°C) needed to produce unit heat flux (W/m^2) through unit area (m^2) under steady conditions. The units are °Cm^2/W.

Total thermal resistance The overall air-to-air *thermal resistance* across all components of a *building element* such as a wall, roof or floor. (This includes the surface resistances which may vary with environmental changes e.g. temperature and humidity, but for most purposes can be regarded as having standard values as given in NZS 4214.)

Verification Method G5/VM1

No specific methods have been adopted for verifying compliance with the Performance of NZBC G5.

Acceptable Solution G5/AS1

1.0 Temperature Control

1.0.1 Heating to provide acceptable temperature control shall take account of:

a) Local climate,

b) Size of the heated space,

c) *Thermal resistance (R-value)* of the *building elements* enclosing the space to be heated, and

d) Whether the walls of the heated space are internal or external.

1.0.2 Indicative *R-values* for different types of *construction* are given in E3/AS1.

1.0.3 Tables 1 and 2 provide a method of determining the heating requirements for the *habitable spaces*, bathrooms and recreation rooms of smaller old people's homes and early childhood centres (up to 10 residents), of single storey *construction*. The heating requirements of larger and multi-storey *buildings* shall be specifically calculated.

Table 1: Acceptable Heating Output for Spaces of up to 10 m² Floor Area (See note 1)
Paragraph 1.0.3

Locality	Average R-value (the average total thermal resistance of floor, walls and roof/ceiling of the space to be heated)	Heating wattage (W) for a space which has: Four external walls	Three external walls	Two external walls	One external wall
North Island	1.5	720	650	580	510
(see note 2)	0.7	1250	1100	950	800
South Island	1.5	1040	940	840	740
	0.7	1650	1410	1170	930

Notes:

1. For floor areas exceeding 10 m² use factors given in Table 2.
2. North Island localities more than 500 m above sea level shall meet South Island requirements.

Table 2: Multiplying Factors for Determining Acceptable Wattage in Spaces Exceeding 10 m² Floor Area
Paragraph 1.0.3 and Table 1

Floor area (m^2)	10	20	40	80	160
Multiplying factor	1.0	1.4	2.0	2.8	4.0

Note:
Interpolation for different floor areas is permitted.

1.0.4 Example of use of Tables 1 and 2:

For a space (South Island) of 20 m^2 and an average *R-value* of 1.5, with 2 external walls, the necessary heating power is:

840 (Table 1) x 1.4 (Table 2) = 1176 W

The average *R-value* for example may be

$$\frac{0.4\text{ (floor)} + 2.0\text{ (walls)} + 3.0\text{ (roof)}}{3} = \frac{5.4}{3} = 1.8$$

In this case the wattage is read from the 1.5 Average *R-value* line, in Table 1.

2.0 Space

2.0.1 Each old people's home shall have spaces for living, dining and sleeping.

2.0.2 Spaces for living and dining may be combined provided that the total space can, if necessary, be divided into separate living and dining areas each satisfying their respective requirements for width and floor area.

2.0.3 Spaces provided shall have dimensions of no less than those given in Table 3.

3.0 People with Disabilities

3.0.1 Acceptable activity space shall comply with NZS 4121.

Table 3: Space Provision for Old People's Homes
Paragraph 2.0.3

	Minimum dimensions	
Type of space	**Width** (m)	**Floor area** (m^2)
Living room	2.75	10 + 1 for each resident over 3 in number
Dining room	2.75	8 + 1 for each resident over 3 in number
Bedroom	2.2	6 for each resident (see note 1)

Note:
1. Floor area for bedrooms shall exclude built-in wardrobes. In the absence of a built-in wardrobe, an additional 0.75 m^2 shall be provided for each resident.

Index G5/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Compliance Document for New Zealand Building Code Clause G6 Airborne and Impact Sound

Prepared by the Department of Building and Housing

This Compliance Document is prepared by the Department of Building and Housing. The Department of Building and Housing is a Government Department established under the State Sector Act 1988.

Enquiries about the content of this document should be directed to:

Department of Building and Housing
PO Box 10-729, Wellington.
Telephone 0800 242 243
Fax 04 494 0290
Email: info@dbh.govt.nz

Sales enquiries should be directed to:
Customer Services,
Victoria University Book Centre
PO Box 12-337, Wellington, New Zealand
Telephone 0800 370 370, (04) 463 5511
Fax (04) 463 5510
Email: dbh@vicbooks.co.nz
www.vicbooks.co.nz
ISBN 0-477-01606-5

Status of Compliance Documents

Compliance Documents are prepared by the Department of Building and Housing in accordance with section 22 of the Building Act 2004. A Compliance Document is for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Compliance Document will be treated as having complied with the provisions of the Building Code to which the Compliance Document relates. However, a Compliance Document is only one method of complying with the Building Code. There may be alternative ways to comply.

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

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

G6: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	19 August 1994	pp. i and ii, Document History p. 5, Figure 2 p. 6, Figure 3	
Amendment 2	1 December 1995	p. ii, Document History p. vi, References p. 3, 1.0.1, 1.0.2	p. 5, Figure 2 p. 7, Figure 5 p. 8, Index

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

Document Status

The most recent version of this document, as detailed in the Document History, is approved by the Chief Executive of the Department of Building and Housing. It is effective from 1 December 1995 and supersedes all previous versions of this document.

People using this Compliance Document should check for amendments on a regular basis. The Department of Building and Housing may amend any part of any Compliance Document at any time. Up-to-date versions of Compliance Documents are available from www.dbh.govt.nz

New Zealand Building Code
Clause G6 Airborne and Impact Sound

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE—*continued*

Clause G6—AIRBORNE AND IMPACT SOUND

Provisions	Limits on application
OBJECTIVE	
G6.1 The objective of this provision is to safeguard people from illness or loss of *amenity* as a result of undue noise being transmitted between abutting occupancies.	
FUNCTIONAL REQUIREMENT	
G6.2 *Building elements* which are common between occupancies, shall be constructed to prevent undue noise transmission from other occupancies or common spaces, to the *habitable spaces* of *household units*.	
PERFORMANCE	
G6.3.1 The *Sound Transmission Class* of walls, floors and ceilings, shall be no less than 55.	
G6.3.2 The *Impact Insulation Class* of floors shall be no less than 55.	

Contents

References

For the purposes of New Zealand Building Code compliance, referenced documents shall be deemed to include any amendments issued prior to the date of the Approved Document as displayed at the foot of the page on which the references are listed.

			Where quoted
	American Society for Testing and Materials		
Amend 2 Dec 1995	ASTM E 336: 1990	Method for measurement of airborne sound insulation in buildings	VM1 1.0.1
	ASTM E 413: 1987	Classification for rating sound insulation	VM1 1.0.1, Definitions
Amend 2 Dec 1995	ASTM E 492: 1990	Test method for laboratory measurement of impact sound transmission through floor-ceiling assemblies using the tapping machine	Definitions
Amend 2 Dec 1995	ASTM E 989: 1989	Classification for determination of impact insulation class (IIC)	VM1 2.0.1
	International Standards Organisation		
	ISO 140/VII: 1978	Field measurements of impact sound insulation of floors	VM1 2.0.1

Definitions

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

Adequate *Adequate* to achieve the objectives of the *building code*.

Amenity An attribute of a *building* which contributes to the health, physical independence, and well being of the *building's* users but which is not associated with disease or a specific illness.

Building has the meaning ascribed to it by the Building Act 1991.

Building element Any structural and non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.

Fixture An article intended to remain permanently attached to and form part of a *building*.

Habitable space A space used for activities normally associated with domestic living, but excludes any bathroom, laundry, water-closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods.

Household unit means any *building* or group of *buildings*, or part of any *building* or group of *buildings*, used or intended to be used solely or principally for residential purposes and occupied or intended to be occupied exclusively as the home or residence of not more than one household; but does not include a hostel or boardinghouse or other specialised accommodation.

Impact insulation class (IIC) A single number rating derived from measured values of normalized impact sound pressure levels in accordance with Method of ASTM E 492, Annex A1, Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine. It provides an estimate of the impact sound insulating performance of a floor-ceiling assembly.

Sound transmission class (STC) A single number rating derived from measured values of transmission loss in accordance with classification ASTM E 413, Determination of Sound Transmission Class. It provides an estimate of the performance of a partition in certain common sound insulation situations.

Verification Method G6/VM1

1.0 Airborne Sound Insulation Field Tests

1.0.1 The performance for airborne sound insulation may be verified using the procedures detailed in ASTM E 336, and the field *sound transmission class* may be verified using the method described in ASTM E 413. Field test results shall be within 5dB of the performance requirement.

2.0 Impact Sound Insulation Field Tests

2.0.1 The performance for impact sound insulation may be verified using the procedures detailed in ISO 140: Part VII, and the field *impact insulation class* may be verified using the method described in ASTM E 989. Field test results shall be within 5dB of the performance requirement.

Acceptable Solution G6/AS1

1.0 Construction of Wall, Floor and Ceiling Assemblies

1.0.1 Sound transmission through *building elements,* shall be minimised by using one or more of the following *construction* techniques:

a) Physical separation of *building elements* comprising each face of any wall, floor or ceiling assembly which is common to two or more *occupied spaces*. Amend 2 Dec 1995

b) Use of noise control *building elements*.

c) Avoidance of rigid service connections (e.g. in plumbing) where the reticulation passes through noise control *building elements* separating different occupancies.

d) Making the noise control installation airtight by sealing all joints between *building elements*, and around penetrations and service fittings.

COMMENT:

1. Common walls should not be used for mounting *fixtures* and appliances which are likely to be a source of noise, e.g. telephones, TV sets, stereos, cupboards with doors, service switches.
2. Where the location of services in common walls and ceilings is unavoidable, they may require additional airborne and impact sound insulation in order that the *building element* achieves the performance.
3. Airtightness of common partition elements is important, as an unsealed air space can in some circumstances amplify, rather than reduce sound.

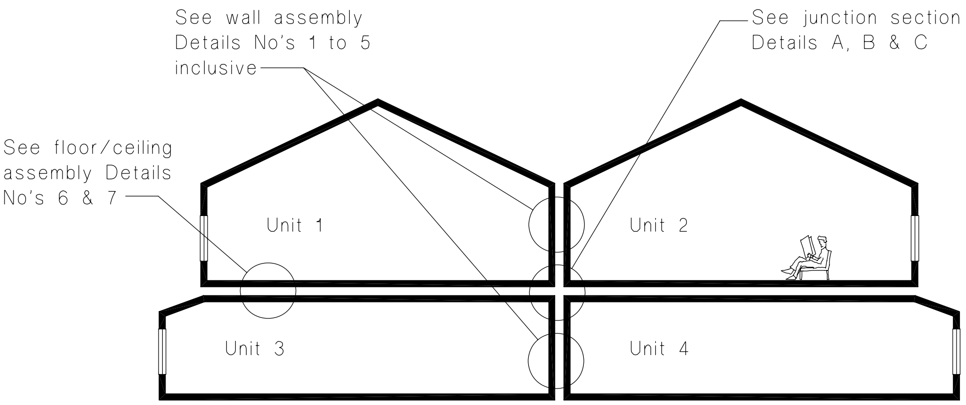
1.0.2 Figure 1 is a schematic presentation showing the *building elements* which require noise control between a *household unit* and the *habitable spaces* of an adjoining *household unit.* Amend 2 Dec 1995

1.0.3 *Building elements* constructed as shown in Figures 2 to 5 are an acceptable solution.

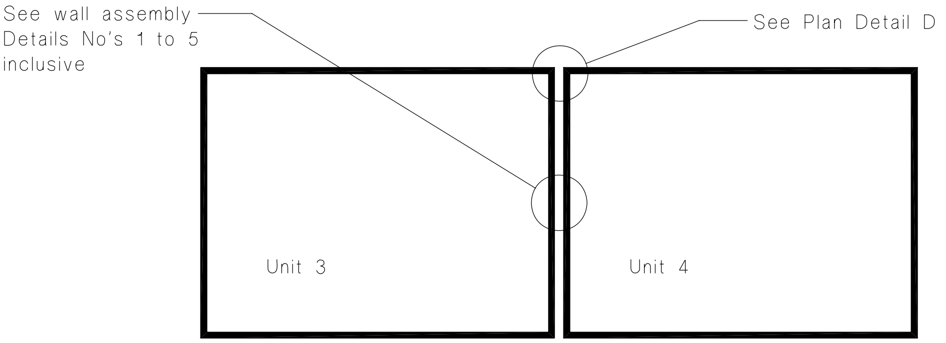
COMMENT:

1. Where carpet on underlay is shown in the figures, it is a requirement of the Acceptable Solution.
2. The glass fibre insulation shown in the figures has a density no less than 10 kg/m^3.

Figure 1: **Location of Building Elements Requiring Noise Control**
Paragraph 1.0.2



SCHEMATIC SECTION THROUGH FOUR UNITS

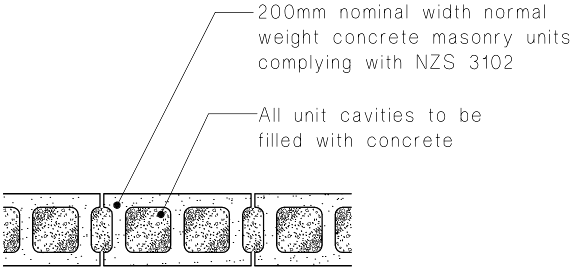


SCHEMATIC PLAN - TWO ADJACENT UNITS

Figure 2: Acceptable Wall Assemblies for Noise Control
Paragraph 1.0.3

Amend 1 Aug 1994

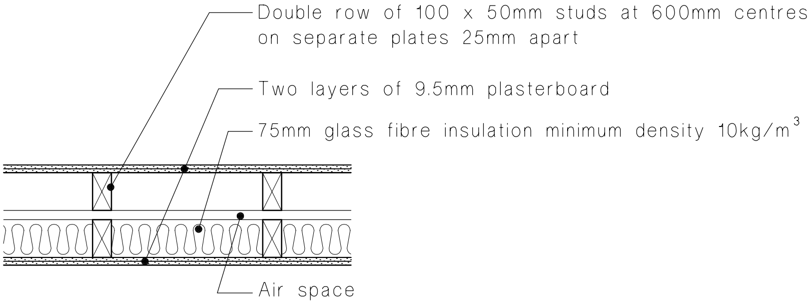
DETAIL 1
STC 55



Amend 2 Dec 1995

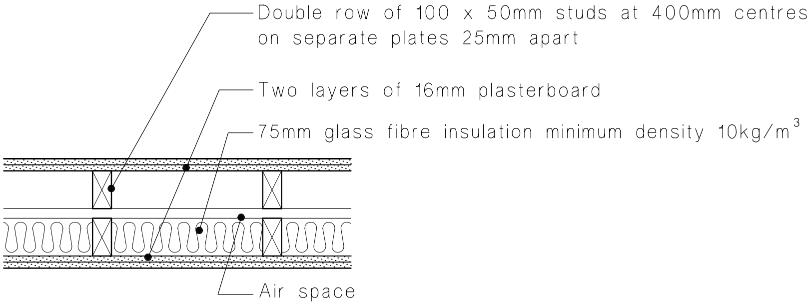
Amend 1 Aug 1994

DETAIL 2
STC 56



Amend 1 Aug 1994

DETAIL 3
STC 60



Amend 1 Aug 1994

DETAIL 4
STC 55

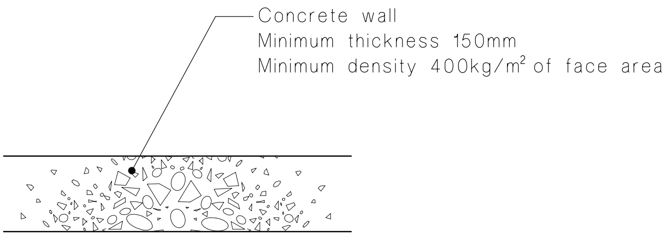
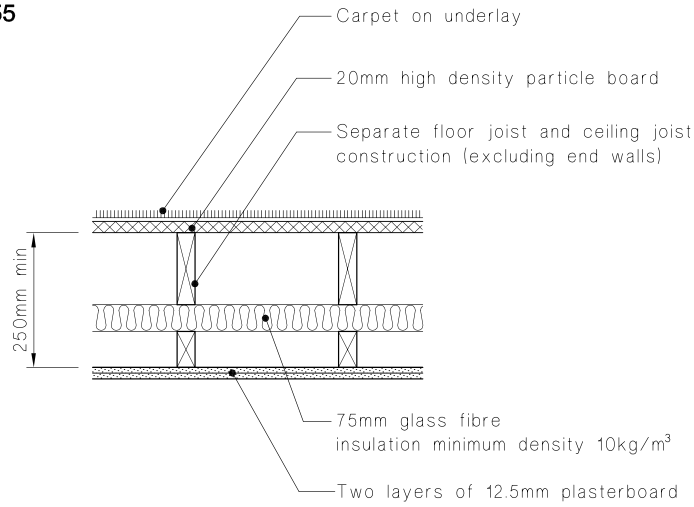


Figure 3: Acceptable Floor/Ceiling Assemblies for Noise Control
Paragraph 1.0.3

Amend 1 Aug 1994

DETAIL 5 STC 55
IIC 55



Amend 1 Aug 1994

DETAIL 6 STC 55
IIC 55

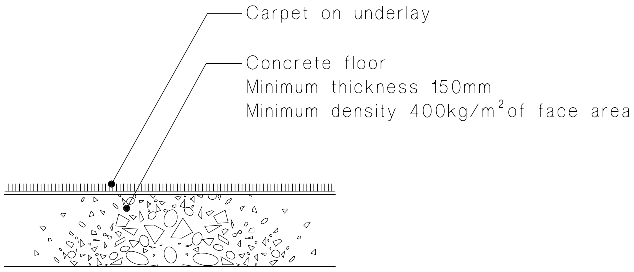


Figure 4: Acceptable Internal/External Wall Junction for Noise Control Between Two Units
Paragraph 1.0.3

PLAN DETAIL D

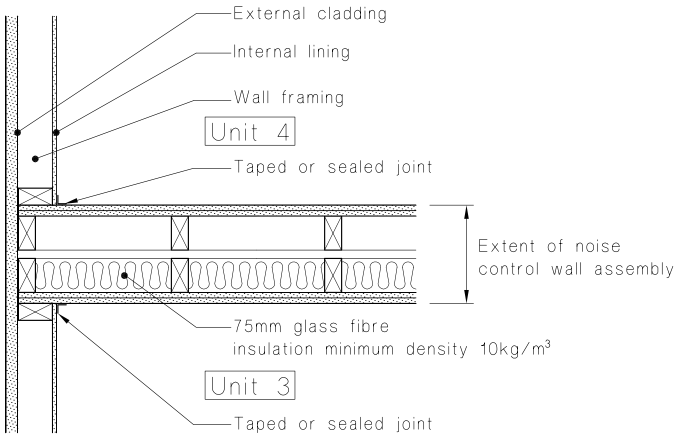
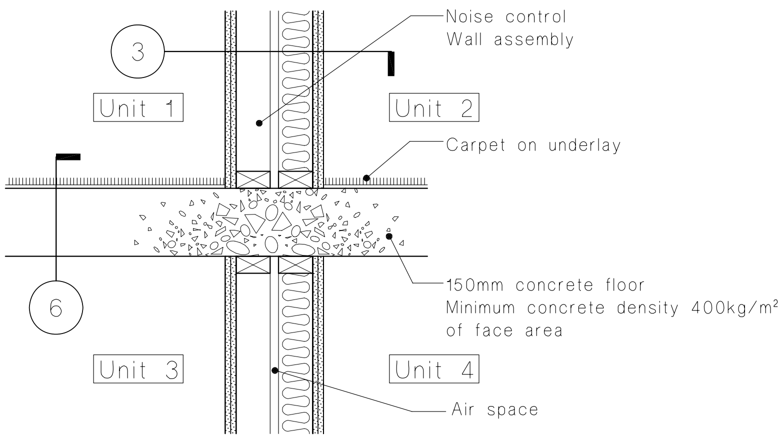


Figure 5: **Acceptable Floor/Wall Junctions for Noise Control Between Four Units**
Paragraph 1.0.3

Amend 2 Dec 1995

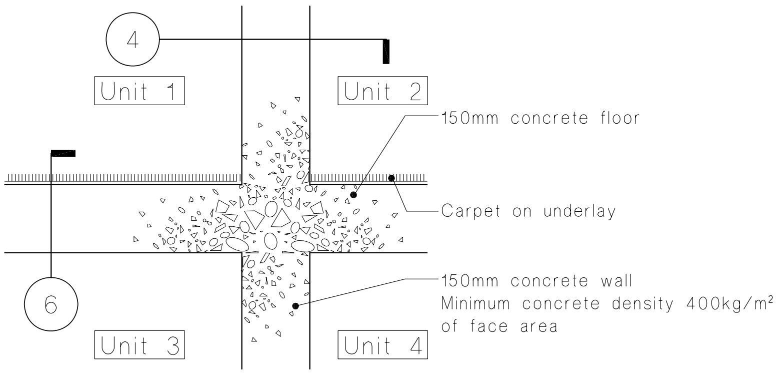
SECTION DETAIL A



Amend 2 Dec 1995

Amend 2 Dec 1995

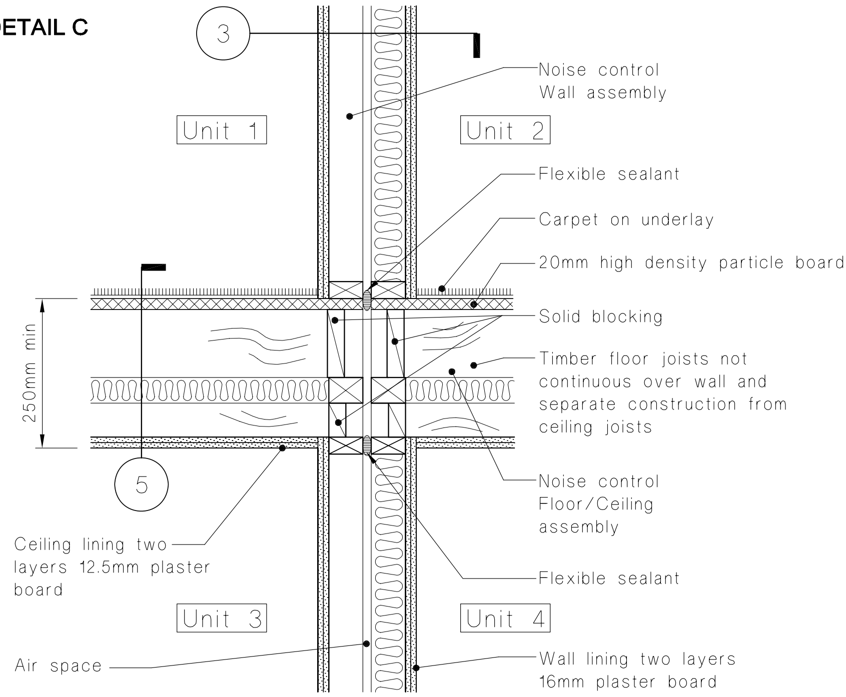
SECTION DETAIL B



Amend 2 Dec 1995

Amend 2 Dec 1995

SECTION DETAIL C



Amend 2 Dec 1995

Index G6/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Preface

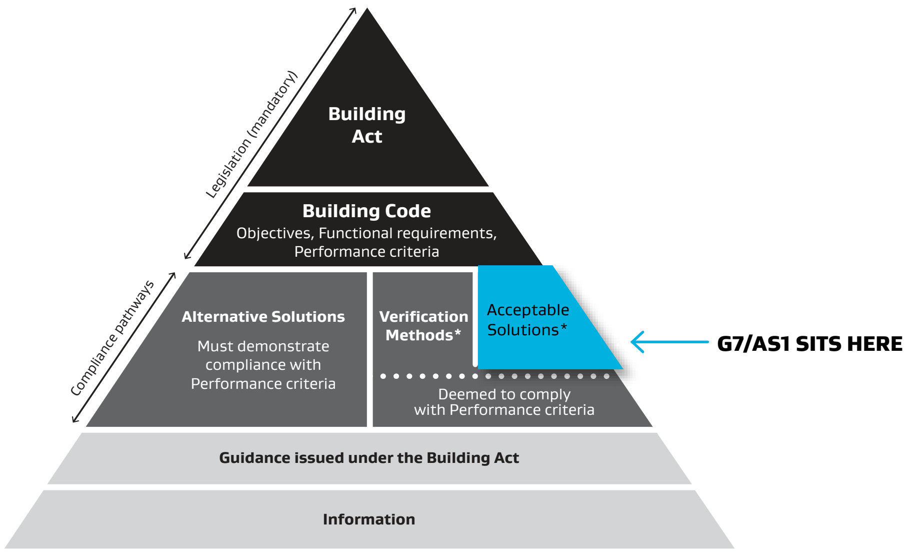
Document status

This document (G7/AS1) is an acceptable solution issued under section 22 (1) of the Building Act 2004 and is effective on 29 November 2021. It does not apply to building consent applications submitted before 29 November 2021. The previous Acceptable Solution G7/AS1 First Edition Amendment 2 can be used to show compliance until 2 November 2022 and can be used for building consent applications submitted before 3 November 2022.

Building Code regulatory system

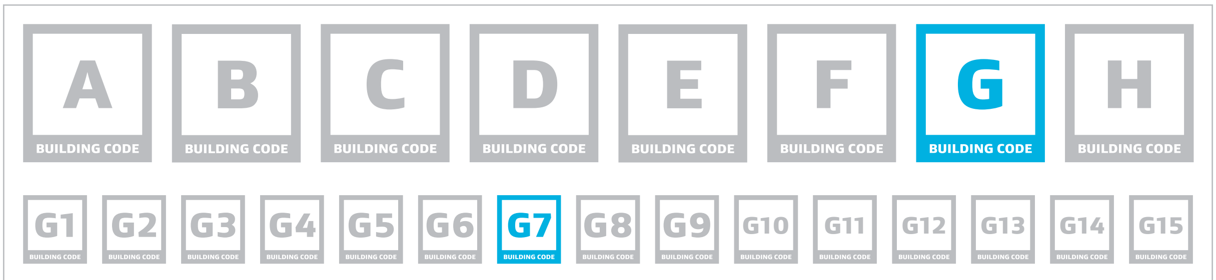
Each acceptable solution outlines the provisions of the Building Code that it relates to. Complying with an acceptable solution or verification method are ways of complying with that part of the Building Code. Other options for establishing compliance are listed in section 19 of the Building Act.

Schematic of the Building Code System



A building design must take into account all parts of the Building Code. The Building Code is located in Schedule 1 of the Building Regulations 1992 and available online at www.legislation.govt.nz.

The part of the Building Code that this acceptable solution relates to is clause G Services and facilities and specifically G7 Natural Light. Further information on the scope of this document is provided in Part 1. General.



Further information about the Building Code, the objectives, functional requirements and performance criteria provisions that it contains, and other acceptable solutions and verification methods are available at www.building.govt.nz.

Main changes in this version

This acceptable solution is the second edition of G7/AS1. The main changes from the previous version of G7/AS1 are:

- The scope of G7/AS1 has been reduced to cover only simple buildings up to 3 storeys in low density developments. Requirements applicable for simple and complex high rise buildings and apartments are available in Acceptable Solution G7/AS2 and Verification Method G7/VM1. To reflect the new scope of the documents and the new document layout, a new introduction and scope has been provided in Part 1. General.
- The scope of G7/AS1 has been reduced and is no longer applicable for awareness of the outside through another space. The applicable requirements can be found in Verification Method G7/VM1.
- Portions of text have been re-written to enhance clarity in the document and provide consistent language with other acceptable solutions and verification methods.
- The definitions page has been revised to include all defined terms used in this document in Appendix B.

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 acceptable solution or verification method at any time. Up-to-date versions of acceptable solutions and verification methods are available from www.building.govt.nz.

Features of this document

- For the purposes of Building Code compliance, the standards and documents referenced in this acceptable solution must be the editions, along with their specific amendments listed in Appendix A.
- Words in *italic* are defined at the end of this document in Appendix B.
- Hyperlinks are provided to cross-references within this document and to external websites and appear with a blue underline.
- Classified uses for buildings, as described in clause A1 of the Building Code, are printed in **bold** in this document.
- Appendices to this acceptable solution are part of, and have equal status to, the acceptable solution. Figures are informative only and the wording of the paragraphs takes precedence. Text boxes headed 'COMMENT' occur throughout this document and are for guidance purposes only.

Contents

Part 1. General

1.1 Introduction

1.1.1 Scope of this document

1.1.1.1 This acceptable solution applies to **housing**, old people's homes, and *early childhood centres*, up to 3 storeys that are:

a) Detached; or

b) Attached side by side multi-unit *buildings* including townhouses.

COMMENT: Old people's homes includes aged care facilities, rest homes and retirement complexes.

1.1.1.2 This acceptable solution applies to *habitable spaces* with external windows and simple façade designs that can be described by a *glazing-to-wall ratio (GWR)*.

1.1.1.3 For *buildings* that do not meet these requirements, refer to the Acceptable Solution G7/AS2 or Verification Method G7/VM1 as a means to demonstrate compliance or use an alternative means to demonstrate compliance.

1.1.2 Items outside the scope of this document

1.1.2.1 This acceptable solution does not include solutions for:

a) *habitable spaces* that rely on daylight borrowed from another space; or

b) *habitable spaces* that do not have at least one window in an *external wall*; or

c) *habitable spaces* that include non-standard features such as advanced daylight redirection systems, complex facades, top lighting strategies, internal divisions, internal obstructions, external shading devices or other specialized designs; or

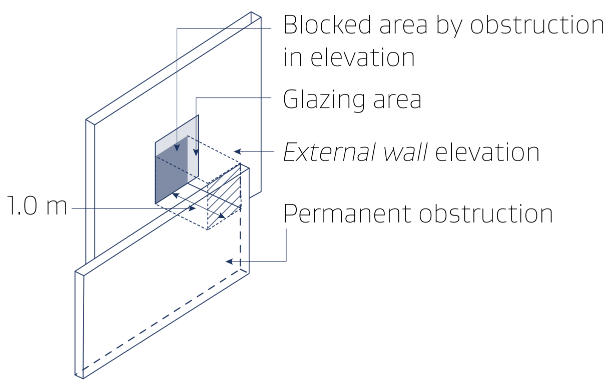
d) *habitable spaces* with floor-to-ceiling heights of more than 3.0 m; or

e) *habitable spaces* where more than 50% of the area of glazing are blocked by permanent external obstructions that are less than 1.0 m from the area of glazing (see Figure 1.1.2.1); or

f) *habitable spaces* where windows are facing a porch, a covered walkway, or are under a balcony.

FIGURE 1.1.2.1: Maximum permitted area blocked by obstruction

Paragraph 1.1.2.1



COMMENT: The distance between the obstruction and the glazing area is measured to the closest point of obstruction.

1.1.2.2 For *buildings* that have more complex configuration or internal rooms with borrowed light, Verification Method G7/VM1 or an alternative means may be used as a means to demonstrate compliance.

1.1.3 Compliance pathway

1.1.3.1 This acceptable solution provides a solution for demonstrating compliance with the performance criteria in Building Code clauses G7.3.1 and G7.3.2.

1.1.3.2 Options for demonstrating compliance with G7 Natural Light through the use of acceptable solutions and verification methods are summarised in Table 1.1.3.2**.** Compliance may also be demonstrated using an alternative solution.

TABLE 1.1.3.2: Demonstrating compliance with G7 Natural Light through acceptable solutions and verification methods

Paragraph 1.1.3.2

Performance clause	Applies to	Relevant acceptable solutions and verification methods
G7.3.1 *Illuminance* G7.3.2 Awareness of the outside environment	**Housing**, old people's homes, and *early childhood centres*	For simple *buildings* up to 3 storeys in low density developments without borrowed light: G7/AS1 For simple *buildings* in low, medium and high density developments (including higher rise *buildings* and apartments) without borrowed light: G7/AS2 For all *buildings* including complex higher rise *buildings*, apartments, and those with borrowed light: G7/VM1

1.2 Using this acceptable solution

1.2.1 Determining the classified use

1.2.1.1 Classified uses for *buildings* are described in clause A1 of the Building Code. Where a specific classified use is mentioned within a subheading and/or within the text of a paragraph, this requirement applies only to the specified classified use(s), and does not apply to other classified uses.

1.2.2 Determining the habitable space

1.2.2.1 For the purpose of determining the *habitable space* for compliance with Building Code clause G7 Natural Light; a *habitable space* is one used for activities normally associated with domestic living, but excludes any bathroom, laundry, water-closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods. The intent is to ensure occupants within *buildings* are able to have access to *adequate* natural light and to have an awareness of the outside to maintain their health and wellbeing.

Part 2. Illuminance

2.1 Illuminance of habitable spaces

2.1.1 Demonstrating compliance

2.1.1.1 For *habitable spaces* of **housing**, old people's homes, and *early childhood centres*, natural light shall provide an *illuminance* of no less than 30 lux at floor level for 75% of the *standard year*. This is demonstrated through the use of the simple calculation method described in Section 2.1.2.

2.1.2 Calculation of vertical windows in external walls

2.1.2.1 Vertical windows in *external walls* shall have:

a) An area of glazing of no less than 10% of the floor area, and

> COMMENT: An area of glazing of 10% of the floor area equates to approximately 33 lux at floor level for 75% of the *standard year*.

b) An area of glazing with a *visual light transmittance (VLT)* of no less than 70%, and

c) A head height of at least:

i) half the room width for windows on the same side or adjacent sides of a room (see Figure 2.1.2.1A), or

ii) one quarter the room width for windows on opposite sides of the room (see Figure 2.1.2.1B).

> COMMENT: Roof windows, skylights and/or clerestory windows could be added in excess of the required area of glazing.

2.1.2.2 High *reflectance* surfaces are required where:

a) Parts of the floor fall beyond the no-sky line (see Figure 2.1.2.2), and

b) where only the minimum area of glazing is provided (see Paragraph 2.1.2.1 a)).

2.1.2.3 Medium *reflectance* surfaces are acceptable in other cases with minimum areas of glazing.

2.1.2.4 *Reflectances* of interior surfaces shall meet the minimum requirements specified in Table 2.1.2.4.

2.1.2.5 For approximate *reflectance* of typical New Zealand *building* finishes, refer to Table 2.1.2.5.

FIGURE 2.1.2.1A: **Window head height for a window on one side or adjacent sides of a room**

Paragraph 2.1.2.1 c) i)

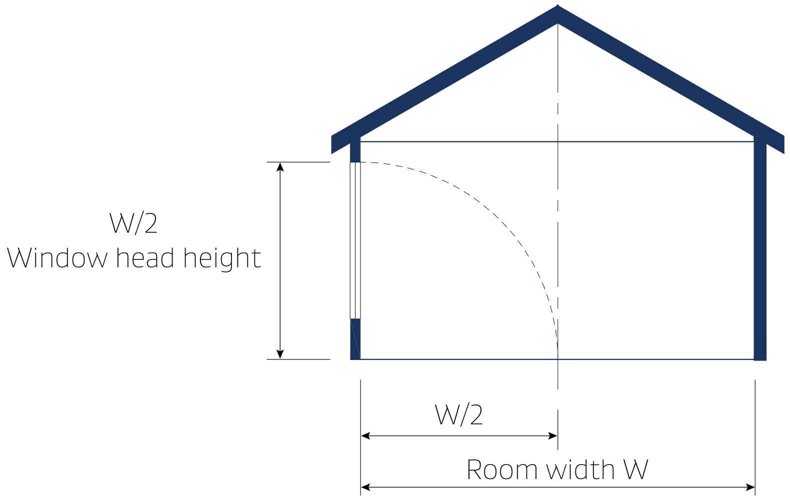
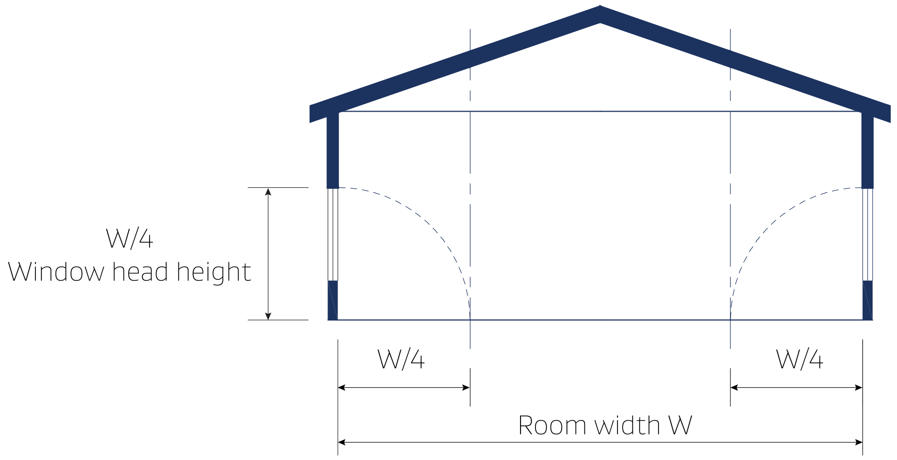


FIGURE 2.1.2.1B: **Window head heights for windows on opposite side of a room**

Paragraph 2.1.2.1 c) ii)



Illuminance

FIGURE 2.1.2.2: No-sky line condition

Paragraph 2.1.2.2 a)

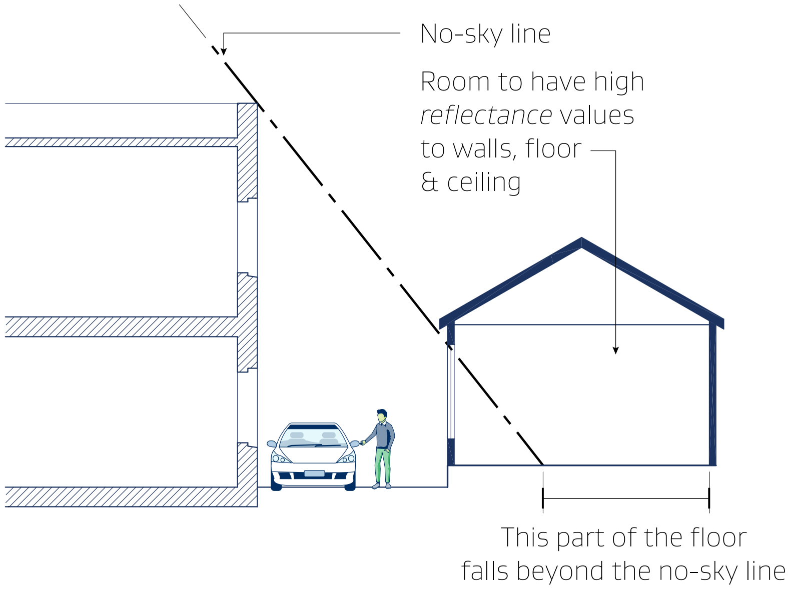


TABLE 2.1.2.4: Acceptable reflectance for interior surface finishes

Paragraph 2.1.2.4

Reflectance level required	Minimum surface reflectance		
	Ceilings	Walls [1]	Floor
Medium *reflectance*	0.7	0.4	0.2
High *reflectance*	0.7	0.6	0.4

Note:

(1) Does not include windows.

TABLE 2.1.2.5: **Approximate reflectance of typical New Zealand building finishes reproduced from NZS 6703**

Paragraph 2.1.2.5

Building finish	Approximate reflectance	Building finish	Approximate reflectance
White emulsion paint on plain plaster surface White glazed tiles	0.8	Fibre cement sheet Portland cement (smooth) Natural particle board	0.4
White emulsion paint on acoustic tile	0.7	Natural rimu (dressed) Varnished Pinus radiata(1)	0.3
White emulsion paint on no-fines concrete	0.6	Concrete (light grey) Portland cement (rough) Natural mahogany (dressed) Varnished particle board	0.25
Natural pine plywood	0.55	Varnished rimu (dressed)(1) Varnished mahogany (dressed)(1)	0.15
White emulsion paint on wood-wool slab	0.5		
Varnished pine plywood(1) Natural Pinus radiata	0.45	Quarry tiles: Red, heather brown	0.1

Note:

(1) Typical varnishing would be two coats of clear gloss polyurethane varnish.

Part 3. Awareness of the outside environment

3.1 Area of transparent glazing

3.1.1 Demonstrating compliance

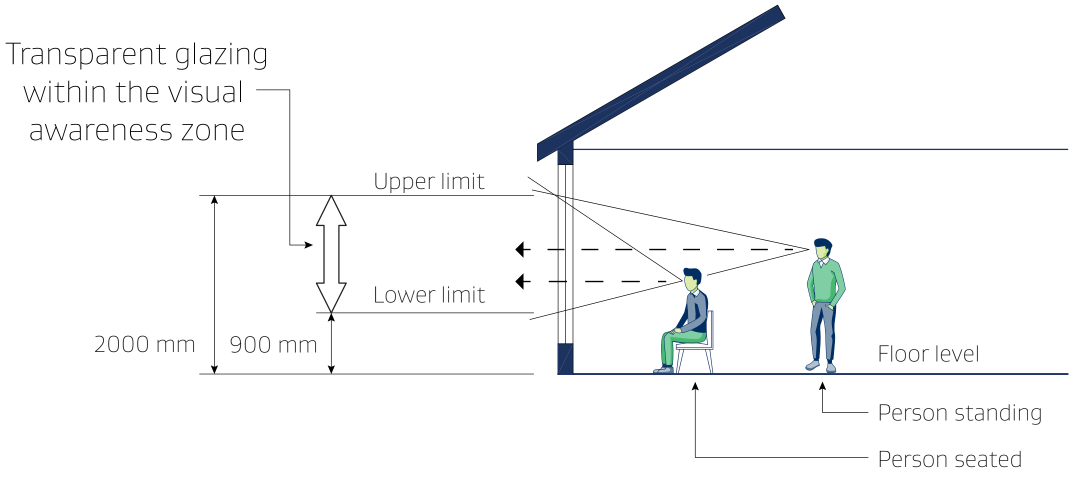
3.1.1.1 For *habitable spaces* of **housing**, old people's homes, and *early childhood centres*, openings to the outside shall have an area of transparent glazing suitable to give awareness of the outside. This is demonstrated through the use of a calculation method described in Subsection 3.1.2.

3.1.2 Calculation of the area of glazing

3.1.2.1 At least 50% of the area of glazing provided for natural light in *habitable spaces* shall be transparent glazing. The transparent glazing shall be located in the zone between the levels 900 mm and 2000 mm from floor level (see Figure 3.1.2.1).

FIGURE 3.1.2.1: Visual awareness zone

Paragraph 3.1.2.1



Appendix A. References

For purposes of compliance with the Building Code, the standard referenced in this acceptable solution must be the edition, along with the specific amendment, listed below.

Standards New Zealand		Where quoted
NZS 6703: 1984	Code of practise for interior lighting design Amend C1: 1985	Table 2.1.2.5

This standard can be accessed from www.standards.govt.nz

Appendix B. Definitions

These definitions are specific to this acceptable solution. Other defined terms found in italics within the definitions are provided in clause A2 of the Building Code.

Adequate	*Adequate* to achieve the objectives of the Building Code.
Building	Has the meaning given to it by sections 8 and 9 of the Building Act 2004.
Early childhood centre (ECC)	Premises used regularly for the education or care of three or more children (not being children of the persons providing the education or care, or children enrolled at a school being provided with education or care before or after school) under the age of six years old— a) by the day or part of a day; but b) not for any continuous period of more than seven days. *ECC* does not include home based early childhood services.
External wall	Any vertical exterior face of a *building* consisting of primary and/or secondary elements intended to provide protection against the outdoor environment.
Glazing-to-wall ratio (GWR)	The percentage of glazing, not including framing and mullions, relative to the area of the *external wall* containing the vertical window.
Habitable space	A space used for activities normally associated with domestic living, but excludes any bathroom, laundry, water-closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods.
Illuminance	The luminous flux falling onto unit area of surface (lumen/m^2).
Reflectance	The ratio of the flux reflected from a surface to the flux incident on it.
Standard year	For the purposes of determining natural lighting, the hours between 8 am and 5 pm each day with an allowance being made for daylight saving.
Visible light transmittance (VLT)	The ratio of luminous flux (light) passing through a translucent surface (e.g. glazing). It is expressed as a percentage of the flux incident upon the surface. A higher value means a greater percentage of visible light passes through the surface.

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington.
Telephone 0800 242 243
Fax 04 494 0290
Email: info@dbh.govt.nz

Verification Methods and Acceptable Solutions are available from www.dbh.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 2), 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 1) 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

G8: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	Effective from 1 July 2001 until 14 August 2014	p. 2, Document History, Status p. 9, Definitions	
Amendment 2	14 February 2014	p. 2A, Document History, Status p. 3, Code Clause G8	p. 7, References p. 9, Definitions

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

New Zealand Building Code Clause G8 Artificial Light

This Clause has been extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

CLAUSE G8—ARTIFICIAL LIGHT

Provisions	Limits on application
OBJECTIVE **G8.1** The objective of this provision is to safeguard people from injury due to lack of *adequate* lighting.	
FUNCTIONAL REQUIREMENT **G8.2** Spaces within *building*s used by people, shall be provided with *adequate* artificial lighting which, when activated in the absence of sufficient natural light, will enable safe movement.	Requirement G8.2 shall apply to: (a) All *exitway*s in *Multi-unit Dwellings*, *Group Dwellings* and *Communal Residential* [(except *backcountry huts*)], *Communal Non-residential, Commercial* and *Industrial buildings*, (b) All *access routes* except those in *Outbuildings* [, *backcountry huts*,] and Ancillary buildings, and (c) All common spaces within *Multi-unit Dwellings, Group Dwellings,* and *Communal Residential* [(except *backcountry huts*)] and *Communal Non-residential buildings*.
PERFORMANCE **G8.3** *Illuminance* at floor level shall be no less than 20 lux.	[Performance G8.3 does not apply during a failure of the main lighting, when the requirements in Clause F6 “Visibility in escape routes” apply.]

Updated 31 Oct 2008

Updated 31 Oct 2008

Updated 31 Oct 2008

Updated 21 Jun 2007

Contents

References

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

Amend 2 Feb 2014

		Where quoted
Standards Association of New Zealand		
NZS 6703: 1984	Code of practice for interior lighting design *Amend C1: 1985*	VM1 1.0.1

Amend 2 Feb 2014

Definitions

Amend 2 Feb 2014

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 1 Jul 2001

Illuminance The luminous flux falling onto a unit area of surface (lumen/m^2).

Amend 2 Feb 2014

Amend 1 Jul 2001

Reflectance The ratio of the flux reflected from a surface to the flux incident on it.

Verification Method G8/VM1

1.0 Illuminance

1.0.1 An acceptable verification method for the measurement of *illuminance* is contained in NZS 6703 Section 11.

1.0.2 Measurements shall be made on the horizontal plane at floor level. The measurements shall be made in areas unobstructed by objects likely to affect the reading. Obstructions, such as furniture shall be removed.

1.0.3 Measurements shall not be made within 500 mm of vertical surfaces. Minimum *illuminances* will generally occur furthest from the luminaire(s) and at least four measurements shall be made around each luminaire on two horizontal axes at right angles. If the layout of luminaires is symmetrical or the room is small and it is physically impossible to take the above measurements, the number of measurements may be reduced.

COMMENT:
The measurement of the minimum *illuminance* is necessary to check New Zealand Building Code compliance, or to reveal the need for maintenance or replacement in an existing installation.

1.0.4 Daylight or spill light from adjacent rooms shall be excluded, and lamps switched on and allowed to stabilize. In the case of fluorescent or discharge lighting this will be not less than 20 minutes.

1.0.5 Because accurate measurement is difficult, an installation shall be deemed to comply with the New Zealand Building Code, if the measured *illuminance* is no less than 18 lux.

Acceptable Solution G8/AS1

1.0 Illuminance

1.0.1 To provide a minimum *illuminance* of 20 lux, the total wattage required per m^2 of floor area is shown in Table 1.

1.0.2 As there can be wide variations in room dimensions, *reflectances* resulting from interior decoration, and floor coverings, rooms differing substantially from the examples given below, may require specific calculations.

COMMENT

Downlights and other luminaires with concentrated or narrow beam distribution, require particular care with spacing, if minimum *illuminance* criteria are to be met.

1.0.3 Refer to NZBC D1 "Access Routes", for stair tread visibility and minimum *illuminance* requirements.

Table 1: Lighting in Common Spaces Wattage Requirement (W/m^2)
Paragraph 1.0.1

Luminaire type	Space category		
	Corridors (note 3)	Stair and lift lobbies (note 4)	Places of assembly (note 5)
Incandescent (plastic shade)	12	10	6
Incandescent (general diffusing enclosure)	15	12	8
Fluorescent 36 W cool white (enclosed diffusing fitting)	7	4	2
Fluorescent compact single-ended 11-16 W (enclosed diffusing fitting)	8	5	–
Discharge 50 W high pressure sodium (enclosed diffusing fitting)	5	5	–
Incandescent reflector type downlights (120 W PAR 38 flood)	–	–	6
Mercury vapour downlight (80 W coated lamp)	–	–	2

Note:

1. The figures given are measurements from site tests and the wattages include the power required for control gear where it is part of the installation. Gaps in the table indicate the unavailability of a specific installation for testing.
2. The figures (W/m^2) are not suitable for situations where narrow beam downlights, or small numbers of high power luminaires are used.
3. Data is based on a corridor 3.0 m wide and longer than 15 m, with ceiling mounted luminaires 3.0 m above floor level.
   Reflectances:
   Ceiling 0.7
   Walls 0.5
   Floors 0.1
4. Data is based on a lobby area 7.0 m by 4.0 m with ceiling mounted luminaires 3.0 m above floor level.
   Reflectances:
   Ceilings 0.7
   Walls 0.5
   Floors 0.2
5. Data is based on an auditorium 16 m by 21 m with a ceiling height on 5.0 m.
   Reflectances:
   Ceiling 0.7
   Walls 0.5
   Floor 0.2

Index G8/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington.
Telephone 0800 242 243
Fax 04 494 0290
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 7), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 5 November 2020 and supersedes all previous versions of this document.

The previous version of this document (Amendment 6) will cease to have effect on 3 November 2021.

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.building.govt.nz

G9: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	September 1993	p. vi, References p. 1, 1.0.1	p. 3, 1.0.1 p. 4, Index
Amendment 2	1 December 1995	pp. i and ii, Document History p. vi, References	p. 1, 1.0.1
Amendment 3	1 July 2001	p. 2, Document History, Status p. 9, Definitions	
Amendment 4	23 June 2007	p. 2, Document History, Status p. 7, References p. 9, Definitions	p. 11 VM1 p. 13 AS1, 1.0.1, 2.0.1
Amendment 5	Published 30 June 2010 Effective from 30 September 2010 until 14 August 2014	p. 2, Document History, Status p. 3, Code Clause G9 p. 7, References	
Reprinted incorporating Amendments 1–5	30 September 2010		
Amendment 6	Effective from 14 February 2014 until 3 November 2021	p. 2A, Document History, Status p. 7, References	p. 9, Definitions
Amendment 7	Effective from 5 November 2020	p. 2A, Document History, Status p. 5, Contents p. 7, References	p. 11, VM1 1.0.1 p. 13, AS1 1.0.1, 2.0.1, 2.0.2 p. 15, Index

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

New Zealand Building Code Clause G9 Electricity

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE—*continued*

Clause G9—ELECTRICITY

Provisions	Limits on application
OBJECTIVE **G9.1** The objective of this provision is to ensure that: (a) In *buildings* supplied with electricity, the *electrical installation* has safeguards against outbreak of *fire* and personal injury, and	
(b) *People with disabilities* are able to carry out normal activities and processes within *buildings*.	Objective G9.1(b) shall apply only to those *buildings* to which section 47A of the Act applies.
FUNCTIONAL REQUIREMENT **G9.2** Where provided in a *building, electrical installations* shall be safe for their *intended use*.	
PERFORMANCE **G9.3.1** The *electrical installation* shall incorporate systems to: (a) protect people from contact with parts of the installation which are live during normal operation, and to prevent parts of the installation or other *building elements* becoming live during fault conditions, (b) permit the safe isolation of the installation and of electrical fittings and appliances, (c) safeguard people from excessive temperatures resulting from either normal operation of electrical equipment, or from currents which could exceed the installation rating, (d) safeguard people from injury which may result from electromechanical stress in electrical components caused by currents in excess of the installation rating,	

Amend 5 Sep 2010

See Note

NOTE:

Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

FIRST SCHEDULE—*continued*

Provisions	Limits on application
(e) Protect *building elements* from risk of ignition, impairment of their physical or mechanical properties, or function, due to temperature increases resulting from heat transfer or electric arc,	
(f) Operate safely in its intended environment, and	
(g) Safeguard against ignition of the surrounding atmosphere where it is potentially flammable or explosive.	
G9.3.2 An *electrical installation* supplying an *essential service* shall:	
(a) Maintain the supply for a time appropriate to that service, and	
(b) Be capable of being isolated from the supply system, independently of the remainder of the installation.	
G9.3.3 An *electrical installation* connected to an *electrical supply* system, shall contain safeguards which protect the safety features of the external supply.	
G9.3.4 In *buildings* intended for use by *people with disabilities*, light switches and plug socket outlets shall be *accessible* and usable.	Performance G9.3.4 shall not apply to Housing, *Outbuildings*, *Ancillary Buildings*, and to *Industrial Buildings* where no more than 10 people are employed.

Contents

Amend 7 Nov 2020

References

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

Amend 4 Jun 2007

Amend 6 Feb 2014

Amend 6 Feb 2014

		Where quoted
Publications by New Zealand Ministry of Economic Development		
NZECP 51: 2004	Homeowner/occupier's electrical wiring work in domestic installations	AS1 1.0.1
New Zealand Legislation		
Electricity (Safety) Regulations 2010		VM1 1.0.1, AS1 2.0.2

Amends 5, 6, 7

Amend 4 Jun 2007

Amend 7 Nov 2020

Amend 7 Nov 2020

Definitions

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 6 Feb 2014

Amend 4 Jun 2007

Accessible Having features to permit use by a *person with a disability.*

Building has the meaning ascribed to it by Sections 8 and 9 of the Building Act 2004.

Building element Any structural and non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.

Electrical installation Any electrical fixed appliances, and components used in the reticulation of electricity, which are intended to remain permanently attached to and form part of the *building*.

Electrical supply system The source of electricity external to the *electrical installation*.

Essential service In the context of an *electrical installation* means emergency lighting, firemen's lifts, alarms, water pumps, sprinklers, detectors, ventilation systems and public address systems necessary for the safety of people in *buildings*.

Intended use in relation to a *building*:

a) includes any or all of the following:

   i) Any reasonably foreseeable occasional other use that is not incompatible with the *intended use*; and

   ii) Normal maintenance; and

   iii) Activities taken in response to *fire* or any other reasonably foreseeable emergency

b) but does not include any other maintenance and repairs or rebuilding.

Amend 4 Jun 2007

Person with a disability means a *person* who has an impairment, or a combination of impairments, that limits the extent to which the person can engage in the activities, pursuits and processes of everyday life, including, without limitation, any of the following:

a) a physical, sensory, neurological, intellectual impairment or

b) a mental illness.

Amend 4 Jun 2007

Verification Method G9/VM1

1.0 Electrical Installations

Amend 7 Nov 2020

Amend 4 Jun 2007

1.0.1 Electrical installations within the scope of the Electricity (Safety) Regulations 2010, and that comply with the Electricity (Safety) Regulations 2010, will meet the performance criteria of NZBC Clause G9.

Acceptable Solution G9/AS1

1.0 Electrical Installations within Domestic Dwellings

Amend 4 Jun 2007

1.0.1 NZECP 51 is an Acceptable Solution for *electrical installations* within domestic dwellings.

Amend 1 Sep 1993

COMMENT:
Regulation 57 of the Electricity (Safety) Regulations 2010 allows owner-occupiers of domestic residential premises to, in certain situations, carry out prescribed electrical work on a *building* in accordance with NZECP 51. However NZECP 51 does not allow new electrical work to be livened. New electrical work undertaken by owner-occupiers must be inspected, tested and certified by a licensed electrical inspector, who will liven the work upon certification.

Amend 7 Nov 2020

2.0 Light Switches and Plug Sockets for use by a Person with a Disability

2.0.1 In *buildings* intended for use by *persons with disabilities*, light switches and *socket outlets* shall comply with the following requirements:

Amend 4 Jun 2007

a) All light switches shall be horizontally aligned with door handles at 900 – 1200 mm above finished floor level.

Amend 7 Nov 2020

b) The toggle, rocker, push pad, or push button control of light switches shall project clear of the switch plate.

COMMENT:
It is recommended that the width of any push pad or button be no less than 20 mm.

c) *Socket outlets* in *accessible* accommodation units shall be fixed between 500 mm and 1200 mm above the finished floor level and at least 500 mm from corners. At least one room light shall have a bedside switch.

d) For *accessible* accommodation, switches and socket outlets shall contrast visually with their surroundings.

Amend 4 Jun 2007

2.0.2 In situations where the location of the light switches and plug sockets conflict with the Electricity (Safety) Regulations 2010, the Electricity (Safety) Regulations 2010 shall take precedence.

Amend 7 Nov 2020

Index G9/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

Ministry of Business, Innovation & Employment

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 8), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 1 January 2017 and supersedes all previous versions of this document.

The previous version of this document (Amendment 7) will cease to have effect on 30 May 2017.

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.building.govt.nz

G10: Document History			
	Date	**Alterations**	
First published	July 1992		
Amendment 1	September 1993	pp. vi–vii, References p. 3, 1.0.1 p. 4, Table 1	p. 7, 2.0.1 b) p. 10, Index
Amendment 2	1 December 1995	pp. i and ii, Document History	p. vi–viii, References
Reprinted incorporating Amendments 1 & 2	April 1996		
Amendment 3	28 February 1998	p. ii, Document History p. vii, References	p. 8, 5.0.1
Amendment 4	23 June 2007	p. 2, Document History, Status p. 8, References p. 11, Definitions	p. 13, VM1 1.0.1 p. 20, AS1 5.0, 5.0.1 p. 21, Index
Amendment 5	Published 30 June 2010 Effective from 30 September 2010	p. 2, Document History, Status p. 5, Contents pp. 7–8, References	p. 15, G10/AS1 1.0.1 p. 16, G10/AS1 Table 1 p. 17, G10/AS1 1.3.1
Reprinted incorporating Amendments 3–5	30 September 2010		
Amendment 6	Effective from 10 October 2011 until 14 August 2014	p. 2, Document History, Status pp. 7–10, References	p. 16, G10/AS1 Table 1
Amendment 7	14 February 2014 until 30 May 2017	p. 2A, Document History, Status pp. 7–8, References p. 11 Definitions p. 13 G10/VM1 1.0.1	p. 15 G10/AS1 1.0.1 p. 16 G10/AS1 Table 1 p. 20 G10/AS1 5.0.1
Amendment 8	Effective 1 January 2017	pp. 7,8 References p. 20 G10/AS1 5.0.1	
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

New Zealand Building Code Clause G10 Piped Services

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE—*continued*

Clause G10—PIPED SERVICES

Provisions	Limits on application
OBJECTIVE	
G10.1 The objective of this provision is to safeguard people from injury or illness caused by extreme temperatures or *hazardous substances* associated with *building* services.	
FUNCTIONAL REQUIREMENT	
G10.2 In *buildings* provided with potentially *hazardous* services containing hot, cold, flammable, corrosive or toxic fluids, the installations shall be constructed to provide *adequate* safety for people	
PERFORMANCE	
G10.3.1 Piping systems shall be constructed to avoid the likelihood of: (a) Significant leakage or damage during normal or reasonably foreseeable abnormal conditions, (b) Detrimental contamination of the contents by other substances, (c) Adverse interaction between services, or between piping and electrical systems, and (d) People having contact with pipes which could cause them harm.	
G10.3.2 Provision shall be made for the ready removal of moisture or condensate in gas pipes.	
G10.3.3 Pipes shall be protected against corrosion in the environment of their use	
G10.3.4 Piping systems shall be identified with markings if the contents are not readily apparent from the location or associated equipment.	

FIRST SCHEDULE—*continued*

Provisions	Limits on application
G10.3.5 Enclosed spaces shall be constructed to avoid the likelihood of accumulating vented or leaking gas.	
G10.3.6 Piped systems shall have isolation devices which permit the installation or individual items of apparatus to be isolated from the supply system, for maintenance, testing, fault detection and repair.	

Contents

References

Amend 7 Feb 2014

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 6 Oct 2011

Amend 7 Feb 2014

		Where quoted
Standards New Zealand		
NZS/BS 21: 1985	Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions) *Amend: 1*	AS1 Table 1
NZS/BS 1387: 1985	Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or screwing to BS 21 pipe threads. *Amend: 1*	AS1 Table 1
NZS 3501: 1976	Specification for copper tubes for water, gas, and sanitation *Amends: 1, 2, 3*	AS1 Table 1
NZS/BS 3601: 1987 (1993)	Specification for carbon steel pipes and tubes with specified room temperature properties for pressure purposes	AS1 Table 1

Amend 5 Sep 2010

Amends 6 and 7

Amend 8 Jan 2017

Amend 2 Dec 1995

Amend 5 Sep 2010

Amend 6 Oct 2011

Amend 7 Feb 2014

Amend 2 Dec 1995

			Where quoted	
Amends 5 and 7	NZS 4219: 2009	Seismic performance of engineering systems in buildings	AS1 1.0.1 a)	
Amend 5 Sep 2010	AS/NZS 4331 Part 1: 1995 Part 2: 1995	Metallic flanges Steel flanges Cast iron flanges	AS1 Table 1	
Amends 4, 5, 7, 8	AS/NZS 5601: 2013 Part 1:	Gas installations General installations *Amends: 1, 2*	VM1 1.0.1, AS1 5.0.1	Amend 2 Dec 1995 Amends 1 and 3
	NZS 5807:-	Code of practice for industrial identification by colour, wording or other coding		
Amend 6 Oct 2011	Part 2: 1980	Identification of contents of piping, conduit and ducts *Amend: 1, 2*	AS1 1.0.1	Amend 1 Sep 1993
	NZS 7646: 1978	Specification for polyethylene pipes and fittings for gas reticulation	AS1 Table 1	
	British Standards Institution			
Amend 6 Oct 2011	BS 10: 2009	Specification for flanges and bolting for pipe, valves and fittings	AS1 Table 1	
	BS 143 and 1256: 2000	Specification for malleable cast iron and cast copper alloy threaded pipe fittings *Amend: 1, 2, 3, 4*	AS1 Table 1	
Amend 5 Sep 2010	BS EN 1044:1999	Brazing. Filler metals	AS1 Table 1	
	BS EN 10253-3: 2007	Butt-welding pipe fittings – non-alloy and ferric alloy steels with specific inspection requirements.	AS1 Table 1	
Amend 6 Oct 2011	BS EN 10253-3: 2008	Butt-welding pipe fittings – wrought austenitic and austenitic-ferritic (duplex) stainless steels without specific inspection requirements.	AS1 Table 1	Amend 1 Sep 1993
Amend 5 Sep 2010	BS 2971: 1991	Specification for Class II arc welding of carbon steel pipework for carrying fluids	AS1 1.3.1 a), Table 1	
	BS 3799: 1974 (1994)	Specification for steel pipe fittings, screwed and socket-welding for the petroleum industry	AS1 Table 1	Amend 2 Dec 1995
	BS EN 10241: 2000	Steel threaded pipe fittings	AS1 Table 1	
Amend 5 Sep 2010	BS EN 14324:2004	Brazing. Guidance on the application of brazed joints	AS1 Table 1	

		Where quoted
Standards Association of Australia		
AS D26: 1972	Tube fittings with dryseal American standard taper pipe and unified threads for automotive and industrial use	AS1 Table 1
AS 1167:-	Welding and brazing – Filler metals	
Part 1: 2005	Filler metal for brazing and braze welding	AS1 Table 1 Amend 2 Dec 1995
AS 1432: 2004	Copper tubes for plumbing, gasfitting and drainage applications	AS1 Table 1
Amend 5 Sep 2010 AS 3688: 2005	Water supply – Copper and copper alloy compression and capillary fittings and threaded connectors *Amend: 1* (Amend 6 Oct 2011)	AS1 Table 1 Amend 2 Dec 1995
American Society for Testing and Materials		
ASTM		
A53-90	Specification for pipe, steel, black and hot-dipped, zinc-coated welded and seamless	AS1 Table 1
A106-91	Specification for seamless carbon steel pipe for high temperature service	AS1 Table 1
American National Standards Institute and American Society of Mechanical Engineers		
ANSI/ASME		
B16.1-1989	Cast iron pipe flanges and flanged fittings, Class 25, 125, 250 and 800	AS1 Table 1
B16.3-1985	Malleable-iron threaded fittings, Classes 150 and 300	AS1 Table 1
B16.5-1988	Pipe flanges and flanged fittings, steel-nickel alloy and other special alloys	AS1 Table 1
B16.9-1990	Factory-made wrought steel butt-welding fittings	AS1 Table 1
ANSI		
B16.11-1980	Forged steel fittings, socket-welding and threaded	AS1 Table 1
American Petroleum Institute		
API SPEC 5L-1991	Specification for line pipeAS1 Table 1	
API STD 1104-1988	Welding of pipelines and related facilities	AS1 1.3.1 b), Table 1

Definitions

Amend 4 Jun 2007

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 7 Feb 2014

Adequate *Adequate* to achieve the objectives of the *building code.*

Amend 4 Jun 2007

Building has the meaning ascribed to it by Sections 8 and 9 of the Building Act 2004.

Hazardous Creating an unreasonable risk to people of bodily injury or deterioration of health.

Intended use in relation to a *building*:

a) includes any or all of the following:

   i) Any reasonably foreseeable occasional other use that is not incompatible with the *intended use*; and

   ii) Normal maintenance; and

   iii) Activities taken in response to *fire* or any other reasonably foreseeable emergency

b) but does not include any other maintenance and repairs or rebuilding.

Amend 4 Jun 2007

Regulator A device which automatically regulates the pressure or volume of gas passing through it to a predetermined level.

Safety shut-off system An arrangement of valves and associated control systems which shuts off the supply of gas when required by a device which senses an unsafe condition.

Tailpipe A device placed at the low point of a gas piping system to collect condensate, and from which the condensate may be removed.

Vent line A pipe or tube which conveys gas to a safe place outside the *building* from a gas pressure *regulator* relief valve.

Verification Method G10/VM1

1.0 Soundness Testing

Amend 7 Feb 2014

1.0.1 AS/NZS 5601.1 Appendix E describes acceptable test methods to establish that piping systems will withstand a forseeable pressure without significant leakage.

Acceptable Solution G10/AS1

It is intended that the New Zealand Building Code will in due course provide acceptable solutions for piping a range of fluids and solids. This acceptable solution is restricted to the reticulation of gas (typically natural or *town gas*), used as an energy source.

For water supply piping, an acceptable solution is given in G12/AS1.

Piping for Gas used as an Energy Source

1.0 Pipework Construction

1.0.1 Pipework installed in *buildings* shall:

Amend 5 Sep 2010
Amend 7 Feb 2014

a) Be designed in accordance with B1/VM1, Paragraphs 2.0 and 13.0,

b) Use materials and jointing techniques complying with Table 1,

c) Have no plain nipples, square back elbows or long screws, and

d) Have metal (including spirally wound metal) gaskets with a minimum melting point of 500°C.

Amend 1 Sep 1993

COMMENT:
Pipework can be identified using the marking conventions given by NZS 5807.

1.1 Drainage and cleaning provisions

1.1.1 Where condensates can form in a pipeline, they shall be removed by grading the pipe with a fall of 4 mm per metre towards a *tailpipe* (drip), located at the piping low point nearest the outlet side of the meter.

1.1.2 If this is impractical, a single *tailpipe* may be provided at the lowest point in the pipeline, which shall have a fall to that point.

1.1.3 Tailpipes

Tailpipes shall be:

a) Constructed to provide:

i) ready access for cleaning and draining,

ii) a trap which on filling will shut off the flow of gas before the condensate can run back to the meter, and

iii) protection from frost,

b) Of sufficient capacity for:

i) the pipes draining into them, and

ii) the amount of condensate likely to occur, and

c) Installed with a suitable control fitting and plug to allow removal of condensate if the *tailpipe* is below ground.

1.2 Pipework installation

1.2.1 A pipework installation shall have:

a) Pipes supported in accordance with Table 2,

b) Pipes separated (by at least 25 mm) from any metallic electrical conduit, or metal armoured or metal sheathed electrical wire,

c) Pipe risers which are:

i) supported by anchors and attachments which are capable of supporting the total weight of the riser and allow for differential expansion,

ii) sleeved through floors,

iii) not jointed at sleeve locations, and

d) Pipe bends and offsets which:

i) are constructed without buckling, cracks, or physical damage, and

ii) give at least the gas-carrying capacity of a standard fitting, and

e) No piping laid on the ground.

Amend 1 Sep 1993

Table 1: Acceptable Standards for Piping Systems
Paragraph 1.0.1 b)

Amend 5 Sep 2010 · Amend 5 Sep 2010 · Amend 5 Sep 2010 · Amend 6 Oct 2011 · Amend 5 Sep 2010 · Amends 5 and 7 · Amend 5 Sep 2010 · Amend 1 Sep 1993

Material	Acceptable piping	Acceptable fittings	Acceptable jointing	Special conditions
Steel	Steel pipe to NZS/BS 1387, NZS/BS 3601, ASTM A53, ASTM A106 or API 5L.	Screwed pipe fittings, malleable cast iron to BS 143 and 1256 or ANSI B16.3. Wrought steel to BS EN 10241, or ANSI B16.11. Socket-welding pipe fittings, sockets to NZS/BS 3799 or ANSI B16.11. Butt-welding fittings to BS EN 10253-2, BS EN 10253-3 or ANSI B16.9. Flanges to BS 10, AS/NZS 4331 ANSI B16.1 and B16.5.	Screwing/socketing to NZS/BS 21. Welding to BS 2971 or API 1104.	1. Black pipe: i) is not permitted below ground unless protected. (Galvanising is not sufficient protection.) ii) is not permitted with wet gas. iii) shall be painted or suitably coated when installed above ground. 2. All joints in locations below ground shall be externally protected against corrosion. 3. Welding shall be by welders certified in accordance with API 1104. 4. Flanged joints may only be used when other jointing methods are impracticable.
Copper	Copper tube to NZS 3501 or AS 1432.	Copper tube expanded with proper forming tools to provide capillary tolerances. Copper and copper alloy capillary fittings to AS 3688. Copper alloy compression fittings to AS 3688 or AS D26.	Brazing in accordance with BS EN 14324 using copper-phosphorous brazing alloy to AS 1167-1 or BS EN 1044, with a nominal silver content of not less than 5% and a melting point in excess of 550°C. Flares formed with proprietary flaring tools.	1. Not for installation below ground, unless in protective ducting.
Plastic	Polyethylene to NZS 7646.	Fittings to NZS 7646.		Below ground use only.

Table 2: Pipe Supports
Paragraph 1.2.1 a)

Nominal pipe size (nominal bore of steel or nominal outside diameter of copper) (mm)		**Horizontal run support spacing** (m)		**Vertical run support spacing** (m)	**Minimum rod diameter for single rod hangers** (mm)
STEEL	COPPER	STEEL	COPPER		
8		2	-		10
10	10	2	1		10
15	15	1.5			10
-	18	-	1.5		10
20	20	2.5	2	At each floor level	10
25	25	2.5	2	but in any case not	10
32	32	3	2	more than 3.0 m	10
40	40	3	2.5		10
50	50	3	3		10
65	65	3	3		16
80	80	4	3		16
100	100	4	3		16

1.3 Welded joints

1.3.1 Welded joints shall comply with the tests and procedures given in:

Amend 5 Sep 2010

a) BS 2971 for pressures up to 420 kPa, or

b) API 1104 for pressures over 420 kPa.

1.4 Concealed piping

1.4.1 In concrete

Piping installed in concrete shall:

a) For steel pipes, have a concrete cover of:

75 mm when concrete is cast against the ground,

50 mm when concrete is exposed to the weather, or

35 mm when concrete is indoors, and

b) Have pipes other than steel, sleeved to allow for expansion, and

c) Have protection (such as wrapping) from corrosion provided at points of entry and exit from the concrete.

COMMENT:
It is recommended that where practicable, such as in industrial construction, pipes be laid in covered floor channels and be protected against corrosion if necessary.

1.4.2 In enclosed spaces

Piping installed in enclosed spaces shall:

a) Not be located in lift wells, air ducts, plenum ceilings, air handling plenums, clothes chutes, rubbish chutes, ventilating ducts, fire hydrant cupboards or fire isolated stairways,

b) In under floor spaces have:

i) pipes suspended clear of the ground by a minimum of 100 mm, and

ii) enclosed spaces ventilated in accordance with E2/AS1,

c) In unventilated and/or inaccessible spaces be installed without joints, and

d) Where joints are unavoidable, have the joint inspected, tested and proved sound before the pipework is concealed.

1.4.3 Underground

Underground pipes shall be:

a) Sleeved and sealed where they penetrate foundation walls,

COMMENT:
The pipes are sleeved and sealed to prevent gas leakage to the *building*, and damage to the pipe resulting from differential settlement.

b) Sufficiently buried to protect the piping from physical damage, and have a minimum cover in accordance with Table 3, and

c) Bedded on firm compacted ground so that:

i) pipes are supported along their entire length and are not resting on collars and flanges, and

ii) bedding material and backfill within 75 mm of the pipe is free of stones.

COMMENT:
It is recommended that where practicable, such as in industrial construction, pipes be laid in covered floor channels, and be protected against corrosion if necessary.

1.5 Pipework in ducts

1.5.1 False ceiling spaces and void spaces within cavity and partition walls containing pipework, shall be constructed as ventilated ducts.

COMMENT:
Such ventilation should be installed in a way that does not compromise any other New Zealand Building Code requirements such as resistance to the spread of fire, or sound transmission.

Table 3: Piping Cover
Paragraph 1.4.3 b)

Low and medium pressure	Under lawns, paths and gardens	300 mm
	Under roadways and driveways	450 mm
Intermediate pressure	Under lawns, paths and gardens	450 mm
	Under roadways and driveways	600 mm

1.5.2 Pipes fitted in horizontal ducts which have open grille type covers, shall be treated as above-ground pipes.

1.5.3 Ventilated ducts

Piping shall be permitted in ventilated ducts when:

a) False ceilings and void spaces within cavity walls are specifically designed and purpose-built as ventilated ducts,

b) The enclosing walls of the duct are not penetrated by pipes of greater than 150 mm nominal bore,

c) Wall penetrations by pipes of 150 mm or less nominal bore are:

i) the minimum necessary to accommodate the pipe, and

ii) the opening is fire-stopped, and

d) The duct has through-flow ventilation by providing a minimum of one opening at each end of the duct or isolated section of the duct. (For horizontal ducts acceptable openings are located at high and low levels),

e) A minimum free ventilation opening of 1/150 of the cross-sectional area of the duct or 50,000 mm^2 whichever is the greater, is provided, and

f) Pipes within horizontal ducts are located near the bottom of the duct.

1.5.4 Unventilated ducts

The installation of pipes in unventilated ducts should be avoided, but when it is necessary for a pipe to pass through an unventilated duct or void, either:

a) The pipes shall be continuously sleeved with the sleeve ventilated at one or both ends into a ventilated space, or

b) The duct void shall be filled with dry, washed sand.

COMMENT:
Dry, washed sand is acceptable because it is inert, non-combustible and non-corrosive.

2.0 Isolating Valves

2.0.1 Gas piping isolating valves shall:

a) For emergency shut-down of commercial and industrial installations, have their location clearly identified on a drawing permanently and prominently displayed near the primary meter set.

Amend 1 Sep 1993

b) For appliances, be of the 1/4 turn type with the handle marked to indicate the direction of gas flow.

c) For domestic and light commercial installations, be provided in an accessible location outside the *building.*

2.0.2 To satisfy Paragraph 2.0.1 b), the meter inlet-valve may be used as an isolating valve in accordance with the requirements of the gas supply authority.

3.0 Corrosion Control

3.0.1 Acceptable solutions for the control of pipework corrosion shall provide for:

a) The installation of a joint which is electrically non-conducting, where a pipe rises above ground,

b) The separation of electrochemically incompatible materials in underground locations, by joining with insulated components, and

c) The painting of black steel pipe as soon as practicable after installation unless it is protected with anti-corrosive wrapping.

4.0 Vent Lines

4.0.1 *Vent lines* shall:

a) Be fitted to all vented *safety shut-off systems*, gas pressure relief devices, and breather vents, installed within a *building*,

b) Have the vent pipe discharge point located no closer than:

  i) 1.0 m in any direction from an opening into a *building*, and

  ii) 2.0 m from any source of ignition, and

c) Have *vent line* diameters complying with:

  i) Table 4 for ventilators, or

  ii) Table 5 for a vented *safety shut-off system*, and

d) Have no *vent lines* of different types interconnected,

e) Have no breather vent connected to a safety system shut-off vent,

f) Have *vent lines* from the same appliance interconnected for:

  i) safety shut-off *vent lines*, and

  ii) breather *vent lines*, and

g) Have common *vent lines* with a cross-sectional area equal to or greater than the sum of the cross-sectional areas of the two largest *vent lines* being interconnected, and

h) Have the *vent line* extended to the outside of the *building* and terminating in a breather vent.

Table 4: Diameters of Vent Lines for Ventilators
Paragraph 4.0.1 c) i)

Length of vent line	Minimum diameter
Less than 10 m	No less than the diameter of the vent connection.
10-30 m	One standard pipe diameter above that of the vent connection.
More than 30 m	Sufficient to prevent excessive back pressure taking into account the effect of *regulator*, inlet pressure, *vent line* flow resistance and the capacity of the *regulator* air relief device.

4.0.2 Breather vents may be vented within a room or enclosure if the diameter of the vent outlet does not exceed the value 'd' given by the formula:

$d = [(0.6 \times V)/P^{0.5}]^{0.5}$

or if the volume of the room exceeds the value of 'V' given by the formula:

$V = 7.72\ d^2\ P^{0.5}$

where:

d = breather vent orifice diameter (mm).

P = inlet pressure to the vented device (kPa).

V = volume of the room or enclosure housing the *regulator* (m^3).

5.0 Another Acceptable Solution

5.0.1 AS/NZS 5601.1 Sections 1, 3, 4, 5 and 6 and Appendices A - M and O – R is another Acceptable Solution.

Amend 4 Jun 2007
Amend 8 Jan 2017
Amends 3, and 7

Table 5: Vent Line Diameters and Lengths for Vented Safety Shut-off Systems
Paragraph 4.0.1 c) ii)

Minimum nominal diameter of vent valve	Vent pipe length in metres							
	Nominal diameter of vent line (mm)							
(mm)	15	20	25	32	40	50	65	80
6	60	160	400					
8	30	80	200					
10	15	40	100					
15	8	20	50					
20		10	25	64				
25			13	32	80			
32				16	40	100		
40					20	50	130	
50						25	65	160

Index G10/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Gas reticulation

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 6), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 1 January 2017 and supersedes all previous versions of this document.

The previous version of this document (Amendment 5) will cease to have effect on 30 May 2017.

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.building.govt.nz

G11: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	September 1993	p. vi, References	
Reprinted incorporating Amendment 1	October 1994		
Amendment 2	28 February 1998	pp. i and ii, Document History p. vi, References p. 3, 1.2.2	p. 4, 5.0.1 p. 5, 9.0.1
Amendment 3	23 June 2007	p. 2, Document History, Status p. 5, Contents p. 7, References p. 9, Definitions	p. 13, 1.2.1, 1.3, 1.4 p. 14, 5.0.1 p. 15, 9.0, 9.0.1 p. 17, Index
Amendment 4	Published 30 June 2010 Effective from 30 September 2010 until 14 February 2014	p. 2, Document History, Status p. 5, Contents p. 7, References	
Reprinted incorporating Amendments 1–4	30 September 2010		
Amendment 5	14 February 2014 until 30 May 2017	p. 2A, Document History, Status p. 7, References p. 9 Definitions	pp. 13, 14, 15, G11/AS1 1.2.2, 1.3.2, 5.0.1, 8.0.1, 9.0.1
Amend 6	Effective 1 January 2017	p. 7 References p. 15 G11/AS1 9.0.1	

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

New Zealand Building Code Clause G11 Gas as an Energy Source

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE—*continued*

Clause G11—GAS AS AN ENERGY SOURCE

Provisions	Limits on application
OBJECTIVE	
G11.1 The objective of this provision is to:	
(a) Safeguard people from injury arising from the use of gas as an energy source,	
(b) Safeguard people and *other property* from the risk of *fire* or explosion, and	
(c) Safeguard people from loss of *amenity* due to the gas supply being inadequate for the *intended use*.	
FUNCTIONAL REQUIREMENT	
G11.2 *In buildings* where gas is used as an energy source, the supply system shall be safe and *adequate* for its *intended use*.	
PERFORMANCE	
G11.3.1 Supply systems shall be constructed to maintain a safe pressure range appropriate to the appliances and the type of gas used.	
G11.3.2 The gas supply to all appliances in a single ventilated space, shall be fitted with an automatic cut-off activated by failure of any continuous forced ventilation system used for combustion, ventilation or safe operation of a fixed gas appliance.	
G11.3.3 A flued fixed gas appliance shall have no adverse interaction with any other flued appliance.	
G11.3.4 Supply systems shall have isolation devices which permit the whole installation, or individual items of apparatus, to be isolated from the supply for maintenance, testing, fault detection or repair.	

FIRST SCHEDULE—*continued*

Provisions	Limits on application
G11.3.5 Where gas is supplied from an external source, the supply system within *buildings* shall be constructed to avoid the likelihood of: (a) Contamination of the external supply from other gas sources within the *building*, (b) Adverse effects on the pressure of the external supply, and (c) The external supply pipe acting as an earthing conductor.	
G11.3.6 The location and installation of meters and service risers shall meet the requirements of the *network utility operator*.	

Contents

References

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

Amend 5 Feb 2014

Amend 3 Jun 2007

Amend 5 Feb 2014

	Where quoted
Standards New Zealand	
AS/NZS 5601: 2013 Gas installations Part 1 General installations *Amends: 1, 2*	AS1 1.2.2, 1.3.2, 5.0.1, 9.0.1

Amends 4,5 & 6

Amend 3 Jun 2007

Definitions

Amend 3 Jun 2007

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 5 Feb 2014

Adequate *Adequate* to achieve the objectives of the *building code*.

Amend 3 Jun 2007

Building has the meaning ascribed to it by Sections 8 and 9 of the Building Act 2004.

Contaminant has the meaning ascribed to it by the Resource Management Act 1991.

Amend 3 Jun 2007

Escape route A continuous unobstructed route from any *occupied space* in a *building* to a *final exit* to enable occupants to reach a *safe place*, and shall comprise one or more of the following *open paths*, *protected paths* and *safe paths*.

COMMENT:
Doors are not obstructions in an *escape route* provided they comply with C/AS1–C/AS7 and D1/AS1.

Amend 5 Feb 2014

Flame safeguard system A system consisting of a flame detector(s) plus associated circuitry, integral components, valves and interlocks the function of which is to shut off the fuel supply to the burner(s) in the event of ignition failure or flame failure.

Flue The passage through which the products of combustion are conveyed to the outside air.

Intended use in relation to a *building*:

a) includes any or all of the following:

  i) Any reasonably foreseeable occasional other use that is not incompatible with the *intended use*; and

  ii) Normal maintenance; and

  iii) Activities taken in response to *fire* or any other reasonably foreseeable emergency

b) but does not include any other maintenance and repairs or rebuilding.

Amend 3 Jun 2007

Lock-out The safety shut down condition of the control system such that re-start cannot be accomplished without manual resetting.

Over-pressure protection Devices preventing the pressure in piping or appliances from exceeding a predetermined value.

Regulator A device which automatically regulates the pressure or volume of the gas passing through it to a predetermined level.

Safe path That part of an *exitway* which is protected from the effects of *fire* by *fire separations*, *external walls*, or by distance when exposed to open air.

Amend 3 Jun 2007

Town gas A manufactured gas.

Verification Method G11/VM1

No specific test methods have been adopted for verifying compliance with the Performance of NZBC G11.

Acceptable Solution G11/AS1

Amends 3 and 5

This Acceptable Solution relates essentially to gas appliances. It should be read in conjunction with G10/AS1, which deals with piping reticulation.

1.0 Pipe Sizing

1.1 Pressure ranges

1.1.1 Pipes shall be sized to maintain the pressure at any appliance inlet, when all appliances are in use, at no less than:

- 0.75 kPa for *town gas*,
- 1.13 kPa for natural gas, or
- 2.75 kPa for LPG.

1.2 Pressures less than 1.5 kPa

1.2.1 Where the meter outlet pressure does not exceed 1.5 kPa, and when all appliances on the supply are operating, the pressure drop between the meter outlet (or *regulator* outlet if no meter is installed), and any appliance, shall be no more than 0.075 kPa for either *town gas* or natural gas.

Amend 5 Feb 2014

1.2.2 Acceptable methods for sizing pipes are given in AS/NZS 5601.1, section 5.2 and Appendix F.

1.3 Pressures greater than 1.5kPa

1.3.1 Where the meter outlet pressure exceeds 1.5 kPa, and when all appliances on the supply are operating, the maximum pressure drop between the meter outlet (or *regulator* outlet if no meter is installed), and any appliance, shall be no more than 10% of the operating pressure.

Amend 3 Jun 2007

Amend 5 Feb 2014

1.3.2 Acceptable methods for sizing pipes are given in AS/NZS 5601.1, section 5.2 and Appendix F.

1.4 Flow velocities

Amend 3 Jun 2007

1.4.1 Flow velocities shall be no more than:

a) 45 metres per second for supplies filtered to give a 5 micron maximum particle size.

b) 20 metres per second for unfiltered supplies.

COMMENT:
The lower flow velocity for unfiltered supplies is necessary to protect the *regulator* from abrasive wear by any impurities.

2.0 Pressure Regulation

2.1 Regulators

2.1.1 *Regulators* shall be fitted to the supply pipe when:

a) Any appliance in the *building* is not fitted with its own *regulator*, and the supply pressure can exceed:
   - 1.5 kPa for *town gas* and natural gas, or
   - 3.5 kPa for LPG.

b) Appliance *regulators* are fitted to all appliances but the supply pressure may exceed the maximum rated inlet pressure of any appliance *regulator*.

3.0 Over-pressure Protection

3.1 Safety devices

3.1.1 *Over-pressure protection* shall be fitted if an appliance ***regulator*** inlet pressure exceeds 7 kPa or where:

a) The *regulator* inlet pressure exceeds the pressure rating of downstream equipment, or

b) The *regulator* outlet pressure is less than 70% of the inlet pressure.

3.1.2 The *over-pressure protection* device shall limit the pressure downstream of the *regulator* to:

a) No greater than the rated working pressure of the downstream equipment, and

b) No greater than 35% above the normal operating pressure.

4.0 Pipework Installation

4.0.1 G10/AS1 Piped Services is an acceptable solution for the installation of pipework to supply gas as an energy source.

5.0 Flues

5.1 Flue materials

Amends 3 and 5

5.0.1 Materials for *flues* shall comply with AS/NZS 5601.1, section 6.7.

5.2 Safety devices

5.2.1 Where flueing is dependent on the operation of an extractor fan:

a) A safety device shall be fitted to prevent the flow of gas to the burner if insufficient draught is provided, and

b) Appliances connected to the *flue* shall be fitted with a *safety shut-off system*.

5.3 Fire dampers

5.3.1 Automatic fire dampers fitted to combustion air ducts shall be interlocked with the gas supply to the appliance, in a way that shuts off that supply when the damper is closed.

6.0 Automatic Extinguishers

6.0.1 Appliances installed beneath automatic fire extinguishers that could, when operating, extinguish the appliance flame, shall be provided with:

a) A 100% shut-off *flame safeguard system,* or

b) Systems which shut-off and *lock-out* the gas supply system when the automatic extinguisher operates.

7.0 Protection of Supply

7.1 Gas contamination

7.1.1 One of the following types of protective device shall be fitted to prevent air, oxygen or other gases from entering the gas supply systems:

a) Non-return valves.

b) Three-way valves that completely close one side before opening the other.

c) Reverse flow detectors that control positive shut-off valves.

d) Normally closed air-activated positive shut-off pressure *regulators* (e.g. zero *regulator*).

e) A *flame safeguard system*.

7.1.2 Protective devices shall be installed as close as possible to the point at which *contaminants* could be introduced.

7.1.3 Gas and air combustion mixers incorporating double diaphragm zero *regulators* require no further protection against gas contamination unless directly connected to air, oxygen or other standby gases which operate at pressures above 7 kPa.

7.2 Low pressure

7.2.1 Protection against dangerously low pressures generated at the meter by the operation of equipment, such as gas compressors or gas engines shall be achieved by the installation of a suitable *lock-out* protective device between the meter and the equipment.

7.2.2 Mechanically or electrically operated diaphragm low pressure shut-off valves with a manual reset are acceptable.

8.0 Gas Meter Location

8.0.1 Gas meters shall not be located in:

a) A liftwell or lift machine room,

b) A space containing electrical switch gear,

c) Vertical *safe path* or riser ducts, or

d) A position that obstructs *escape routes* in the event of an emergency. (See C/AS1–C/AS7 for other *escape routes* requirements.)

Amend 5 Feb 2014

Amend 3 Jun 2007

9.0 Another Acceptable Solution

Amends 5 and 6

9.0.1 AS/NZS 5601.1, Sections 1, 3, 4, 5, 6 and Appendices A–M and O–R is another Acceptable Solution to Paragraphs 1.0 to 8.0.

Amend 2 Feb 1998

Index G11/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Dear Customer

Please find enclosed Amendment 6, effective 1 January 2017, to the Acceptable Solution and Verification Method for Clause G11 Gas as an Energy Source of the New Zealand Building Code. The previous amendment to G11 (Amendment 5) was in February 2014.

Section	**Old G11**	**January 2017 Amendment 6**
Title pages	Remove title page and document history page 1-2B	Replace with new title page and document history pages 1–2B
References	Remove page 7/8	Replace with new page 7/8
G11/AS1	Remove page 15/16	Replace with new page 15/16

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 6), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 1 January 2017 and supersedes all previous versions of this document.

The previous version of this document (Amendment 5) will cease to have effect on 30 May 2017.

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.building.govt.nz

G11: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	September 1993	p. vi, References	
Reprinted incorporating Amendment 1	October 1994		
Amendment 2	28 February 1998	pp. i and ii, Document History p. vi, References p. 3, 1.2.2	p. 4, 5.0.1 p. 5, 9.0.1
Amendment 3	23 June 2007	p. 2, Document History, Status p. 5, Contents p. 7, References p. 9, Definitions	p. 13, 1.2.1, 1.3, 1.4 p. 14, 5.0.1 p. 15, 9.0, 9.0.1 p. 17, Index
Amendment 4	Published 30 June 2010 Effective from 30 September 2010 until 14 February 2014	p. 2, Document History, Status p. 5, Contents p. 7, References	
Reprinted incorporating Amendments 1–4	30 September 2010		
Amendment 5	14 February 2014 until 30 May 2017	p. 2A, Document History, Status p. 7, References p. 9 Definitions	pp. 13, 14, 15, G11/AS1 1.2.2, 1.3.2, 5.0.1, 8.0.1, 9.0.1
Amend 6	Effective 1 January 2017	p. 7 References p. 15 G11/AS1 9.0.1	
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

References

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

Amend 5 Feb 2014

Amend 3 Jun 2007

Amend 5 Feb 2014

Standards New Zealand	Where quoted
AS/NZS 5601: 2013 Gas installations Part 1 General installations *Amends: 1, 2*	AS1 1.2.2, 1.3.2, 5.0.1, 9.0.1

Amends 4,5 & 6

Amend 3 Jun 2007

8.0 Gas Meter Location

8.0.1 Gas meters shall not be located in:

a) A liftwell or lift machine room,

b) A space containing electrical switch gear,

c) Vertical *safe path* or riser ducts, or

d) A position that obstructs *escape routes* in the event of an emergency. (See C/AS1–C/AS7 for other *escape routes* requirements.)

Amend 5 Feb 2014

9.0 Another Acceptable Solution

Amend 3 Jun 2007

Amends 5 and 6

9.0.1 AS/NZS 5601.1, Sections 1, 3, 4, 5, 6 and Appendices A–M and O–R is another Acceptable Solution to Paragraphs 1.0 to 8.0.

Amend 2 Feb 1998

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington.6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 12), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 27 June 2019 and supersedes all previous versions of this document.

The previous version of this document (Amendment 11) will cease to have effect on 31 October 2019.

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.building.govt.nz

G12: Document History

	Date	Alterations		
First published	July 1992			
Amendment 1	September 1993	pp. vi–viii, References p. ix, Definitions p. 15, Table 4	p. 16, 4.5.1, 4.5.3 p. 19, 5.2.2 b) p. 22, Table 7	p. 26, Index
Amendment 2	19 August 1994	pp. i and ii, Document History p. v, Contents p. viii, References	p. 3, 2.2.1 e) p. 6, 2.6, 2.6.1 p. 19, 4.13.1, 4.14, 4.14.1	p. 26, 29, Index
Amendment 3	1 December 1995	p. ii, Document History pp. vi–viii, References	p. 5, Table 1 p. 6, 2.5.2	
Second edition published July 2001	Effective from 1 October 2001	Document revised – Second edition issued		
Amendment 4	6 January 2002	pp. 3–5 Code Clause G12		
Amendment 5	25 February 2004	p. 2, Document History p.7, Contents pp. 9–11 References	pp. 23-38, 3.7.1, 3.7.4, 4.1, 6.2.1, 6.3.2–6.15, Figure 13 pp. 43-45 Index	
Amendment 6	23 June 2007	p. 2, Document History, Status pp. 9 and 11, References	p. 13, Definitions p. 15, VM1 1.0.1	
Third edition published October 2007	Effective from 1 December 2007	G12/AS1 amended: p. 27, Table 5 p. 32, 6.5.1 p. 35, 6.9, 6.10	p. 36, 6.11.5 p. 37, 6.14.3 p. 38, 6.15 (deleted) p. 40, 7.5.2	New Acceptable Solution G12/AS2 included
Amendment 7	Published 30 June 2010 Effective from 30 September 2010	p. 2, Document History, Status pp. 3 and 4, Code Clause G12 pp. 7–10, References	p. 17, G12/AS1 2.1.2, Table 1 p. 27, G12/AS1 Table 5 p. 32, G12/AS1 Table 6	p. 41, G12/AS1 9.3.2
Amendment 8	Effective from 10 October 2011 until 14 August 2014	p. 2, Document History, Status pp. 7–10, References p.12, Definitions	p. 21, G12/AS1 3.6.1 p. 23, G12/AS1 3.7.2	p. 41, G12/AS1 9.3.2 p. 43, G12/AS2 1.1.1
Amendment 9	14 February 2014 until 30 May 2017	p. 2A, Document History, Status pp 7, 8, 10 References p. 11 Definitions	p. 17 G12/AS1 2.1.2 p. 27 G12/AS1 Table 5 p. 40 G12/AS1 7.5.2	pp. 44–47, 49–50, 64, G12/AS2 2.1.4, 3.1.1, 3.2.1, 3.6.1, 3.6.2, 7.2.3, Tables 1, 2 and 3
Amendment 10	Effective 1 January 2017 until 31 March 2019	pp. 9, 10 References p.17 G12/AS12.2, Table 1 p. 21 G12/AS1 3.6.2	p. 23 G12/AS1 3.7.4 p. 24 G12/AS1 5.2.3 p. 32 G12/AS1 Table 6	p. 35 G12/AS1 6.11.3 p. 43 G12/AS2 1.1.1 p. 51 G12/AS2 4.2.2, 5.0.1
Amendment 11	Effective from 30 November 2018 until 31 October 2019	p. 10 References		
Amendment 12	Effective 27 June 2019	p. 10 References p. 15 G12/VM1 1.0.1	p. 20 G12/AS1 3.5.2 p. 51 G12/AS2 4.2.2	

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

New Zealand Building Code Clause G12 Water Supplies

The mandatory provisions for building work are contained in the New Zealand Building Code (NZBC), which comprises the First Schedule to the Building Regulations 1992. The relevant NZBC Clause for Water Supplies is G12.

Schedule **Building Amendment Regulations 2001**

Schedule
New clause G12 substituted in First Schedule of principal regulations

Clause G12–Water Supplies

Provisions	Limits on application	
Objective		
G12.1 The objective of this provision is to– (a) safeguard people from illness caused by contaminated water: (b) safeguard people from injury caused by hot water system explosion, or from contact with excessively hot water: (c) safeguard people from loss of *amenity* arising from– (i) a lack of hot water for personal hygiene; or (ii) water for human consumption, which is offensive in appearance, odour or taste:		
(d) ensure that *people with disabilities* are able to carry out normal activities and functions within *buildings*.	Objective G12.1(d) shall apply only to those *buildings* to which section 47A of the Act applies.	Amend 7 Sep 2010 See Note
Functional requirement		
G12.2 *Buildings* provided with water outlets, *sanitary fixtures* or *sanitary appliances* must have safe and *adequate* water supplies.		
Performance		
G12.3.1 Water intended for human consumption, food preparation, utensil washing or oral hygiene must be potable	Performance G12.3.1 does not apply to *backcountry huts*.	Amended Oct 2008
G12.3.2 A potable *water supply system* shall be– (a) protected from contamination; and (b) installed in a manner which avoids the likelihood of contamination within the system and the *water main*; and (c) installed using components that will not contaminate the water.		
G12.3.3 A non-potable *water supply system* used for personal hygiene shall be installed in a manner that avoids the likelihood of illness or injury being caused by the system.		
G12.3.4 Water pipes and outlets provided with non-potable water shall be clearly identified.		

NOTE:
Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

Building Amendment Regulations 2001 Schedule

Provisions	Limits on application
Performance–continued	
G12.3.5 *Sanitary fixtures* and *sanitary appliances* must be provided with hot water when intended to be used for– (a) utensil washing; and (b) personal washing, showering or bathing.	Performance G12.3.5(b) shall apply only to *housing*, retirement homes and early childhood centres.
G12.3.6 Where hot water is provided to *sanitary fixtures* and *sanitary appliances*, used for personal hygiene, it must be delivered at a temperature that avoids the likelihood of scalding.	
G12.3.7 *Water supply systems* must be installed in a manner that– (a) pipes water to *sanitary fixtures* and *sanitary appliances* flow rates that are *adequate* for the correct functioning of those *fixtures* and *appliances* under normal conditions; and (b) avoids the likelihood of leakage; and (c) allows reasonable access to components likely to need maintenance; and (d) allows the system and any backflow prevention devices to be isolated for testing and maintenance.	
G12.3.8 Vessels used for producing or storing hot water must be provided with safety devices that– (a) relieve excessive pressure during both normal and abnormal conditions; and (b) limit temperatures to avoid the likelihood of flash steam production in the event of rupture.	
G12.3.9 A *hot water system* must be capable of being controlled to prevent the growth of legionella bacteria.	
G12.3.10 Water supply taps must be *accessible* and usable for *people with disabilities*.	Performance G12.3.10 applies only to those *buildings* to which section 47A of the Act applies.

Amend 7
Sep 2010

See Note

Clerk of the Executive Council.

NOTE:

Section 47A is in the Building Act 1991. The equivalent section in the Building Act 2004 is section 118.

Contents

References

Amend 9 Feb 2014

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in these Verification Methods and Acceptable Solutions (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 these Verification Methods and Acceptable Solutions must be used.

Amend 8 Oct 2011 — Amend 9 Feb 2014

		Where quoted
Standards New Zealand		
NZS/BS 1387: 1985	Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or screwing to BS 21 pipe threads *Amend: 1*	AS1 Table 1
NZS 3501: 1976	Specification for copper tubes for water, gas, and sanitation *Amends: 1, 2, 3*	AS1 Table 1
NZS 3604: 2011	Timber framed buildings	AS2 1.1.1
NZS 3604: 1999	Timber framed buildings	AS2 1.1.1
NZS 3604: 1990	Timber framed buildings	AS2 1.1.1
NZS 4203:1992	Code of Practice for general structural design and design loadings for buildings	AS2 1.1.1
NZS 4602: 1988	Low pressure copper thermal storage electric water heaters *Amend: 1*	AS1 Table 5
NZS 4603: 1985	Installation of low pressure thermal storage electric water heaters with copper cylinders (open-vented systems) *Amend: 1*	AS1 6.9.1, 6.11.5
NZS 4606:	Storage water heaters	
Part 1: 1989	General requirements *Amends: 1, 2, 3*	AS1 Table 5
Part 2: 1989	Specific requirements for water heaters with single shells *Amend: A*	AS1 Table 5
Part 3: 1992	Specific requirements for water heaters with composite shells *Amend: A*	AS1 Table 5
NZS 4607: 1989	Installation of thermal storage electric water heaters: valve-vented systems	AS1 6.10.1
NZS 4608: 1992	Control valves for hot water systems	AS1 Table 6
NZS 4613: 1986	Domestic solar water heaters	AS2 7.2.3

Amend 8 Oct 2011 (NZS/BS 1387); Amend 7 Sep 2010 (Amend: 1); Amend 8 Oct 2011 (NZS 3604: 2011); Amend 9 Feb 2014 (NZS 4613)

		Where quoted
NZS 4614: 1986	Installation of domestic solar hot water heating systems *Amend: 1 (1986) Erratum*	AS2 4.2.2
NZS 4617: 1989	Tempering (3-port mixing) valves	AS1 6.14.2 b)
NZS 5807: 1980	Code of practice for industrial identification by colour, wording or other coding	
Part 2: 1980	Identification of contents of piping, conduit and ducts *Amends: 1, 2*	AS1 4.3.1
NZS 6214: 1988	Thermostats and thermal cutouts for domestic thermal storage electric water heaters (alternating current only)	AS1 6.5.1
NZS 7601: 1978	Specification for polyethylene pipe (Type 3) for cold water services	AS1 Table 1
NZS 7602: 1977	Specification for polyethylene pipe (Type 5) for cold water services *Amend: 1*	AS1 Table 1
NZS 7610: 1991	Specification for blue polyethylene pipes up to nominal size 63 for below ground use for potable water *Amends: 1, 2, 3*	AS1 Table 1

Amend 9 Feb 2014

Amend 7 Sep 2010

Amend 8 Oct 2011

Amend 7 Sep 2010

Amend 7 Sep 2010

British Standards Institution

BS EN 1490: 2000	Building valves. Combined temperature and pressure relief valves. Tests and requirements.	AS1 Table 6
BS EN 1491: 2000	Building valves. Expansion valves. Tests and requirements	AS1 Table 6
BS EN 1567: 1999	Building valves. Water pressure reducing valves and combination water reducing valves. Requirements and tests.	AS1 Table 6
BS 6920	Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water	
Part 1: 2000	Specification	AS1 2.1.2
Part 2: 2000	Methods of tests	AS1 2.1.2
Part 3: 2000	High temperature tests	AS1 2.1.2

Amend 7 Sep 2010

Standards Australia

		Where quoted
AS 1308: 1987	Electric water heaters – Thermostats and thermal cut-outs *Amend: 1*	AS1 6.5.1
AS 1357:	Water valves for use with unvented water heaters	
Part 1: 2009	Protection valves *Amend: 1, 2*	AS1 Table 6
Part 2: 2005	Control valves *Amend: 1, 2*	AS1 6.14.2 b), Table 6
AS 2845:	Water supply – Mechanical backflow prevention devices	
Part 3: 1993	Field testing and maintenance *Amend: 1*	AS1 3.6.1 b), 3.7.2

Amend 7 Sep 2010

Amend 8 Oct 2011

Amend 7 Sep 2010

Australian/New Zealand Standards

AS/NZS 1170:	Structural Design Actions	
Part 0: 2002	General principles *Amend: 1, 2 and 4*	AS2 1.1.1
Part 1: 2002	Permanent, imposed and other actions *Amend: 1, 2*	AS2 1.1.1
Part 2: 2011	Wind Actions *Amend: 1, 2 and 3*	AS2 1.1.1
Part 3: 2003	Snow and ice actions *Amend: 1*	AS2 1.1.1
NZS 1170:		AS2 1.1.1
Part 5: 2004	Earthquake design actions – New Zealand	
AS/NZS 1477: 2006	PVC pipes and fittings for pressure applications *Amend: 1*	AS1 Table 1
AS/NZS 2032: 2006	Installation of PVC pipe systems *Amend: 1*	AS1 7.4.1, 7.5.2
AS/NZS 2642:	Polybutylene pipe systems	
Part 1: 2007	Polybutylene (PB) pipe extrusion compounds	AS1 Table 1
Part 2: 2008	Polybutylene (PB) pipe for hot and cold water applications	AS1 Table 1
Part 3: 2008	Mechanical jointing fittings for use with polybutylene (PB) pipes for hot and cold water applications *Amend: 1*	AS1 Table 1

Amend 10 Jan 2017

Amend 8 Oct 2011

Amend 7 Sep 2010

Amend 8 Oct 2011

Amend 8 Oct 2011

Amendment	Standard	Title	Where quoted	Amendment
Amend 9 Feb 2014			**Where quoted**	
Amend 10 Jan 2017	AS/NZS 2712: 2007	Solar and heat pump water heaters – Design and construction *Amend: 1, 2 and 3*	AS2 3.1.1, 3.6.1	
Amend 10 Jan 2017 Amend 8 Oct 2011 Amend 10 Jan 2017	AS/NZS 2845: Part 1: 2010	Water supply – Backflow prevention devices Materials, design and performance requirements *Amend: 1*	 AS1 3.6.2	
Amend 9 Feb 2014 Amends 7 & 10	AS/NZS 60335.2.35: 2013	Household and similar electrical appliances. Safety – Part 2.35 Particular requirements for instantaneous water heaters	AS1 Table 5	
Amends 10 & 12 Amends 9 & 11 Amends 9 & 11	AS/NZS 3500: Part 1: 2018 Part 4: 2018	Plumbing and drainage Water services Heated water services *Amend: 1*	 VM1 1.0.1 a), AS1 3.5.2 Comment VM1 1.0.1 b) AS2 1.1.1 c), 4.2.2 Comment, 5.0.1	Amend 11 Nov 2018 Amend 12 Jun 2019
	AS/NZS 4020: 2005	Testing of products for use in contact with drinking water	AS1 2.1.2	
Amend 10 Jan 2017	AS/NZS 4129: 2008	Fittings for polyethylene (PE) pipes for pressure applications *Amend: 1*	AS1 Table 1	
Amend 7 Sep 2010	AS/NZS 4130: 2009	Polyethylene (PE) pipes for pressure applications *Amend: 1*	AS1 Table 1	
	AS/NZS 4692: Part 2: 2005	Electric water heaters Minimum Energy Performance Standards (MEPS) requirements and energy labelling	 AS2 3.1.2	
Amend 7 Sep 2010	AS/NZS 5000.1 2005	Electric cables – Polymeric insulated – For working voltages up to and including 0.6/1 (1.2) kV *Amend: 1*	AS1 9.3.2	
Amend 8 Oct 2011	AS/NZS 5000.2 2006	Electric cables – Polymeric insulated Part 2: For working voltages up to and including 450/750 v.	AS1 9.3.2	
	New Zealand Regulations			
	Gas Regulations 1993		AS1 Table 5	
	Master Plumbers, Gasfitters and Drainlayers NZ Inc and Water New Zealand			
Amend 8 Oct 2011	NZ Backflow testing standard 2011	Field testing of backflow prevention devices and verification of air gaps	AS1 3.6.1 b), 3.7.2	

Definitions

This is an abbreviated list of definitions for words or terms particularly relevent to these Verification Methods and Acceptable Solutions. The definitions for any other italicised words may be found in the New Zealand Building Code Handbook. Amend 9 Feb 2014

Adequate *Adequate* to achieve the objectives of the *Building Code.*

Air gap The vertical distance through air between the lowest point of the water supply outlet and the *flood level rim* of the equipment or the *fixture* into which the outlet discharges.

Amenity means an attribute of a *building* which contributes to the health, physical independence, and well being of the *building's* users but which is not associated with disease or a specific illness.

Backflow The unplanned reversal of flow of water or mixtures of water and *contaminants* into the *water supply system*. See *back-siphonage* and *back-pressure.*

Backflow prevention device A device that prevents *backflow*.

Back-pressure A *backflow* condition caused by the downstream pressure becoming greater than the supply pressure.

Back-siphonage A *backflow* condition caused by the supply pressure becoming less than the downstream pressure.

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

Check valve A valve that permits flow in one direction but prevents a return flow and is part of a *backflow prevention device.*

Cladding The exterior weather-resistant surface of a *building*.

COMMENT:
Includes any supporting substrate and, if applicable, surface treatment.

Contaminant includes any substance (including gases, liquids, solids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or heat

a) When discharged into water, changes or is likely to change the physical, chemical, or biological condition of water, or

b) When discharged onto or into land or into air, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged.

This is the meaning ascribed to it by the Resource Management Act 1991.

Cross connection Any actual or potential connection between a *potable water* supply and a source of contamination.

Diameter (or bore) The nominal internal *diameter*.

EPDM (Ethylene Propylene Diene Monomer) A thermosetting synthetic rubber used as a resilient part of a sealing washer, or as a roof *membrane*.

Fixture An article intended to remain permanently attached to and form part of a *building*.

Flashing A component, formed from a rigid or flexible *waterproof* material, that drains or deflects water back outside the *cladding system.*

Flood level rim The top edge at which water can overflow from equipment or a *fixture*.

Framing Timber members to which *lining*, *cladding*, flooring, or decking is attached; or which are depended upon for supporting the structure, or for resisting forces applied to it

Free outlet (push through) In the context of *storage water heaters* means a *water heater* with a tap on the cold water inlet so designed that the hot water is discharged through an open outlet.

Household unit

a) means any *building* or group of *buildings*, or part of a *building* or group of *buildings*, that is:

i) used, or intended to be used, only or mainly for residential purposes; and

ii) occupied, or intended to be occupied, exclusively as the home or residence of not more than one household; but

b) does not include a hostel, boarding house or other specialised accommodation.

Masonry tiles Clay or concrete tile roof *cladding*.

Membrane A non-metallic material, usually synthetic, used as a fully supported roof *cladding*, *deck* surface or, in conjunction with other *claddings*, as gutters or *flashings*.

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

Amend 8 Oct 2011

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

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.

Non-return valve A valve that permits flow in one direction but prevents a return flow and is part of a hot or cold water system.

Open vented storage water heater A *water heater* incorporating a *vent pipe* which is permanently open to the atmosphere.

Potable (and potable water) Water that is suitable for human consumption.

Purlin A horizontal member laid to span across *rafters* or trusses, and to which the roof *cladding* is attached.

Rafter A *framing* timber, normally parallel to the slope of the roof, providing support for sarking, *purlins* or roof *cladding*.

Sanitary appliance An appliance which is intended to be used for *sanitation*, but which is not a *sanitary fixture*. Included are machines for washing dishes and clothes.

Sanitary fixture Any *fixture* which is intended to be used for *sanitation*.

Sanitation The term used to describe the activities of washing and/or excretion carried out in a manner or condition such that the effect on health is minimised, with regard to dirt and infection.

Specific design Design and detailing of a proposed *building* or parts of a *building*, demonstrating compliance with the building code, that shall be provided to the building consent authority for assessment and approval as part of the *building consent* process.

Buildings, or parts of *buildings*, requiring *specific design* are beyond the scope of this Acceptable Solution.

Storage water heater A *water tank* with an integral *water heater* for the storage of hot water.

Toxic environment An environment that contains *contaminants* that can contaminate the water supply in concentrations greater than those included in the New Zealand Drinking Water Standard 1995.

Valve vented storage water heater (Also known as an unvented *storage water heater*.) A *storage water heater* in which the required venting to the atmosphere is controlled by a valve.

Vent pipe A pipe which is open to the atmosphere at one end and acts as a pressure limiting device.

Water heater A device for heating water.

Water main A water supply pipe vested in, or is under the control, or maintained by, a *network utility operator*.

Water supply system Pipes, fittings and tanks used or intended to be used for the storage and reticulation of water from a *water main* or other water source, to *sanitary fixtures*, *sanitary appliances* and fittings within a *building*.

Water tank (vessel) A covered fixed container for storing hot or cold water.

Weathertightness and **weathertight** Terms used to describe the resistance of a *building* to the weather.

Weathertightness is a state where water is prevented from entering and accumulating behind the *cladding* in amounts that can cause undue dampness or damage to the *building elements*.

COMMENT:

The term *weathertightness* is not necessarily the same as *waterproof*.

However, a *weathertight building*, even under severe weather conditions, is expected to limit moisture ingress to inconsequential amounts, insufficient to cause undue dampness inside *buildings* and damage to *building elements*. Moisture that may occasionally enter is able to harmlessly escape or evaporate.

Wind zone Categorisation of wind force experienced on a particular site as determined in NZS 3604, Section 5.

COMMENT:

Maximum ultimate limit state speeds are:

Low *wind zone*	=	wind speed of 32 m/s
Medium *wind zone*	=	wind speed of 37 m/s
High *wind zone*	=	wind speed of 44 m/s
Very high *wind zone*	=	wind speed of 50 m/s.

Specific design is required for wind speeds greater than 50 m/s.

Verification Method G12/VM1

1.0 Water Supply System

1.0.1 A design method for *water supply systems* may be verified as satisfying the Performances of NZBC G12 if it complies with:

Amend 6 Jun 2007 Amend 12 Jun 2019

a) AS/NZS 3500.1 Section 2, Section 3 and Appendix C: Sizing method for supply piping for dwellings (note that Appendix C is part of this Verification Method even though it is included in the standard as an "Informative" Appendix), and

Amend 6 Jun 2007

b) AS/NZS 3500.4.

Acceptable Solution G12/AS1

1.0 Scope

1.0.1 This acceptable solution applies to below ground and above ground piped *water supply systems.*

2.0 Materials

2.1 Water quality

2.1.1 Components of the *water supply system* shall not contaminate *potable water.*

2.1.2 Water supply materials and components shall comply with:

a) BS 6920 if non-metallic, or

Amend 7 Amend 9 b) AS/NZS 4020 if metallic or non-metallic.

2.2 Pipe materials

2.2.1 Pipe and pipe fitting materials shall comply with Table 1. Amend 10 Jan 2017

2.2.2 All pipes and pipe fittings used for the piping of water shall be:

a) Suitable for the temperatures and pressures within that system,

b) Compatible with the water supply and environmental conditions in the particular location, and

c) Where installed in an exposed situation, resistant to UV light.

Amend 10 Jan 2017

Amend 10 Jan 2017 **Table 1: Materials for Hot and Cold Water**
Paragraphs 2.1.2, 2.2.1 and 6.7.2

Material	Relevant Standard
Hot and Cold	
Copper	NZS 3501
Galvanised steel	NZS/BS 1387
Polybutylene	AS/NZS 2642: Parts 1, 2 and 3
Cold Only	
PVC-U	AS/NZS 1477
Polyethylene	NZS 7601 for pressures up to 0.9 MPa (Type 3) NZS 7602 for pressures up to 1.2 MPa (Type 5) NZS 7610 for pressures up to 1.2 MPa AS/NZS 4129 for fittings AS/NZS 4130 for pressures up to 2.5 MPa

Amend 7 Sep 2010

Amend 7 Sep 2010

3.0 Protection of Potable Water

3.1 Drawn water not to be returned

3.1.1 Water drawn from the *water main* shall be prevented from returning to that system by avoiding *cross connections* or *backflow*.

3.2 Cross connections prohibited

3.2.1 The *water supply system* shall be installed so that there is no likelihood of *cross connection* between:

a) A *potable water supply system* and a non-*potable water supply system*,

b) A *potable water supply system* connected to a *water main*, and any water from another source including a private water supply,

c) A *potable water supply system* and any bathing facilities including swimming, spa or paddling pools, and

d) A *potable water supply system* and pipes, *fixtures* or equipment (including boilers and pumps) containing chemicals, liquids, gases or other non-*potable* substances.

3.3 Cross Connection Hazard

3.3.1 High hazard

Any condition, device or practice which, in connection with the *potable water supply system*, has the potential to cause death.

COMMENT:
High hazard may include but not necessarily be limited to:

a) Autoclaves and sterilisers

b) Systems containing chemicals such as anti-freeze, anti-corrosion, biocides, or fungicides

c) Beauty salon and hairdresser's sinks

d) Boiler, chiller and cooling tower make-up water

e) Car and factory washing facilities

f) Chemical dispensers

g) Chemical injectors

h) Chlorinators

i) Dental equipment

j) Direct heat exchangers

k) Fire sprinkler systems and fire hydrant systems that use toxic or hazardous water

l) Hose taps associated with High hazard situations like mixing of pesticides

m) Irrigation systems with chemicals

n) Laboratories

o) Mortuaries

p) Pest control equipment

q) Photography and X-ray machines

r) Piers and docks

s) Sewage pumps and sump ejectors

t) Sluice sinks and bed pan washers

u) Livestock water supply with added chemicals

v) Veterinary equipment

Note: The examples given are not an exhaustive list. Where there is doubt comparison must be made to the hazard definitions.

3.3.2 Medium hazard

Any condition, device or practice which, in connection with the *potable water supply system*, has the potential to injure or endanger health.

COMMENT:
Medium hazard may include but not necessarily be limited to:

a) Appliances, vehicles or equipment

b) Auxiliary water supplies such as pumped and non-pumped fire sprinkler secondary water

c) Deionised water, reverse osmosis units and equipment cooling without chemicals

d) Fire sprinkler systems and *building* hydrant systems

e) Hose taps and fire hose reels associated with Medium hazard

f) Irrigation systems with underground controllers

g) Irrigation without chemicals

h) Livestock water supply without added chemicals

i) Untreated water storage tanks

j) Water and steam cleaning

k) Water for equipment cooling

l) Drink dispensers with carbonators

m) Swimming pools, spas and fountains

Note: The examples given are not an exhaustive list. Where there is doubt comparison must be made to the hazard definitions.

3.3.3 Low hazard

Any condition, device or practice which, in connection with the *potable water supply system,* would constitute a nuisance, by colour, odour or taste, but not injure or endanger health.

COMMENT:

Low hazard may include but not necessarily be limited to:

a) Drink dispensers (except carbonators).

Note: The example given is not an exhaustive list. Where there is doubt comparison must be made to the hazard definitions.

3.4 Backflow protection

3.4.1 *Backflow* protection shall be provided where it is possible for water or *contaminants* to *backflow* into the *potable water supply system.*

COMMENT:

The protection of non-*potable water* used for personal hygiene is contained in Paragraph 4.1.

3.4.2 *Backflow* protection shall be determined by identifying the individual *cross connection* hazard(s) and *backflow* protection required. Water from each hazard shall be regarded as non-*potable* until an appropriate *backflow* protection is installed.

3.4.3 *Backflow* protection shall be achieved by:

a) An *air gap,* in accordance with Paragraph 3.5, or

b) A *backflow prevention device* selected in accordance with Paragraphs 3.4.4 and 3.4.5.

3.4.4 *Backflow* protection shall be appropriate to the *cross connection* hazard contained in Paragraph 3.3.

3.4.5 The selection of the appropriate *backflow* protection for the *cross connection* hazard is given in Table 2.

COMMENT:

Table 2 includes *air gap* separation.

Table 2: Selection of Backflow Protection
Paragraph 3.4.5

Type of backflow protection	CROSS CONNECTION HAZARD					
	HIGH		MEDIUM		LOW	
	back-pressure	back-siphonage	back-pressure	back-siphonage	back-pressure	back-siphonage
Air gap (see **Note 1**)	✓	✓	✓	✓	✓	✓
Reduced pressure zone device	✓	✓	✓	✓	✓	✓
Double *check valve* assembly (see **Note 2**)			✓	✓	✓	✓
Pressure type vacuum breaker (see **Note 3**)		✓		✓		✓
Atmospheric vacuum breaker (see **Note 4**)		✓		✓		✓

Note:

1. *Air gaps* must not be installed in a *toxic environment.*
2. Double *check valves* can be installed in a medium and low hazard *toxic environment.*
3. Pressure type vacuum breakers are designed to vent at 7 kPa or less. However, they require a significantly higher pressure to reseat and must be installed only in systems which provide pressures sufficient to ensure full closing of the valve.
4. Hose outlet vacuum breakers are a specific type of atmospheric vacuum breaker.

3.4.6 All *backflow prevention devices* must be testable in service to verify effective performance.

3.5 Air gap

3.5.1 An *air gap* shall be an unobstructed distance between the lowest opening of a water supply outlet and the highest level of the overflow water. The *air gap* separation shall be the greater of 25 mm or twice the supply pipe *diameter*, as shown in Figure 1.

3.5.2 To ensure the *air gap* distance is maintained the overflow pipe discharge flow rate shall be no less than the inlet pipe flow rate.

COMMENT:

Amend 12 Jun 2019 AS/NZS 3500.1 Appendix G: Storage Tanks – Inflow and Overflow may be used to calculate the size of the overflow.

3.5.3 *Air gaps* shall not be used in a *toxic environment* to prevent contaminated air entering the water and piping system through the *air gap.*

3.5.4 Where any *fixture* or tank has more than one supply pipe, the *air gap* separation shall be the greater of 25 mm or twice the sum of the inlet pipe *diameters* and shall also comply with Paragraph 3.5.2.

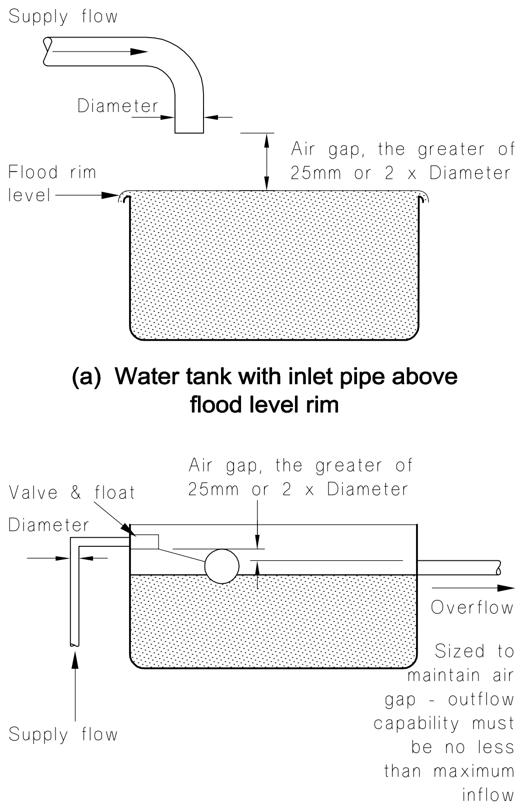
3.6 Backflow prevention devices

3.6.1 Location

Backflow prevention devices and *air gaps* shall be located:

a) As near as practicable to the potential source of contamination, and

Figure 1: Air Gap Separation
Paragraph 3.5.1



(a) Water tank with inlet pipe above flood level rim

(b) Water tank with ball valve and overflow pipe below flood level rim

b) In an accessible position for maintenance and testing to AS 2845.3 or NZ backflow testing standard.

Amend 8 Oct 2011

3.6.2 Manufacture

Backflow prevention devices shall be manufactured as follows:

a) Reduced pressure zone devices to AS/NZS 2845.1 Section 12 (see Figure 2 (a)),

Amend 10 Jan 2017

b) Double *check valve* devices to AS/NZS 2845.1 Section 10 (see Figure 2 (b)),

c) Pressure type vacuum breakers to AS/NZS 2845.1 Section 9, (see Figure 2 (c)), and

d) Atmospheric vacuum breakers to AS/NZS 2845.1 Section 4 for atmospheric vacuum breakers (see Figure 2 (d)), and Section 5 for hose tap vacuum breakers.

3.6.3 General installation requirements

Backflow prevention devices shall be:

a) Fitted with a line strainer upstream to prevent particles and corrosion products from the pipework rendering the device ineffective,

b) A by-pass may only be fitted where the by-pass contains another *backflow prevention device* appropriate to the same hazard rating,

c) Protected from the effects of corrosive or *toxic environments*, and

d) Protected from damage.

COMMENT:

1. The device should be attached only after the pipework has been flushed.
2. Corrosive environments may cause the malfunction of the device. Polluted air from a *toxic environment* may enter the piping system through the *air gap* or open port vent thus negating the effective *air gap* separation.
3. The device should be protected from physical and frost damage and installed without the application of heat.

3.6.4 Specific installation requirements

Backflow prevention devices shall be installed as follows:

a) Reduced pressure zone devices. These devices shall:

- i) have free ventilation to the atmosphere for the relief valve outlet at all times,
- ii) be located in an area that is not subject to ponding,
- iii) have the relief drain outlet located not less than 300 mm above the surrounding surface, and
- iv) be installed horizontally with the relief valve discharge facing vertically down, unless different orientations are specifically recommended by the device manufacturer.

b) Double *check valve* devices. There are no additional requirements to those in Paragraph 3.6.3.

c) Pressure type vacuum breakers. These devices shall:

- i) be located not less than 300 mm above the highest outlet, measured from the highest outlet to the lowest part of the valve body,
- ii) be installed vertically with the air ports at the top, and
- iii) have free ventilation to the air ports at all times.

d) Atmospheric vacuum breakers. These devices shall:

- i) be located not less than 150 mm above the highest outlet, measured from the highest outlet to the lowest part of the valve body,
- ii) have no valves located downstream of the vacuum breaker,
- iii) under normal operation, not remain continuously pressurised for more than 12 hours,
- iv) be installed vertically with the air ports at the top, and
- v) Have free ventilation to the air ports at all times.

5.0 Water Supply

5.1 Water tanks

5.1.1 To ensure the health and safety of people in the event of the *water main* supply being interrupted, *buildings* having the classification of Community Care (e.g. hospitals, old people's homes, prisons) shall be provided with cold water storage of no less than 50 litres per person.

COMMENT:

1. Cold water storage is required only to maintain *adequate* personal hygiene within *buildings* where the principal users are legally or physically confined.
2. Refer to the NZBC A1 for classification of *buildings*.
3. *Network utility operators* cannot guarantee a continuous supply of water. *Building* owners may therefore wish to provide water storage to *buildings* having a classification other than Community Care, to enable continuation of a business, service, industrial process or other reason.
4. The "litres per person" is based on a daily use of 20 litres WC, 25 litres washing, 5 litres drinking.

5.2 Water tank installation

5.2.1 Location

Water tanks in roof spaces shall be located and supported as detailed in Figure 4.

5.2.2 Overflow pipes

Water tanks shall have an overflow pipe to discharge any overflow to a visible place within the same property that does not create a nuisance or damage to *building elements*. The overflow pipe shall be sized so that the discharge capacity is no less than the maximum inlet flow. The outlet of the overflow pipe shall not permit the entry of birds or vermin. Overflow from a WC cistern may discharge internally into a WC pan.

5.2.3 Safe trays

Amend 10 Jan 2017

Performance E3.3.2: states that; Free water from accidental overflow from *sanitary fixtures* or *sanitary appliances* must be disposed of in a way that avoids loss of *amenity* or damage to *household units* or *other property*. An acceptable method of preventing water damage is to locate a safe tray below the water tank (see Figure 4). The safe tray shall incorporate a drain with a minimum diameter of 40 mm. Where the tank overflow discharges into the safe tray, the diameter of the safe tray drain shall be greater than the overflow pipe from the tank and comply with Paragraph 5.2.2.

Amend 10 Jan 2017

5.2.4 Covers

Covers shall be provided to:

a) *Potable water tanks* to prevent contamination and the entry of vermin, and

b) All tanks located in roof spaces to prevent condensation damaging *building elements*.

5.2.5 Access

Covers to *water tanks* shall be removable or shall contain a covered opening to allow access for inspection and maintenance.
A minimum height clearance of 350 mm above the opening is necessary for easy access.

5.2.6 Supporting structure

The supporting structure for *water tanks* shall be protected from damage due to condensation where durability of the supports could be compromised by moisture.
A material such as H3 treated timber shall be installed under the *water tank*.

5.2.7 Structural support

NZBC B1 requires *water tanks* to be adequately supported including seismic restraint. The method illustrated in Figure 4 is acceptable for *water tanks* up to 150 litre capacity and the maximum height to breadth ratio of 1:1.

5.3 Water pipe size

5.3.1 Pipe sizing

Pipes shall be sized:

a) To achieve the flow rates given in Table 3, or

b) Using the sizes given in Table 4.

COMMENT:

Manufacturers' literature must be referenced for pressure and flow information on tempering valves and tapware. Outlets (e.g. shower mixers and showerheads) must be appropriate for the available flow and pressure. Note the limitations on lengths and pipe sizes given in Table 3.

Table 3: Acceptable Flow Rates to Sanitary Fixtures
Paragraph 5.3.1

Sanitary fixture	Flow rate and temperature l/s and °C	How measured
Bath	0.3 at 45°C	Mix hot and cold water to achieve 45°C
Sink	0.2 at 60°C* (hot) and 0.2 (cold)	Flow rates required at both hot and cold taps but not simultaneously
Laundry tub	0.2 at 60°C* (hot) and 0.2 (cold)	Flow rates required at both hot and cold taps but not simultaneously
Basin	0.1 at 45°C	Mix hot and cold water to achieve 45°C
Shower	0.1 at 42°C	Mix hot and cold water to achieve 42°C

* The temperatures in this table relate to the temperature of the water used by people in the daily use of the *fixture*.

Note:

The flow rates required by Table 3 shall be capable of being delivered simultaneously to the kitchen sink and one other *fixture*.

Table 4: Tempering Valve and Nominal Pipe Diameters
Paragraphs 5.3.1 and 6.12.1

Amend 5 Feb 2004

	Low pressure (i.e. header tank supply or low pressure)	Low and medium pressure unvented (valve vented) and open vented	Mains pressure
Pressure of water at tempering valve (kPa)	20 – 30	30 – 120	over 300
Metres head (m)	2 – 3	>3 – 12	over 30
Minimum tempering valve size	25 mm	20 mm	15 mm
Pipes to tempering valve	25 mm (see **Note 3**)	20 mm	20 mm (15 mm optional) (see **Note 1**)
Pipes to shower	20 mm	20 mm (see **Note 4**)	20 mm (see **Note 5**) (15 mm optional) (see **Note 1**)
Pipes to sink/laundry (see **Note 2**)	20 mm	20 mm	15 mm
Pipes to bath (see **Note 2**)	20 mm	20 mm	15 mm
Pipes to basins (see **Note 2**)	15 mm	15 mm	10 mm

Notes:

1. If supplied by separate pipe from *storage water heater* to a single outlet.
2. This table is based on maximum pipe lengths of 20 metres.
3. 2 m maximum length from *water heater* outlet to tempering valve.
4. 15 mm if dedicated line to shower.
5. 10 mm if dedicated line to shower.
6. Table 3 pipe sizes have been calculated to deliver water simultaneously to the kitchen sink and one other *fixture*.

5.4 Maintenance facilities

5.4.1 The *water supply system* shall be provided with an isolating valve where a supply pipe enters the *building* or at each Dwelling unit within a Multi-unit dwelling.

5.4.2 Where the water supply pipe serves a Detached dwelling, the isolating valve required by Paragraph 5.4.1 may be located at the property boundary.

COMMENT:
Additional isolating valves may be provided for the maintenance of *storage water heaters*, valves and components.

5.4.3 Provision shall be made for draining *storage water heaters* in accordance with Figure 7.

6.4 Safety devices

6.4.1 Valve vented (unvented) systems shall have in addition to Paragraph 6.3.3 the following safety devices:

a) Combined temperature/pressure relief valve for systems with a working pressure greater than 120 kPa,

b) Combined temperature/pressure relief valve or a pressure relief valve for systems with a working pressure less than 120 kPa,

c) An energy cut-off for each heating unit on gas and electric systems, and

d) Valves complying with Table 6.

6.4.2 *Free outlet (push through) water heaters* shall have a relief valve. No relief valve drain is required.

6.5 Temperature control devices

Third Edition Dec 2007

6.5.1 Electric thermostats and energy cut-off devices shall comply with NZS 6214 or AS 1308.

6.5.2 Energy cut-off devices shall be designed to:

a) Be reset manually, and

Amend 5 Feb 2004

b) Disconnect the energy supply before the water temperature exceeds 95°C.

6.6 Relief valves

6.6.1 All valves shall have flow rates, pressure and *diameter* compatible with the system they serve.

6.6.2 Pressure relief valves and expansion control valves shall have:

a) A flow rate capacity of no less than the rate of cold water supply, and

b) A maximum pressure rating of no more than the working pressure of the hot water storage vessel.

COMMENT:

The provision of cold water expansion valves satisfies two objectives of the New Zealand Building Code:

1. Safety: Protects the pressure relief or combined temperature/pressure relief valve from blockage due to calcium and other similar deposits where hard water is frequently discharged through the valve.
2. Energy Efficiency (NZBC H1): Cold water instead of hot water is discharged to waste during the frequent warm up cycles.

6.6.3 Expansion control valves shall have a pressure rating of no less than that of the water supply pressure to the *storage water heater*, but less than the pressure rating of the relief valve. Amend 5 Feb 2004

Table 6: Storage Water Heater Valves
Paragraph 6.3.3 c) and 6.4.1 d)

Valve type	Standard
Cold water expansion valves (Amend 7 Sep 2010)	NZS 4608 BS EN 1491 AS 1357: Part 1
Temperature/pressure relief valve (Amend 7 Sep 2010)	NZS 4608 BS EN 1490 AS 1357: Part 1
Non-return valves	NZS 4608 AS 1357: Part 1
Vacuum relief valves	NZS 4608 AS 1357: Part 2
Pressure reducing valves and pressure limiting valves	NZS 4608 BS EN 1567 AS 1357: Part 2
Pressure relief valves	NZS 4608

Amend 5 Feb 2004

Amend 10 Jan 2017

6.6.4 The following valves shall have an energy rating greater than that of the energy sources heating the water:

a) Temperature/pressure relief valve, and

b) Pressure relief valve.

6.6.5 Valve installation

a) Temperature/pressure relief valves shall be located with their probe within the top 20% of the water capacity and no more than 150 mm from the top of the container,

b) Pressure relief valves shall be located no further than 1 metre from the *storage water heater*, and

c) Valves shall be installed in a manner which provides for easy access for replacement, servicing or maintenance of devices.

6.6.6 There shall be no valve or restriction between the relief valve and the *storage water heater*.

6.7 Relief valve drains

6.7.1 Relief valve drains (see Figures 12 and 13) shall be fitted to:

a) Temperature/pressure relief valves,

b) Pressure relief valves, and

c) Expansion control valves.

6.7.2 Relief valve drains shall:

a) Be of copper pipe,

b) Have no restrictions or valves,

c) Have a continuous fall from the relief valve to the outlet,

d) Discharge in a visible position which does not present a hazard or damage to other *building elements* (except when used in association with *free outlet storage water heaters*),

e) Have a minimum *diameter* of the same size as the valve outlet,

f) Have the number of changes in direction plus the length of the relief drain (in metres) not exceeding 12,

COMMENT:
For example: 7 metres of pipe allows the total number of bends to be 5.

Amend 5 Feb 2004

g) Be connected to a relief valve in accordance with the valve manufacturer's specification,

h) Comply with Paragraph 6.7.3 when relief valve drains are combined, and

i) Comply with Paragraphs 6.7.4 and 6.7.5 when freezing is likely.

6.7.3 Combined relief valve drains
When relief valve drains are combined the combined drain shall (see Figure 13):

a) Receive discharges from one temperature/ pressure relief valve or the pressure relief valve and one expansion control valve,

b) Discharge via a minimum air break of 25 mm, and

c) Have a minimum size of 20 mm *diameter* and be one size larger than the largest relief valve outlet.

COMMENT:
The drain from the *storage water heater* may also be connected into the combined relief valve drain.

6.7.4 Water heaters located where freezing is likely

Additional requirements for relief valve drains are (see Figure 12):

a) Relieve one valve only, and

b) Comply with Paragraph 6.7.5 when freezing of the drain is likely.

COMMENT:
This paragraph applies to *water heaters* that are installed outside the *building's* thermal envelope in cold climates.

6.7.5 Relief drains located where freezing is likely

Additional requirements for relief drains located where freezing is likely (see Figure 12) are that:

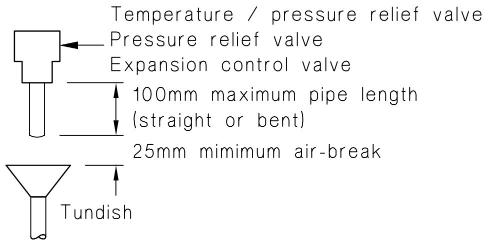
a) Relief valve drain pipes shall discharge over a tundish with a 25 mm air break before the drain pipe enters a zone where freezing is likely, and

b) Relief valve drains from a tundish shall be one size larger than the outlet *diameter* of the relief valve.

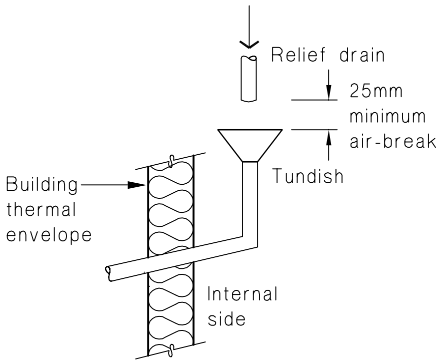
Amend 5 Feb 2004

Amend 5 Feb 2004

Figure 12: Relief Valve Drains – Freezing Protection
Paragraphs 6.7.1, 6.7.4 and 6.7.5



(a) Storage water heater located where freezing likely
e.g. External to building thermal envelope in cold climates



(b) Relief drain located where freezing likely
e.g. Internal storage water heater with drain discharging externally (See figure 13 also)

COMMENT:
This paragraph applies to *storage water heaters* located inside the *building's* thermal envelope with relief valve drains discharging where freezing of the drain is likely.

6.7.6 Closed cell foam polymer insulation or fibre glass insulation which is preformed to the shape of the pipe and not less than 13 mm thick, is acceptable material for preventing pipes less than or equal to 40 mm *diameter* from freezing. Any insulation material that absorbs moisture shall be protected in a waterproof membrane.

Amend 5 Feb 2004

6.8 Vent pipes

6.8.1 *Vent pipes* for *open vented storage water heaters* shall comply with the provisions of Paragraphs 6.8.2 and 6.8.3.

6.8.2 Installation

a) Materials: The pipe material shall be copper complying with Table 1,

b) *Diameter:* The *diameter* of the *vent pipe* shall be no less than that of the hot water outlet fitting on the *storage water heater* and no less than 20 mm where the energy input rating is greater than 3 Kw,

c) Termination: The *vent pipe* (see Figure 6) shall terminate either:

i) outside the *building*, or

ii) over a water tank supplying the *storage water heater*, and

d) Height: The *vent pipe* height, measured in metres from the base of the *storage water heater*, shall not exceed the height (in metres) that equates to the maximum pressure rating of the *storage water heater*, and

e) Water level: The normal standing water level in the *vent pipe* shall be a minimum of 3.0 metres above the highest outlet. The height of the *vent pipe* shall be:

i) 300 mm above the standing water level of the *vent pipe*, for tank fed systems, and

ii) 1.0 m above the standing water level, for pressure reducing valve fed systems.

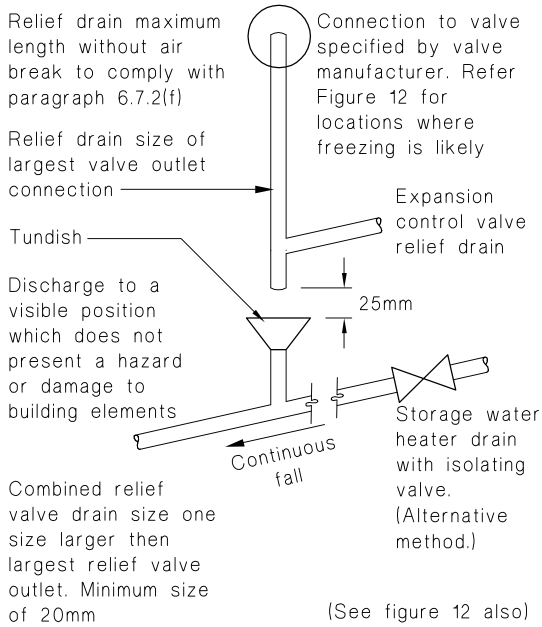
COMMENT:
a) The 1.0 m height has been found to prevent hot water loss due to the pressure reducing valve creeping.

b) The 3.0 m height is measured from the highest fitting in order to ensure sufficient working head to that fitting.

c) 9.81 kPa = 1 metre in head = 1 metre in height.

Amend 5 Feb 2004

Figure 13: Relief Valve Drains – Combined
Paragraphs 6.7.1, 6.7.2 f) and 6.7.3



Amend 5 Feb 2004

6.8.3 Insulation

a) Where the *vent pipe* is likely to be subjected to freezing, it shall be insulated between the top of the *storage water heater*, and a point no less than 300 mm above the normal standing water level in the *vent pipe*.

b) Insulation material is to comply with Paragraph 6.7.6.

Third Edition Dec 2007

6.9 Another acceptable solution for the installation of open vented storage water heaters

6.9.1 NZS 4603 is an acceptable solution for open vented low pressure *storage water heaters*, but may exceed the performance criteria of NZBC G12.

Third Edition Dec 2007

6.10 Another acceptable solution for the installation of unvented (valve vented) storage water heaters.

6.10.1 NZS 4607 is an acceptable solution for unvented (valve vented) *storage water heaters*, but may exceed the performance criteria of NZBC G12.

Amend 5 Feb 2004

6.11 Water heater installation

6.11.1 *Water heaters* shall be installed in accordance with the manufacturer's instructions.

6.11.2 Where heating units, sacrificial anodes, thermostats, pipework connections, valves, or other accessories being components of a *storage water heater* are installed, they shall be accessible for inspection, maintenance and removal.

6.11.3 *Storage water heaters* shall have:

a) Safe trays complying with Paragraph 5.2.3

Amend 10 Jan 2017

b) Connections compatible with the pipe material used, and

c) Drain pipes (for every *storage water heater* of more than 45 litres capacity) which:

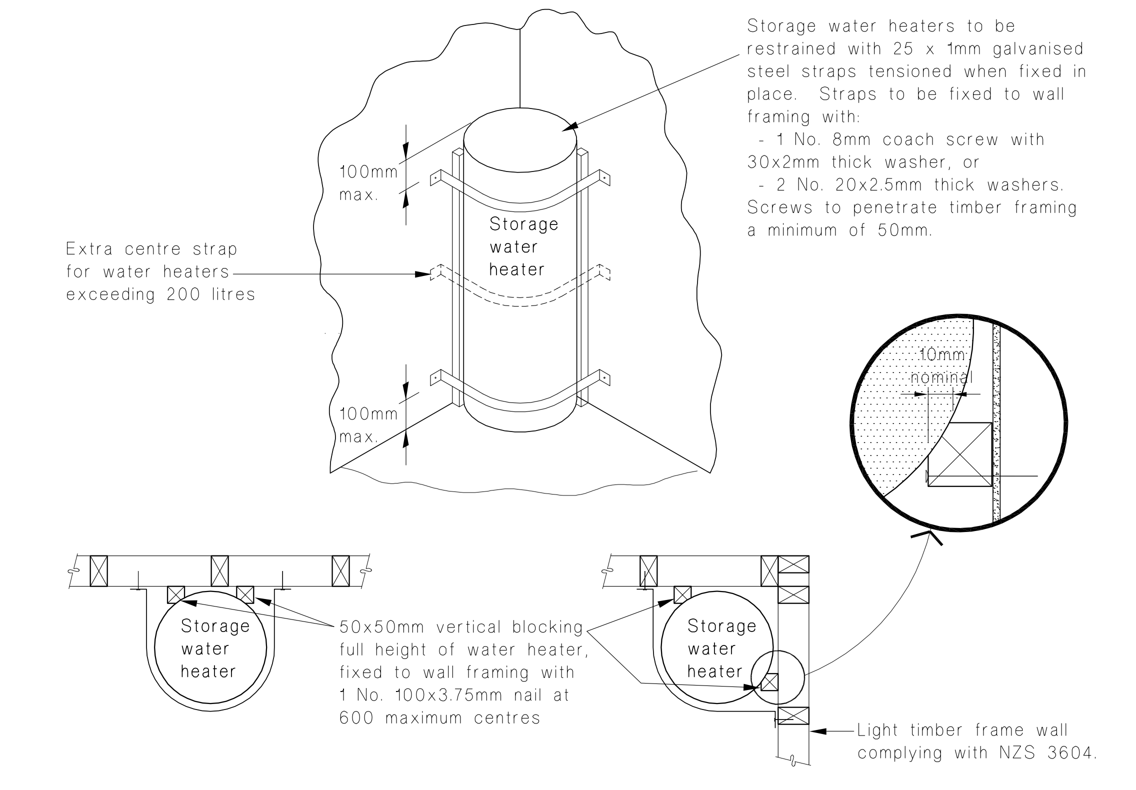
i) have a conveniently located isolating valve, and terminate with a cap or plug suitably located to easily empty the vessel for maintenance, or

ii) terminate outside the *building* with a cap only.

Amend 5 Feb 2004

Amend 5
Feb 2004

Figure 14: **Seismic Restraint of Storage Water Heaters 90 – 360 litres**
Paragraph 6.11.4



6.11.4 Structural Support

NZBC B1.3.2 requires *building elements* (including *storage water heaters)* to be adequately supported including support against earthquake forces. The method illustrated in Figure 14 is acceptable for *water heaters* up to 360 litre capacity. Where fittings and pipework are attached to the *water heater* through the supporting platform or floor a 50 mm minimum clearance shall be provided between the fitting and the support structure.

Third Edition
Dec 2007

6.11.5 Another acceptable solution for securing *storage water heaters* against seismic forces is given in Section 203 of NZS 4603.

6.12 Hot water pipe sizes

6.12.1 The *diameter* of hot water supply pipes from *storage water heaters* and to *sanitary fixtures* shall be no less than those required by Table 4.

Amend 5
Feb 2004

6.13 Wet-back water heaters

6.13.1 Wet-back *water heaters* shall be:

a) Connected only to *open vented storage water heaters*, or a water storage vessel (see Figure 15), and

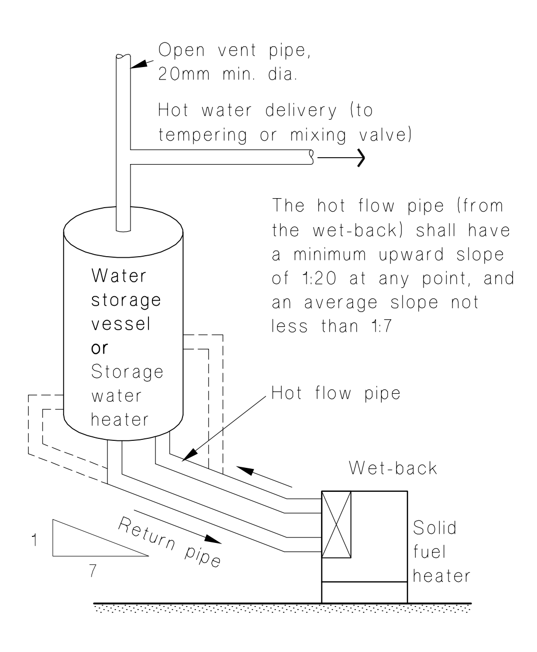
b) Made of copper.

6.13.2 Copper pipework shall be used between the wet-back and the *water tank*.

Amend 5
Feb 2004

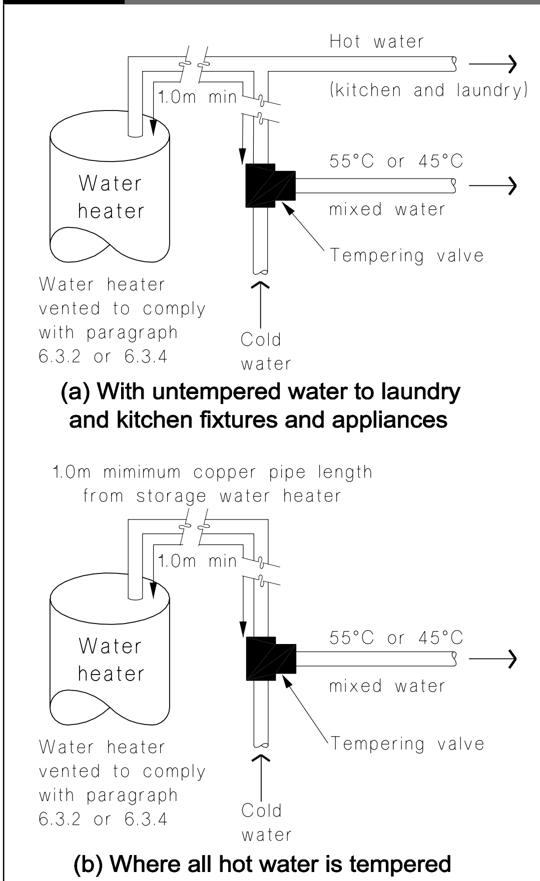
Amend 5
Feb 2004

Figure 15: Wet-back Installation – Open Vented System
Paragraph 6.13.1 a)



Amend 5
Feb 2004

Figure 16: Tempering Valve Installation
Paragraph 6.14.2 a)



Note:

1. For optimum system efficiency the tempering valve, for other than a mains pressure system, may be located as low as practicable to achieve the manufacturer's recommended head, at the tempering valve.
2. 1.0m minimum copper pipe length from storage water heater.

6.14 Safe water temperatures

6.14.1 Maximum temperatures

The delivered hot water temperature at any *sanitary fixture* used for personal hygiene shall not exceed:

a) 45°C for early childhood centres, schools, old people's homes, institutions for people with psychiatric or physical disabilities, hospitals, and

b) 55°C for all other *buildings*.

COMMENT:

1. At greatest risk from scalding are children, the elderly, and people with physical or intellectual disabilities, particularly those in institutional care.
2. ***Sanitary fixtures*** used for personal hygiene includes showers, baths, hand basins and bidets.

6.14.2 Hot water delivered from storage water heaters

a) An acceptable method of limiting hot water temperature delivered from *storage water heaters* is to install a mixing device between the outlet of the *water heater* and the *sanitary fixture* (see Figure 16).

Amend 5
Feb 2004

b) Tempering valves shall comply with NZS 4617 or AS 1357.2.

6.14.3 Legionella bacteria

Irrespective of whether a mixing device is installed, the *storage water heater* control thermostat shall be set at a temperature of not less than 60°C to prevent the growth of Legionella bacteria.

Third Edition
Dec 2007

Amend 5
Feb 2004

Table 7: Water Supply Pipework Support Spacing
Paragraph 7.1.3

Pipe material	Pipe diameter (mm)	Maximum distance between supports (m) Vertical pipe	Graded and horizontal pipe
Copper	10 – 15 20 – 25	1.5 2.0	1.2 1.5
Galvanised steel	15 – 20 25	2.0 3.0	1.5 2.5
uPVC	15 – 20 25	2.0 2.4	1.0 1.2
Polyethylene and polybutylene (cold water supply)	15 – 20 25	1.5 1.8	0.75 0.9
Polybutylene (hot water supply)	15 – 18 20 – 22	1.0 1.4	0.6 0.7

Note:
The spacing for these pipe materials is based on the pipes being located within the *building* structure.

Amend 5 Feb 2004

6.14.4 The water temperatures within flow and return circulating systems shall be maintained at not less than 60°C.

COMMENT:
Alternative methods of controlling Legionella within hot water circulating or warm water systems may include chlorine disinfection, UV sterilisation, high temperature pasteurisation combined with system flushing as part of a documented maintenance programme.

Third Edition Dec 2007

7.0 Installation Methods

7.0.1 *Water supply systems* shall be installed to comply with the durability requirements of NZBC B2.

7.1 Pipe supports

7.1.1 Pipes and their supports shall be electrochemically compatible.

7.1.2 Except where anchor points are necessary, the pipes shall be installed and supported in a manner which permits thermal movement.

7.1.3 Support spacing

Above ground water supply pipework shall be securely supported at centres of no greater than those given in Table 7.

7.1.4 Anchor points

Anchor points shall be provided where:

a) Seal ring joints are used, and

b) The joint is not able to resist the thrust imposed by the water pressure.

7.2 Protection from freezing

7.2.1 Where there is the likelihood of freezing, hot and cold *water supply systems* shall be protected in the following manner:

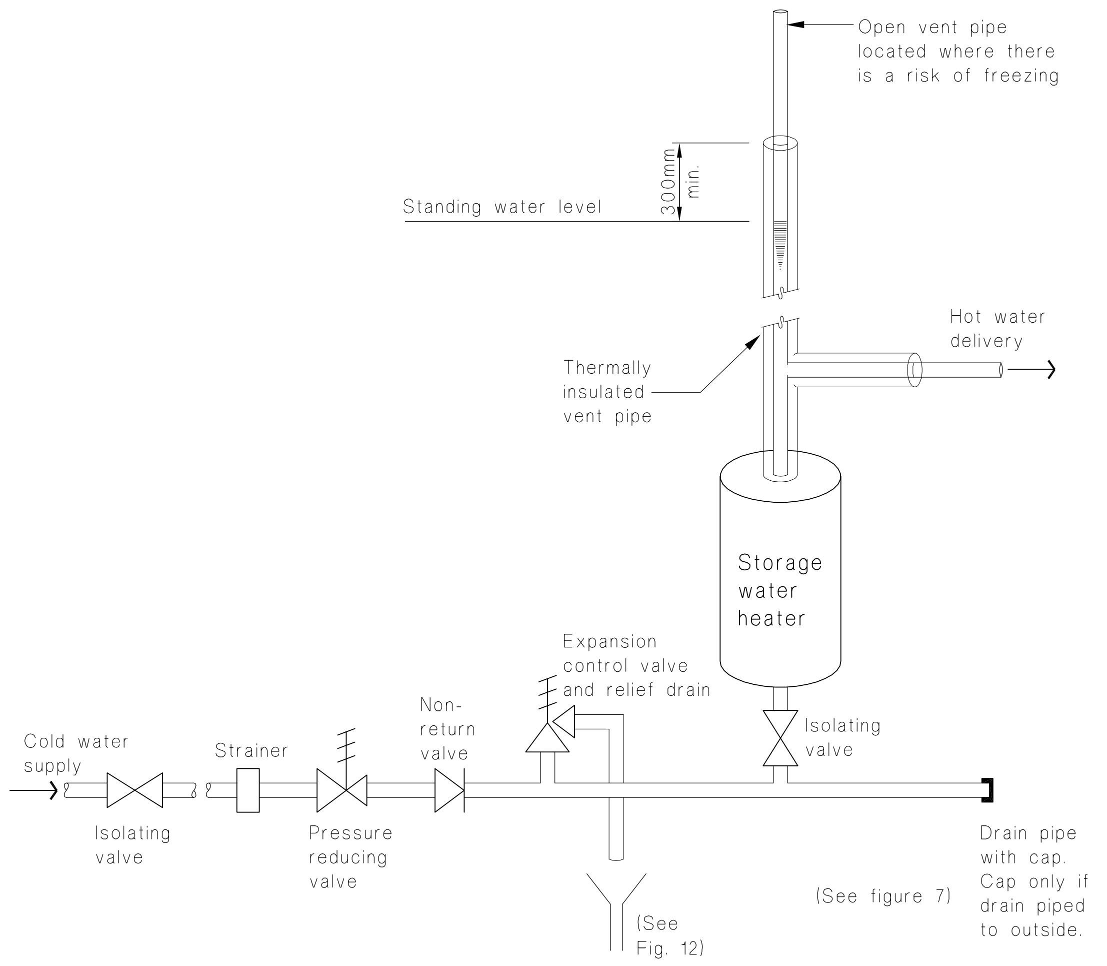
a) Piping outside of the *building* thermal envelope shall be insulated,

b) Piping buried in the ground shall be insulated or installed below a level affected by freezing, and

c) *Storage water heater vent pipes* shall be insulated (see Figure 17).

7.2.2 In climates where freezing temperatures are likely for a period of greater than 24 hours an expansion control valve is required in addition to *vent pipe* insulation (see Figure 17).

Figure 17: Open Vented Storage Water Heaters in Climates Subject to Freezing
Paragraphs 7.2.1 c) and 7.2.2



7.3 Protection from damage

7.3.1 Water supply pipes shall be protected from the likelihood of damage.

7.3.2 Pipes below ground level

An acceptable method of protecting water supply pipes is to provide the minimum covers given below:

Cover	Location
600 mm	Residential driveways and similar areas subjected to occasional heavy traffic
450 mm	Gardens, lawns or other areas not subjected to traffic

7.3.3 Movement in concrete or masonry

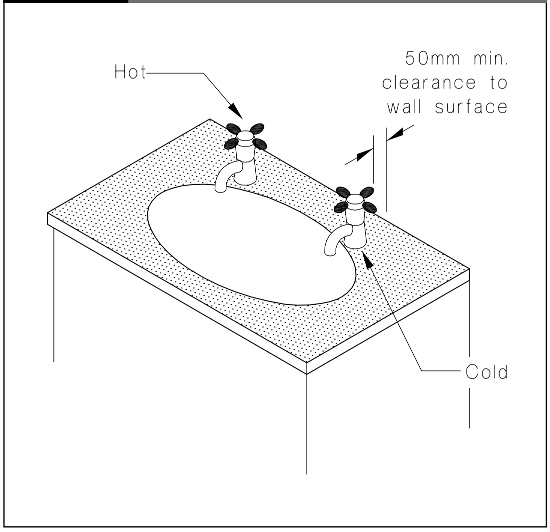
Pipes penetrating concrete or masonry elements shall be either wrapped with a flexible material, or passed through a sleeve or duct, to permit free movement for expansion and contraction.

Pipework in or under a concrete slab must be installed in a manner to achieve a 50 year durability.

7.4 Installation of uPVC Pipes

7.4.1 An acceptable method of installing uPVC pipe is given in NZS 7643.

Figure 18: **Usable Water Taps**
Paragraph 8.0.1



7.5 Watertightness

7.5.1 The *water supply system* shall be tested to ensure watertightness. An acceptable testing method is to:

a) Subject the hot and cold system to a pressure of 1500 kPa for a period of not less than 15 minutes, and

b) Inspect the system to ensure that there are no leaks.

COMMENT:

1. Testing should be carried out before concealing pipework behind interior linings, flooring or within concrete, or before backfilling trenches.
2. All *fixtures*, appliances, *water tanks, storage water heaters* and other equipment, which may be damaged during pressure testing, should be isolated before testing.

Third Edition Dec 2007

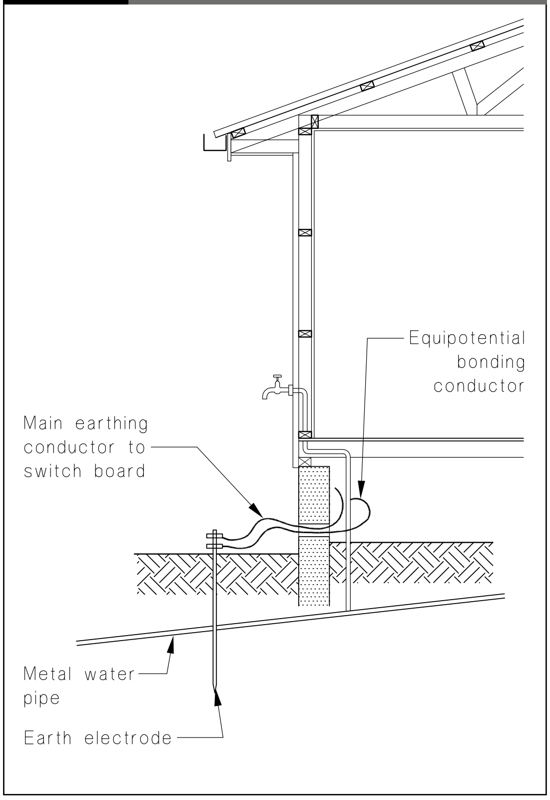
Amend 9 Feb 2014

7.5.2 Another acceptable solution for testing PVC-U water piping systems is given in Section 7 of AS/NZS 2032.

8.0 Usable Facilities for People with Disabilities

8.0.1 Where taps are likely to be used for personal hygiene or the washing of utensils by *people with disabilities*, they shall have (see Figure 18):

Figure 19: **Equipotential Bonding of Metallic Water Supply Pipe**
Paragraph 9.2.1 a)



a) Lever or capstan handles,

b) 50 mm clearances to wall surfaces, and

c) The hot tap located to the left of the cold tap.

COMMENT:

This requirement does not apply to Housing, Outbuildings, Ancillary *buildings*, and Industrial *buildings* employing fewer than 10 people.

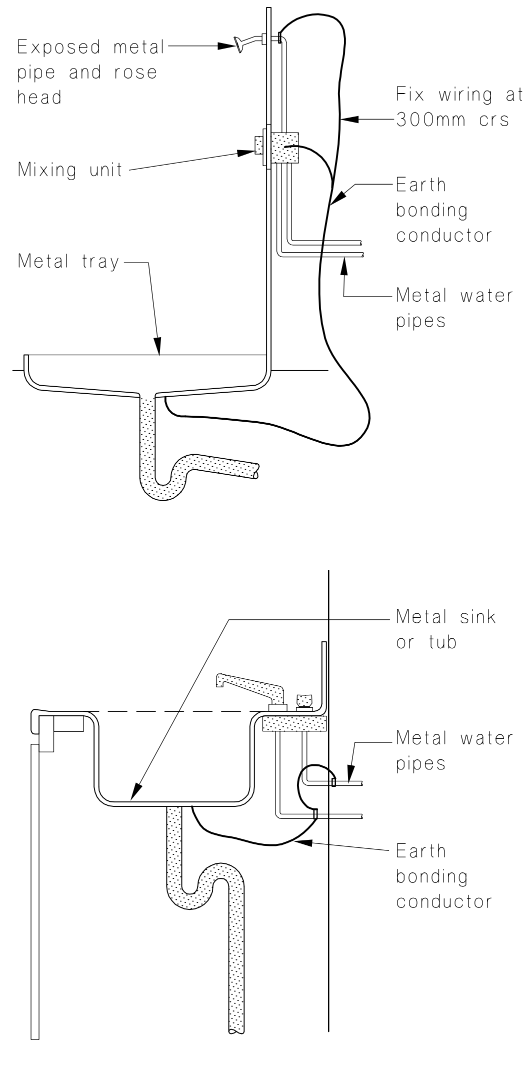
9.0 Equipotential Bonding

9.1 General

9.1.1 NZBC G9 requires any electrical installation within a *building* to be constructed to protect users from the dangers of contact with parts of the *building* that may become live during fault conditions.

9.1.2 Equipotential bonding is required where all of the following conditions are likely to exist:

Figure 20: Equipotential Bonding of Metallic Sanitary Fixtures
Paragraph 9.2.2 a)



a) Electricity is provided within a *building*,

b) The water supply pipe is metallic,

c) *Building* users are able to make contact with exposed parts of metal water supply pipe, or any metallic *sanitary fixtures* connected to it, and

d) The metal pipe is in contact with the ground, and forms a continuous metallic link from the ground to those parts of the pipe exposed to *building* users.

COMMENT:
No equipotential bonding is required if the water supply piping is plastic.

9.2 Installation of equipotential bonding conductors

9.2.1 Water supply pipe

a) Metallic water supply pipe shall be bonded to the earth electrode with an equipotential bonding conductor, as shown in Figure 19. The connection to the water pipe shall be as close as practicable to the point where the pipe leaves the ground, and

b) Metallic hot and cold water supply pipes shall be bonded together.

9.2.2 Metallic sanitary fixtures

a) Metallic *sanitary fixtures* shall be bonded to the metallic water supply pipe with an equipotential bonding conductor, as shown in Figure 20.

COMMENT:
Metallic *sanitary fixtures* are only required to be bonded to metallic water supply pipes where it is possible for a person to simultaneously touch the pipe (via a tap) and the *fixture*.

b) The bonding conductor shall be connected directly to the *sanitary fixture*. The bonding conductor may connect to the waste pipe where a metallic waste pipe is connected to the *sanitary fixture* and a continuous metallic link is formed between the waste pipe and the *fixture*.

9.3 Earth bonding conductors

9.3.1 Earth bonding conductors shall be:

a) Made of copper and have a cross-sectional area no less than 4.0 mm^2,

b) Sheathed with insulating material coloured green, and

c) Fixed at intervals of no greater than 300 mm with aluminium cable fixings.

9.3.2 Earth bonding conductors shall comply with AS/NZS 5000.1 or AS/NZS 5000.2 as appropriate.

Amend 7 Sep 2010
Amend 8 Oct 2011

Acceptable Solution G12/AS2 Solar Water Heaters

1.0 Scope

1.0.1 This Acceptable Solution applies to solar *water heaters* installed in or on *buildings*.

1.0.2 To comply with this Acceptable Solution solar *water heaters* must also comply with the appropriate requirements of G12/AS1. This Acceptable Solution meets the requirements of NZBC Clauses B1, B2, E2, G12 and H1.

1.0.3 Text boxes headed '**COMMENT**' occurring throughout this document are for guidance purposes only.

1.1 Structural support limitations

1.1.1 Where a *building* has not been specifically designed to support a solar *water heater*, this Acceptable Solution can be used for the support and fixing of a solar collector on *buildings* that meet the structural requirements specified in any one of the following:

- NZS 3604: 1990
- NZS 3604: 1999
- NZS 3604: 2011 (Amend 8 Oct 2011)
- NZS 4203
- AS/NZS 1170: Parts 0, 1, 2, 3 and NZS 1170: Part 5.

But only when all of the following requirements are met:

a) the weight of solar collector, including frames, fittings, and heat transfer fluid, has a combined weight of no more than 22 kg per square metre (based on the gross area of the solar collector), and

b) the hot water storage tank is not installed on or above the roof, and

c) where the hot water storage tank is located within a roof it has a maximum size of:

i) 200 litres when installed in accordance with NZS 3604: 1999 Section 14, or

ii) 450 litres when installed in accordance with AS/NZS 3500 Part 4 Section 5, and (Amend 10 Jan 2017)

d) the roof has a pitch no steeper than 45°, and

e) the *building* is in a *wind zone* where wind speeds do not exceed 50 m/s (VH *wind zone* defined in NZS 3604: 1999), and

f) the solar collector has an area no greater than 4 m^2, and

g) the design ground snow loading for the building is less than:

(i) 0.5 kPa as determined by NZS 4203, or NZS 3604: 1990 or NZS 3604: 1999 Section 15, or

(ii) 1.0 kPa as determined by AS/NZS 1170 or NZS 3604: 2011, Section 15, and (Amend 8 Oct 2011)

h) either:

i) the solar collectors are installed parallel to the roof *cladding*, or

ii) where solar collectors are installed at a different pitch to the pitch of the roof:

- the pitch of the solar collector is not greater than 45° to the horizontal, and
- the *building* is in a *wind zone* where wind speeds do not exceed 44 m/s (H *wind zone* defined in NZS 3604: 1999), and
- the solar collector faces in the same compass direction as the section of roof the solar collector is installed on.

COMMENT:

1. The limitations described in Paragragh 1.1.1 are necessary, because roofs are likely to have limited capacity to support additional loads.

1.1.2 When any of the requirements described in Paragraph 1.1.1 are not met, specific engineering design is required.

COMMENT:

Specific engineering design will require a structure assessment to be completed. This may result in either an assessment that the roof structure is sufficient to support the additional load or details of how to strengthen the roof structure to support the additional load.

1.2 Exclusions

1.2.1 If the solar *water heater* includes connection to an application such as underfloor heating, a swimming pool or any similar application, this Acceptable Solution applies only to the solar *water heater* and its components and not to the application.

2.0 Materials

2.1 Material selection

2.1.1 All material used to install the solar *water heater* must:

a) meet the *durability* requirements of NZBC Clause B2, and

b) be suitable for their use, location and environment as shown in Table 1, and

c) be compatible with adjoining materials as shown in Table 2, and

d) be compatible with materials subject to run-off as shown in Table 3 (except as described in Paragraph 2.1.2).

2.1.2 Table 3 states that "butyl/EPDM" to "steel, galvanized unpainted" is "not permitted"; however, water flow from small areas of ***EPDM*** will not significantly affect the *durability* of the roofing. Therefore it is acceptable to use unpainted ***EPDM*** boots with unpainted galvanised steel roofing if:

a) the boots are small (for 60 mm pipe diameter or smaller), and

b) there are no more than 10 boots used for the solar *water heater* installation, and

c) the boots contain no greater than 15% carbon black.

2.1.3 If the requirements described in Paragragh 2.1.2 are not met then either the ***EPDM*** boots or the galvanised roofing must be painted with a suitable protective coating.

2.1.4 Table 2 shows that galvanized fixings must be used rather than stainless steel when in contact with galvanized *cladding* and zinc-aluminium-magnesium (combinations) coated *cladding*. (This includes mounting brackets and straps.)

Amend 9 Feb 2014

Table 1: Material selection (reproduced from E2/AS1 Table 20)
This table shall be read in conjunction with Tables 2 and 3 and Paragraphs 2.1.1, 2.1.2, 2.1.3 and 2.1.4

Material	Exposure(1)(2)(4)(6) NOTE: Consider all walls as 'Sheltered' for steel based claddings(8)	Type	Acceptable Exposure Zones as per NZS 3604 – Section 4 (3)(4)(6) 15 years	50 years for hidden elements(2)(9)
CLADDINGS AND FLASHINGS				
Aluminium, zinc	Hidden(2)		B,C,D,E	B,C,D,E
	Exposed		B,C,D,E	
	Sheltered		B,C,D,E	
Copper, lead, or stainless steel	Hidden(2)		B,C,D,E	B,C,D, E
	Exposed		B,C,D,E	
	Sheltered		B,C,D,E	
Factory painted				
Aluminium-zinc-magnesium (combinations) coated or galvanised steel, to AS 1397 and AS/NZS 2728 with AM100, ZM274, and AZ150 minimum coatings	Hidden(9)	Type 4	B,C,D,E	B,C,D
	Hidden(9)	Type 6	B,C,D,E	B,C,D,E
	Exposed(8)	Type 4	B,C,D	
	Exposed(8)	Type 6	B,C,D,E	
	Sheltered	Type 4	B,C	
	Sheltered	Type 6	B,C,D	
Pressed metal tiles coated to minimum AZ150 or AM100 to AS 1397, AS/NZS 2728 or with post-form factory painting to cl 8.3.4.2.	Exposed	Type 6	B,C,D,E	
	Sheltered	Type 6	B,C,D	
Non-factory painted				
Aluminium-zinc-magnesium (combinations) coated steel, to AS 1397 with AZ150 or AM125 minimum coatings	Hidden(9)		B,C,D,E	B,C,D
	Exposed(8)		B,C	
	Sheltered		B	
Galvanised steel Z450 to AS 1397	Hidden(9)		B,C,D	B,C
	Exposed(8)		B,C	
	Sheltered		B	
Non-metallic				
Bituminous material, or uPVC	Hidden		B,C,D,E	B,C,D,E
	Exposed (uPVC only)		B,C,D,E	
	Sheltered (uPVC only)		B,C,D,E	
Butyl rubber	Hidden		B,C,D,E	B,C,D,E
	Exposed		B,C,D,E	
	Sheltered		B,C,D,E	
FIXINGS(7)				
Aluminium, bronze, and stainless steel (Types 304 and 316)(10)	Hidden		B,C,D,E	B,C,D,E
	Exposed		B,C,D,E	
	Sheltered		B,C,D,E	
Nails – Hot-dip galvanised steel to AS/NZS 4680	Hidden(5)(9)		B,C,D	B,C
	Exposed		B,C,	
	Sheltered		B	
Screws – galvanised steel, painted or unpainted, to AS 3566: Part 2	Hidden(5)(9)	Class 3	B,C,D,E(3)(4)	B,C,D,E
	Exposed	Class 4	B,C,D	
	Sheltered	Class 4	B,C	

Amend 9
Feb 2014

Table 1: Material selection – continued

Note:

1) Refer to manufacturer's information for maintenance requirements in Exposed and Sheltered locations.
2) The term "hidden" means concealed behind another element such that no part is visible. Hidden elements require a 50 year *durability* under the *NZBC*. The term "exposed" means having surfaces exposed to rain washing. The term 'sheltered' means being visible, but not rain washed. For diagrammatic outline, refer NZS 3604 Figure 4.3(a). Exposed and sheltered elements require a 15 year *durability*. Where an element can be categorised as both 'sheltered' and 'exposed', the 'sheltered' condition will apply.
3) AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand, determined by exposure to wind-driven sea-spray. NZS 3604 references atmospheric classes B (Low), C (Medium) and D (High). E2/AS1 references atmospheric zones B,C,D,E. For the purposes of *cladding* selection, Zone E (Severe marine classified as breaking surf beach fronts) has been included. Designers must consult metal supplier's information for specific *durability* requirements of sites in Zone E.
4) The geographic limits of atmospheric classes in NZS 3604 and AS/NZS 2728 may vary. Table 1 uses the limits outlined in NZS 3604.
5) Includes fixings protected by putty and an exterior paint system of primer, undercoat and two top coats of paint.
6) Microclimates based on evidence from adjacent structures of corrosion caused by industrial or geothermal atmospheres are outside the scope of this Acceptable Solution.
7) Refer to Tables 2 and 3 for compatibility of fixings with metal *claddings*.
8) *Roof* only. Coated steel *wall claddings* must be considered as 'sheltered'.
9) Hidden steel coated elements in ventilated cavities in zones D and E (exposure to salt air) must be considered as 'sheltered'
10) The use of stainless steel fixings is not recommended by steel manufacturers for use with coated steel in severe marine and industrial environments, as they are considered to cause deterioration.

Amend 9 Feb 2014

Table 2: Compatibility of materials in contact

This table must be read in conjunction with Tables 1 and 3 and Paragraphs 2.1.1., 2.1.2, 2.1.3 and 2.1.4

Amend 9 Feb 2014

	Aluminium, anodised or mill-finish	Aluminium, coated (1)	Butyl rubber & EPDM	CCA-treated timber (2)	Cedar	Cement plaster (uncoated)	Ceramic tiles (cement grout)	Clay bricks (cement mortar)	Concrete old (unpainted)	Concrete green (unpainted)	Copper/brass	Glass	Glazed roof tiles	Lead (including lead-edged) unpainted	Plastics	Stainless steel	Steel, galvanised coil-coated	Steel, galvanized (unpainted)	Zinc	Zinc-aluminium-magneisum (combinations), coated (1)	Zinc-aluminium-magnesium (combinations), (unpainted)
Aluminium, anodised or mill-finish	✓	✓	✓	✘	✓	✘	✘	✘	✓	✘	✘	✓	✓	✘	✓	B	✓	✓	✓	✓	✓
Aluminium, coated (1)	✓	✓	✓	B	✓	✘	✘	✘	✓	✘	✘	✓	✓	B	✓	B	✓	✓	✓	✓	✓
Butyl rubber & EPDM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CCA-treated timber (2)	✘	B	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	B	✘	✘	B	✘
Cedar	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✘
Cement plaster (uncoated)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✓	✓	✓	✓	✓	✓	✘
Ceramic tiles (cement grout)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘
Clay bricks (cement mortar)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘
Concrete old (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Concrete green (unpainted)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✓	✓	✘	✘	✘	✘	✘
Copper/brass	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	B	✓	B	✘	✘	✘	✘	✘
Glass	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Glazed roof tiles	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lead (including lead-edged) unpainted	✘	B	✓	✓	✓	✘	✓	✓	✓	✘	B	✓	✓	✓	✓	B	B	B	B	B	✘
Plastics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stainless steel	B	B	✓	✓	✓	✓	✓	✓	✓	✓	B	✓	✓	B	✓	✓	B	✘	✘	B	B
Steel, galvanised coil-coated	✓	✓	✓	B	✓	✓	✓	✓	✓	✘	✘	✓	✓	B	✓	B	✓	✓	✓	✓	✓
Steel, galvanized (unpainted)	✓	✓	✓	✘	✘	✓	✓	✓	✓	✘	✘	✓	✓	B	✓	✘	✓	✓	✓	✓	✓
Zinc	✓	✓	✓	✘	✘	✓	✓	✓	✓	✘	✘	✓	✓	B	✓	✘	✓	✓	✓	✓	✓
Zinc-aluminium-magenesium (combinations), coated (1)	✓	✓	✓	B	✓	✓	✓	✓	✓	✘	✘	✓	✓	B	✓	B	✓	✓	✓	✓	✓
Zinc-aluminium-magnesium (combinations) (unpainted)	✓	✓	✓	✘	✘	✘	✘	✘	✓	✘	✘	✓	✓	✘	✓	B	✓	✓	✓	✓	✓

Amend 9 Feb 2014

LEGEND:

✓ Materials satisfactory in contact.

✘ Contact between materials is not permitted. Minimum gap of 5 mm is required to prevent moisture bridging.

B Avoid contact in sea-spray zone or corrosion zone D.

NOTES:

(1) Coated – includes factory-painted, coil-coated and powder-coated.

(2) Includes copper azole and copper quaternary salts.

Table 3: Compatibility of materials subject to run-off

This table must be read in conjunction with Tables 1 and 2 and Paragraphs 2.1.1., 2.1.2, 2.1.3 and 2.1.4

Amend 9 Feb 2014

Material that water flows from \ Material that water flows onto	Aluminium, anodised or mill-finish	Aluminium, coated (1)	Butyl rubber & EPDM	CCA-treated timber (2)	Cedar	Cement plaster (uncoated)	Ceramic tiles (cement grout)	Clay bricks (cement mortar)	Concrete old (unpainted)	Concrete green (unpainted)	Copper/brass	Glass	Glazed roof tiles	Lead (including lead-edged) unpainted	Plastics	Stainless steel	Steel, galvanised coil-coated	Steel, galvanized (unpainted)	Zinc	Zinc-aluminium-magneisum (combinations), coated (1)	Zinc-aluminium-magnesium (combinations), (unpainted)
Aluminium, anodised or mill-finish	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Aluminium, coated (1)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✘
Butyl rubber & EDPM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✘
CCA-treated timber (2)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘	✘	✘
Cedar	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✘
Cement plaster (uncoated)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✘	✓	✓	✓	✘	✘	✓	✘
Ceramic tiles (cement grout)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✘	✘	✓	✘
Clay bricks (cement mortar)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✘	✘	✓	✘
Concrete old (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓
Concrete green (unpainted)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✘	✓	✓	✘	✘	✘	✘	✘
Copper/brass	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘	✘	✘
Glass	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Glazed roof tiles	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Lead (including lead-edged) unpainted	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘
Plastics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Stainless steel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Steel, galvanised coil-coated	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Steel, galvanized (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Zinc	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Zinc-aluminium-magenesium (combinations), coated (1)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Zinc-aluminium-magnesium (combinations) (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓

Amend 9 Feb 2014

LEGEND:

✓ Materials satisfactory with water run-off as indicated.

✘ Water run-off is not permitted as indicated.

A Etching or staining of glass may occur with run-off.

NOTES:

(1) Coated – includes factory-painted, coil-coated and powder-coated.

(2) Includes copper azole and copper quaternary salts.

3.0 Solar Water Heater Requirements

3.1 Solar water heaters and components

3.1.1 Solar *water heaters* must comply with AS/NZS 2712

Amend 9 Feb 2014

3.1.2 Tanks installed as part of a pumped solar *water heater* where the tank is separately mounted from the collector must comply with the minimum tank insulation requirements of AS/NZS 4692.2.

COMMENT:
AS/NZS 4692.2: 2005 specifies Minimum Energy Performance Standard (MEPS) requirements for electric *water heaters***.** Clause 1.4 of this Standard excludes solar *water heaters.* Paragraph 3.1.2 of this Acceptable Solution modifies this exclusion so that hot water tanks mounted separately from solar collectors used in a solar *water heater* must now comply with the MEPS requirements specified in AS/NZS 4692.2: 2005.

3.2 Solar controller

3.2.1 Where a solar *water heater* has a controller, the controller must meet the requirements specified in AS/NZS 2712: clause 6.3.

Amend 9 Feb 2014

3.2.2 The controller or the solar *water heater* design must minimise the use of supplementary heating while meeting the requirements described in Paragraph 3.5.

3.2.3 A solar *water heater* which meets the requirements described in Paragraphs 3.2.1 and/or 3.2.2 satisfies NZBC Clause H1.3.4.

3.3 Sizing of systems

3.3.1 Solar *water heaters* must have a minimum of 50 litres of hot water storage per square metre of collector area.

COMMENT:
The sizing requirement described in Paragraph 3.3.1 is to prevent overheating of the system. The capacity of the tank should not be less than one day's expected use. For most houses the expected hot water consumption is 40–60 litres per person per day when stored at 60°C.

3.4 Operating and safety devices

3.4.1 Storage tanks in solar *water heaters* must have operating and safety devices that meet the requirements of G12/AS1 Paragraph 6.

3.4.2 Water from the installed system must not discharge onto the roof. *Vent pipes* and outlets from pressure relief valves must be plumbed to a suitable drain point.

3.5 Protection from Legionella bacteria

3.5.1 To prevent the growth of Legionella bacteria, solar *water heaters* must either:

a) have a continuously energised heating element fitted within 55% of the bottom of the *water tank* (by volume) and a thermostat set to 60°C or higher, or

b) be controlled so that the water above the element is heated to 60°C once a day, and the element is in the bottom 20% of the *water tank* (by volume) and no more than 150 mm from the bottom of the tank, or

c) be controlled so that all of the stored water is heated to 60°C or higher, once a week for not less than 1 hour. The temperature must be measured by a probe in the bottom 20% of the *water tank* (by volume) and no more than 150 mm from the bottom of the water tank. For open loop systems the stored water includes the water in the solar collector and water must be circulated through the collector during the heating period.

3.5.2 Where the solar *water heater* stores potable water and is used as a pre-heater for an instantaneous *water heater*, either:

a) the hot water storage tank connected to the solar collector must be fitted with supplementary heating and a controller operating to meet the conditions outlined in Paragraph 3.5.1, or

b) the instantaneous *water heater* must heat all water passing through it to not less than 70°C.

3.5.3 Where the solar *water heater* supplies inlet water to a *storage water heater* with an element in the bottom 20% of the water tank (by volume) and no more than 150 mm from the bottom of the tank with a thermostat set to no less than 60°C, no additional Legionella control is required.

COMMENT:
Paragraph 3.5 of this Acceptable Solution provides ways to demonstrate that the NZBC Clause G12.3.9 (i.e. "A hot water system must be capable of being controlled to prevent the growth of Legionella bacteria") is satisfied. This is a heat disinfection method which is considered the most effective method to control Legionella.

The heating required to control the growth of Legionella does not necessarily have to be achieved using supplementary electric heating; it could also be achieved using gas, solar or wood as a heating fuel.

3.6 Protection from frosts

3.6.1 For protection from freezing, collectors installed in climate zones 1 and 2 (as shown in Figure 1) must:

a) pass the level 1 test described in AS/NZS 2712 Appendix E, or (Amend 9 Feb 2014)

b) have an automatic drain-down system.

3.6.2 For protection from freezing, collectors installed in climate zone 3 (as shown in Figure 1) must:

a) pass the level 2 test described in AS/NZS 2712 Appendix E, or (Amend 9 Feb 2014)

b) have an automatic drain-down system.

Figure 1: **New Zealand climate zones for frost protection**
Paragraph 3.6

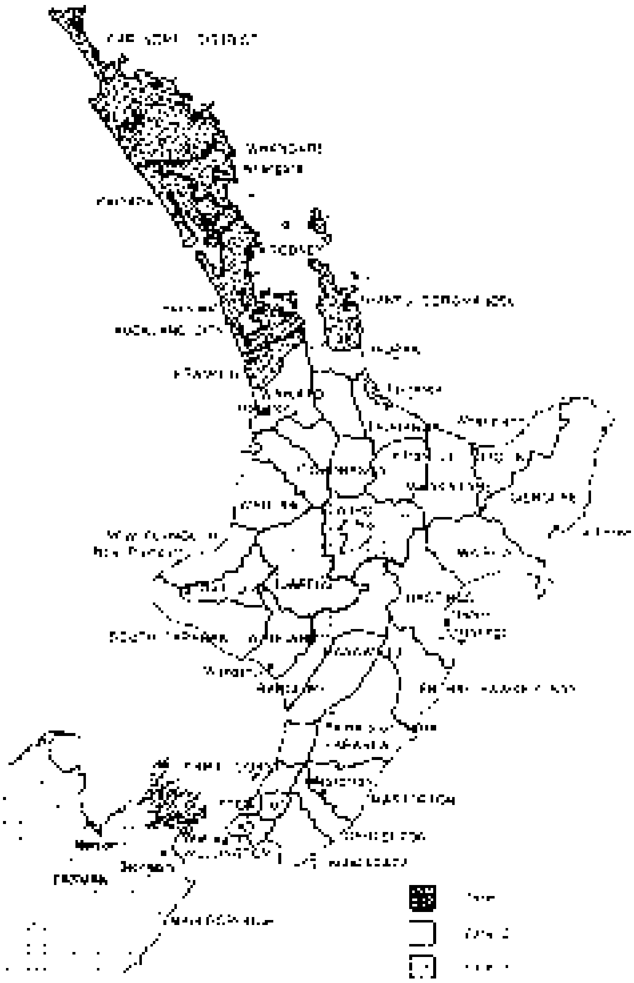


Figure B1 – Climate zones

Zone 3 includes all of the South Island, Stewart Island and the Chatham Islands
Figure B1 from NZS 4218: 2004 is reproduced with permission of Standards New Zealand under Licence 684.

4.0 Location of Solar Water Heaters

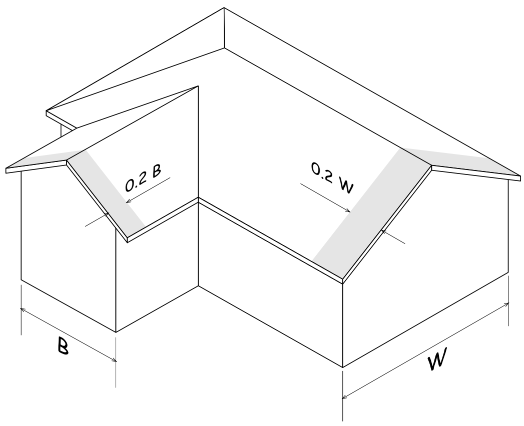
4.1 Location

4.1.1 Solar *water heaters* must be located away from the edge of a gable roof structure outside the high pressure *wind zone* shown in Figure 2.

4.2 Solar orientation and inclination

4.2.1 Solar collectors must face within +/- 90 degrees of geographic north (ie between east and west) to satisfy the requirements of NZBC Clause H1.3.4(a).

Figure 2: **High pressure wind zone**
Paragraph 4.1



4.2.2 Solar collectors must be inclined at an angle within +/- 20 degrees of the angle of latitude (from the horizontal) to satisfy the requirements of NZBC Clause H1.3.4(a).

COMMENT:

1. The ideal orientation of a solar collector is geographic north with an inclination angle from the horizontal the same as the angle of latitude for the location. Deviations from the ideal orientation will reduce the performance of the solar *water heater*.

   Details of the impact of changes in orientation and inclination are provided in NZS 4614: 1986, and are shown in the following diagram.

FACTORS FOR INCLINATION AND SOLAR ORIENTATION

		Inclination angle (degrees)					
Direction (degrees)		0°	20°	40°	60°	80°	90°
West	270	0.85	0.85	0.8	0.72	0.6	0.53
	300	0.85	0.92	0.92	0.86	0.73	0.65
	330	0.85	0.98	0.99	0.93	0.8	0.71
North	0	0.85	0.97	1	0.94	0.8	0.7
	30	0.85	0.94	0.95	0.88	0.74	0.65
	60	0.85	0.88	0.86	0.77	0.65	0.57
East	90	0.85	0.8	0.73	0.64	0.52	0.46

Good orientation		Moderate orientation		Poor orientation

   The relative performance of flat-plate collectors in different orientations is illustrated. It is clear that collectors should face within about 45° of north, and be fitted at an inclination angle between 20° and 50°.

   If for some reason it were necessary to place the collectors facing the west at 60° inclination, then to avoid loss in performance, the collectors would have to be 1/0.72 (or 1.4) as large (i.e. increased by 40% in the collector area).

   Where collectors other than flat-plate type (cylindrical shape for instance) are used, similar optimum requirements for orientation will apply (i.e. the axis of the cylinder should be inclined at 20° to 50°). The performance loss by using poorer orientation has not been as fully explored as for the flat-plate case.

   Figure 12 from NZS 4614: 1986 is reproduced with the permission of Standards New Zealand under Licence 684.

2. Shading of solar collectors should be minimised to ensure maximum performance of the system.

   Significant shading between 9:00 am and 3:00 pm will affect the performance of a solar *water heater*.

   The solar altitude may be determined using a commercial "sun locator" or a simple solar altitude sight may be constructed using the diagrams given in AS/NZS 3500.4 Appendix H: Estimation of Shading of Collectors Amends 10 and 12

5.0 Installation of Solar Water Heaters

5.0.1 Solar *water heaters* must be installed in accordance with the requirements of AS/NZS 3500 Part 4, unless modified by this Acceptable Solution. Amend 10 Jan 2017

5.0.2 Water storage tanks that form part of a solar *water heater* must have drain pipes that:

a) have an easily reached isolating valve, and terminate with a cap or plug to empty the vessel for maintenance, or

b) terminate outside the *building* with a cap only.

5.0.3 Fixings used for the installation of a solar *water heater* must meet the requirements described in Paragraphs 2.1.1, 2.1.2, 2.1.3 and 2.1.4.

5.0.4 All metal swarf from drilling or cutting must be removed from the roof surface to prevent corrosion. Care must also be taken to avoid scratching of any roof *cladding* protective coating.

5.1 Wetback water heaters

5.1.1 Where water is heated by a wetback *water heater* and a solar collector, independent water pipe circuits must be installed for each heat source.

5.1.2 A wetback *water heater* must have an open-vent connected to the:

a) *water tank*, or

b) wetback *water heater* flow pipe (see G12/AS1 Figure 5).

COMMENT:

In Paragraph 5.1.2 (b) a heat-exchanger is required when the tank pressure is higher than the open-vented wetback circuit.

5.2 Weathertightness

5.2.1 Any penetrations made in the *building cladding* during the installation of a solar *water heater* must be flashed, or sealed using purpose-made sealing washers or boots to prevent leaks.

5.2.2 Where roof penetrations are required for large openings such as solar collectors installed in or below the roof:

a) the edge of roofing penetrations over 200 mm wide must be supported in either direction with additional *framing* as shown in Figure 3, and

b) for the catchment area of the roof above the penetration as shown in Figure 4, the roof length must be limited to the areas shown in Table 4.

5.2.3 Penetrations through masonry tile roofs must be as shown in Figure 5.

5.2.4 Pipe penetrations in pressed metal tile roofs must be flashed using *EPDM* or silicone rubber boot *flashings* as shown in Figure 6.

Table 4: Maximum catchment areas above penetrations greater than 200 mm wide
Paragraph 5.2.2 b)

Penetration width	Maximum roof length above penetration in metres			
	Profiled metal			
	Corrugated	Trapezoidal	Trough profile	Other roofs
800 to 1200 mm	4 m	8 m	16 m	4 m
600 to 800 mm	6 m	12 m	18 m	6 m
400 to 600 mm	8 m	16 m	18 m	8 m
200 to 400 mm	12 m	18 m	18 m	10 m

Figure 3: Support for penetration greater than 200 mm wide
Paragraph 5.2.2 a)

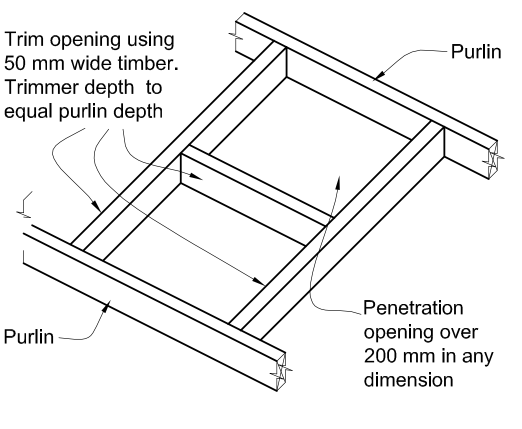


Figure 4: Catchment area for penetrations greater than 200 mm wide – see table 4
Paragraph 5.2.2 b)

NOTE: Profiled metalled roofing refer to Table 4 for maximum roof lengths above penetrations

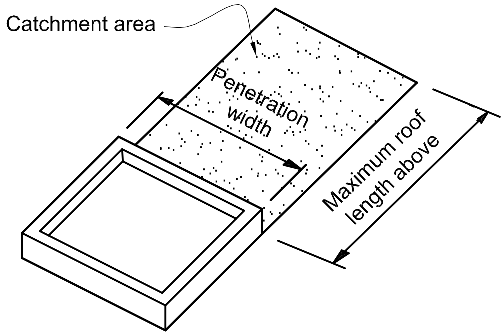
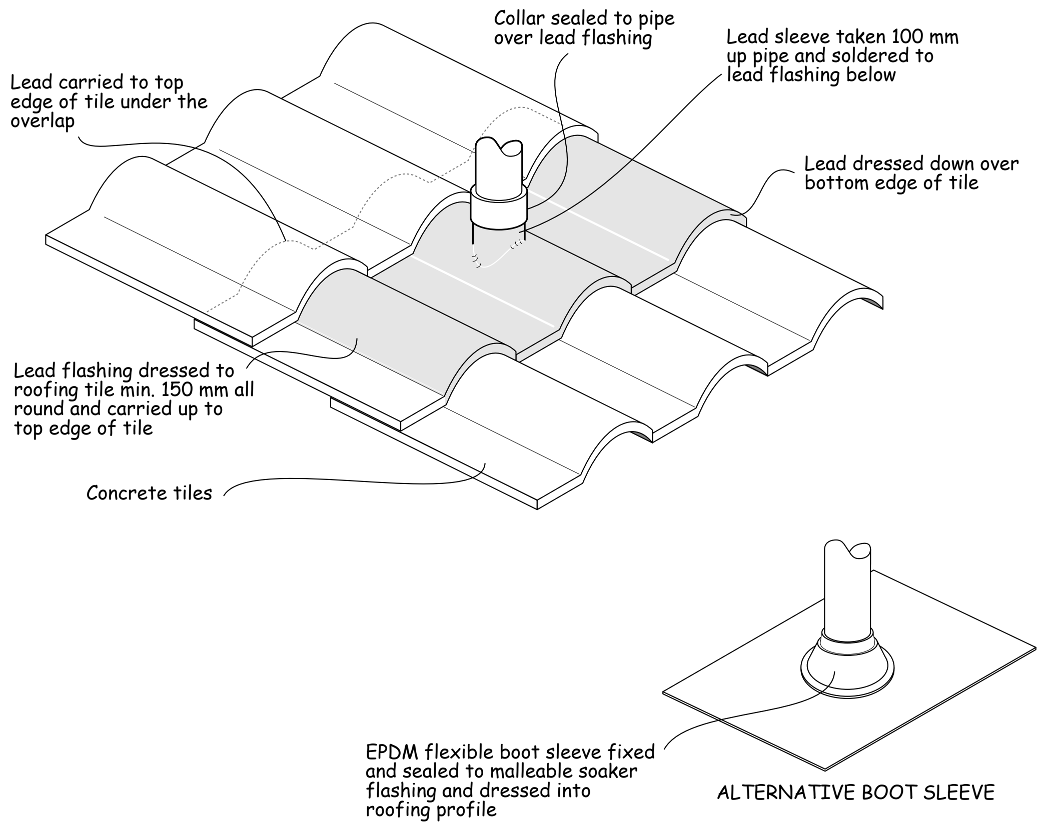


Figure 5: Pipe penetration for masonry tile roof
Paragraph 5.2.3



5.2.5 Roof penetrations in profiled metal roofs must be flashed as follows.

a) Pipe penetrations up to 60 mm diameter must be flashed using an *EPDM* boot *flashing* as shown in Figure 6, and

b) Rectangular penetrations up to 1200 mm wide must be flashed using a soaker type *flashing* as shown in Figure 7.

5.2.6 Penetrations on roofs will require *specific design* when:

a) the pitch is less than 15° for concrete tile or pressed metal roofs, or

b) the pitch is less than 10° for profiled metal roofs, or

c) the penetration is larger than 60 mm, or

d) the penetration requires specialised or complex *flashings*.

COMMENT:
The *cladding* manufacturer may be able to provide additional guidance.

Figure 6: Flashing for pipes, cables and other penetrations
Paragraphs 5.2.4 and 5.2.5 a)

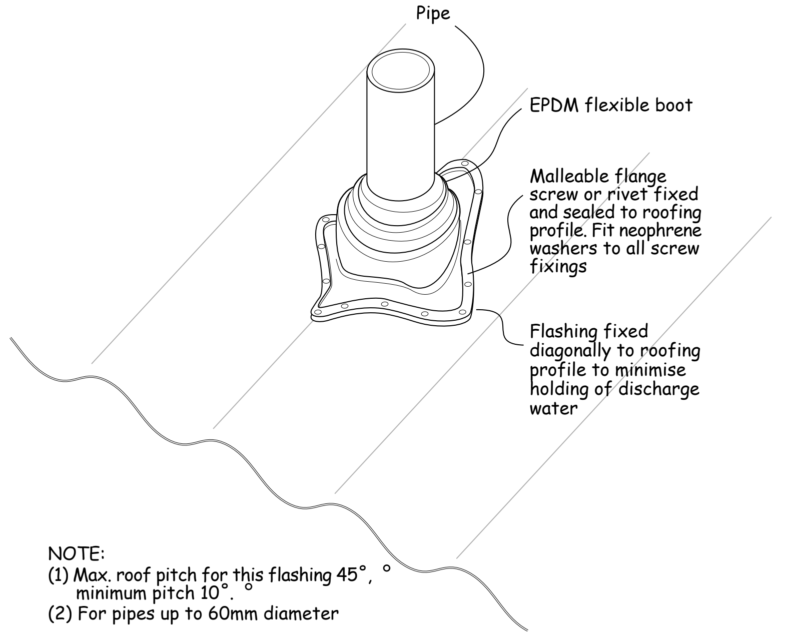
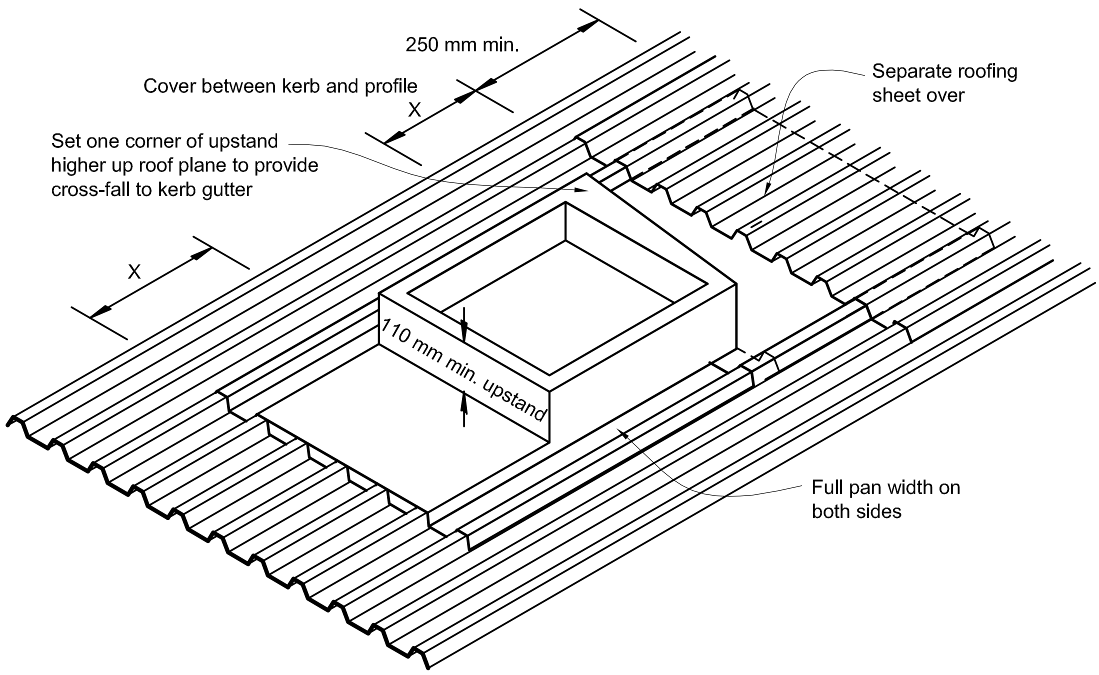


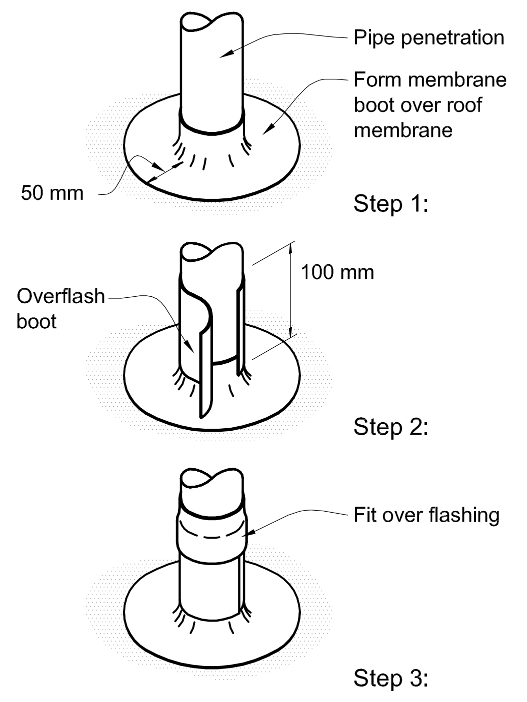
Figure 7: Soaker flashings for penetrations (profiled metal roofs)
Paragraph 5.2.5 b)

NOTE: (1) X = 200 mm min.
(2) Suitable for penetrations up to 1200 mm wide.
(3) Suitable only for roof pitches of 10° or higher.



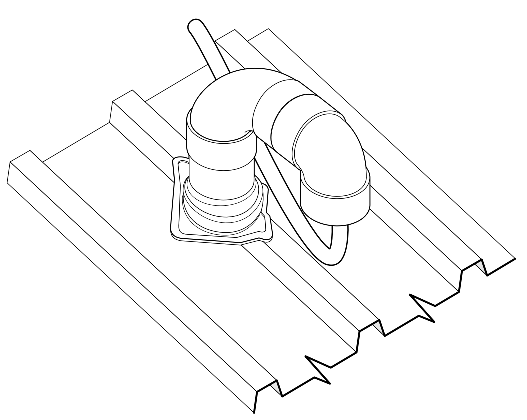
5.2.7 Penetrations through *membrane* roofs must be as shown in Figure 8.

Figure 8: Pipe penetration in membrane roofing
Paragraph 5.2.7



5.2.8 One method of *flashing* penetrations through roofs for electrical conduits or fittings is shown in Figure 9.

Figure 9: Flashed penetration for electrical conduits
Paragraph 5.2.8



The diameter of the conduit should be the minimum practicable diameter to suit the cable size and any electrical regulatory requirements.

COMMENT:
Alternatively, a nylon cable gland can be used on the flat part of a profiled metal roof which meets or exceeds IP55.

Other methods can also be used that meet the electrical regulatory requirements and are *weathertight*.

5.2.9 Sealant used in the installation of solar *water heaters* must be a neutral cure silicone sealant and must be used in conjunction with mechanical fasteners. The sealant must comply with:

a) Type F, Class 2OLM or 25LM of ISO 11600, or

b) low modulus Type II Class A of Federal Specification TT-S-00230C.

5.2.10 Acetic cured silicone sealants may be used with stainless steel but must not be used on zinc or aluminium-zinc coatings.

5.2.11 Sealants used on roof penetrations must not be used as the primary method of excluding the ingress of moisture. Joints must be designed to allow the discharge of water in the absence of any sealant.

5.2.12 All fixings or penetrations through the roof must be through the crests of the roof *cladding*.

5.3 Pipe installation

5.3.1 Pipes and their supports must be electrochemically compatible or be electrolytically separated (refer to Table 2).

5.3.2 Pipes must be installed and supported to permit thermal movement, except where anchor points are necessary.

5.3.3 Water supply pipe work must be supported at centres of no greater than those given in G12/AS1, Table 7: Water Supply Pipework Support Spacing.

5.4 Pipe insulation

5.4.1 Hot water pipes must be insulated to satisfy the requirements of NZBC Clause H1.3.4, except where connected to a heat dissipation device.

5.4.2 Where closed cell elastomeric pipe insulation is used outside the *building* envelope, it must be painted or have another form of protection to prevent rapid deterioration due to exposure to UV radiation. Pipe insulation must be protected and must have a *durability* of not less than 5 years.

COMMENT
One way to meet the hot water pipe insulation requirements referred to in Paragraph 5.4.1 is to comply with NZS 4305: 1996 Domestic type hot water systems.

6.0 Structural Support for Solar Water Heaters

6.1 Scope

6.1.1 Paragraph 1.1.1 of this Acceptable Solution describes when these structural and fixing requirements can be used.

6.2 General requirements

6.2.1 The installation of solar collectors on roofs must not produce restrictions to rainwater flow that could cause water to accumulate or pond.

6.2.2 The installation of solar collectors must not dent, bend or distort the roof *cladding* or damage any protective coatings.

6.2.3 All fixings that penetrate metal *cladding* must be provided with sealing washers or boots to prevent leakage in accordance with Paragraph 5.2.

COMMENT:
For additional guidance on selection and application of fastenings, refer to the roof *cladding* manufacturer.

6.2.4 Solar collectors must be supported at no less than four points. The outermost support points must be within 200 mm of the outside edge of the solar collector.

6.2.5 Roof framing must not be reduced in strength except for drilling for bolts or screws for attaching solar collectors.

6.2.6 All screw and bolt fixings into roof *framing* timber must be installed with minimum distances from the centre of the fixing to the edge of the timber of:

a) 20 mm for 8 gauge screws,

b) 25 mm for 14 gauge screws,

c) 40 mm for 10 mm bolts.

6.2.7 The centre of all fixings must be no closer than 10 fixing diameters from the end of a piece of timber.

COMMENT:
End and edge distances for fixings are in accordance with NZS 3603: 1993.

6.3 Direct fixed solar collectors parallel to the roof

6.3.1 Solar collectors can be fixed directly to the roof as shown in Figures 10 and 11 or Figures 12 and 13, where the requirements described in Paragraph 6.3 are met.

Figure 10: **Direct fixed strap with rail – section**
Paragraph 6.3.1

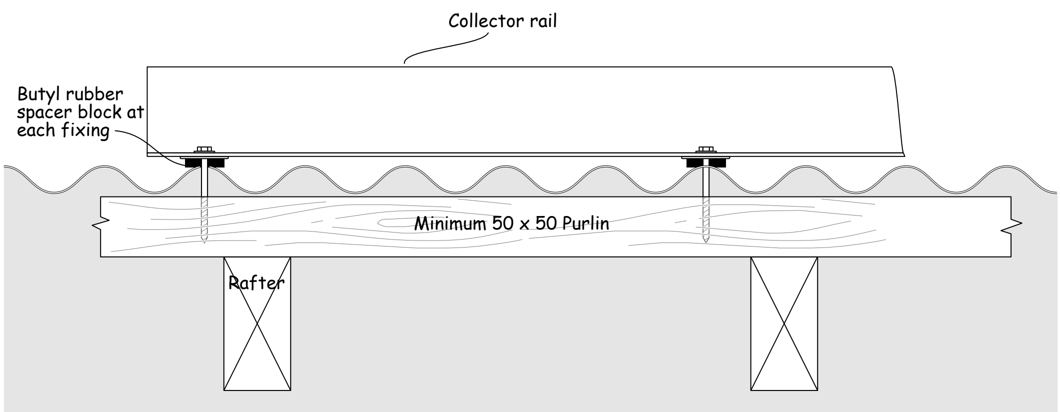
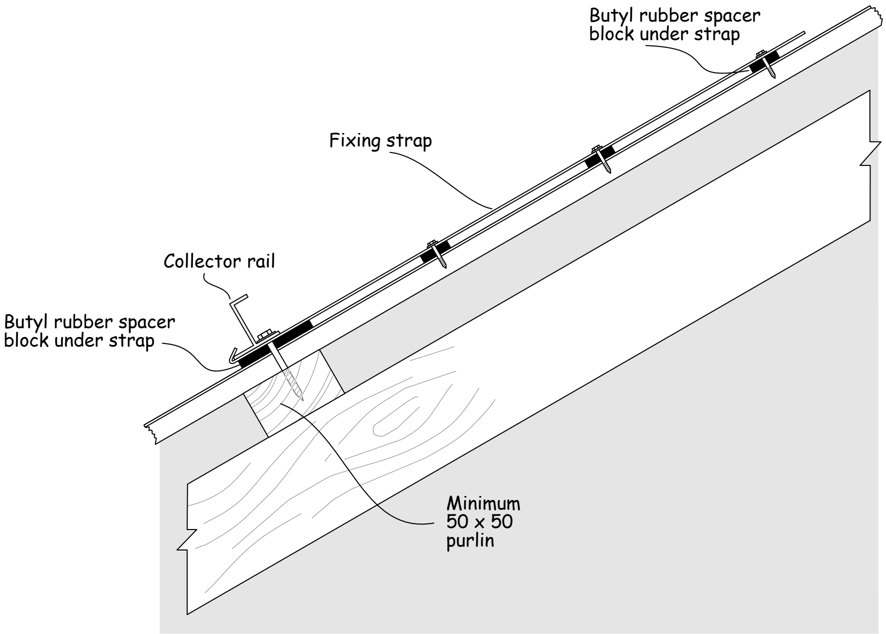


Figure 11: Direct fixed strap with rail – elevation
Paragraph 6.3.1



6.3.2 Solar collectors mounted on the roof cladding must meet the materials requirements described in Paragraph 2.

6.3.3 Solar collectors fixed directly to metal roof *cladding* must be:

a) attached with 12 self-tapping 8 gauge (4 mm) metal screws fixed to metal roof *cladding* provided the weight of the solar collector is spread over a sufficient number of points of contact so that the average load on any one point is not more than 15 kg, and

b) attached with 4 x 8 gauge (4 mm) screws into purlins 50 mm wide or larger within 200 mm of each of the four corners of the solar collector.

6.3.4 Solar collectors can be installed on concrete or clay tiles with:

a) stainless steel straps inserted through the joints between successive rows of tiles and screw fastened to *rafters*, truss top chords or under-*purlins* 75 x 45 mm or larger, and

b) support within 100 mm of the centre of the underlying tile batten, and

c) the load distributed across as many tiles as practicable.

COMMENT:

1. *Cladding* materials which need regular washing may require solar collectors to be elevated above the roof *cladding*. Refer to your roof cladding manufacturer for specific advice. Elevated options are provided in Paragraphs 6.4 to 6.6.
2. The susceptibility for concrete and clay tiles to breakage means that special care must be taken when working on and attaching systems to these roofs.
3. Solar *water heater* manufacturers and installers have developed proprietary mounting systems which may have equivalent performance to this Acceptable Solution.

Figure 12: Direct fixed channel – section
Paragraph 6.3.1

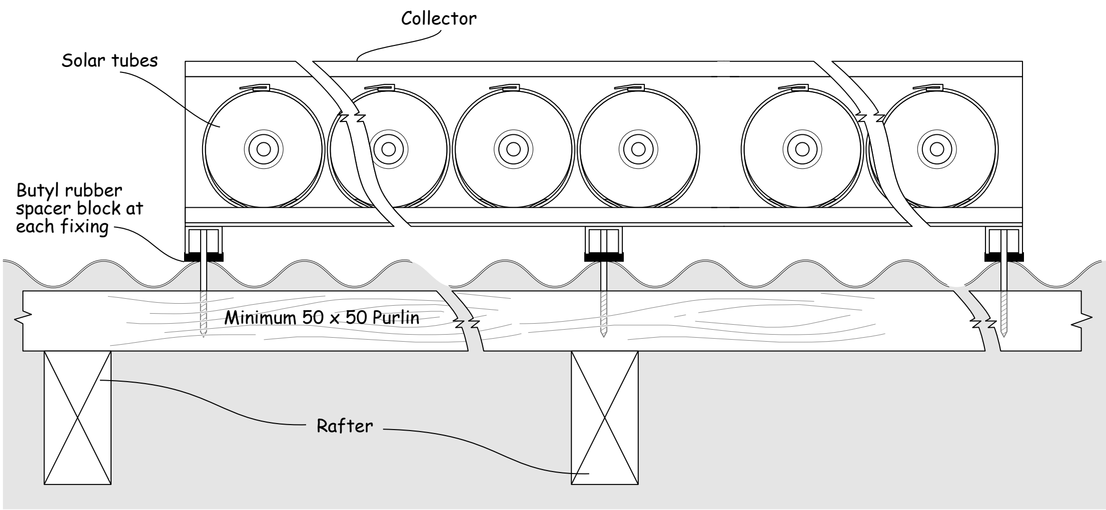
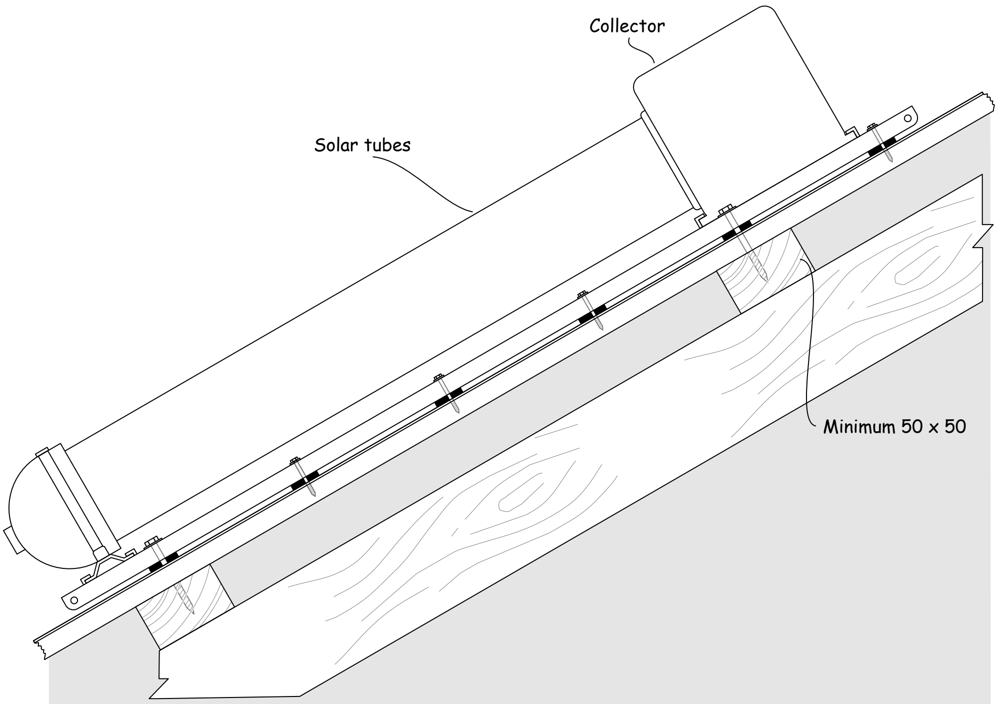


Figure 13: Direct fixed channel – elevation
Paragraph 6.3.1



6.4 Elevated solar collector panels parallel to the roof

6.4.1 Solar collectors mounted parallel to the roof that are elevated up to 50 mm above the roof *cladding* must be fixed:

a) as shown in Figure 14, with 14 gauge screws into one of the following:

   i) *purlins* 70 x 45 mm or larger on their flat, that span no more than 700 mm, or

   ii) *purlins* 90 x 45 mm or larger on their flat, that span no more than 900 mm, or

   iii) *rafters* 90 x 45 mm or larger, or

   iv) truss top chords 90 x 45 mm or larger, or

b) as shown in Figure 15, with 10 mm hot dip galvanised bolts to *purlins* 90 x 45 mm or larger that span no more than 900 mm, or

c) as shown in Figure 16, with 12 mm bolts welded to 3 mm plate, hot dip galvanised after welding and screw fixed to either:

   i) *rafters*, or

   ii) truss top chords.

6.4.2 Solar collectors mounted parallel to the roof that are elevated up to 50 mm above the roof *cladding* must be supported by:

a) underlying *purlins* conforming to Paragraph 6.4.1 (a) or (b), or

b) underlying *rafters* or trusses with connections conforming with Paragraphs 6.4.1 (a) or (c), or

c) collector support rails conforming to Paragraph 6.5.

Figure 14: Screw fixing
Paragraph 6.4.1 b)

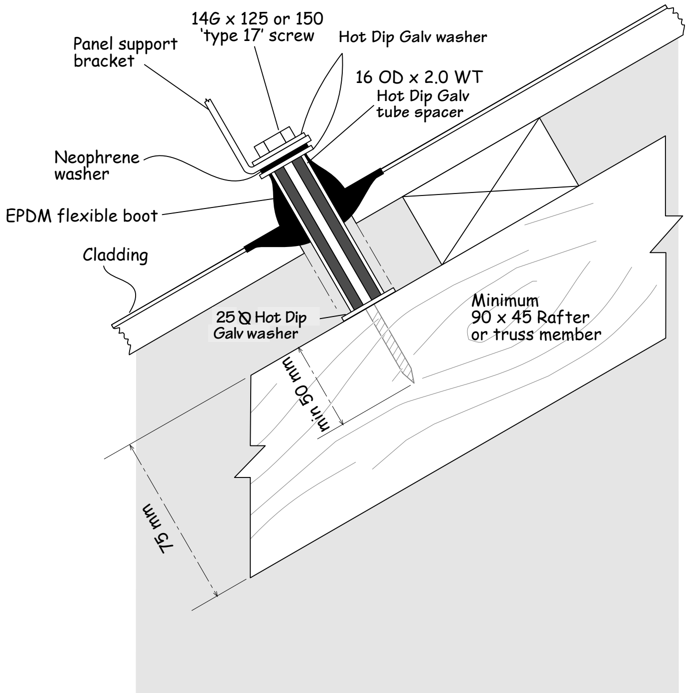


Figure 15: Bolt fixing
Paragraph 6.4.1 a)

Support point for collector parallel to roof

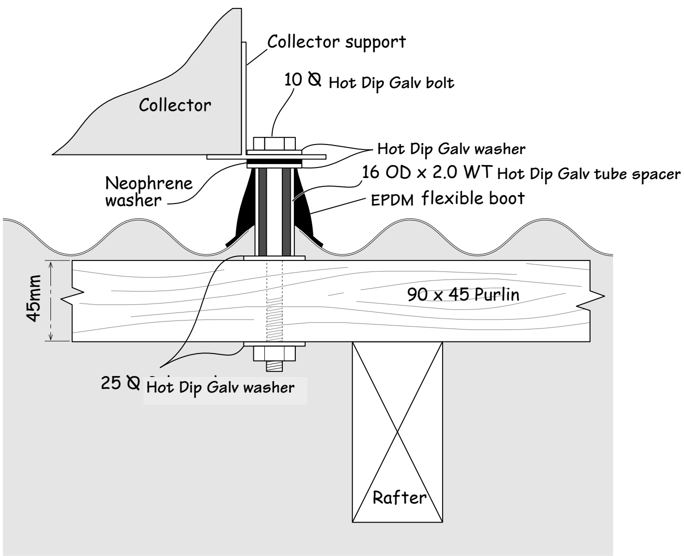
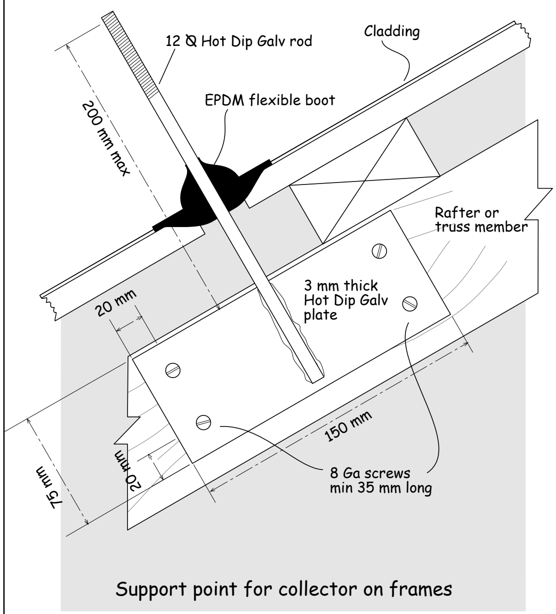
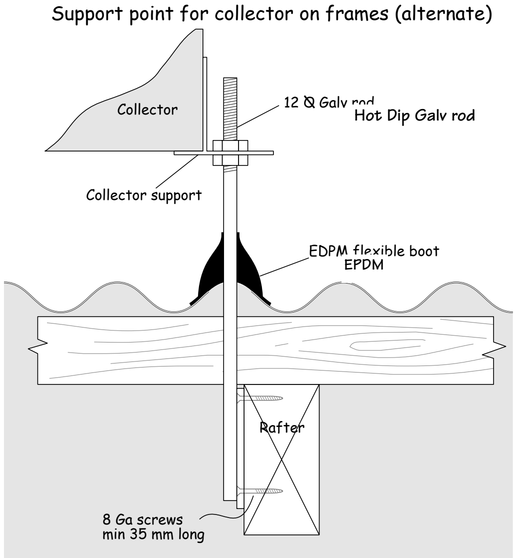


Figure 16: Stud fixing
Paragraph 6.4.1 c)



Elevation

Support point for collector on frames (alternate)



Section

Figure 17: Collector support rails across roof slope
Paragraph 6.5.1 a)

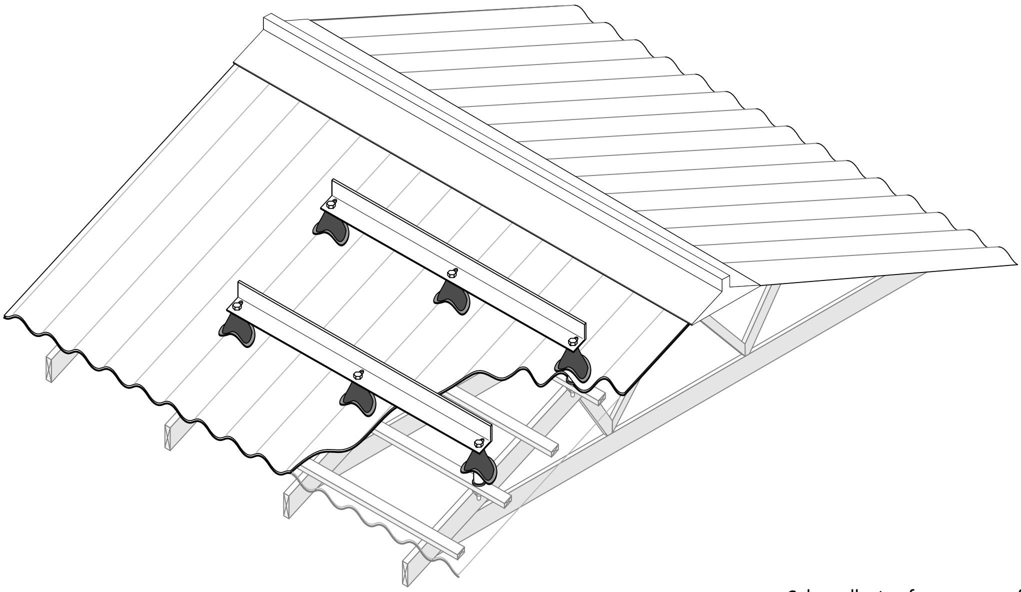
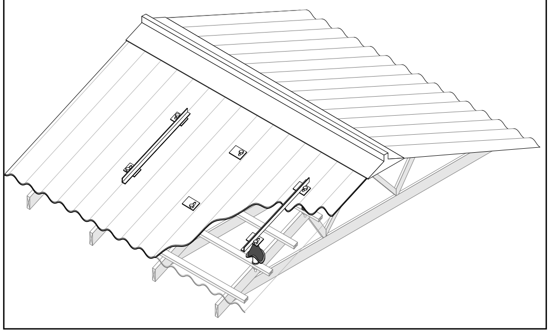


Figure 18: Collector frame up slope of roof
Paragraph 6.5.1 b)



6.5 Collector support rails

6.5.1 Collector support rails may either:

a) run horizontally across the slope of the roof as provided for in Paragraph 6.5.2 and Figure 17, or

b) run up the slope of the roof as provided for in Paragraph 6.5.3 and Figure 18.

6.5.2 Collector support rails running horizontally across the roof slope, as shown in Figure 17, must be in one piece and span each space between *rafters* or trusses that have a solar collector above them. Rails may cantilever up to 200 mm beyond a rafter or truss. The collector support rails are to be fixed to either:

a) each *rafter* or truss that they cross using the details given in Figures 14 and 16, or

b) *purlins*, provided the *purlins* are a minimum size of 90 x 45 mm on their flat and span a maximum of 900 mm using the details given in Figures 14 and 15.

6.5.3 Collectors laid on support rails running up the slope of the roof must be in one piece and be supported as shown in Figure 18 by either:

a) each *purlin* that is crossed of a minimum size of 90 x 45 mm on their flat which spans a maximum of 950 mm using the connection details given by Figure 14, or

b) *rafters* or truss top chords at not more than 1500 mm centres and within 300 mm of each end of the collector support rails using the connection details given by Figure 14 or 16.

6.6 Mounting collectors at a different pitch to the roof cladding

6.6.1 Solar collectors mounted at a different pitch to the pitch of the roof must be installed with no less than 8 fixing points and must meet all the requirements described in Paragraph 6.6 and Figure 19.

6.6.2 Solar collectors must be mounted on support rails running horizontally across the roof slope that comply with Paragraph 6.5.2 except for the following differences:

a) they must be supported by four *rafters* or truss top chords, and

b) they must be hot dip galvanised mild steel or stainless steel angles with a minimum section modulus about axes parallel to the sides of the angle of 3.3 cm^3 x 10 mm^3, and

c) they must be connected to the *rafters* or truss top chords with fixings as shown in Figure 20, and

d) the connections between the struts and the collector support rails must be mid-way between the outer pair of collector support rail fixings.

COMMENT:

1. A steel angle section 50 x 50 x 6 mm meets the minimum strength requirements of Paragraph 6.6.2.
2. Other materials can be used for the support rails which meet the materials requirements described in Paragraph 2.0 and have equivalent strength to the rails described in Paragraph 6.6.2 b).

Figure 19: **Collector at different pitch to roof**
Paragraph 6.6.1

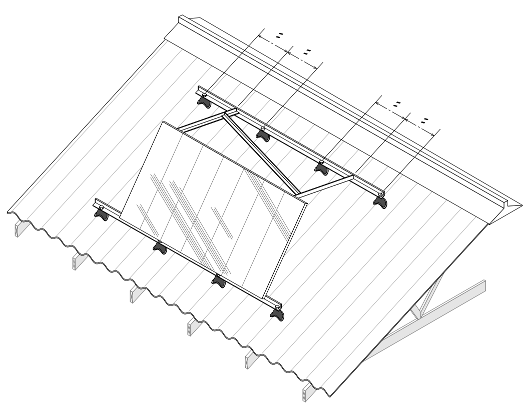
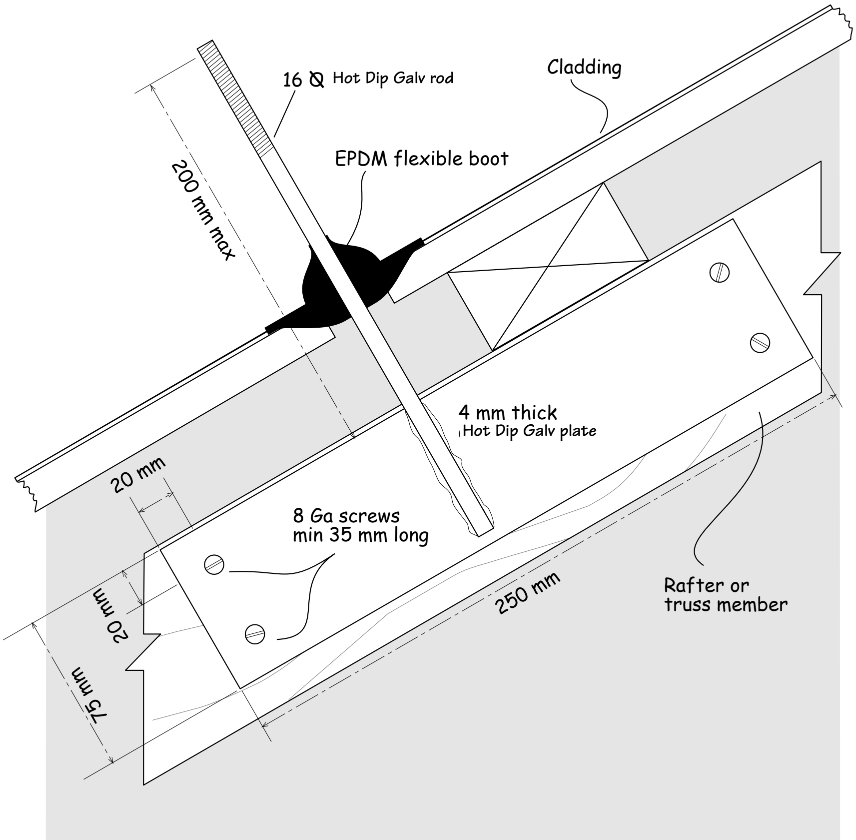


Figure 20: Stud fixing for panels at different pitch
Paragraph 6.6.2 c)



6.6.3 The edge of the panel elevated above the roof plane is to be supported by hot dip galvanized steel or stainless steel angle struts which are:

a) 25 x 25 x 3 mm angle for struts up to 1.0 m long

b) 30 x 30 x 3 mm angle for struts up to 1.4 m long, or

c) 40 x 40 x 3 mm angle for struts up to 2.4 m long.

Cuts or holes made in steel after galvanizing are to be protected from corrosion.

6.6.4 A diagonal is to run from within 50 mm of the top of one strut to within 50 mm of the bottom of the other strut. It must be the same size as the struts.

6.6.5 Connections between the struts, the diagonal and support rails are to be:

a) for hot dip galvanized steel, one M8 hot dip galvanized Class 4.8 bolt with nut and washers at each intersection, or

b) for stainless steel, one M8 stainless steel bolt with nut and washers at each intersection, or

c) fully welded – any mild steel that is welded must be hot dip galvanized after welding.

6.6.6 Connections between the upper ends of the struts and the collector must be of equivalent strength to the those of Paragraph 6.6.5

6.6.7 Alternatively, proprietary elevated frames can be used which:

a) meet the requirements described in Paragraphs 6.6.1 and 6.6.2

b) are subject to specific engineering design

c) result in the load on each collector support rail being evenly distributed over each of the four fixing points.

7.0 Maintenance and Durability

7.1 Maintenance

7.1.1 A permanent label must be fixed to a prominent part of the system which includes all markings required in the appropriate Standard identified in Paragraph 3.1.1.

COMMENT

1. Solar *water heaters* should be installed so that they can be easily maintained and owners should be provided with adequate instructions on the maintenance requirements.
2. Maintenance should be carried out to achieve the required:
   a) system performance, and
   b) *durability* of the solar *water heater* and any affected *building* components and junctions.
3. The maintenance required is dependent on the:
   a) type of solar *water heater*,
   b) materials and components used in the system manufacture and installation,
   c) manufacturer's recommendations,
   d) position of the solar *water heater* on the *building*,
   e) geographical location and specific site conditions.

COMMENT:

Washing by rain removes most accumulated atmospheric contaminants from roof *cladding*, but sheltered areas below solar collectors may be protected from the direct effects of rain and therefore may require regular manual washing. High pressure water must not be directed at sensitive junctions such as penetrations and other *flashings*. Care must be taken to avoid water being driven past anti-capillary gaps and *flashings*.

7.2 Durability

7.2.1 Solar *water heaters* and their components must meet the *durability* requirements specified in NZBC Clause B2.

7.2.2 A solar *water heater* is easy to access and moderately difficult to replace and therefore the *durability* requirement is 15 years.

7.2.3 Some components of the system will require maintenance and/or replacement. Components requiring maintenance or replacement before 15 years must be clearly identified in the owner's manual.

COMMENT:

NZS 4613:1986 states that:

"All materials used in the construction of solar equipment must have an expected in-service life of at least 15 years unless specifically excluded by the manufacturer" (Clause 103.2), and

"Collectors must have an expected service life of at least 15 years with no loss of fitness for purpose or rapid degradation during this period" (Clause 104.1).

NZS 4613: 1986 has been incorporated by reference in the Acceptable Solutions for G12 since October 2001. Amend 9 Feb 2014

Index G12/VM1 & AS1/AS2

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington.
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

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 5 November 2020 and supersedes all previous versions of this document.

The previous version of this document (Amendment 8) will cease to have effect on 3 November 2021.

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.building.govt.nz

G13: Document History			
	Date	**Alterations**	
First published	July 1992		
Amendment 1	September 1993	pp. vii–viii, References p. xi, Definitions	p.25, Figure 3 p. 31, Figure 7
Reprinted incorporating Amendment 1		October 1994	
Amendment 2	1 December 1995	p. viii, References	
Amendment 3	28 February 1998	p. ii, Document History p. viii, References	p. 1, 1.0.1 p. 21, 1.0.1
Second edition	Effective from 1 October 2001	Document revised – second edition issued	
Amendment 1	Published March 2007 Effective from 23 June 2007	p. 2, Document History, Status p. 6, Contents pp. 7–8, References	pp. 9–10, Definitions p. 52A, AS3 1.0, 1.0.1, 1.0.2 p. 55, Index
Erratum 1	Effective from 23 June 2007	pp. 5–6, Contents pp. 33–34, AS1 8.0, 8.1	pp. 50–51, AS2 7.0, 7.1
Amendment 2	Effective from 21 June 2007	p. 2, Document History, Status pp. 3, 4, 4A, Building Code Clause p. 6, Contents	p. 8, References p. 52A, VM4 p. 54, Index
Amendment 3	Published 30 June 2010 Effective from 30 September 2010	p. 2, Document History, Status pp. 7–8, References p. 11, G13/VM1 1.0.1 p. 13, G13/AS1 Table 1 p. 32, G13/AS1 6.1.1 p. 33, G13/AS1 6.2.2, 6.3.1, 6.3.2, 7.1.2, Table 7	p. 37, G13/AS2 Table 1 p. 42, G13/AS2 5.1.2 p. 50, G13/AS2 6.1.2 p. 51, G13/AS3 1.0.1 pp. 54–55, Index
Amendment 4	Effective from 10 October 2011 until 14 August 2014	p. 2, Document History, Status p. 8, References	p. 10, Definitions p. 37, G13/AS2 Table 1
Amendment 5	14 February 2014 until 30 May 2017	p. 2A, Document History, Status pp. 7–8, References p. 9, Definitions p. 35, G13/VM2 1.0.1	p. 44, G13/AS2 5.6.1 p. 51, G13/SA2 1.03 p. 52A, 1.1.2
Amendment 6	Effective 1 January 2017 until 31 March 2019	p. 8, References p. 31 G13/AS1 5.8.2, 5.8.3 p. 33 G13/AS1 6.4.1	p. 37 G13/AS2 Table 1 p. 51 G13/AS3 2.0.1, 2.0.2
Amendment 7	Effective from 30 November 2018 until 31 October 2019	p. 8 References p . 33 G13/AS1 7.1.3	p. 50 G13/AS2 6.1.3 p. 51 G13/AS3 2.0.1

G13: Document History *(continued)*			
	Date	**Alterations**	
Amendment 7	Effective from 30 November 2018 until 31 October 2019	p. 8 References p . 33 G13/AS1 7.1.3	p. 50 G13/AS2 6.1.3 p. 51 G13/AS3 2.0.1
Amendment 8	Effective 27 June 2019 until 3 November 2021	p. 8 References	p 33 G13/AS1 6.4.1
Amendment 9	Effective 5 November 2020	p 6 Contents p. 8 References p. 10 Definitions p. 13 G13/AS1 Table 1 p. 31 G/13/AS1 5.8.2 p. 33 G13/AS1 6.2.2	p. 40 G13/AS2 3.3.1, 3.3.2, 3.4.2 p. 45 G13/AS2 Figure 7 p. 50 G13/AS2 6.1.2 pp. 51–52 G13 AS3 1.0 pp. 53-54 Index
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

New Zealand Building Code Clause G13 Foul Water

The mandatory provisions for building work are contained in the New Zealand Building Code (NZBC), which comprises the First Schedule to the Building Regulations 1992. The relevant NZBC Clause for Foul Water is G13.

1992/150 ***Building Regulations 1992*** 75

FIRST SCHEDULE–*continued*

Clause G13–FOUL WATER

Provisions	Limits on application
OBJECTIVE **G13.1** The objective of this provision is to: (a) Safeguard people from illness due to infection or contamination resulting from personal hygiene activities; and (b) Safeguard people from loss of *amenity* due to the presence of unpleasant odours or the accumulation of offensive matter resulting from *foul water* disposal.	
FUNCTIONAL REQUIREMENT **G13.2** *Buildings* in which *sanitary fixtures* and *sanitary appliances* using water-borne waste disposal are installed must be provided with— (a) an *adequate* plumbing and draining system to carry *foul water* to appropriate outfalls; and (b) if no *sewer* is available, an *adequate* system for the storage, treatment, and disposal of *foul water*. Amend 1 Jun 2007	
PERFORMANCE **G13.3.1** The *plumbing system* shall be constructed to: (a) Convey *foul water* from *buildings* to a drainage system, (b) Avoid the likelihood of blockage and leakage, (c) Avoid the likelihood of foul air and gases entering *buildings*, and (d) provide reasonable access for maintenance and clearing blockages.	
G13.3.2 The drainage system shall: (a) Convey *foul water* to an appropriate *outfall*, (b) Be constructed to avoid the likelihood of blockage,	

76 *Building Regulations 1992* 1992/150

FIRST SCHEDULE–*continued*

Clause G13–FOUL WATER

Provisions	Limits on application
(c) Be supported, jointed and protected in a way that will avoid the likelihood of penetration of roots or the entry of ground water,	
(d) Be provided with reasonable access for maintenance and clearance blockages,	
(e) Be ventilated to avoid the likelihood of foul air and gases accumulating in the drainage system and *sewer*, and	
(f) Be constructed to avoid the likelihood of damage from superimposed loads or normal ground movement.	
G13.3.3 Where a *sewer* connection is available, the drainage system shall be connected to the *sewer*, and the connection shall be made in a manner that avoids damage to the *sewer* and is to the approval of the *network utility operator*.	
G13.3.4 If no *sewer* is available, facilities for the storage, treatment, and disposal of *foul water* must be constructed—	
(a) with *adequate* capacity for the volume of *foul water* and the frequency of disposal; and	
(b) with *adequate* vehicle access for collection if required; and	
(c) to avoid the likelihood of contamination of any potable water supplies in compliance with Clause G12 "Water supplies"; and	
(d) to avoid the likellihood of contamination of soils, ground water, and waterways except as permitted under the Resource Management Act 1991; and	

Amend 1
Jun 2007

1992/150 ***Building Regulations 1992*** 77?

FIRST SCHEDULE–*continued*

Clause G13–FOUL WATER

Provisions	**Limits on application**
(e) from materials that are impervious both to the *foul water* for which disposal is required, and to water; and (f) to avoid the likelihood of blockage and leakage; and (g) to avoid the likelihood of foul air and gases accumulating within or entering into *buildings*; and (h) to avoid the likelihood of unauthorised access by people; and (i) to permit easy cleaning and maintenance; and (j) to avoid the likelihood of damage from superimposed loads or normal ground movement; and (k) if those facilities are buried underground, to resist hydrostatic uplift pressures.	

Amend 1 Jun 2007

Contents

Erratum 1 Jun 2007

Erratum 1 Jun 2007

Amends 1, 6, 9

Amend 2 Jun 2007

References

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in these Verification Methods and Acceptable Solutions (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 these Verification Methods and Acceptable Solutions must be used.

Amend 4 Oct 2011

Amend 5 Feb 2014

Amend 5 Feb 2014

		Where quoted
Standards New Zealand		
Amend 3 Sep 2010		
NZS 3501: 1976	Specification for copper tubes for water, gas, and sanitation *Amends: 1, 2, 3*	AS1 Table 1, AS2 Table 1
NZS 3604: 2011 (Amend 5 Feb 2014)	Timber framed buildings	AS2 5.6.1
NZS 4229: 2013 (Amend 5 Feb 2014)	Concrete masonry buildings not requiring specific engineering design	AS2 5.6.1
NZS 4442: 1988	Welded steel pipes and fittings for water, sewage and medium pressure gas	AS2 Table 1
Amend 3 Sep 2010		
British Standards Institution		
BS 437: 2008	Specification for cast iron drain pipes, fittings and their joints for socketed and socketless systems	AS2 Table 1
BS EN 12056:- Part 2: 2000 (Amend 3 Sep 2010)	Gravity drainage systems inside buildings. Sanitary pipework, layout and calculation	VM1 1.0.1
Standards Australia		
AS 1579: 2001 (Amend 3 Sep 2010)	Arc welded steel pipes and fittings for water and waste water	AS2 Table 1
AS 1589: 2001	Copper and copper alloy waste fittings	AS1 Table 1
AS 1646: 2007 (Amend 3 Sep 2010)	Elastomeric seals for waterworks purposes	AS2 Table 1
AS 2887: 1993 (Amend 3 Sep 2010)	Plastic waste fittings	AS1 Table 1
Amend 3 Sep 2010		
AS 3571: 2009 (Amend 4 Oct 2011)	Plastic piping systems – Glass reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin – pressure and non-pressure drainage and sewerage (ISO 10467: 2004 MOD)	AS2 Table 1
AS 4139: 2003 (Amend 3 Sep 2010)	Fibre reinforced concrete pipes and fittings	AS2 Table 1

		Where quoted
Australian/New Zealand Standards		
AS/NZS 1260: 2017	PVC-U pipes and fittings for drain, waste and vent applications	AS1 Table 1, AS2 Table 1
AS/NZS 1547: 2012	On-site domestic wastewater management	VM4 1.1.2
AS/NZS 2032: 2006	Installation of PVC pipe systems *Amend: 1*	AS1 6.1.1, 6.2.2, 6.3.1, 7.1.2 AS2 5.1.2, 6.1.2, Table 1
AS/NZS 2033: 2008	Installation of polyethylene pipe systems *Amend: 1, 2*	AS1 Table 1
AS/NZS 2280: 2014	Ductile iron pipes and fittings *Amend: 1, 2*	AS2 Table 1
AS/NZS 2566:- Part 2: 2002	Buried flexible pipelines Installation *Amend: 1, 2, 3*	AS2 Table 1
AS/NZS 3500:-	Plumbing and drainage	
Part 2: 2018	Sanitary plumbing and drainage	AS1 7.1.3, VM2 1.0.1 Comment, AS2 6.1.3, AS3 1.0, 1.0.1, 1.0.2
AS/NZS 3518:2013	Acrylonitrile butadiene styrene (ABS) compounds, pipes and fittings for pressure applications *Amend: 1*	AS2 Table 1
AS/NZS 4058: 2007	Pre cast concrete pipes (pressure and non pressure)	AS2 Table 1
AS/NZS 4130: 2018	Polyethylene (PE) pipe for pressure applications	AS2 Table 1
AS/NZS 4401: 2006	High density polyethylene (PE-HD) pipes and fittings for soil and waste discharge (low and high temperature) systems inside buildings	AS1 Table 1
AS/NZS 4936: 2002	Air Admittance valves for use in sanitary plumbing and drainage systems.	AS1 5.8.2, Table 1
AS/NZS 5065: 2005	Polyethylene and polypropylene pipe and fittings for drainage and sewerage applications *Amend: 1, 2*	AS2 Table 1
European Standards		
BS EN 12380: 2002	Air admittance valves for drainage systems. Requirements, test methods and evaluation of conformity	AS1 5.8.2, Table 1
American Society of Sanitary Engineers		
ASSE 1050: 2009	Performance requirements for stack air admittance valves for sanitary drainage systems	AS1 5.8.2, Table 1
ASSE 1051: 2009	Performance requirements for individual and branch type air admittance valves for sanitary drainage systems	AS1 5.8.2, Table 1

Amends 3, 4, 9
Amends 5, 6, 9
Amends 2 and 5
Amend 3 Sep 2010
Amend 9 Nov 2020
Amend 4 Oct 2011
Amends 5, 6, 9
Amend 4 Oct 2011
Amends 6 and 9
Amend 1 Jun 2007
Amends 5, 6, 7, 8
Amend 7 Nov 2018
Amends 8 and 9
Amends 6 and 9
Amend 1 Jun 2007
Amend 9 Nov 2020
Amend 3 Sep 2010
Amend 3 Sep 2010
Amend 6 Oct 2016
Amends 4 and 9
Amend 9 Nov 2020

Definitions

Amend 1 Jun 2007 This is an abbreviated list of definitions for the words or terms particularly relevant to these Verification Methods and Acceptable Solutions. The definitions for any other italicised words may be found in the New Zealand Building Code Handbook. Amend 5 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.*

Access point A place where access may be made to a *drain* or *discharge pipe* for inspection, cleaning or maintenance; and may include a *cleaning eye, inspection point, rodding point, inspection chamber* or *access chamber.*

Adequate *Adequate* to achieve the objectives of the *building code.*

Air admittance valve A valve that allows air to enter but not to escape in order to limit pressure fluctuations within the sanitary plumbing or drainage system.

Branch discharge pipe A *discharge pipe* that serves one or more *fixture discharge pipes* for any one floor.

Branch vent pipe A *vent pipe* that serves two or more *fixture vent pipes.*

Amend 1 Jun 2007 **Building** has the meaning ascribed to it by Sections 8 and 9 of the Building Act 2004.

Cleaning eye A small *diameter access point* usually formed as part of a fitting or trap.

Combined waste pipe A *discharge pipe* which serves two or more *waste pipes.*

Developed length The total length along the centre line of a pipe including fittings and bends.

Diameter (or bore) The nominal internal *diameter*.

Discharge pipe Any pipe that is intended to convey discharge from *sanitary fixtures* or *sanitary appliances.*

Discharge stack A *discharge pipe* that has one or more *discharge pipe* connections, and which is vented at one end via a *discharge stack vent.*

Discharge stack vent A *vent pipe* connected to the top of the *discharge stack.*

Discharge unit The unit of measure for the discharge (hydraulic load) in the *plumbing system,* and is based on the rate, duration and frequency of discharge from a *sanitary fixture* or *sanitary appliance.*

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

Drain vent pipe Any pipe which is intended to permit the movement of air into and out of the *drain* and *sewer*.

Fixture An article intended to remain permanently attached to and form part of a *building.*

Fixture discharge pipe A *discharge pipe* that is used to convey waste from a single *sanitary fixture* or *sanitary appliance* to a *branch discharge pipe*, a *discharge stack*, or directly to a *drain*. It does not include any pipes forming part of a *sanitary appliance.*

Fixture vent pipe (trap vent) A *vent pipe* that is connected to a *fixture discharge pipe* or the sanitary *fixture* itself.

Floor waste An outlet located at the low point of a graded floor or in a level floor designed to receive accidental or intentional discharges.

Floor waste pipe A pipe that receives the discharge from a *floor waste* and that discharges outside the *building* or to the *foul water* drainage or sanitary *plumbing system.*

Foul water The discharge from any *sanitary fixture* or *sanitary appliance.*

Foul water drainage system *Drains*, joints and fittings normally laid underground and used specifically for the conveyance of water from the *plumbing system* to an *outfall*.

Grease trap A device designed to intercept grease in a *foul water* discharge.

Gully trap A fitting designed to prevent foul air escaping from the drainage system and used to receive the discharge from *waste pipes.*

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

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.

Amend 4 Oct 2011

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 *sewer* or a septic tank. For *surface water,* the *outfall* may include a natural water course, kerb and channel, or soakage system.

Plumbing system Pipes, joints and fittings, laid above ground and used for the conveyance of *foul water* to the *foul water drain* and includes *vent pipes.*

Relief vent A *vent pipe* which is connected to a *discharge stack* below the lowest branch connection and which connects at its upper end to the *discharge stack vent* or terminates as an open vent.

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

Sanitary appliance An appliance which is intended to be used for *sanitation* and which is not a *sanitary fixture*. Included are machines for washing dishes and clothes.

Sanitary fixture Any *fixture* which is intended to be used for *sanitation*.

COMMENT:
Toilets, urinals, bidets, baths, showers, basins, sinks and tubs are examples of common *sanitary fixtures*.

Amend 9 Nov 2020

Sanitation The term used to describe the activities of washing and/or excretion carried out in a manner or condition, such that the effect on health is minimised, with regard to dirt, contamination and infection.

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

Soil fixture A *sanitary fixture* constructed to receive solid and/or liquid excreted human waste. It includes bedpan disposal units, slop sinks, urinals, water closet pans, and water-flushed sanitary towel disposal units.

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.

Vent pipe A pipe for the purpose of protecting *water seals* that at its upper end is either open to the atmosphere or fitted with an *air admittance valve* and that at its lower end is connected to a *discharge pipe.*

Waste pipe A *discharge pipe* that conveys the discharge from *waste water fixtures* to a *gully trap.*

Waste water fixture A *sanitary fixture* or *sanitary appliance* used to receive wastes, and which is not a *soil fixture.*

Water seal The depth of water that can be retained in a *water trap.*

Water trap A fitting designed to retain a depth of water that prevents foul air and gases escaping from the *plumbing system* or *foul water drainage system* and entering a *building*.

Verification Method G13/VM1 Sanitary Plumbing

1.0 Sanitary Plumbing

1.0.1 A design method for conveying *foul water* from *buildings*, and for avoiding the likelihood of foul air entering *buildings*, may be verified as satisfying the relevant Performances of NZBC G13 if the method complies with BS EN 12056.2.

Amend 3 Sep 2010

Acceptable Solution G13/AS1 Sanitary Plumbing

1.0 Scope

1.0.1 This Acceptable Solution applies to above-ground non-pressure (gravity flow) sanitary plumbing for *buildings* having 3 levels or less and includes all pipework for *foul water* within, or on the *building*, including any basements.

1.0.2 The solution does not include:

a) Specialised types of *sanitary fixtures* or *sanitary appliances* used within *buildings* such as hospitals, laboratories and factories, or

b) The conveyance of industrial liquid wastes, chemical or toxic wastes and other wastes which cannot be discharged to a *sewer* without pretreatment.

1.0.3 Protection of water seals

Water seals shall be protected from pressure fluctuations within the sanitary pipework so as to prevent foul air and gases from entering the *building*. The method described in this Acceptable Solution for protecting *water seals* is based on a fully vented *plumbing system* and generally requires each *fixture discharge pipe* to be vented.

COMMENT:
Individually venting each *fixture discharge pipe* provides the greatest flexibility in the arrangement and lengths of *discharge pipes.*

2.0 Materials

2.1 Pipes, traps and fittings

2.1.1 Materials for sanitary *plumbing systems* using gravity flow shall comply with Table 1.

3.0 Water Traps

3.1 Water trap requirements

3.1.1 Discharge points from *sanitary fixtures* and *sanitary appliances* shall have a *water trap* to prevent foul air from the *plumbing system* entering the *building*.

3.1.2 *Water traps* shall be:

a) Removable,

b) Able to be dismantled, or

c) Fitted with a *cleaning eye.*

COMMENT:
Removable panels are not required for access to bath traps.

Table 1: Pipes, traps and fittings
Paragraph 2.1.1

Material	Standard
Pipes and fittings	
Air admittance valves (Amends 3 and 9)	ASSE 1050 or ASSE 1051, BS EN 12380, AS/NZS 4936
Copper pipe	NZS 3501
Copper fittings	AS 1589
PVC pipe and fittings	AS/NZS 1260
Plastic fittings	AS 2887
PE pipe and fittings	AS/NZS 4401
Elastomeric rings (Amend 3 Sep 2010)	AS/NZS 4130 or AS 1646
Traps	
Plastic	AS 2887
Copper	AS 1589

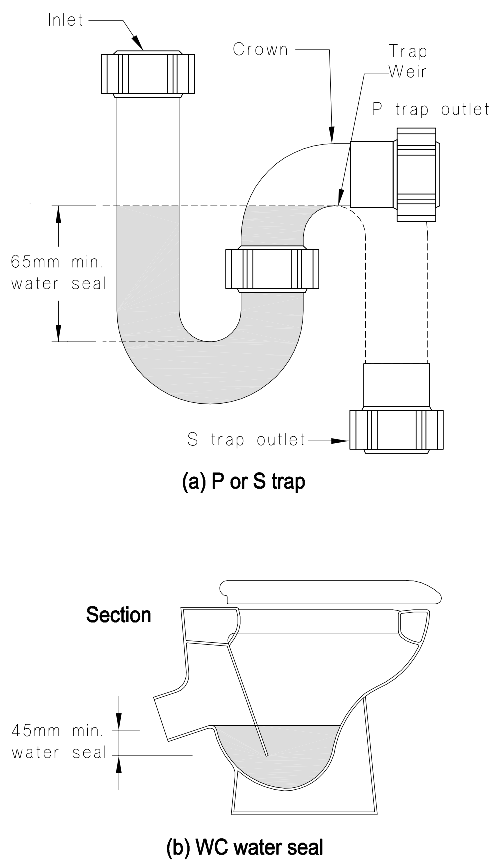
3.2 Water trap dimensions

3.2.1 Under normal operating conditions, *fixture* traps shall retain a *water seal* depth of not less than 25 mm (see Figure 1).

COMMENT:

1. The nominal depth of *water seal* is 75 ± 10 mm for *waste water fixture* traps.
2. The nominal depth of *water seal* is 50 ± 5 mm for *soil fixture* traps.
3. The system should be tested under load conditions to ensure that a 25 mm minimum *water seal* depth is not compromised.

Figure 1: Depth of water seal
Paragraph 3.2.1



3.2.2 The *diameter* of the *water trap* shall be not less than that given in Table 2.

3.3 Water trap location

3.3.1 A *water trap* shall:

a) Be located as close as possible to the *sanitary fixture* or *sanitary appliance* it serves,

b) Have a *discharge pipe* with a *developed length* not exceeding 1.2 m measured between the *water seal* and either the *sanitary fixture* outlet or the *sanitary appliance* discharge point, and

c) Not be located in a different room to the *sanitary fixture* or *sanitary appliance* it serves.

COMMENT:

1. Waste material may build up on the walls of *discharge pipes* and may cause offensive odours to enter the *building* through the *fixture* outlet. A short *discharge pipe* reduces the likelihood of this happening.
2. Traps may be located under the floor or in ceiling spaces of the floor below.

3.3.2 Multiple outlets

A single *water trap* may serve any one of the following outlet combinations located within the same space (see Figure 2):

a) One or two adjacent domestic kitchen sinks together with a dishwashing machine.

b) One or two adjacent domestic kitchen sinks together with a waste disposal unit.

c) One or two adjacent laundry tubs together with a clothes washing machine.

d) Two adjacent basins, domestic kitchen sinks or laundry tubs.

e) One or two adjacent domestic kitchen sinks, together with a waste disposal unit and a dishwashing machine when fitted with a 50 mm trap and *discharge pipe.*

COMMENT:

Commercial sinks – one *water trap* is not permitted to serve two adjacent commercial sinks, as a sink containing *foul water* may contaminate an adjacent sink being used for food preparation.

Table 2: Fixture discharge pipe sizes and discharge units
Paragraphs 3.2.2, 4.3.1, 4.3.2 and 4.7.1

Sanitary fixture or appliance	Discharge units	Minimum trap and discharge pipe diameter (mm)
Basin	1	32
Bath (with or without overhead shower)	4	40
Bathroom group (water closet pan, bath and shower, basin, and bidet in one compartment)	6	(Note 1)
Bidet	1	32
Cleaner's sink	1	40
Clothes washing machine (domestic)	5	40
Dishwashing machine (domestic)	3	40
Drinking fountain	1	25
Kitchen sink (commercial)	3	50
Kitchen sink (domestic, single or double, with or without waste disposal unit)	3	40
Laundry (single or double tub, with or without a clothes washing machine)	5	40
Shower	2	40
Urinal (1 or 2 stall)	1 per 600 mm length	50
Urinal (bowl type)	1	32
Urinal (3 or more stalls)	1 per 600 mm length	80
Water closet pan	4	80

Note:

1. For groups of *fixtures*, traps are sized for the individual *fixtures*. *Discharge pipes* for groups are sized in accordance with Paragraph 4.3.2.

3.4 Floor outlets

3.4.1 *Floor waste* outlets shall have a removable grating that is flush with the floor.

COMMENT:

1. The grating is to permit safe and easy movement of people using the space containing the floor outlet.
2. *Floor wastes* in this section are not intended to receive liquid or excreted human wastes.

3.4.2 The *floor waste*, and the *water trap* if used, shall have a minimum *diameter* of 40 mm.

3.4.3 A *floor waste* shall:

a) Be trapped, discharge 50 mm above the grating of a *gully trap* and be vented as shown in Figure 3,

b) Be trapped, charged to maintain the *water seal* and discharge to the *foul water plumbing system* in accordance with Paragraphs 4.5 and 5.0, or

c) If its only purpose is to discharge accidental overflows:

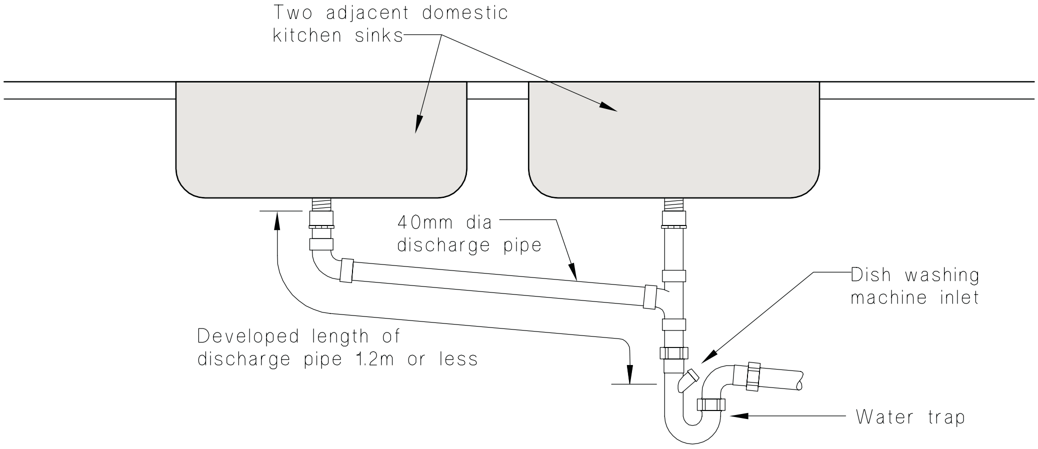
i) have no *water trap*,

ii) discharge to the open air within the property boundary,

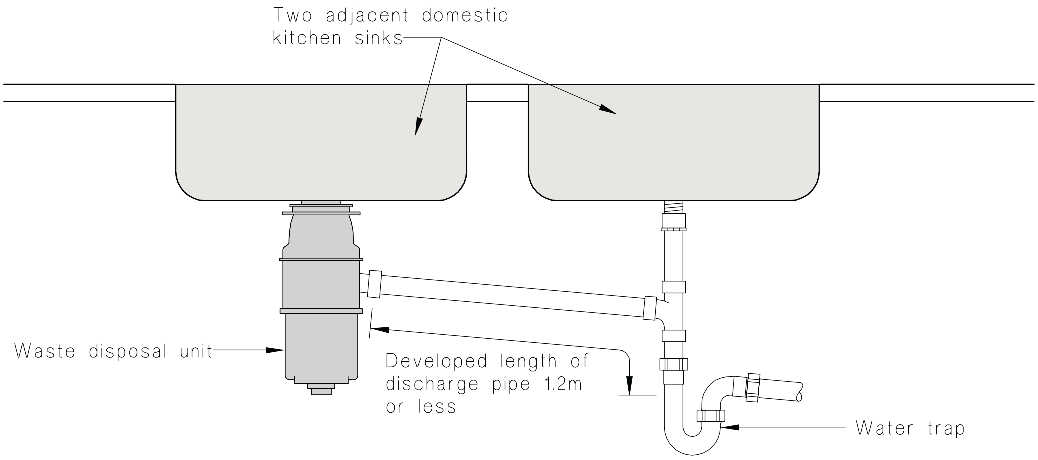
iii) discharge to a safe location, and

iv) be fitted with a means to prevent the entry of birds and vermin.

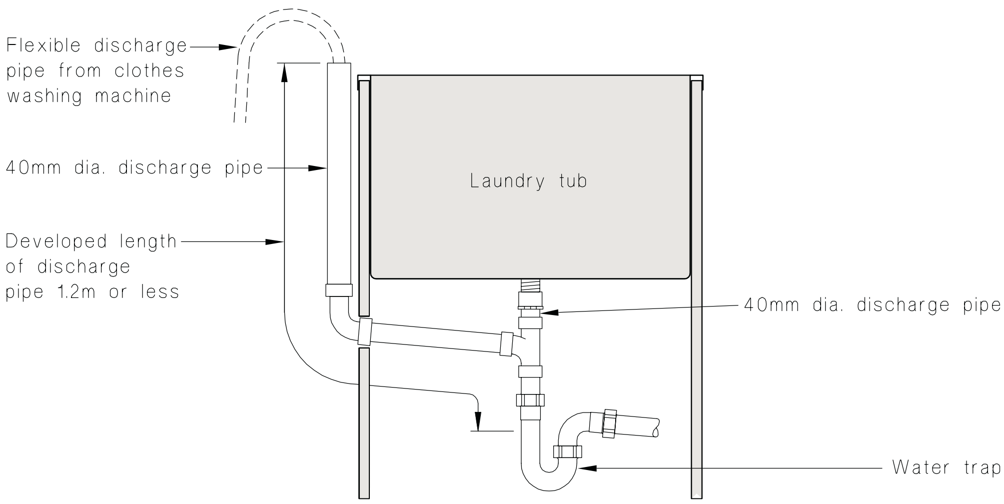
Figure 2: Multiple outlets
Paragraph 3.3.2



(a) Two adjacent domestic kitchen sinks and one dishwasher inlet

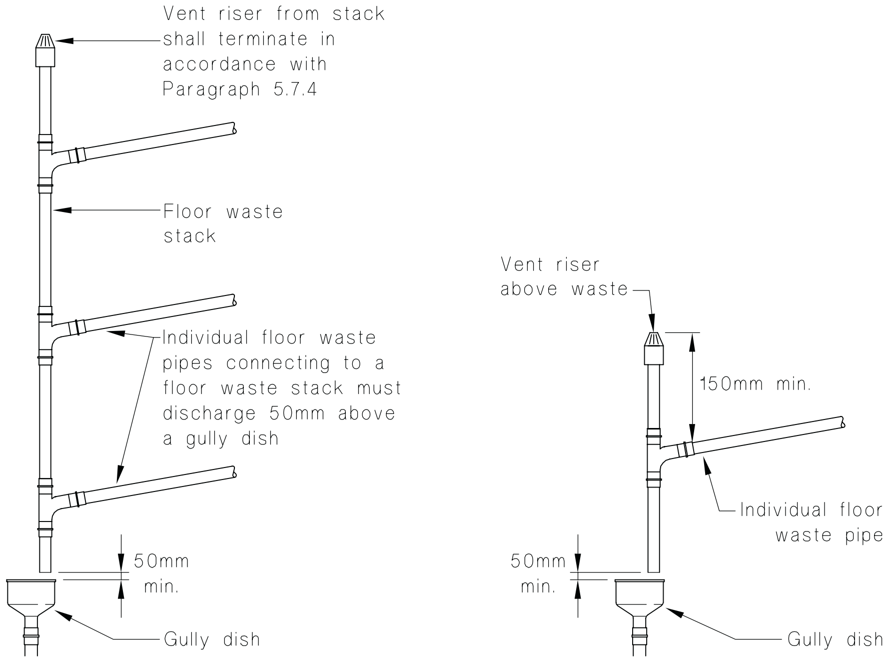


(b) Two adjacent domestic kitchen sinks and one disposal unit



(c) Laundry tub and discharge pipe for a clothes washing machine

Figure 3: Floor waste stacks and pipes
Paragraphs 3.4.3 and 3.4.4



(a) Multiple floor waste pipes connecting to floor waste stack

(b) Single floor waste pipes connecting to floor waste stack

Table 3: Diameters for floor waste discharge pipes
Paragraph 3.4.4

Number of floor wastes	Diameter of waste outlet (mm)	Discharge stack size (mm)
1 – 3	40	40
4 – 6	40	50
1 – 3	50	50
4 – 6	50	80

3.4.4 *Floor waste pipes* may be combined to form a *floor waste* stack and shall have a *diameter* not less than that given in Table 3 (see Figure 3).

Individual *floor waste pipes* connected to a *floor waste* stack need not be vented (see Figure 3).

3.4.5 *Floor waste discharge stacks* shall:

a) Be open vented,

b) Be vented independently from any other sanitary *plumbing system*, and

c) Comply with the termination requirements of Paragraph 5.7.4.

COMMENT:
Independent venting reduces the risk of foul air and gases entering the *floor waste* system.

3.4.6 Charging floor wastes

The *water seal* of a trapped *floor waste* discharging directly to the *foul water plumbing system* shall be maintained by (see Figure 4):

a) A charge pipe of not less than 32 mm *diameter* from a tap or a *drain* from a hot or cold water relief valve, which shall drain over a tundish so that the air gap is maintained,

b) A mechanical trap priming device and *discharge pipe*,

c) A tap for floor washing, located in the same room and in close proximity to the *floor waste.*

In all cases the charge pipe shall have a maximum length of 10 m.

All trap charging systems shall incorporate backflow prevention in accordance with G12/AS1.

COMMENT:
Backflow protection can be achieved by an appropriate air gap or backflow prevention device.

4.0 Discharge Pipes

4.1 Layout

4.1.1 *Discharge pipes* shall follow the most practicable route with the least number of bends.

4.2 Access for cleaning

4.2.1 *Access points* shall be provided in *discharge pipes* to allow the easy clearance of blockages.

4.2.2 *Access points* shall be provided at the following points:

a) At the junction of a soil *discharge pipe* with a *discharge stack*,

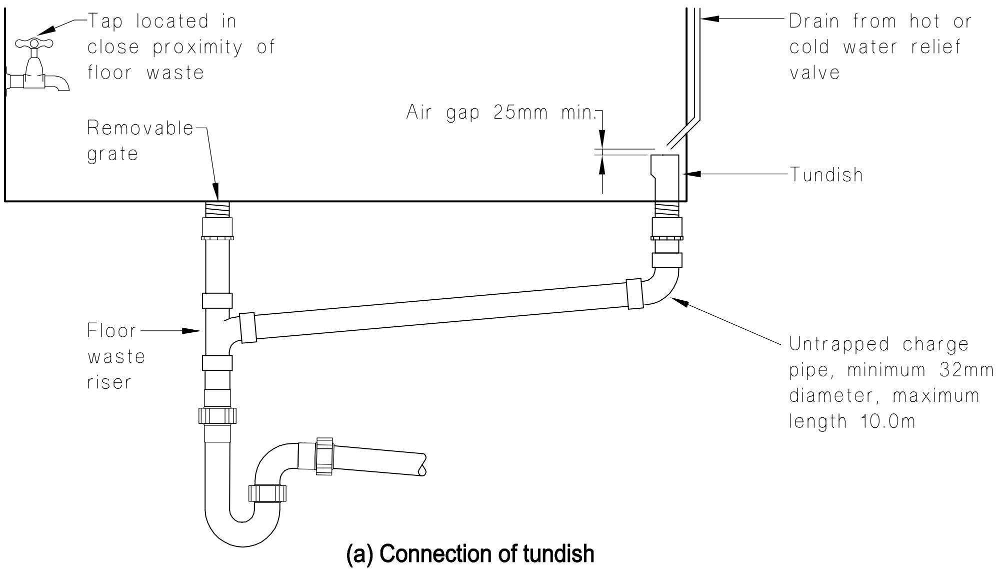
b) Where a number of changes of direction occur,

c) In a *discharge pipe* where access to junctions or changes of direction are restricted, and

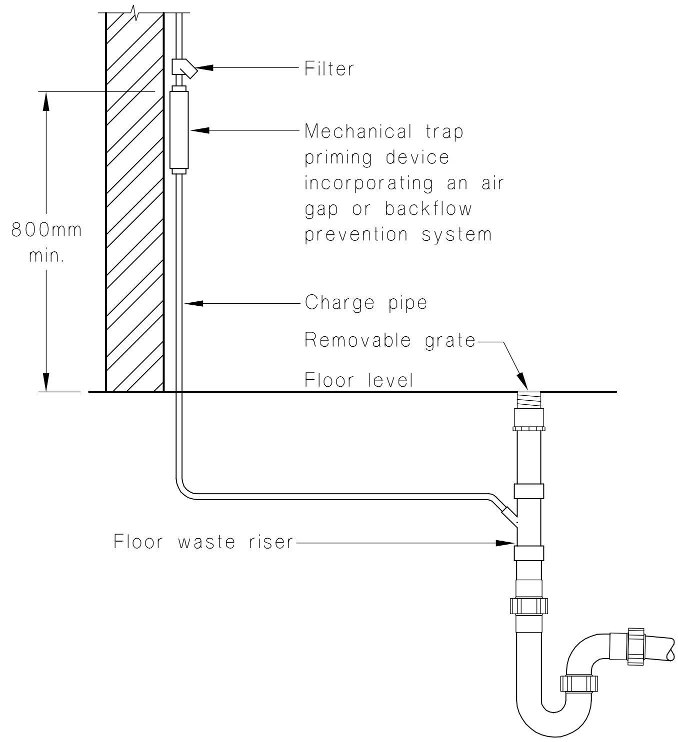
d) At the base of any soil stack at the point of connection to the *drain*.

COMMENT:
Proprietary fittings that provide access into the pipe should be used at these points.

Figure 4: Methods of charging floor waste traps
Paragraph 3.4.6



(a) Connection of tundish



(b) Trap primer arrangement

4.3 Diameter

4.3.1 *Fixture discharge pipes* shall have *diameters* of not less than those given in Table 2 and shall not decrease in size in the direction of flow.

4.3.2 Where a *discharge pipe* receives the discharge from more than one *fixture*, the *diameter* of the *discharge pipe* shall be not less than that required in Table 4 using:

a) The *discharge unit* loading to be conveyed, calculated as the sum of the *discharge unit* loading given in Table 2, for all *fixtures* served, and

b) The gradient of the *discharge pipe.*

4.4 Gradient

4.4.1 The gradient of *discharge pipes* shall be not less than that required in Table 4 for the relevant *discharge unit* loading.

COMMENT:
The minimum gradients specified are necessary to avoid the risk of blockage.

4.5 Fixture discharge pipes serving waste water fixtures

4.5.1 *Waste water fixture discharge pipes* shall discharge either to:

a) A *gully trap*, in accordance with Figure 5 of G13/AS1 and Figure 3 of G13/AS2, or

b) A *discharge stack* as in Paragraph 4.7 and Figures 7 and 8.

4.5.2 *Water seal* protection: *Waste water fixture discharge pipes* shall be vented to comply with Paragraph 5.0 and as required in Table 5.

4.6 Fixture discharge pipes serving soil fixtures

4.6.1 *Fixture discharge pipes* serving *soil fixtures* shall discharge either:

a) Directly to the *drain*, as shown in Figure 6(1), or

b) To a stack, as in Paragraph 4.7 and as shown in Figures 7 and 8.

4.6.2 *Water seal* protection: *Soil fixture discharge pipes* shall be vented to comply with Paragraph 5.0 and as required in Table 5 (see Figure 6(2)).

Table 4: Discharge unit loading for stacks and graded discharge pipes
Paragraphs 4.3.2, 4.4.1 and 4.7.1

Diameter (mm)	Maximum discharge from any one floor	Vertical stack (Note 1)	Graded discharge pipes – Minimum gradient 1:20	1:30	1:40	1:50	1:60
32	1	1	1				
40	2	6	6	5	4		
50	5	15	15	10	8		
65	6	18	51	29	21		
80	13	40	65	39	27	20	16
100	65	195	376	248	182	142	115

Note:
Shaded area = not permitted
1. Total loading at the base of the *discharge stack*.

4.7.2 Where *discharge pipe* connections to vertical *discharge stacks:*

a) Are near the base of a *discharge stack*, they shall not be connected to the *discharge stack* or *drain* within the positive pressure zone as shown in Figure 7.

COMMENT:
Whenever a *discharge stack* incorporates a bend greater than 45°, a hydraulic jump may occur in the horizontal pipe downstream of the bend. The hydraulic jump can cause very high positive pressures in the pipe near the bend. If a branch pipe is connected to the *discharge stack* in this zone, these high pressures may blow out *water seals* connected to that branch pipe.

b) Consist of two branches entering the *discharge stack* at the same level, they shall have a double Y-junction with either:

i) sweep entries, or

ii) entries with an included angle of 90° (see Figure 9 (b)).

c) Are at different levels, they shall not be connected to the *discharge stack* within the restricted entry zones shown in Figure 9 (a), unless the connection method is in accordance with Figures 9 (b) and (c).

4.7.3 Where *discharge pipe* connections are to graded *discharge stacks* they shall not enter at opposite positions and if they are near bends they shall not be made within 450 mm of any bend (see Figure 8).

4.7.4 The change of direction at the base of any vertical section in a *discharge stack* shall incorporate:

a) Two nominal 45° bends, or

b) One nominal 45° bend and a Y-junction.

5.0 Venting

5.1 Venting required

5.1.1 *Discharge pipes* shall be vented where required by Table 5.

5.1.2 *Vent pipes* that serve *fixtures* that discharge to a *gully trap* or *grease trap* shall be vented independently of any *vent pipe* system connected directly to the *foul water drainage system.*

COMMENT:
An independent *vent pipe* system for *fixtures* discharging to a *gully trap* is necessary to avoid the risk of *sewer* gases escaping through any *waste pipes* discharging to a *gully trap.*

5.2 Vent pipes

5.2.1 *Vent pipes* shall be one of the following types:

a) A vertical or graded *fixture vent pipe* terminating in accordance with Paragraph 5.7.1 or 5.8.1 (see Figure 10 (a)), or

b) An ascending graded or vertical *fixture vent pipe* to connect to:

i) a branch *vent pipe*, as shown in Figure 10 (b),

ii) a *discharge stack vent* as shown in Figures 7, 8 and 10 (b), or

iii) a *relief vent*, as shown in Figure 7.

The connection shall be made at a height of not less than 50 mm above the overflow level of the *sanitary fixture* it serves.

5.3 Diameter of vent pipes

5.3.1 *Fixture vent pipes, branch vent pipes*, *discharge stack vents* and *relief vents* shall have a *diameter* of no less than that given in Table 6.

Table 5: Venting requirements
Paragraphs 4.5.2, 4.6.2, 5.1.1, 5.5.1, 5.5.2 and 5.8.1

Stacks

Stack vent: All stacks discharging to another stack or to a *drain* require an open vent, sized in accordance with Table 6. Venting with an *air admittance valve* is permitted only on second and subsequent stacks as at least one open vent (the stack vent, if acting as main *drain* vent) is required to ventilate the *drain*.

Relief vent: All stacks that receive discharges from 3 floor levels shall be vented with a *relief vent* sized in accordance with Table 6. *Relief vents* shall be open vented.

Fixtures connected to a stack

All connections to a stack, except the highest connection, require venting by either an open vent, or an *air admittance valve*, sized in accordance with Table 6.

Highest fixture connected to a stack

The individual highest connection to a stack requires venting by either an open vent, or an *air admittance valve*, sized in accordance with Table 6, if the *discharge pipe* is longer than:

– 6 m for 100 mm pipe,
– 1.5 m for 80 mm pipe, and
– 3.5 m for 65 to 32 mm pipes.

Soil fixtures connected to an unvented branch drain

All *soil fixtures* connected to an unvented branch *drain* require venting by either an open vent, or an *air admittance valve*, sized in accordance with Table 6.

Soil fixtures connected to a vented drain with a gradient of less then 1:60

All *soil fixtures* connected to a vented *drain*, where the branch and the vented *drain* are at a gradient of less than 1:60, require venting by either an open vent, or an *air admittance valve* sized in accordance with Table 6.

Individual soil fixtures connected to a vented drain with a gradient of 1:60 or steeper

Individual *soil fixtures* connected to a vented *drain*, where the branch and the vented *drain* are at a gradient of 1:60 or steeper, require venting by either an open vent, or an *air admittance valve*, sized in accordance with Table 6, if the *discharge pipe* is longer than:

– 6 m for 100 mm pipe, or includes a vertical drop greater than 2 m, and
– 1.5 m for 80 mm pipe *diameters*.

Fixtures discharging to a gully trap

1. *Fixtures* connected to a combined *waste pipe* require venting by either an open vent, or an *air admittance valve*, sized in accordance with Table 6.
2. Individual *fixture discharge pipes* over 3.5 m in length require venting by either an open vent, or an *air admittance valve*, sized in accordance with Table 6.
3. Where any 32 mm *discharge pipe* has a vertical drop of greater than 1.5 m it shall be vented with a 32 mm vent pipe or an *air admittance valve*.

Venting of main drains

Main *drains* discharging to the *sewer* or to an on-site disposal system are required to be vented with a minimum 80 mm open vent.

Venting of branch drains

Branch *drains* connected to a vented *drain* that exceed 10 m in length require venting with an open vent, sized in accordance with Table 6.

Table 6: Vent pipe sizes
Paragraphs 5.3.1, 5.6.1, 5.6.3 c) and Table 5, G13/AS2 Paragraph 4.2.2 and Table 3

For fixture vent pipes	
Diameter of fixture discharge pipe (mm)	**Minimum diameter of fixture vent pipe (mm)**
32	32
40	32
50	40
65	40
80	40
100	40
For branch vent, branch drain vent, relief vent (see Note) and discharge stack vent pipes	
Maximum discharge units connected to the discharge pipe	**Minimum diameter of open vent pipe (mm)**
Up to 15	40
16 to 65	50
66 to 376	65
More than 376	80
For main drain vents	
Maximum discharge units connected to the discharge pipe	**Minimum diameter of open vent pipe (mm)**
Not applicable	80

Note:
Relief vent sizes are acceptable for a maximum developed length of 12 m.

5.4 Gradient of vent pipes

5.4.1 *Fixture vent pipes* and *branch vent pipes* shall extend upwards from the point of connection to the *fixture discharge pipe* to the open atmosphere, or to an *air admittance valve*, with a gradient of not less than 1:80.

5.5 Connection of vents to fixture discharge pipes

5.5.1 The *fixture vent pipe*, when required by Table 5 for *fixtures* discharging to a *gully trap,* shall connect to the *waste pipe* at a point between 75 mm and 3.5 m from the crown of the *water trap*, as shown in Figure 11 (a).

5.5.2 The *fixture vent pipe*, when required by Table 5 for *fixtures* discharging to a *stack* or directly to the drainage system, shall connect:

a) If serving a WC pan:

i) to the vent horn of the pan, or

ii) to the *discharge pipe* within 1.5 m of the crown of the trap, and not less than 300 mm above any bend at the base of a vertical drop (see Figure 6(2)).

b) If serving a basin or bidet: at a point between 75 mm and either (see Figure 11 (b)):

i) 600 mm from the crown of the *water trap*, or

ii) before the first bend in the *fixture discharge pipe.*

c) If serving other *fixture discharge pipes:* at a point between 75 mm and 1.5 m from the crown of the *water trap*, provided that the connection is not less than 300 mm above any bend at the base of a vertical drop within the *fixture discharge pipe* (see Figure 11 (b)).

5.6 Discharge stack and relief vents

5.6.1 The *discharge stack vent*, if also acting as a *drain vent pipe* shall have a *diameter* of not less than 80 mm. Where not acting as a *drain* vent the *discharge stack vent pipe* shall have a *diameter* of not less than that required in Table 6.

5.6.2 Every *discharge stack* serving *sanitary fixtures* or *sanitary appliances* from 3 floors within a *building* shall include a *relief vent* pipe as shown in Figure 7.

5.6.3 *Relief vent* pipes shall:

a) Connect to the bottom of the *discharge stack* at no less than 300 mm below the lowest *discharge pipe* served, and at an angle of 45°, as shown in Figure 7,

b) Be extended upwards at a gradient of no less than 1:80 to connect to the *discharge stack vent*, as shown in Figure 7, or extend separately to the atmosphere as an open vent, and

c) Have a *diameter* of no less than that given in Table 6.

5.7 Termination of open vent pipes

5.7.1 Open *vent pipes* shall terminate outside the *building* in accordance with Paragraphs 5.7.2 and 5.7.3 or 5.7.4.

5.7.2 *Vent pipes* shall terminate outside the *building* and:

a) Be at a height of not less than 50 mm above the overflow level of the highest *sanitary fixture* they serve, and

COMMENT:
The height of 50 mm above the overflow level is to ensure that the *vent pipe* does not convey *foul water* in the event of the *discharge pipe* becoming blocked.

b) Incorporate a means to prevent the entry of birds and vermin and shall have an open area not less than 80% of the cross-sectional area of the *vent pipe* they serve.

5.7.3 Open *vent pipes* serving *discharge pipes* directly connected to the *foul water drainage system* shall terminate no closer to *building elements* than (see Figure 12):

a) Ground level – 3.0 m above,

b) Windows and other openings – 600 mm above, and 3.0 m below and horizontally,

c) Roofs – 150 mm above,

d) Decking having pedestrian access – 3.0 m above, below and horizontally,

e) Eaves or parapets – 600 mm above, below and horizontally, and

f) Air intakes – 5.0 m in any direction.

COMMENT:
These requirements reduce the likelihood of foul air from the *foul water drainage system* entering the *building.*

5.7.4 *Fixture vent pipes* serving *waste pipes* discharging to a *gully trap* shall:

a) Terminate outside the *building* and be not less than 900 mm from any opening to the *building*, and

b) Be vented to the atmosphere independently of any *vent pipe* system connected directly to the *foul water drainage system.*

COMMENT:
1. The location of the outlet of the *vent pipe* serving a *waste pipe* is less restrictive than the requirements for *vent pipes* serving *discharge pipes* connected directly to the *drain*. This is permitted because a *waste pipe* is not connected directly to the *foul water drainage system,* and hence a source of foul air.
2. An independent vent pipe system for *waste pipes* is needed to avoid the risk of *sewer* gases escaping through a *waste pipe* to a *gully trap.*

5.8 Air admittance valves

5.8.1 General

Air admittance valves may be used as venting where specified in accordance with Table 5.

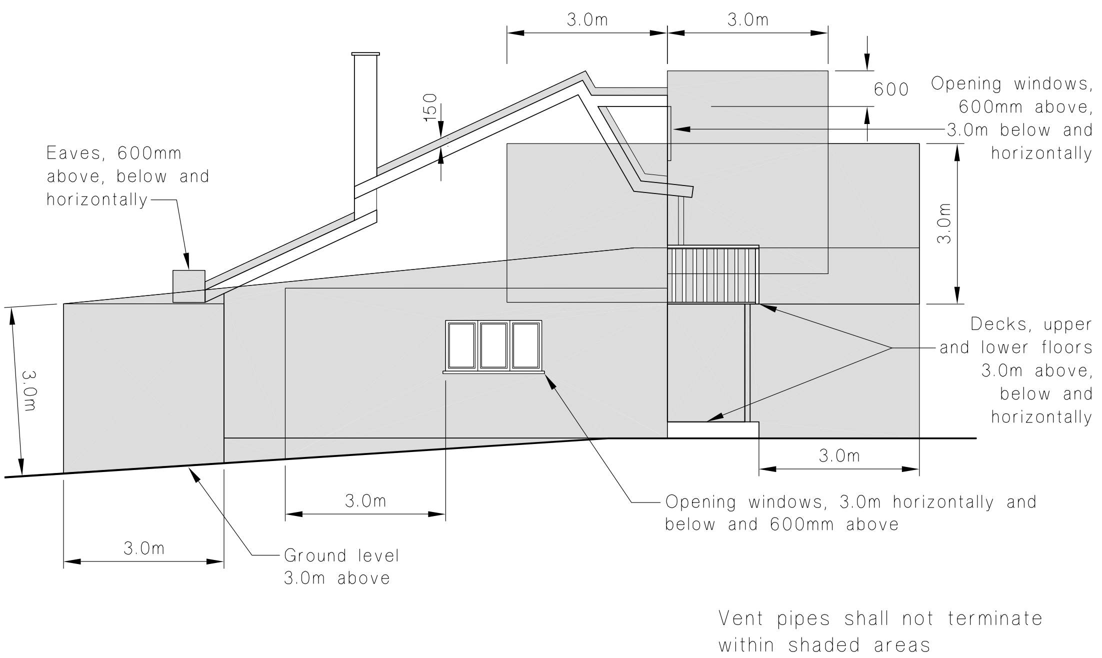
5.8.2 *Air admittance valves* shall be manufactured to ASSE 1050, ASSE 1051, BS EN 12380 or AS/NZS 4936. Amends 6 and 9

5.8.3 Size of air admittance valves

The *air admittance valve* shall have a *diameter* no less than that given in Table 6, and be no smaller in *diameter* than the *vent pipe* that it serves. Amend 6 Jan 2017

Air admittance valves that form an integral part of a *fixture trap* shall only be used as a *trap* vent.

Figure 12: **Restricted location for the termination of vent pipes**
Paragraph 5.7.3



5.8.4 Location

Air admittance valves shall be installed in an upright (vertical) position at least 100 mm above the weir of the *fixture* trap and in a location (see Figure 10 (c)):

a) Accessible for maintenance and inspection,

b) Where the valve is unlikely to become frozen,

c) Protected from likely damage, and

d) Where *adequate* air can enter the valve.

Ventilated openings shall be provided for *air admittance valves* installed within a wall space. The free area of the openings shall be not less than 1.5 times that of the *vent pipe.*

COMMENT:
A significant amount of ventilating pipework and roof penetrations may be avoided with the use of *air admittance valves.* However the pipework sizing, whether for individual *fixture* vents or branch vents, should follow the requirements of this Acceptable Solution. *Air admittance valves* are intended for anti-siphon situations and may not protect the ***water seals*** of traps in positive pressure situations.

6.0 Installation

6.1 Jointing methods

6.1.1 Jointing methods for PVC-U pipe shall comply with AS/NZS 2032. Amend 3 Sep 2010

6.2 Pipe supports

6.2.1 Pipes shall be supported at centres not exceeding those in Table 7.

Amend 3 Sep 2010 **6.2.2** For PVC-U pipes carrying discharges of greater than 60°C, support for the pipe shall be in accordance with Paragraph 6.3.2 of AS/NZS 2032. Amend 3 Sep 2010

COMMENT:
Supports are required to ensure that the pipe gradient does not fall below minimum values given in Table 4. Amend 9 Nov 2020

6.3 Thermal movement

6.3.1 The *plumbing system* shall accommodate without failure the expected longitudinal movement in pipes resulting from temperature changes. All copper and PVC-U pipes shall incorporate expansion joints. The provisions described in Section 6.4 of AS/NZS 2032 shall be used for PVC-U pipes. Amend 3 Sep 2010 Amend 3 Sep 2010

6.3.2 At supports, and at wall and floor penetrations not incorporating expansion joints, movement shall be accommodated using pipe sleeves or a durable and flexible lagging material.

COMMENT: Amend 3 Sep 2010
1. Thermal expansion will cause a 10 m length of PVC-U to extend 0.8 mm for each 1°C rise of pipe temperature.
2. Provision for thermal movement by correctly locating expansion joints, with fixed and sliding supports, prevents damage to pipes and *fixtures*.

6.4 Fire separation

6.4.1 Fire stopping shall be fitted to pipes passing through fire separations in accordance with C/AS2 Paragraph 4.4. Amends 6 and 8

7.0 Watertightness

7.1 Test methods

7.1.1 All above ground sanitary plumbing pipework shall be tested by water test or air test to verify that the system is watertight.

7.1.2 Water test: The method described in AS/NZS 2032 may be used for ensuring watertightness of above ground sanitary plumbing pipework. Amend 3 Sep 2010

7.1.3 Air tests may be carried out in accordance with either clause 15.3 of AS/NZS 3500.2 or paragraph 8.3 of E1/VM1. Amend 7 Nov 2018

Erratum 1 Jun 2007

Table 7: Distances Between Supports
Paragraph 6.2.1

Amend 3 Sep 2010

Material	Pipe diameter (mm)	Maximum distance between supports (m) Vertical pipe	Graded pipe
Copper pipes	32 to 50	3.0	2.5
	greater than 50	3.5	3.0
PVC-U pipes	32 to 50	1.0	0.5
	65 to 100	1.2	1.0
	greater than 100	1.8	1.2

Verification Method G13/VM2 Drainage

1.0 Drainage

1.0.1 No specific methods have been adopted for verifying compliance with the Performance of NZBC G13.

Amend 5 Feb 2014

COMMENT:
AS/NZS 3500.2 is referenced in G13/AS3.

Acceptable Solution G13/AS2 Drainage

1.0 Scope

1.0.1 This Acceptable Solution is for below ground non-pressure (gravity flow) *foul water drains* having a *diameter* of no greater than 150 mm.

1.0.2 It does not apply to *foul water drainage systems* where it is necessary to dispose of industrial liquid wastes, chemical or toxic wastes and other wastes which cannot be discharged to a *sewer* without pre-treatment. See G14/VM1.

2.0 Materials

2.0.1 Materials for drainage pipes and joints shall comply with the appropriate standards shown in Table 1.

2.1 Fill materials

2.1.1 Fill materials, as shown in Figure 7, shall be:

a) Bedding material of clean granular non-cohesive material with a maximum particle size of 20 mm,

b) Selected fill of fine-grained soil or granular material that is free from topsoil and rubbish and has a maximum particle size of 20 mm, or

c) Ordinary fill of excavated material.

3.0 Design

3.1 Bends

3.1.1 To reduce the risk of blockages, the *foul water drainage system* shall:

a) Have a simple layout that incorporates the least number of changes of direction,

b) Use bends having a radius of the practical maximum, and

c) Be laid only in straight lines between bends or junctions (both horizontally and vertically).

3.2 Junctions

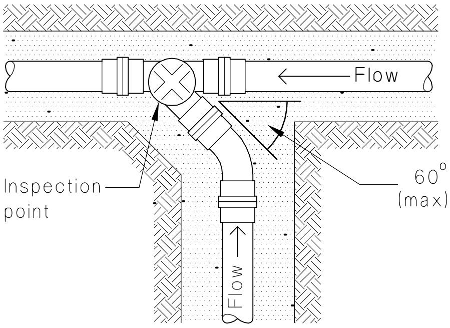
3.2.1 Any connection to a *drain*, excluding *vent pipe* connections, shall be made by means of sweep or oblique junctions. The angle that the branch makes at the point of entry with the main *drain*, shall be no greater than 60° (see Figure 1).

Table 1: **Materials for drainage pipes**
Paragraphs 2.0.1 and 5.3.1

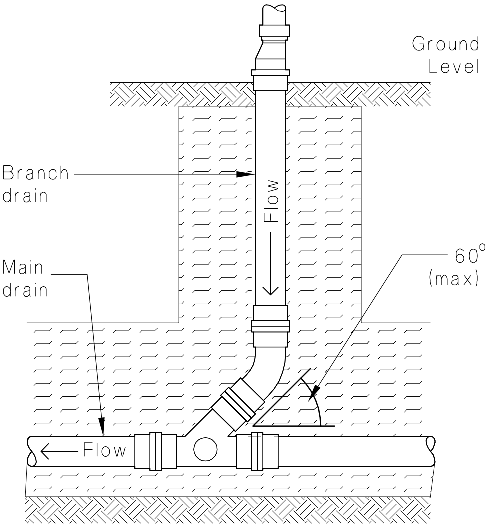
Material	Manufacturing Standard	Installation Standard
Cast iron	BS 437	
Concrete	AS/NZS 4058	
Steel	NZS 4442 or AS 1579	
PVC-U	AS/NZS 1260	AS/NZS 2032
Polyethylene	AS/NZS 4130, AS/NZS 5065	AS/NZS 2033
Polypropylene	AS/NZS 5065	AS/NZS 2566
Ductile iron	AS/NZS 2280	
ABS	AS/NZS 3518	
Copper	NZS 3501	
GRP	AS 3571	
FRC	AS 4139	
Elastomeric rings	AS 1646	

Amend 3 Sep 2010
Amend 3 Sep 2010
Amend 4 Oct 2011
Amend 3 Sep 2010
Amend 3 Sep 2010
Amend 6 Jan 2017
Amend 6 Jan 2017

Figure 1: **Connection of drains**
Paragraph 3.2.1

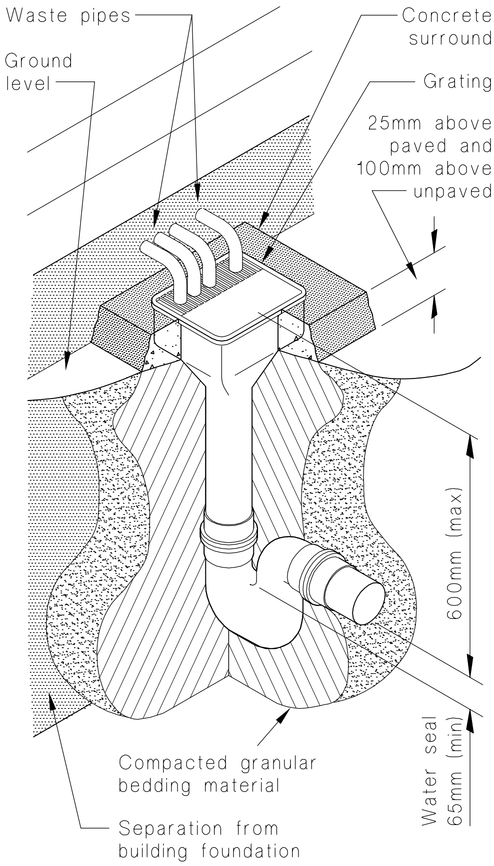


(a) Horizontal connection



(b) Vertical connection

Figure 2: **Details of gully traps**
Paragraph 3.3.1



3.3 Gully traps

3.3.1 All *gully traps* shall be constructed to prevent the ingress of *surface water* and foreign bodies likely to cause a blockage, shall be located within the legal boundary of the land on which the *building* is erected, and shall have (see Figures 2 and 3):

a) The overflow level of the gully dish no less than:

i) 25 mm above paved surfaces, or

ii) 100 mm above unpaved surfaces,

COMMENT:
It is imperative that the *waste pipe* connections to the *gully trap* remain watertight to prevent the ingress of ground/*surface water.*

b) A grating that will allow surcharge,

c) A minimum outlet pipe *diameter* of 100 mm,

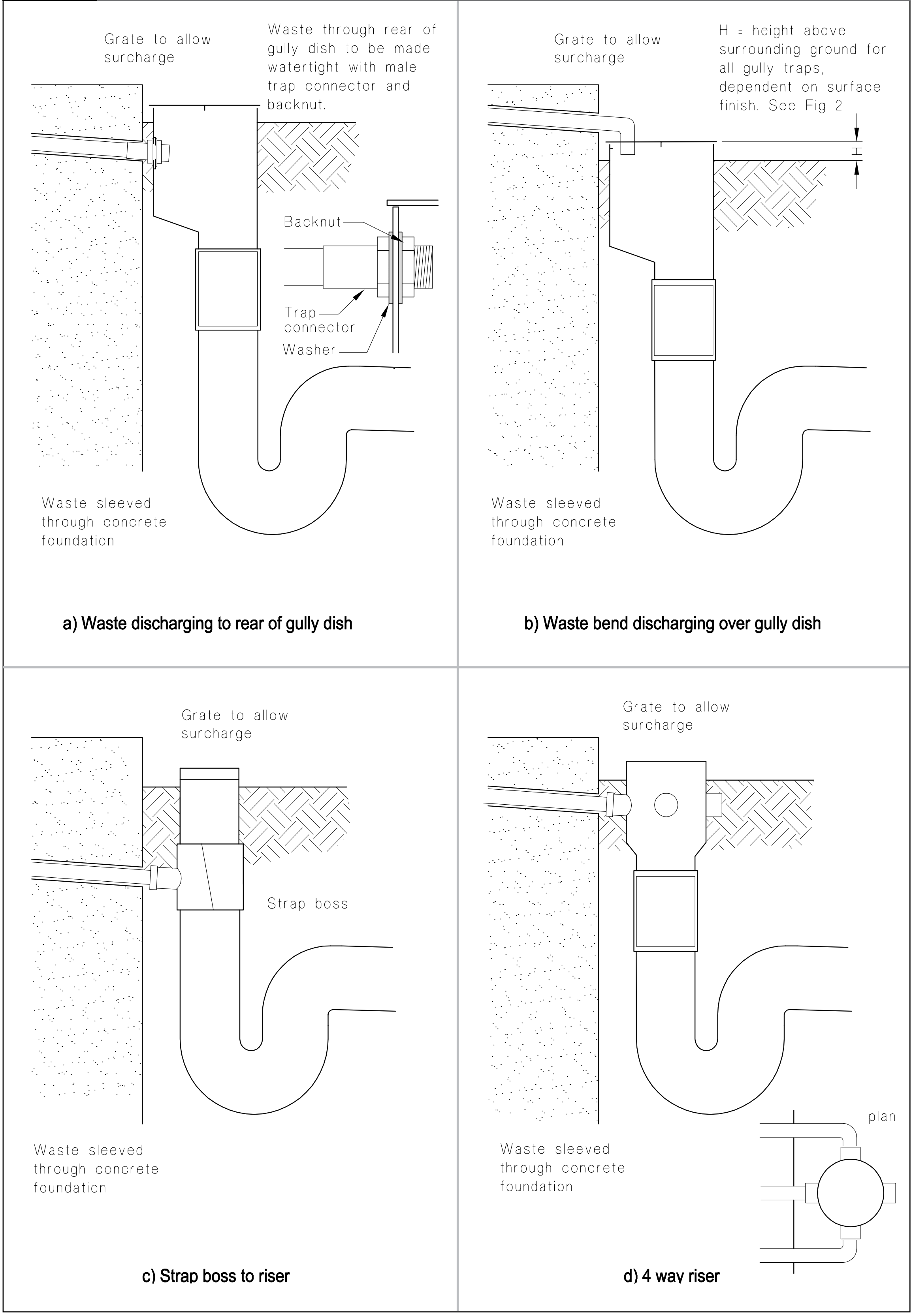
d) A *water seal* depth of at least 65 mm,

e) At least one *discharge pipe* discharging to the *gully trap* to avoid *water seal* evaporation,

f) *Waste pipes* that discharge to the *gully trap* arranged to permit easy cleaning of the *gully trap,*

g) *Waste pipe* outlets located at least 20 mm above *water seal* level, and at least 20 mm below the grating,

Figure 3: **Methods of connecting to gully traps**
Paragraph 3.3.1



a) Waste discharging to rear of gully dish

b) Waste bend discharging over gully dish

c) Strap boss to riser

d) 4 way riser

h) The top of the *water seal* no more than 600 mm below the top of the gully dish, and

COMMENT:
To permit the *gully trap* to be easily cleaned by hand.

i) *Adequate* support from bedding and backfilling with:

i) concrete no less than 75 mm thick surrounding the entire gully dish and which is separated from the *building* foundation, where the *gully trap* is likely to be damaged, or

Amend 9 Nov 2020

ii) compacted bedding material complying with Paragraph 2.1.1, in other areas, and

j) A minimum of 600 mm clear access space above the gully dish.

3.3.2 In order to provide overflow relief for the drainage system, every *building* used for Housing shall be provided with at least one *gully trap* which shall:

a) Be positioned so that the top of the gully dish is no less than 150 mm below the overflow level of the lowest *sanitary fixture* served by the drainage system,

b) Have a grating that will allow surcharge,

c) Be located in a visible position, and

d) Be installed so that surcharge cannot enter into or under *buildings*.

Amend 9 Nov 2020

COMMENT:
Housing is a classified use defined in Clause A1 of the *Building Code*.

3.4 Grease traps

3.4.1 *Grease traps* shall be provided for any *discharge pipe* serving a sink(s) where the *foul water* discharges to a soak pit.

3.4.2 In *buildings* other than *Housing*, *grease traps* shall be provided where waste water is likely to convey grease.

Amend 9 Nov 2020

COMMENT:
Housing is a classified use defined in Clause A1 of the *Building Code*.

3.4.3 The capacity of a *grease trap* shall be at least twice the capacity of all *sanitary fixtures* and *sanitary appliances* discharging to it, and in no case less than 100 litres as shown in Figure 4.

3.4.4 For restaurants and cafés, the capacity of the *grease trap* shall be at least 5 litres for each person for whom seating is provided, and in no case less than that required by Paragraph 3.4.3.

3.4.5 *Grease traps* located outside a *building* shall be configured as shown in Figure 4.

3.4.6 The top of the outlet junction shall be extended to finished ground level and fitted with a watertight *rodding point* access cover as shown in Figures 4 and 10.

3.4.7 Other types of *grease trap* such as those that separate or digest grease must be approved by the *network utility operator* as required by G14/VM1 1.2.

3.5 Gradient of drains

3.5.1 *Drains* shall:

a) Be laid at an even grade, and

b) Have no obstructions to flow.

3.5.2 *Drains* shall be installed at the maximum practicable gradient.

3.5.3 The gradient of drainage pipes shall be not less than that required in Table 2 for the relevant *discharge unit* loading.

Table 2: Drain discharge unit loading and minimum gradients
Paragraphs 3.5.3, 3.6.3 and 5.2.1

Diameter	Minimum gradient									
(mm)	1:20	1:40	1:60	1:80	1:100	1:120	1:140	1:160	1:180	1:200
80	215	100	61	44	34	–	–	–	–	–
100	515	255	205	149	122	104	–	–	–	–
150	2920	1790	1310	1040	855	760	677	611	558	515

See Paragraph 5.2.2 for *drains* laid at gradients within shaded area.

3.6 Diameter of drains

3.6.1 The *diameter* of a *drain* shall not decrease in size in the direction of flow.

3.6.2 *Drains* shall have a *diameter* of not less than 100 mm, except that 80 mm is acceptable where the *drain* serves only *waste water fixtures.*

3.6.3 *Diameters* and gradients of *drains* shall be no less than those given in Table 2 for the calculated *discharge unit* loading determined from Table 2 of Acceptable Solution G13/AS1 "Sanitary Plumbing".

4.0 Drain Ventilation

4.1 Ventilation requirements

4.1.1 The drainage system shall be ventilated to allow a flow of air and to minimise the build up of foul air.

4.1.2 Every main *drain*, and every branch *drain* longer than 10 m, shall be ventilated in accordance with Table 3.

4.1.3 Ventilation shall be provided by a *drain vent pipe* located so that the length of *drain* upstream of the *drain* vent connection is less than 10 m (see Figure 5).

4.1.4 To allow for regular flushing of the *drain* vent connection, it shall be located downstream of, but not more than 10 m, from the discharge connection closest to the head of the *drain* (see Figures 5 (a) and 6).

COMMENT:
The head of the *drain* is that point on the drainage system that is the furthermost from the *outfall*.

4.1.5 Any open *discharge stack vent* that is located within 10 m from the head of the *drain* may be used as a *drain* vent (see Figure 5 (b)).

4.2 Diameter of drain vent pipe

4.2.1 A main *drain* vent shall have a minimum *diameter* of 80 mm, and shall comply with termination requirements of Paragraph 5.7.3 of G13/AS1 "Sanitary Plumbing".

4.2.2 Branch *drain* vents shall be sized in accordance with Table 6 in G13/AS1.

5.0 Installation

5.1 Jointing

5.1.1 Rigid pipes shall have flexible joints to resist damage from differential settlement.

5.1.2 Jointing for PVC-U pipes and fittings shall be in accordance with the methods described in AS/NZS 2032. Amend 3 Sep 2010 Amend 3 Sep 2010

5.2 Construction

5.2.1 *Drains* shall be constructed to withstand the combination and frequency of loads likely to be placed upon them without collapse, undue damage or undue deflection (see Figure 7). In addition, *adequate* support needs to be provided to prevent gradients becoming less than those required by Table 2 as a result of:

a) Differential settlement, or

b) Deflection of an unsupported span.

5.2.2 Where *drains* are laid at gradients of 1:80 or less, verifiable levelling devices shall be used to ensure uniform and accurate gradients.

COMMENT:
Laser and dumpy levels are recommended devices.

5.3 Construction methods

5.3.1 Figure 7 gives acceptable methods for the bedding and backfilling of the drainage pipes listed in Table 1 except where:

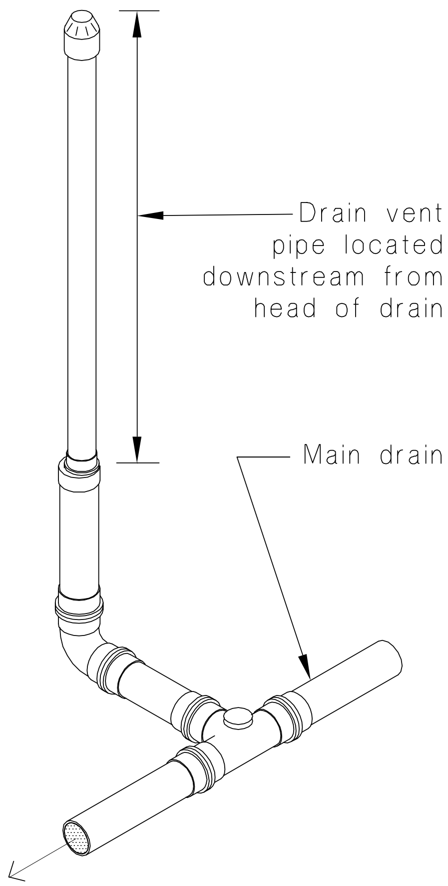
a) The trench is located within or above peat,

b) Scouring of the trench is likely due to unstable soils,

c) The horizontal separation between any *building* foundation and the underside of the pipe trench is less than that required by Paragraph 5.7.1, or

d) The cover H to the pipe is more than 2.5 m.

Figure 6: Typical drain vent connection
Paragraph 4.1.4



5.3.2 *Drains* laid in ground described in Paragraph 5.3.1 shall be subject to specific design.

5.4 Trench width

5.4.1 The width B of the trench shall be no less than the pipe *diameter* D plus 200 mm. The width of the trench at the top of the pipe shall be no more than 600 mm unless the pipes in the trench are covered with concrete, as shown in Figure 7 (c).

5.5 Placing and compacting

5.5.1 Base bedding (beneath the pipe) shall be placed and compacted before pipes are laid.

5.5.2 Side bedding (along both sides of the pipe) and cover bedding (where used) up to 300 mm above the pipe, shall be compacted.

5.6 Proximity of trench to building

5.6.1 For light timber framed 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 V to the underside of any *building* foundation, as shown in Figure 8. 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 5
Feb 2014

5.7 Access points

5.7.1 Except in accordance with Paragraphs 5.8 and 5.9, all *drains* shall be laid to allow easy access for maintenance and the clearance of blockages.

5.7.2 *Drains* shall be provided with *access points* to facilitate cleaning and the clearance of blockages. Such *access points* shall be constructed to prevent the ingress of ground water and tree roots.

5.7.3 *Access points* may comprise *access chambers, inspection chambers, rodding points* or *inspection points.* Methods of *access point* construction are shown in Figures 9 to 12.

COMMENT:
Rodding points are preferred to *inspection points* in landscaped or sealed areas and within *buildings*.

5.8 Additional requirements for drains installed under buildings

5.8.1 *Drains* installed under *buildings* shall be:

a) Straight and of even gradient,

b) Separated from the *building* foundation by at least 25 mm, and

c) When passing through concrete, sleeved or wrapped in a durable and flexible material to allow for expansion and contraction.

5.8.2 *Drains* passing beneath *buildings* with a concrete slab on the ground floor shall have in addition to Paragraph 5.8.1:

a) 50 mm clearance from the top of the pipe to the underside of the slab, and

b) Junctions beneath the *building* joining at an angle of not more than 45^{o} (see Figure 13).

COMMENT:

Drains located under *buildings* must meet the Durability Performance requirement of B2.3.1 (a), that is the life of the *building* being not less than 50 years.

5.9 Access to drains under buildings

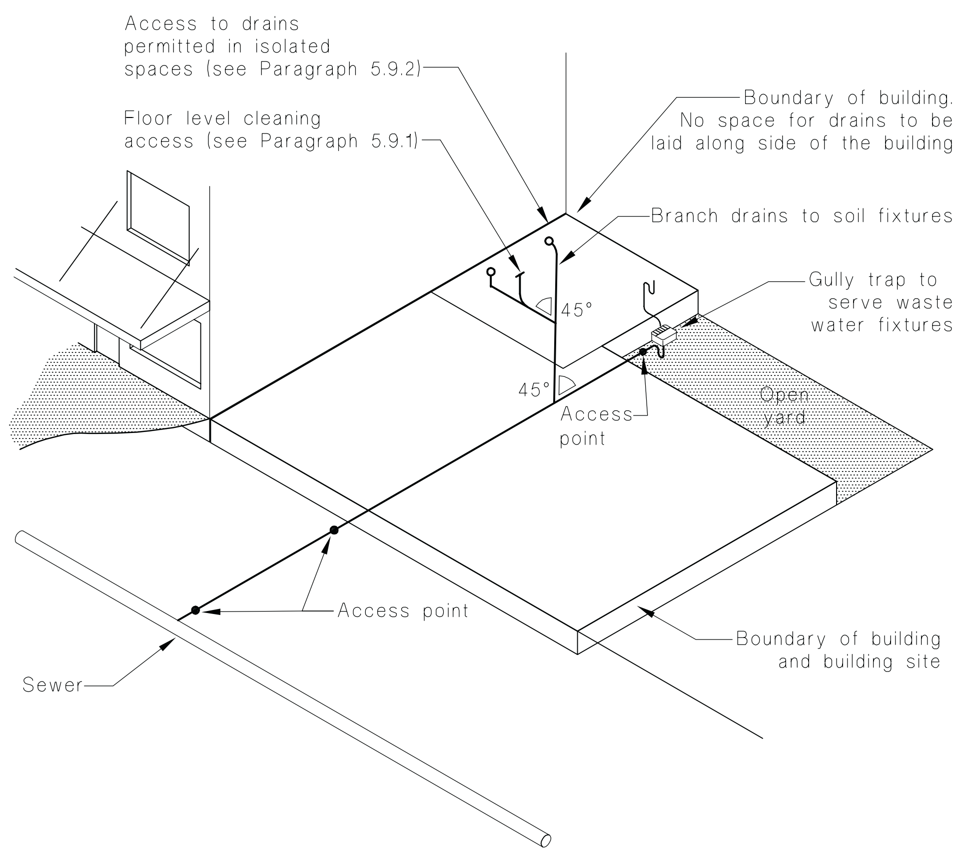
5.9.1 Where two or more *soil fixtures* are connected to a branch *drain* beneath the *building*, access for cleaning shall be provided by a sealed floor level *rodding point* located downstream of the highest *fixture* connection to the branch *drain* (see Figures 10 and 13).

5.9.2 *Access points* located within a *building* shall be in an area that complies with the isolation and ventilation requirements for spaces in which *soil fixtures* are located.

COMMENT:

Refer to G1/AS1 "Personal Hygiene" and G4/AS1 "Ventilation".

Figure 13: Drains under buildings
Paragraphs 5.8.2 and 5.9.1



5.9.3 *Access points* may be located in a space containing a *soil fixture*.

5.10 Disused drains

5.10.1 Where a *drain* or part of a *drain* is no longer required, it shall be disconnected from the *foul water drainage system* at the junction with the live *drain* or at the property boundary.

5.10.2 The live *drain* shall be sealed by either of the following *methods*:

a) Purpose made junctions sealed with a tight-fitting plug that is fixed securely in place and does not protrude into the live *drain*, or

b) In in-situ formed junctions, where disused branch *drains* which have been inserted into an existing length of pipe, these shall be cut off as close as practicable to the junction and sealed with a purpose made cap, plug or stopper. Alternatively, the length of pipe into which the branch *drain* was inserted may be replaced.

COMMENT:
The unsatisfactory disconnection of old branch *drains* from live *drains* can lead to a source of major infiltration of ground water into the drainage system.

6.0 Watertightness

6.1 Testing

6.1.1 All sections of the drainage system shall be tested by water test or air test to ensure watertightness.

COMMENT:
Testing should be undertaken before backfilling for the easy identification of any leaks.

6.1.2 Water test

Amends 3 , 7, 9

AS/NZS 2032 Section 7 gives an acceptable method for ensuring watertightness of below ground PVC-U drainage pipework.

Amend 3 Sep 2010

6.1.3 Air tests may be carried out in accordance with either clause 15.3 of AS/NZS 3500.2 or paragraph 8.3 of E1/VM1.

Amend 7 Nov 2018

6.1.4 Where a disused *drain* is being reinstated, the disused *drain* shall be tested to verify that the *drain* is sound.

6.1.5 Where a *building* is proposed to be built over an existing *drain*, the *drain* shall be verified as being sound both before and after construction.

Erratum 1 Jun 2007

Amend 9 Nov 2020

Acceptable Solution G13/AS3 Sanitary plumbing and drainage

1.0 AS/NZS 3500.2

1.0.1 AS/NZS 3500.2, as modified by Paragraph 1.0.2, is an Acceptable Solution for the design and installation of sanitary plumbing and drainage systems.

Amend 3 Sep 2010

Amends 6 and 7

Amend 6 Jan 2017

1.0.2 Modifications to AS/NZS 3500.2

Clause 2.2 Delete and replace with "Materials and products shall comply with NZBC Clause B2 Durability and G13/AS1 Paragraph 2.0 Materials".

Clause 3.19 Delete Clause.

Clause 4.4 Replace "inspection shafts" with "access point" in this Clause.

Clause 4.6.6 This applies only to *Housing*.

COMMENT:
Housing is a classified use defined in Clause A1 of the Building Code

Clause 4.9.1 Delete and replace with

"**4.9.1 Drains installed at grade**

4.9.1.1 General

The connection of any drain to a graded drain shall be by means of a junction with an upstream angle not greater than 45° and shall conform to the following:

(a) Double 45° junctions shall not be used.

(b) Where unequal junctions are used, the invert of the branch drain shall be at least 10 mm higher than the soffit of the drain to which it connects.

4.9.1.2 New installations

Where a junction is used to make the connection of a DN 100 branch drain to a main drain of the same size, the entry level of the branch drain shall be elevated at an incline of not less than 15° above the horizontal.

NOTE 1: See Figure 4.9.1(a) for a typical example.

NOTE 2: Positioning the junction a minimum of 15° above horizontal removes the probability of the partial backwash of a discharge into the branch causing stranding that can lead to blockages in the drain.

4.9.1.3 Other installations

For repairs or extensions to existing installations or where the main and branch drains are not DN 100 the entry level of the branch drain may be on grade.

NOTE 1: Where sufficient height is available in existing installations, the provisions of Clause 4.9.1.2 should be followed to avoid the potential for blockages." Amend 9 Nov 2020

Clause 5.6 Delete and replace with "Drains in other than stable ground shall be subject to specific design." Amends 1 and 6

Clause 6.6.2.4 Delete and replace with

"6.6.2.4 Junctions installed at grade

6.6.2.4.1 General

Discharge pipes shall be joined to each other by means of a 45° junction. Where unequal size junctions are used, the invert of the branch pipe shall be 10 mm higher than the soffit of the pipe to which it connects.

6.6.2.4.2 New installations

Where a junction is used to make the connection of a DN 100 branch pipe to a common discharge pipe of the same size, the entry level of the branch pipe shall be elevated at an incline of not less than 15° above the horizontal.

NOTE 1: See Figure 4.9.1(a) for a typical example.

NOTE 2: Positioning the junction a minimum of 15° above horizontal removes the probability of the partial backwash of a discharge into the branch causing stranding that can lead to blockages in the drain.

6.6.2.4.3 Other installations

For repairs or extensions to existing installations the entry level of the branch pipe may be on grade.

NOTE 1: Where sufficient height is available in existing installations, the provisions of Clause 6.6.2.4.1 should be followed to avoid the potential for blockages." Amend 9 Nov 2020

Clause 6.6.2.6 Delete and replace with

"**6.6.2.6 Junctions for stacks connected to a graded pipe**

Junctions installed on grade for the connection of a stack to a graded pipe shall be in accordance with Clause 6.8.3."

Clause 6.8.3 (a) Delete and replace with

"(a) a 45° junction installed on grade in accordance with Clause 6.6.2.4 and a bend at the base of the stack in accordance with Clause 6.8.4; or"

Clause 10.7 Delete and replace with "PVC-U piping systems shall be installed in accordance with AS/NZS 2032 and the requirements of this Standard."

Amend 9 Nov 2020

Section 14 Delete section.

Amends 1, 5, 6

Verification Method G13/VM4 Foul Water: On-Site Disposal

1.0 General

1.1 Scope

1.1.1 This document describes the design methods for systems used for the collection, storage, treatment and disposal of *foul water*.

Amend 5
Feb 2014

Amend 2
Jun 2007

1.1.2 A design method and construction details given in sections 5.1 to 5.5 and 6.1 to 6.2 of AS/NZS 1547 (and the appendices referred to in these sections), for the treatment of domestic *foul water* for flow rates up to a maximum 14,000 litres/week from a population equivalent of up to 10 persons, may be verified as satisfying the performance criteria of G13 Foul Water.

Amend 9
Nov 2020

Index G13/VM1/VM2 & AS1/AS2/AS3

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

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.

Enquiries about the content of this document should be directed to:

MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Telephone 0800 242 243
Email: info@building.govt.nz

Verification Methods and Acceptable Solutions are available from www.building.govt.nz

New Zealand Government

Document Status

The most recent version of this document (Amendment 6), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 1 January 2017 and supersedes all previous versions of this document.

The previous version of this document (Amendment 5) will cease to have effect on 30 May 2017.

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.building.govt.nz

G14: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	September 1993	pp. vi – viii, References	
Amendment 2	1 December 1995	pp. i and ii, Document History	p. iv, G14.3.2 (d)
Second edition	21 June 2007	Document revised – second edition issued	
Amendment 3	Published 30 June 2010 Effective from 30 September 2010	p. 2, Document History, Status pp. 7–9, References	p. 19, G14/VM1 Table 3 p. 22, G14/VM1 Table 4
Amendment 4	Effective from 10 October 2011 until 14 August 2014	p. 2, Document History, Status p. 11, Definitions	pp. 7–9, References p. 19, G14/VM1 Table 3
Amendment 5	14 February 2014 until 30 May 2017	p. 2A, Document History, Status p. 5, Contents p. 7, References p. 11, Definitions	pp. 16–17, G14/VM1 1.3, 1.4, 1.6.2, Table 2 p. 25, G14/AS1 1.2.1, 1.2.2
Amendment 6	Effective from 1 January 2017	pp. 7, 8 References	

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

New Zealand Building Code Clause G14 Industrial Liquid Waste

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 2005.

FIRST SCHEDULE–*continued*

Clause G14–INDUSTRIAL LIQUID WASTE

Provisions	Limits on application
OBJECTIVE **G14.1** The objective of this provision is to safeguard people from injury or illness caused by infection or contamination resulting from industrial liquid waste.	
FUNCTIONAL REQUIREMENT **G14.2** *Buildings* in which industrial liquid waste or foul water is generated shall be provided with *adequate* spaces and facilities for the safe and hygienic collection, holding, treatment and disposal of the waste.	
PERFORMANCE **G14.3.1** Industrial liquid waste or foul water shall be conveyed to storage containers and within disposal systems in a way that will: (a) Transfer wastes from *buildings* safely and hygienically, (b) Avoid the likelihood of blockage and leakage, (c) Avoid the likelihood of foul air and gases entering *buildings*, and (d) Provides reasonable access for clearing of blockages.	
G14.3.2 Facilities for the storage, treatment, and disposal of industrial liquid waste must be constructed— (a) with *adequate* capacity for the volume of waste and the frequency of disposal; and (b) with *adequate* vehicle access for collection if required; and (c) to avoid the likelihood of contamination of any potable water supplies in compliance with Clause G12 "Water Supplies"; and	

Amend 1
Jun 2007

FIRST SCHEDULE–*continued*

Provisions	Limits on application
(d) to avoid the likelihood of contamination of soils, ground water, and waterways except as permitted under the Resource Management Act 1991; and (e) from materials that are impervious both to the waste for which disposal is required, and to water; and (f) to avoid the likelihood of blockage and leakage; and (g) to avoid the likelihood of foul air and gases accumulating within or entering into *buildings*; and (h) to avoid the likelihood of unauthorised access by people; and (i) to permit easy cleaning and maintenance; and (j) to avoid the likelihood of damage from superimposed loads or normal ground movement; and (k) if those facilities are buried underground, to resist hydrostatic uplift pressures.	

Amend 1 Jun 2007

Contents

Amend 5
Feb 2014

References

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in these Verification Methods and Acceptable Solutions (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 these Verification Methods and Acceptable Solutions must be used.

Amend 4 Oct 2011 | Amend 5 Feb 2014 | Amend 5 Feb 2014

Amendment	Reference	Where quoted
	Standards New Zealand	
	NZS/BS 21: 1985 Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions) *Amend: 1*	VM1 Table 3
Amend 3 Sep 2010	NZS/BS 1387: 1985 Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads *Amend: 1*	VM1 Table 3
Amend 3 Sep 2010	NZS 3106: 2009 Design of concrete structures for the storage of liquids.	VM1 3.2.2, Table 4
Amend 5 Feb 2014	NZS 4219: 2009 Seismic performance of engineering systems in buildings.	VM1 3.2.1
	NZS 4442: 1988 Welded steel pipes and fittings for water, sewage and medium pressure gas	VM1 Table 3
	NZS 7601: 1978 Specification for polyethylene pipe (Type 3) for cold water services	VM1 Table 3
Amend 3 Sep 2010	**Standards Australia/Standards New Zealand**	
Amend 4 Oct 2011; Amends 5 & 6	AS/NZS 1260: 2009 PVC-U pipes and fittings for drain, waste and vent applications *Amends: 1, 2*	VM1 Table 3
Amend 4 Oct 2011	AS/NZS 1477: 2006 PVC pipes and fittings for pressure applications *Amend: 1*	VM1 Table 3
	AS/NZS 1546: On-site domestic wastewater treatment units	
Amend 4 Oct 2011	Part 1: 2008 Septic tanks	VM1 Table 4
Amend 3 Sep 2010; Amend 6 Jan 2017	AS/NZS 2032: 2006 Installation of PVC pipe systems *Amend: 1*	VM1 Table 3
Amend 3 Sep 2010; Amend 4 Oct 2011	AS/NZS 2033: 2008 Installation of polyethylene pipe systems *Amends: 1, 2*	VM1 Table 3
Amend 4 Oct 2011	AS/NZS 2642: Polybutylene pipe systemsVM1 Table 3	
	Part 2: 2008 Polybutylene (PB) for hot and cold water applications	
Amend 4 Oct 2011	Part 3: 2008 Mechanical jointing fittings for polybutylene pipes for hot and cold water applications *Amend: 1*	

	Where quoted
Amend 6 Jan 2017 AS/NZS 3518: 2013 Acrylonitrile butadiene styrene (ABS) compounds, pipes and fittings for pressure applications	VM1 Table 3
Amend 3 Sep 2010 AS/NZS 4058: 2007 Pre Cast concrete Pipes (pressure and non pressure)	VM1 Table 1
Amend 4 Oct 2011 AS/NZS 4129: 2008 Fittings for polyethylene (PE) pipes for pressure applications Amend 6 Jan 2017 *Amend: 1*	VM1 Table 3
Amend 4 Oct 2011 AS/NZS 4130: 2009 Polyethylene (PE) pipes for pressure applications *Amend: 1*	VM1 Table 3
AS/NZS 4331: 1995 Metallic flanges Part 1: Steel flanges Part 2: Cast iron flanges Part 3: Copper alloy and composite flanges	VM1 Table 3
Amend 3 Sep 2010 AS/NZS 4401: 2006 High density polyethylene (PE-HD) pipes and fittings for soil and waste discharge (low and high temperature) systems inside buildings	VM1 Table 3
Amend 3 Sep 2010 AS/NZS 4765: 2007 Modified polyvinyl chloride (PVC-M) pipes for pressure applications	VM1 Table 3
British Standards Institution	
Amend 3 Sep 2010 BS 143, and BS 1256: 2000 Specification for malleable cast iron and cast copper alloy threaded pipe fittings. *Amend: 1, 2, 3, 4*	VM1 Table 3
BS EN 1595: 1997 Pressure equipment made from borosilicate glass 3.3 – general rules for design, manufacture and testing	VM1 Table 3
Amend 3 Sep 2010	
Amend 4 Oct 2011	
Amend 3 Sep 2010	
BS 2971: 1991 Specification for Class II arc welding of carbon steel pipework for carrying fluids	VM1 Table 3
BS 4991: 1974 (1982) Specification for propylene copolymer pressure pipe	VM1 Table 3
Amend 3 Sep 2010	
BS 6374:– Lining of equipment with polymeric materials for the process industries Part 1: 1985 Specification for lining with sheet thermoplastics Part 2: 1984 Specification for lining with non-sheet applied thermoplastics Part 3: 1984 Specification for lining with stoved thermosetting resins Part 4: 1984 Specification for lining with cold curing thermosetting resins Part 5: 1985 Specification for lining with rubbers	VM1 Table 4

		Where quoted
BS 6464: 1984	Specification for reinforced plastics pipes, fittings and joints for process plants	VM1 Table 3
BS 7159: 1989	Code of practice for design and construction of glass-reinforced plastics (GRP) piping systems for individual plants or sites	VM1 Table 3
BS 7777: 1993	Flat bottomed, vertical, cylindrical storage tanks for low temperature service	VM1 Table 4
Part 1:	Guide to the general provisions applying for design, construction and installation	
Part 2:	Specification for design and construction of single, double and full containment metal tanks for the storage of liquified gas at temperatures down to –165°C	
Part 3:	Recommendations for the design and construction of prestressed and reinforced concrete tanks and tank foundations and for the design and installation of tank insulation, tank lines and tank coating	
BS EN 10241: 2000	Steel threaded pipe fittings	VM1 Table 3
BS EN 12285:	Workshop fabricated steel tanks	
Part 1: 2003	Horizontal cylindrical single skin and double skin tanks for the underground storage of flammable and non-flammable water polluting liquids	VM1 Table 4
Part 2: 2005	Horizontal cylindrical single skin and double skin tanks for the aboveground storage of flammable and non-flammable water polluting liquids	VM1 Table 4
BS EN 12585: 1999	Glass plant, pipeline and fittings – Pipeline and fittings DN 15 to 1000 – compatibility and interchangeability	VM1 Table 3
BS EN 13121-3: 2008	GRP tanks and vessels for use above ground. Design and workmanship *Amend: 1 (2010)*	VM1 Table 4

Amend 4 Oct 2011
Amend 3 Sep 2010
Amend 3 Sep 2010
Amend 4 Oct 2011

Standards Association of Australia

AS 1741: 1991	Vitrified clay pipes and fittings with flexible joints – sewer quality	VM1 Table 3
AS 3690: 2009	Installation of ABS pipe systems	VM1 Table 3

Amend 3 Sep 2010
Amend 4 Oct 2011

New Zealand Regulations

Hazardous Substances (Disposal) Regulations 2001	VM1 1.2.1
The Resource Management Act 1991	VM1 1.2.1, 3.3.1

Definitions

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 5 Feb 2014

Adequate *Adequate* to achieve the objectives of the *Building Code*.

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

Grease trap A device designed to intercept grease in a *foul water* discharge.

Hazardous Creating an unreasonable risk to people of bodily injury or deterioration of health.

Interceptor trap A device which will separate and retain desired liquids and solids from a liquid stream and which will provide a water barrier to prevent foul air or gas from entering any downstream 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 Amend 4 Oct 2011

(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

(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

Piping system An assembly of pipes, pipe-fittings, gaskets, bolting and pipe supports.

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

Verification Method G14/VM1 Industrial Liquid Waste

1.0 General

1.1 Scope

1.1.1 This document describes the requirements to be satisfied by specific design for systems used for the collection, storage, treatment and disposal of industrial liquid waste.

1.1.2 Where waste is *hazardous*, the storage facilities shall also comply with NZBC F3 Hazardous Substances and Processes.

1.2 Treatment and disposal

1.2.1 The method of treatment and disposal (see Figure 1) may include:

a) Discharge to a *sewer* either with or without pre-treatment, as permitted by the *network utility operator.*

b) Discharge to a natural waterway either with or without treatment, in accordance with the Resource Management Act 1991, or

c) Storage within the *building* site for later removal and disposal in a manner that meets the requirements of the Resource Management Act 1991 or other relevant legislation.

COMMENT:
The type, quality and quantity of industrial liquid waste that may be released to a sewer, natural waterway or disposed of by some other means may be covered by legislation such as the Hazardous Substances (Disposal) Regulations 2001 or by local Trade Waste Bylaws.

1.2.2 Table 1 gives examples of industrial liquid wastes and typical treatment and disposal methods.

Figure 1: Treatment and disposal methods
Paragraph 1.2.1

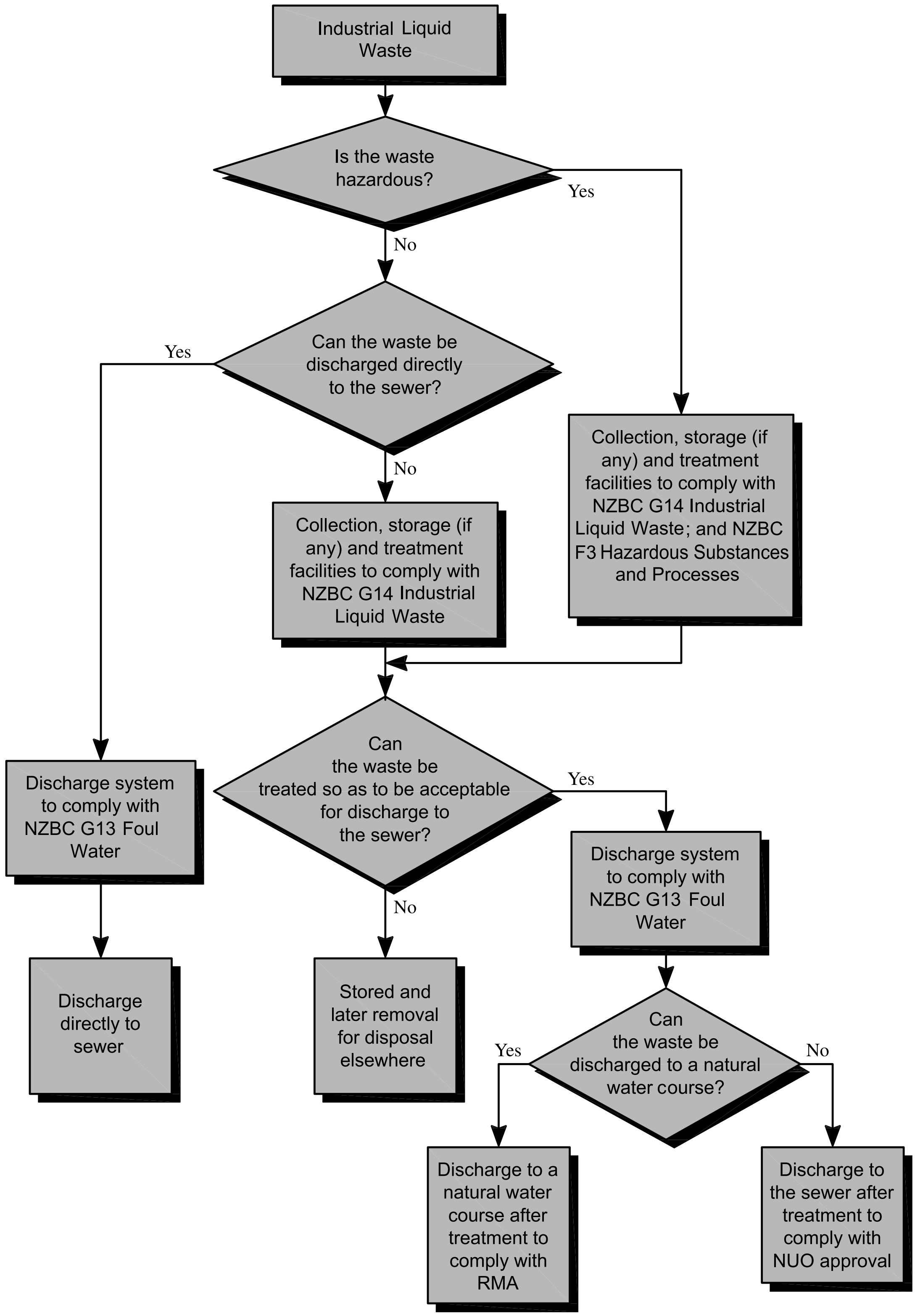


Table 1: Examples of industrial liquid waste and typical treatment and disposal methods (see Note)
Paragraph 1.2.2

Type of industrial waste	Industry source	Typical contaminants	Typical treatment and disposal methods
Waste containing organic compounds:			
1) Natural organic waste from food and drink manufacture	Meat processing Dairy processing Canning Poultry processing Brewing Vegetable processing Wine-making Sugar refining Food processing Fish processing	Soluble and suspended solids Carbohydrates Proteins Fat and grease Alkalis	Neutralisation Grease recovery Sedimentation flotation Biological Land application Discharge to sewer
2) Other organic waste from processing animal and vegetable matter	Pulp and paper Tannery and leather processing Wool scouring Textile and carpet manufacture Timber treatment Hospitals Mortuaries	Carbohydrates Proteins Acids, alkalis Tannins Inorganic salts Dyes, bleaches Latex Suspended solids Viruses Fat and grease	Neutralisation Screening Sedimentation flotation Chemical precipitation Cooling towers Disinfection Heat
Waste containing metals and cyanides	Mineral processing Steel mills Foundries Plating operations Metal fabrication Electrical manufacturing	Acids, alkalis Oil Heavy metals Chromium Cyanides Solvents Suspended solids	Neutralisation Sedimentation flotation Chemical precipitation Ion exchange Filtration Distillation and stream stripping Cooling towers Heat
Other chemical waste	Fertiliser works Paint manufacture Pharmaceutical Petrochemical Agrochemical production Plastics manufacture	Organic chemicals Solvents Acids, alkalis Suspended solids Inorganic salts Viruses	Neutralisation Screening Sedimentation flotation Chemical treatment Absorption and ion exchange Distillation and steam stripping Membrane separation Biological Incineration Secure landfill Disinfection

NOTE:
This table gives examples but does not purport to be an exhaustive list.

1.3 Related Acceptable Solutions and Verification Methods

Amend 5 Feb 2014

1.3.1 Table 2 identifies the Acceptable Solutions and Verification Methods that are referenced in G14/VM1.

1.4 Location of collection, storage and treatment facilities and disposal systems

1.4.1 Collection, storage and treatment facilities and disposal systems shall be located:

a) In areas that will not create health or safety hazards,

b) To ensure that spillage from storage tanks or ponds can be safely contained, and

Amend 5 Feb 2014

COMMENT:
Verification Method F3/VM1 Hazardous Substances and Processes gives guidance on the requirements for the capacity of compounds intended for the containment of spillage.

c) In areas with sufficient access for cleaning, clearing of blockages, and maintenance.

1.4.2 Storage tanks may be placed below ground provided:

a) Precautions are taken to avoid:

   i) health or safety hazards,

   ii) corrosion that threatens the integrity of the tank or associated plant, and

b) Tanks are designed to withstand the effects of associated loads.

1.5 Construction materials

1.5.1 All materials in contact with industrial liquid waste shall be resistant to corrosion, chemical attack, and any abrasion or physical abuse that can be reasonably expected.

1.5.2 Any corrosion allowance provided in the design of equipment handling liquid waste shall be *adequate* for the *intended life* of the facilities.

Amend 5 Feb 2014

Table 2: Building Code clauses, Acceptable Solutions and Verification Methods referenced in G14/VM1
Paragraph 1.3.1

Building Code clause	Subject	Paragraph in G14/VM1
NZBC B1 Structure and B1/VM1	Seismic restraint of tanks	3.2.1
NZBC D1 Access Routes	Vehicle access	1.8
NZBC F3 Hazardous Substances and Processes and F3/AS1	Collection and storage of hazardous liquid waste	1.1.2, Figure 1 and 1.4.1
NZBC G12 Water Supply and G12/AS1	Contamination of water supply	1.6.3
	Water hose for emergency use near storage tanks	3.3.2
NZBC G13 Foul Water and G13/AS1	Conveyance of treated wastewater	2.0.1 and Figure 1
	Drainage of water used in emergency near storage tanks	3.3.2

1.6 Avoiding contamination

1.6.1 Industrial liquid waste systems, storage and treatment tanks and *piping systems* shall be tested on completion to avoid contamination of any soil, ground water or waterways through run-off from washing-down, rain, accidental overflows or other causes.

1.6.2 The area containing waste storage facilities shall be impervious and contained so as to avoid contamination of any soil, ground water or waterways through run-off from washing-down, rain, accidental overflows or other causes.

Amend 5 Feb 2014

COMMENT:
Verification Method F3/VM1 Hazardous Substances and Processes gives guidance on the requirements for the capacity of compounds intended for the containment of spillage.

1.6.3 Industrial liquid waste facilities shall be installed to avoid contamination of any potable water supply, as required by NZBC G12 Water Supplies.

1.7 Separation of waste

1.7.1 Separate systems shall be provided to convey and store industrial liquid wastes that require different treatment and/or disposal methods, or where the wastes are incompatible.

COMMENT:
This situation is usual for premises that produce both industrial liquid waste and *foul water*. Incompatibility may be due to the physical **or** chemical nature of the wastes.

1.8 Vehicle access

1.8.1 Vehicle access areas for the collection of industrial liquid waste shall:

a) Comply with NZBC D1 Access Routes. Where possible, access layout shall provide sufficient space for vehicles to drive in and out of the facility without reversing or interference with other activities on the site,

b) Drain any spilled waste to a kerbed area sloped so that the waste does not collect under the vehicle, or drain in an uncontrolled manner to other areas of the plant, and

c) Any spilled waste shall:
   i) be contained on-site for subsequent removal,
   ii) not enter the surface water system, and
   iii) not enter the sewage system unless the spilled waste is acceptable as a discharge to the *sewer* by the *network utility operator*.

1.9 Security

1.9.1 Where unauthorised access to storage and treatment facilities may be *hazardous*, security shall be provided by:

a) Locating the facilities in a lockable enclosed space within a *building*, or

b) An external security fence with lockable gates if located in the open.

2.0 Conveyance of industrial liquid waste

2.0.1 Where the *network utility operator* accepts the discharge of industrial liquid waste to a *sewer*, the waste shall be conveyed in a plumbing and drainage disposal system complying with NZBC G13 Foul Water.

2.1 Layout

2.1.1 Screens, grit chambers, *grease traps* or similar appropriate equipment should be installed at the head of *piping systems* if suspended solids or material within the liquid waste might cause blockage of the *piping system*.

2.1.2 Wherever possible, *piping systems* shall convey industrial liquid waste using gravity flow.

2.1.3 Gravity flow pipelines should have sufficient gradient to provide flow velocities that prevent the settlement of entrained solids and grit.

2.1.4 Pipework containing *hazardous* liquid waste shall not be buried except where this is unavoidable.

2.1.5 Piping above access areas shall have a ground clearance of no less than 4.5 m. In vehicle access areas, signs shall be dis-played indicating the amount of clearance.

2.1.6 Valves shall be readily accessible. The distance between operating floor level and the centreline of any valve handwheels located above floor level shall be no more than 2.2 m, unless extension operating gear is provided. Valve stems shall not slope downwards in a way that allows solids to enter the gland.

2.1.7 Pipework flanges shall not be located over roads, walkways or cable trays, or places where leakage could cause damage or a hazard.

2.2 Drainage

2.2.1 Floor surfaces used to drain free flowing liquid should slope towards waste collection systems:

a) For non-*hazardous* waste – no less than 1 in 80 for a travel distance of no more than 12.0 m, or

b) For *hazardous* waste – no less than 1 in 40 for a travel distance of no more than 6.0 m.

COMMENT:
Drainage valleys should not coincide with access ways. Kerbs may be required to prevent hazardous liquid waste contaminating access areas or mixing with other fluids.

2.2.2 Industrial liquid waste shall be prevented from polluting or overflowing onto adjacent property.

2.2.3 *Interceptor traps* shall be installed at the exit points of areas containing flammable liquid waste that is immiscible in water, to prevent the spread of *fire*.

2.2.4 Liquid-sealed traps shall be provided at any branch connections to contain *hazardous* gases within parts of the conveyance system. Traps shall be vented to a safe location no less than 3.0 m above ground level.

2.2.5 *Grease traps* shall be provided where liquid waste is likely to convey grease.

COMMENT:
Grease solids shall not be allowed to accumulate to an extent that the *grease trap* is blocked. Refer to G13/AS2.

2.3 Piping

2.3.1 The *piping system* shall comply with the Standards applicable to the material used and waste being conveyed. Related Standards are listed in Table 3.

Table 3: Standards relevant to piping systems
Paragraph 2.3.1

Amend 3 Sep 2010
Amend 4 Oct 2011

Material	System	Standards	Special conditions
Steel	Piping	NZS 4442 NZS/BS 1387	Welded pipe 100 to 1000 mm nominal diameter Tube suitable for screwing to BS 21
	Fittings	BS 143 and BS 1256 BS EN 10241 AS/NZS 4331	Screwed pipe fittings, malleable cast iron Screwed pipe fittings, wrought steel Flanges
	Jointing	NZS/BS 21 BS 2971	Screwed/socketed Welded
Concrete	Piping	AS/NZS 4058	Precast concrete
Plastic (see Note 1)	ABS	AS/NZS 3518 AS 3690	Pipes and fittings Installation
	Polybutylene piping	AS/NZS 2642	Pipes and fittings
	Polyethylene piping	NZS 7601 AS/NZS 4130 AS/NZS 4129 AS/NZS 4401 AS/NZS 2033	Maximum working pressure up to 0.9 MPa Pipe for pressure applications Fittings for pressure applications Soil and waste systems Installation and jointing techniques for above and below ground
	Polypropylene Copolymer piping	BS 4991	For temperatures up to 100°C
	PVC piping	AS/NZS 1260 AS/NZS 1477 AS/NZS 4765 AS/NZS 2032	Drain waste and venting Pipes and fittings for pressure applications Pipes for pressure applications Installation of PVC-U pipe above and below ground
	Reinforced piping	BS 6464 BS 7159	For glass reinforced piping system and fittings
Ceramic	Piping	AS 1741	Pipe and fittings for waste
Glass	Piping	BS EN 1595 BS EN 12585	Borosilicate glass 3.3 pipe and fittings – design, manufacture, testing Glass pipeline and fittings nominal sizes

NOTE:

1. The pressure resistance of plastic piping and fittings is significantly reduced at elevated temperatures. Manufacturers' data should be consulted for working temperatures above 20°C.

2.3.2 Joints, fittings and valves – The number of joints, fittings and valves in the *piping system* shall be kept to a practical minimum.

COMMENT:
This reduces the likelihood of blockage and leakage.

2.3.3 Bends shall have a centreline radius of no less than 1.5 times the nominal pipe diameter.

2.3.4 Pipe wall thickness shall be designed to avoid failure, paying due regard to:

a) Operating temperature and pressure,

b) Corrosion and erosion allowances, and

c) Manufacturing tolerances.

2.3.5 Thermal movement – Piping layouts shall allow for expansion and contraction due to temperature change, without placing excessive stresses on piping materials, or excessive forces and moments on equipment anchors. Methods of accommodating thermal movement in piping may include:

a) Positioning of connected equipment to take advantage of the inherent flexibility of pipework,

b) Expansion loops or offset legs,

c) Expansion bellows units,

d) Expansion joints, and

e) Accommodation of stresses by control of expansion direction via supports, anchors and guides.

2.3.6 *Piping systems* for *hazardous* liquid waste shall have:

a) Flanged or butt-welded joints,

b) Fail-safe control valves, normally closed,

c) Protection against temperature both from the fluid conveyed or the occurrence of *fire*,

d) Metal reinforced, spiral-wound and ring-jointed gaskets of a material suitable for the temperature and the waste being handled, and

e) Protection against over-pressure.

COMMENT:
Threaded joints weaken the pipe, are particularly prone to leakage, and perform poorly in corrosive service. When leakage around the valve stem cannot be tolerated, valves with double packing boxes or with a bellows seal should be used.

2.4 Pumps

2.4.1 Pumps shall be designed with regard to:

a) The required capacity and flow rate,

b) Maximum internal or external coincident pressure,

c) Minimum or maximum temperatures expected in service,

d) The suspended solids likely to be present in the liquid waste,

e) Protection against leakage, by the selection of an appropriate chemically-resistant seal packing material,

f) Minimising the length of suction lines, and providing the required net positive suction head,

g) Ensuring any spillage is conducted away from the pump and motor,

h) Providing a means of isolation for maintenance purposes, and

i) Providing an appropriate alarm system to monitor pump operation failure and liquid waste overflow.

2.4.2 Where suspended solids are likely to cause blockages, centrifugal pumps having a suction inlet diameter of no less than 100 mm shall be used.

2.4.3 Typical pump installation layouts are shown in Figure 2.

2.4.4 When *hazardous* liquid waste is to be conveyed, pumps shall:

a) Be sealless or glandless pumps, and

b) Include a remotely or automatically actuated shut-off valve in the pump inlet line.

3.0 Storage or treatment tanks

3.1 General

3.1.1 The design and construction of storage tanks shall comply with NZBC Clause B1 Structure. Appropriate Standards are given in Table 4.

3.1.2 Storage tanks shall be fitted with an accurate liquid level indicator that can be easily removed from the tank for maintenance purposes, without the need to empty the tank.

3.2 Resistance to loads

3.2.1 Free-standing tanks shall be secured against earthquake forces. The methods given in NZS 4219 are acceptable.

COMMENT:
NZBC Clause B1, through B1/VM1, requires building services to be secured against earthquake forces.

3.2.2 Storage and treatment tanks that are buried shall be designed to withstand super-imposed loads and uplift forces. The methods given in NZS 3106 for concrete tanks are acceptable.

3.3 Liquid hazardous waste

3.3.1 Tanks for the storage of toxic or corrosive liquid *hazardous* waste, or waste producing foul air, shall be fitted with sealed covers and be provided with a pressure relief system that vents to a safe outdoor location.

COMMENT:
1) A safe location does not necessarily include the *sewer* or surface water system.
2) Where the pressure relief system results in regular discharges to the environment, then the owner or operator should approach the regional council to determine consent requirements under a Regional Plan or the Resource Management Act 1991.

3.3.2 Within the immediate vicinity of any toxic and corrosive liquid waste, a safety shower, eyewash unit and a wash-down hose complying with G12/AS1 and G13/AS1 shall be provided, and be clearly identified.

3.3.3 A typical tank storage facility for corrosive liquid waste is shown in Figure 3.

Table 4: **Standards used for the design of acceptable tank storage systems** (see Note)
Paragraph 3.1.1

Material	Standards	Special Conditions
Steel	BS EN 12285.1 BS EN 12285.2 BS 7777	Horizontal cylindrical vessels Horizontal cylindrical vessels Design, construction, installation, cold storage
Concrete	NZS 3106 AS/NZS 1546.1	– For up to 10 people and 14,000 litres/week
Plastic	BS EN 13121.3 BS 6374 AS/NZS 1546.1	Above ground GRP tanks For tank linings For up to 10 people and 14,000 litres/week

Amend 3 Sep 2010

Amend 3 Sep 2010

NOTE:
In all cases Standards must be used only for applications appropriate to the liquid waste being stored.

Acceptable Solution G14/AS1 Industrial Liquid Waste

1.1 Security

1.1.1 A fence erected to ensure security against unauthorised access to storage and treatment facilities shall comply with F5/AS1 Construction and Demolition Hazards.

1.2 Acceptable disposal systems

1.2.1 Discharge to the sewer without pre-treatment – Where the *network utility operator* accepts the discharge of industrial liquid waste to a *sewer* without pre-treatment, the disposal system shall comply with Acceptable Solution G13/AS2.

Amend 5 Feb 2014

1.2.2 Discharge to the sewer after pre-treatment – Where the *network utility operator* accepts the discharge of industrial liquid waste to a *sewer* with pre-treatment, that part of the discharge system used to convey the waste after treatment shall comply with Acceptable Solution G13/AS2.

Amend 5 Feb 2014

Index G14/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Compliance Document for New Zealand Building Code Clause G15 Solid Waste

Prepared by the Department of Building and Housing

This Compliance Document is prepared by the Department of Building and Housing. The Department of Building and Housing is a Government Department established under the State Sector Act 1988.

Enquiries about the content of this document should be directed to:

Department of Building and Housing
Te Tari Kaupapa Whare

Department of Building and Housing
PO Box 10-729, Wellington.
Telephone 0800 242 243
Fax 04 494 0290
Email: info@dbh.govt.nz

Compliance Documents are available from www.dbh.govt.nz

New Zealand Government

Status of Compliance Documents

Compliance Documents are prepared by the Department of Building and Housing in accordance with section 22 of the Building Act 2004. A Compliance Document is for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Compliance Document will be treated as having complied with the provisions of the Building Code to which the Compliance Document relates. However, a Compliance Document is only one method of complying with the Building Code. There may be alternative ways to comply.

Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the status of Compliance Documents 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 Compliance Document.

G15: Document History

	Date	Alterations	
First published	July 1992		
Amendment 1	September 1993	p. vi, References	
Amendment 2	1 July 2001	p. 2, Document History, Status p. 4, Definitions	
Amendment 3	Published 30 June 2010 Effective from 30 September 2010	p. 2, Document History, Status p. 5, Contents p. 7, References	p. 9, Definitions p. 14, G15/AS1 3.1 p. 17, Index
Reprinted incorporating Amendments 1–3	30 September 2010		

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

Document Status

The most recent version of this document, as detailed in the Document History, is approved by the Chief Executive of the Department of Building and Housing. It is effective from 30 September 2010 and supersedes all previous versions of this document.

People using this Compliance Document should check for amendments on a regular basis. The Department of Building and Housing may amend any part of any Compliance Document at any time. Up-to-date versions of Compliance Documents are available from www.dbh.govt.nz

New Zealand Building Code Clause G15 Solid Waste

This Clause has been extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

FIRST SCHEDULE–*continued*

Clause G15–SOLID WASTE

Provisions	Limits on application
OBJECTIVE **G15.1** The objective of this provision is to safeguard people from injury or illness caused by infection or contamination from solid waste.	
FUNCTIONAL REQUIREMENT **G15.2** *Buildings* shall be provided with space and facilities for the collection, and safe hygienic holding prior to disposal, of solid waste arising from the *intended use* of the buildings.	Requirement G15.2 shall not apply to *Detached Dwellings, household units* of *Multi-unit Dwellings, Outbuildings* or *Ancilliary buildings* if there is independent access or private open space at ground level.
PERFORMANCE **G15.3.1** Where provision is made within *buildings* for the collection and temporary holding of solid waste, the spaces provided shall be: (a) Of sufficient size for the volume of waste and frequency of disposal, (b) Provided with reasonable access for the depositing and collection of the waste, (c) Capable of maintaining sanitary conditions having regard to the types of waste and storage containers, and (d) Capable of maintaining the appropriate temperature for the type of waste stored. **G15.3.2** Where a rubbish chute is provided, it shall be located and constructed to: (a) Convey the solid waste to an appropriate storage container, (b) Avoid the likelihood of blockage or leakage, (c) Permit easy cleaning and maintenance,	

FIRST SCHEDULE–*continued*

Provisions	Limits on application
(d) Avoid the likelihood of foul air or gases accumulating or entering the *building*, (e) Avoid the likelihood of the spread of *fire* beyond the refuse chute, (f) Have openings that allow waste to be safely deposited in the chute, and (g) Restrict access by children, animals and vermin. **G15.3.3** Where it is acceptable to the *network utility operator*, solid waste which has been suitably treated for disposal to a *sewer* may be discharged via a *foul water drain* complying with Clause G13 "Foul Water".	

Contents

Amend 3 Sep 2010

References

Amend 1 Sep 1993

For the purposes of New Zealand Building Code compliance, the acceptable New Zealand and other Standards, and other documents referred to in this Compliance Document (primary reference documents) shall be the editions, along with their specific amendments, listed below. Where the primary reference documents refer to other Standards or other documents (secondary reference documents), which in turn may also refer to other Standards or other documents, and so on (lower order reference documents), then the applicable version of these secondary and lower order reference documents shall be the version in effect at the date this Compliance Document was published.

Amend 3 Sep 2010

		Where quoted
Standards New Zealand		
NZS 3114: 1987	Specification for concrete surface finishes *Amend: 1*	AS1 3.0.2
NZS 4304: 2002	Health care waste management	AS1 3.1.1

Amend 1 Sep 1993

Amend 3 Sep 2010

Definitions

Amend 3 Sep 2010

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

Adequate *Adequate* to achieve the objectives of the *building code.*

Amend 3 Sep 2010

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

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

Fixture An article intended to remain permanently attached to and form part of a *building*.

Foul water The discharge from any *sanitary fixtures* or *sanitary appliances.*

Habitable space A space used for activities normally associated with domestic living, but excludes any bathroom, laundry, water-closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods.

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, or geothermal energy; or

b) operates or proposes to operate a network for the purpose of—

Amend 2 Jul 2001

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 3 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.

Amend 3 Sep 2010

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 *sewer* or a septic tank. For *surface water*, the *outfall* may include a natural water course, kerb and channel, or soakage system.

Plumbing system Pipes, joints and fittings laid above ground and used for the conveyance of *foul water* to the *foul water drain,* and includes *vent pipes.*

Sanitary appliance An appliance which is intended to be used for *sanitation,* but which is not a *sanitary fixture.* Included are machines for washing dishes and clothes.

Sanitary fixture Any *fixture* which is intended to be used for *sanitation*.

Sanitation The term used to describe the activities of washing and/or excretion carried out in a manner or condition such that the effect on health is minimised, with regard to dirt and infection.

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

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.

Verification Method G15/VM1

No specific test methods have been adopted for verifying compliance with the Performance of NZBC G15.

Acceptable Solution G15/AS1

1.0 Capacity of Containers and Storage Areas

1.0.1 The method of solid waste disposal in *multi-unit* and *group dwellings* shall be by the provision of moveable containers having a capacity of at least 80 litres for each dwelling unit.

1.0.2 Where containers are stored in a common area within a *building* or part of a *building*, a space of at least 0.5 m x 0.5 m by 1 m high shall be provided for each dwelling unit.

1.0.3 If a common storage area such as a ground floor rubbish area is provided within the *building*, it shall be *adequately* ventilated to the open air in compliance with NZBC G4.

COMMENT:

1. Because rubbish is likely to be removed less frequently in multi-storey residential *buildings*, ventilated space for the storage of the container is desirable.
2. The container capacity is based on the volume of a typical rubbish bag and on the assumption that the wastes will be collected weekly.
3. For most *detached dwellings* this storage will be outside the *building*.

2.0 Carry Distance

2.0.1 In *multi-unit* and *group dwellings*, the maximum carry distance between any occupancy and a common solid waste storage area or chute shall be 30 m.

COMMENT:

1. Common rubbish storage areas which are remote from accommodation units will encourage the accumulation of rubbish within each unit, and may become a health hazard.
2. There is no requirement for non-residential *buildings*.

3.0 Solid Waste Storage Areas

3.0.1 An acceptable common storage area for solid waste (see Figure 1) shall:

a) Have interior surfaces which are easily cleaned,

b) Be totally enclosed and separated from *habitable spaces* and food preparation areas,

c) Be protected from high temperatures which could hasten putrification, and

d) Be screened from *habitable spaces* to reduce visual impact.

3.0.2 Concrete floors are acceptable if they have a U5 trowelled finish complying with NZS 3114 and are graded at 1 in 50 to a floor drain. Floor drains shall comply with NZBC G13.

3.0.3 Walls in spaces where storage bins are likely to receive food wastes and are subject to spillage shall be constructed of concrete, galvanised sheet steel, vinyl or similar material.

3.0.4 Windows facing north in any food waste storage area shall be screened from direct sunlight in order to reduce the likelihood of putrification.

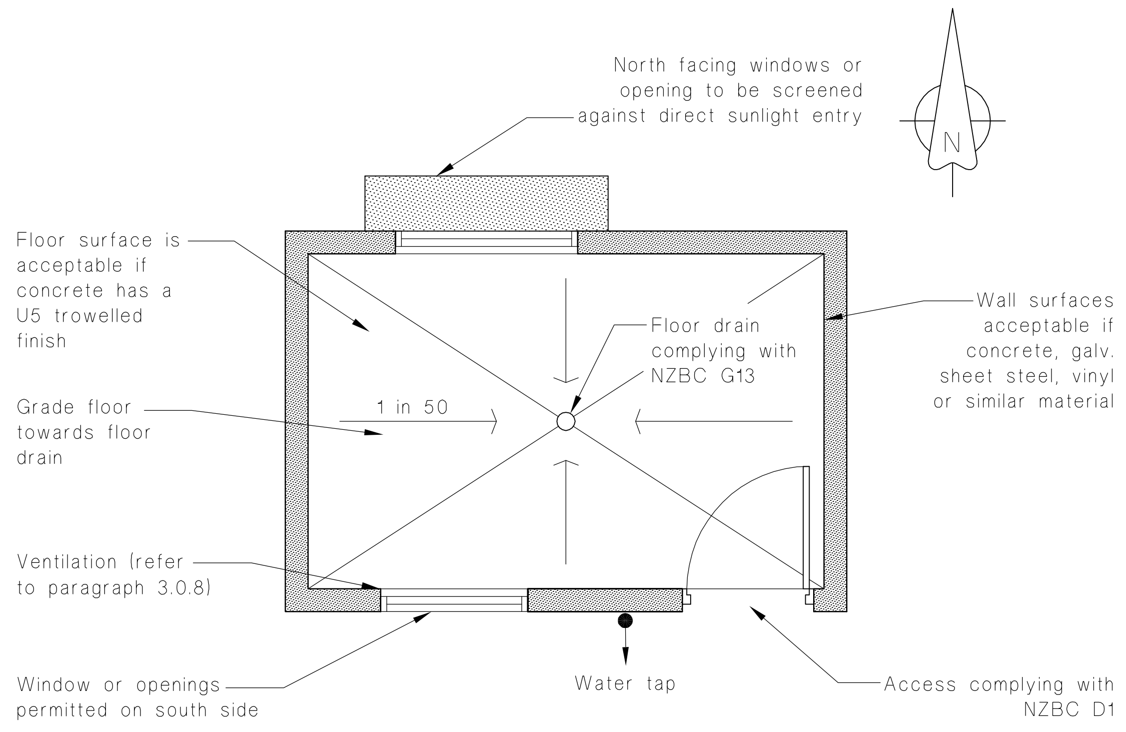
3.0.5 An alternative solution is for perishable wastes to be stored within a refrigerated store room.

3.0.6 Opening windows shall be screened to prevent entry by insects and other vermin.

3.0.7 A water supply tap, complying with NZBC G12, shall be provided for washing down common waste storage areas.

3.0.8 Ventilation: Storage areas located indoors shall be *adequately* ventilated to open air in compliance with NZBC G4.

Figure 1: Details of Waste Storage Areas
Paragraph 3.0.1



3.0.9 Mechanical ventilation: Where mechanical ventilation is used, it shall:

a) Provide no less than 6 air changes per hour,

b) Maintain a negative pressure within the storage area relative to adjacent areas (if any), and

c) Discharge foul air to a safe place to avoid the likelihood of exhaust air entering any *building*.

3.0.10 Access between the storage area and collection vehicle shall comply with NZBC D1.

COMMENT:
For ease of collection, the access route should be level and as short as possible.

3.1 Another Acceptable Solution

3.1.1 NZS 4304 Section 6.2 is another Acceptable Solution for storage areas, but may exceed the performance criteria of NZBC G15.

Amend 3 Sep 2010

4.0 Solid Waste Chutes

4.0.1 Where waste chutes with side-entry hoppers (see Figure 2) are used as an alternative to common storage areas, the chute shall:

a) Have a minimum internal diameter of 450 mm,

b) Be self-cleaning, vertical and have smooth joints,

c) Be vented at the top above the roof line, and at the bottom above the container, and

d) Terminate centrally over a suitable container located in a room complying with Paragraphs 3.0.1 to 3.0.9.

COMMENT:
The chute cut-off should be kept open except when changing containers, to ensure the chute is clear at all times.

4.0.2 Side-entry hoppers (see Figure 2) shall:

a) Have a maximum opening diameter of 250 mm,

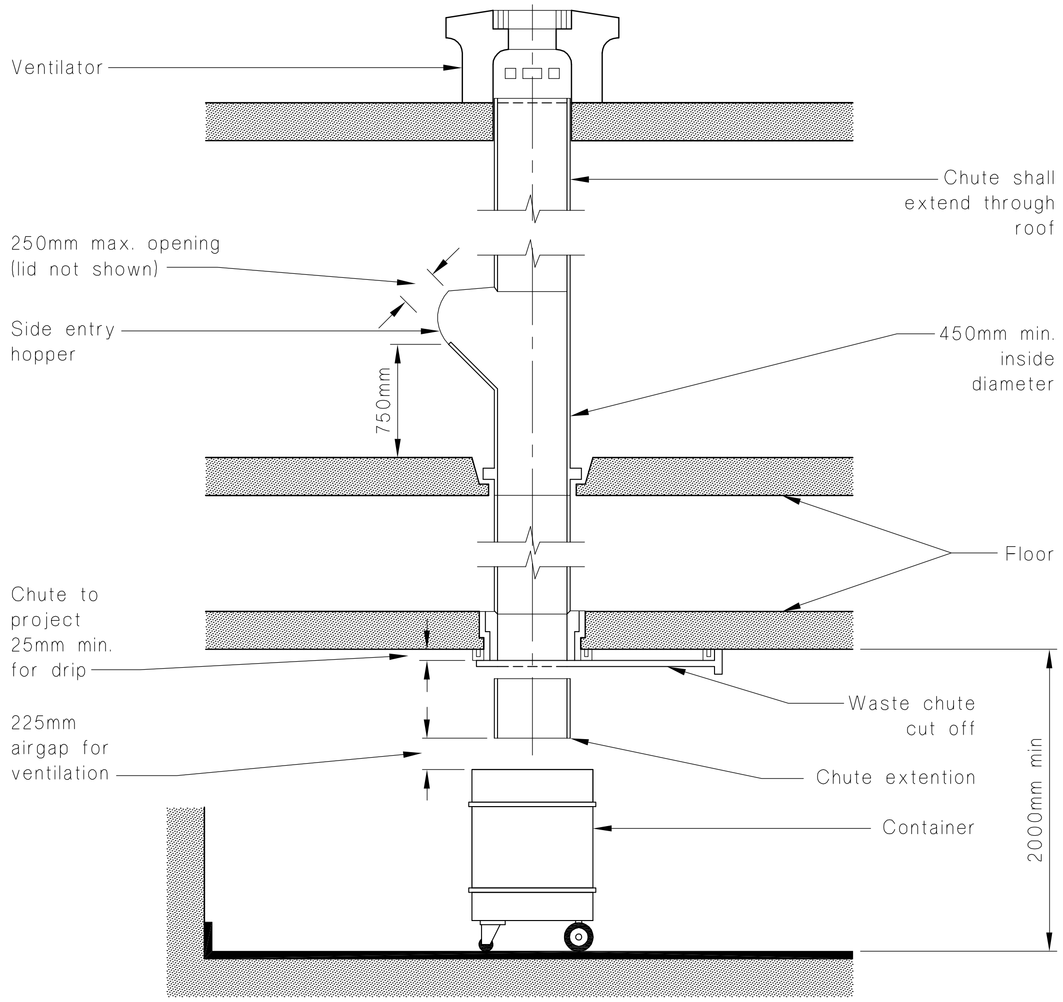
b) Have self-closing, tight-fitting doors to prevent odours escaping,

c) Have an easily cleaned wall surface surrounding the opening for 300 mm (this may be galvanised steel, ceramic tiles or similar material),

d) Be located outside any dwelling or enclosed stair access, and away from any *habitable space* or food preparation area, and

e) Have *adequate* ventilation, preferably by being located in the open air (e.g. on an outside balcony). Where hoppers are inside *buildings*, they shall be located in separate ventilated compartments complying with NZBC G4.

Figure 2: Waste Chute with Side-entry Hoppers
Paragraphs 4.0.1 and 4.0.2



COMMENT:

1. Hoppers are not intended for weekly rubbish bags, but are for daily use in smaller quantities.
2. Hoppers should not be situated near bedrooms because of noise and odours. To prevent maintenance problems, it is recommended that no more than 6 household units be serviced by each hopper entry.
3. Hoppers are best located to take advantage of natural daylight. *Adequate* artificial light should also be available.

4.0.3 *Buildings* incorporating waste chutes, shall be provided with a water supply tap on every second floor, adjacent to the chute, to facilitate cleaning.

Index G15/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Solid Waste

Preface

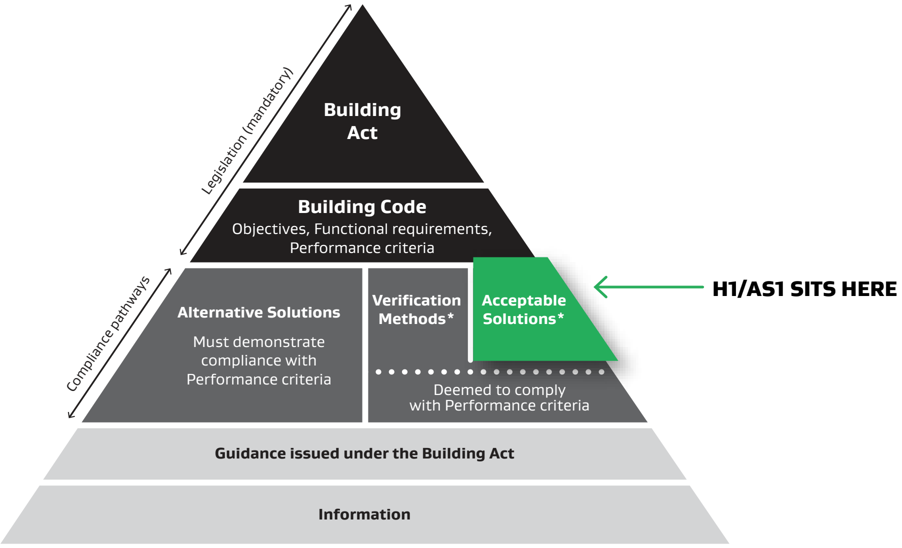
Document status

This document (H1/AS1 Fifth Edition Amendment 1) is an acceptable solution issued under section 22 (1) of the Building Act 2004 and is effective on 4 August 2022. It does not apply to building consent applications submitted before 4 August 2022. The previous Acceptable Solution H1/AS1 Fifth Edition (unamended) can be used to show compliance until 4 August 2022. The previous Acceptable Solution H1/AS1 Fourth Edition Amendment 4, can be used to show compliance until 2 November 2022 and can be used for building consent applications submitted before 3 November 2022.

Building Code regulatory system

Each acceptable solution outlines the provisions of the Building Code that it relates to. Complying with an acceptable solution or verification method is a way of complying with that part of the Building Code. Other options for establishing compliance are listed in section 19 of the Building Act.

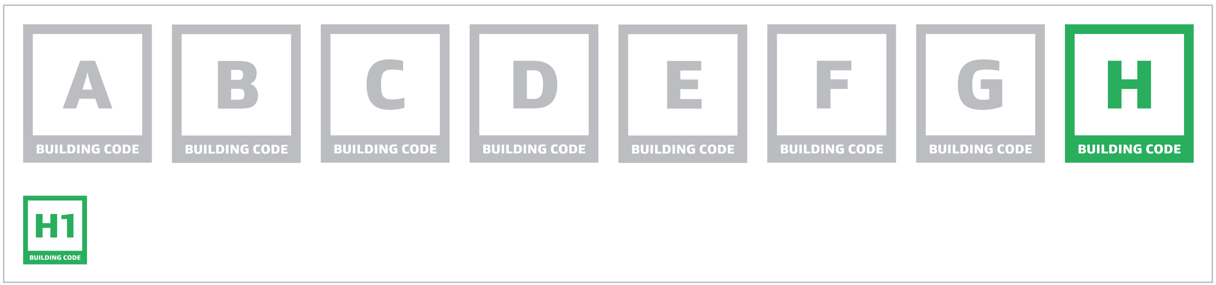
Schematic of the Building Code System



* *may include cited standards and information*

A building design must take into account all parts of the Building Code. The Building Code is located in Schedule 1 of the Building Regulations 1992 and available online at www.legislation.govt.nz

The part of the Building Code that this acceptable solution relates to is clause H Energy Efficiency. Further information on the scope of this document is provided in Part 1. General.



Further information about the Building Code, the objectives, functional requirements and performance criteria provisions that it contains, and other acceptable solutions and verification methods are available at www.building.govt.nz

Main changes in this version

This acceptable solution is amendment 1 of the fifth edition of H1/AS1. The main changes from the previous fourth edition are:

- The scope of H1/AS1 has been reduced to cover only housing, and buildings other than housing less than 300 m^2. Requirements applicable to buildings other than housing over 300 m^2 have been combined into the new Acceptable Solution H1/AS2. To reflect the new scope of the documents and the new document layout, a new introduction and scope has been provided in Part 1. General.
- Buildings with curtain walling have been excluded from the scope of H1/AS1.
- Citation of NZS 4218: 2009 "Thermal insulation – Housing and small buildings" has been removed from the document. The relevant content from this standard has been adopted into H1/AS1 with permission from Standards New Zealand.
- The minimum R-values previously found in NZS 4218 are replaced with new values and new text in Part 2. Building thermal envelope.
- The requirements for determining the thermal resistance and construction R-value of building elements have been revised to better reflect the thermal performance of windows, doors, skylights and slab-on-ground floors.
- Portions of text have been re-written to enhance clarity in the document and provide consistent language with other acceptable solutions and verification methods.
- Requirements for artificial lighting have been removed from H1/AS1 as these now apply to buildings outside of the new scope of H1/AS1.
- References have been revised to include only documents within the scope of H1/AS1 and have been amended to include the most recent versions of AS/NZS 4859.1, NZS 4246, and ALF in Appendix A.
- Additional references have been added to include BS EN 673, ISO 10077-1, ISO 13370, and ISO 13789 in Appendix A.
- The definitions page has been revised to include all defined terms used in this document in Appendix B.
- The three-zone climate zone map previously found in NZS 4218 has been updated with a six-zone climate zone map in Appendix C.
- Requirements for establishing the orientation of a building have been added in Appendix D.
- The thermal performance tables for windows and glazing previously found in NZS 4218 have been replaced with a single table with updated construction R-values for vertical windows and doors in Appendix E.
- Tables with construction R-values of selected slab-on-ground floor scenarios have been added to a new Appendix F.
- Tables with construction R-values of selected slab-on-ground floor scenarios have been added to a new Appendix F.

The main changes from the unamended version of the fifth edition of H1/AS1 are:

- Alternate thermal resistance requirements have been added to the Schedule method and Calculation method. These are only permitted to be used for housing, where building consent applications are submitted before 1 May 2023. For roofs, walls and floors these alternate construction R-values are equivalent to the requirements of the previous fourth edition of H1/AS1.
- An additional option for determining the construction R-value of concrete slab-on-ground floors has been added to Appendix F, which is only permitted to be used for housing, where building consent applications are submitted before 1 May 2023. This additional option is consistent with the previous fourth edition of H1/AS1.
- Throughout the document some obvious errors in the text, formatting and cross-references have been corrected, and minor text clarifications with minor to no impact have been made.

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 acceptable solution or verification method at any time. Up-to-date versions of acceptable solutions or verification methods are available from www.building.govt.nz.

Features of this document

- For the purposes of Building Code compliance, the standards and documents referenced in this acceptable solution must be the editions, along with their specific amendments listed in Appendix A.
- Words in *italic* are defined at the end of this document in Appendix B.
- Hyperlinks are provided to cross-references within this document and to external websites and appear with a blue underline.
- Classified uses for *buildings*, as described in clause A1 of the Building Code, are printed in **bold** in this document. These requirements are also denoted with classified use icons for:

H	**Housing**	Com	**Commercial**	Out	**Outbuildings**
CR	**Communal residential**	Ind	**Industrial**	Anc	**Ancillary**
CN	**Communal non-residential**				

- Appendices to this acceptable solution are part of, and have equal status to, the acceptable solution. Figures are informative only and the wording of the paragraphs takes precedence. Text boxes headed 'COMMENT' occur throughout this document and are for guidance purposes only.

Contents

Part 1. General

1.1 Introduction

1.1.1 Scope of this document

1.1.1.1 This document applies to:

H a) **housing**; and

b) other *buildings* with an area of *occupied space* no greater than 300 m^2.

COMMENT: **Housing** includes detached dwellings, multi-unit dwellings such as *buildings* which contain more than one separate household or family, e.g. an apartment *building*, and also group dwellings, e.g. a *wharenui*.

1.1.1.2 For *buildings* that do not meet these characteristics, refer to the Acceptable Solution H1/AS2 or Verification Method H1/VM2 as a means to demonstrate compliance or use an alternative means to demonstrate compliance.

1.1.2 Items outside the scope of this document

1.1.2.1 This acceptable solution does not include the use of foil insulation.

1.1.2.2 This acceptable solution does not apply to *buildings* with *curtain walling*. For these, use Verification Method H1/VM1 or use an alternative means to demonstrate compliance.

Com 1.1.2.3 For **commercial** *buildings*, this acceptable solution does not include requirements to comply with clause H1.3.6 of the Building Code. For this clause, use Verification Method H1/VM3 or use an alternative means to demonstrate compliance.

1.1.3 Compliance pathway

1.1.3.1 This acceptable solution is one option that provides a means of establishing compliance with the performance criteria in Building Code clauses H1.3.1, H1.3.3, H1.3.4, and H1.3.5.

1.1.3.2 Options for demonstrating compliance with H1 Energy Efficiency through the use of acceptable solutions and verification methods are summarised in Table 1.1.3.2. Compliance may also be demonstrated using an alternative solution.

1.1.3.3 Compliance with Building Code clause H1.3.1(a) (*adequate thermal resistance*) satisfies clause H1.3.2E (*Building Performance Index* or *BPI*).

COMMENT:
1. The Schedule and Calculation methods as described in Part 2 are acceptable solutions for Building Code clause H1.3.1(a) (*adequate thermal resistance*). However, compliance with clause H1.3.2E (*Building Performance Index or BPI*) is not sufficient for demonstrating compliance with clause H1.3.1(a) (*adequate thermal resistance*).
2. ALF 4.0, published by BRANZ, calculates the *BPI*. Note that the ALF procedures are intended for detached dwellings and are not suitable for multi-unit dwellings.
3. The 20°C stated in the definition of *heating energy* is for calculation purposes only.

TABLE 1.1.3.2: Demonstrating compliance with H1 Energy Efficiency through acceptable solutions and verification methods

Paragraph 1.1.3.2

Performance clause	Applies to	Relevant acceptable solutions and verification methods
H1.3.1 (a) and (b) *Thermal Envelope*	H **Housing** CR **Communal residential** CN **Communal non-residential** (assembly care only) Com **Commercial**	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 or H1/VM1 For large *buildings*: H1/AS2 or H1/VM2
H1.3.2E *Building performance index*	H **Housing**	H1/AS1 or H1/VM1
H1.3.3 (a) to (f) Physical conditions	All *buildings*	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 or H1/VM1 For large *buildings*: H1/AS2 or H1/VM2
H1.3.4 (a) Heating of hot water	All *buildings*	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 For large *buildings*: H1/AS2
H1.3.4 (b) Storage vessels and distribution systems	Individual storage vessels ≤ 700 L in capacity and distribution systems	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 For large *buildings*: H1/AS2
H1.3.4 (c) Efficient use of hot water	H **Housing**	H1/AS1
H1.3.5 Artificial lighting	Lighting not provided solely to meet the requirements of Building Code clause F6 in: Com CN **Commercial** and **Communal non-residential** having *occupied space* greater than 300 m^2	H1/AS2
H.1.3.6 *HVAC systems*	Com **Commercial**	H1/VM3

1.2 Using this acceptable solution

1.2.1 Determining the classified use

1.2.1.1 Classified uses for *buildings* are described in clause A1 of the Building Code. Where a specific classified use is mentioned within a subheading and/or within the text of a paragraph, this requirement applies only to the specified classified use(s), and does not apply to other classified uses.

Ind 1.2.1.2 In *buildings* containing both **industrial** and other classified uses, the non-industrial portion shall be treated separately according to its classified use. For example, in a *building* containing both **industrial** and **commercial** classified uses, the **commercial** area shall meet the relevant energy efficiency requirements of the Building Code.

1.2.2 Determining the area of the building

H 1.2.2.1 For **housing**, use the *floor area* of the *building*.

1.2.2.2 For *buildings* other than **housing**, calculate the area based on the *occupied space* of the *building*.

Part 2. Building thermal envelope

2.1 Thermal resistance

2.1.1 Demonstrating compliance

H CR CN Com

2.1.1.1 For **housing, communal residential, communal non-residential** assembly care, and **commercial** *buildings,* the *building envelope* shall be provided with *construction* that provides *adequate thermal resistance.* The minimum required *construction R-values* shall be determined through the use of:

a) The Schedule method in Subsection 2.1.2, or

b) The Calculation method in Subsection 2.1.3, or

c) The Modelling method in H1/VM1.

> i
>
> COMMENT: To satisfy the Building Code performance requirement E3.3.1 for internal moisture, it may be necessary, depending on the method adopted, to provide more insulation (a greater *R-value*) than that required to satisfy energy efficiency provisions alone.

2.1.1.2 The requirements for the Schedule method and Calculation method are separated based on the relevant climate zone for the *building*. A list of the New Zealand climate zones is provided in Appendix C.

2.1.1.3 For *building elements* with embedded heating systems, the minimum *construction R-values* shall be determined through the Schedule method. These apply whenever *building elements* that are part of the *thermal envelope* include heating systems and may not be reduced by applying the Calculation method in Subsection 2.1.3.

2.1.1.4 The *construction R-values* of individual *building elements* shall be determined in accordance with Subsection 2.1.4.

2.1.1.5 Insulation materials shall be installed in a way that achieves the intended thermal performance in *buildings* without compromising the durability and safety of insulation or *building elements* and the health and safety of installers and *building* occupants. NZS 4246 sections 5, 6, 7 and 10 provide acceptable methods for installing bulk thermal insulation in light-timber and steel-framed residential *buildings*.

> i
>
> COMMENT: Slab perimeter insulation should be protected against water absorption, ultraviolet (UV) exposure, and impact damage. However, deviating from step 2 in section 10.3 in NZS 4246, encapsulation of slab perimeter insulation is not recommended as it can result in moisture getting trapped.

2.1.2 Schedule method

2.1.2.1 The schedule method shall only be used where:

a) The *glazing* area is 30% or less of the *total wall area*; and

b) The combined *glazing area* on the east, south, and west facing walls (refer to Appendix D) is 30% or less of the combined total area of these walls; and

c) The *skylight area* is no more than 1.5 m^2 or 1.5% of the *total roof area* (whichever is greater);

d) The *opaque door area* is no more than 6 m^2 or 6% of the *total wall area* (whichever is greater).

2.1.2.2 *Building elements* that are part of the *thermal envelope* shall have minimum *construction R-values* no less than those in:

a) For *building elements* that contain embedded heating systems, those in Table 2.1.2.2A; or

b) For *building elements* that do not contain embedded heating systems, those in Table 2.1.2.2B.

i) Table 2.1.2.2B or

H ii) alternatively, for **housing** only, for *building consent* applications submitted before 1 May 2023, those in Table 2.1.2.2C.

2.1.2.3 For *building consent* applications submitted before 2 November 2023, the minimum *construction R-values* for windows and doors in climate zones 1 and 2 are permitted to be reduced to R0.37 m²·K/W.

i

COMMENT: Paragraph 2.1.2.3. allows for a longer transition period for higher minimum *construction R-values* for windows and doors in climate zones 1 and 2. However, starting on 2 November 2023, all *building consent* applications for climate zones 1 and 2 must use a minimum *construction R-value* of R0.46 m²·K/W.

TABLE 2.1.2.2A: Minimum construction R-values for heated ceilings, walls or floors

Paragraph 2.1.2.2 a)

Building element	Construction R-values (m²·K/W)[(1),(2),(3)]					
	Climate zone 1	Climate zone 2	Climate zone 3	Climate zone 4	Climate zone 5	Climate zone 6
Heated ceiling[(4), (5)]	R6.6	R6.6	R6.6	R6.6	R6.6	R6.6
Heated wall[(6)]	R2.9	R2.9	R2.9	R2.9	R2.9	R2.9
Heated floor[(7)]	R2.5	R2.5	R2.5	R2.8	R3.0	R3.0

Notes:

(1) R_{IN}/*R-value* < 0.1 and R_{IN} is the *thermal resistance* between the heated plane and the inside air.

(2) Floor coverings, for example carpet or cork, will reduce the efficiency of the *heated floor*.

(3) Climate zone boundaries are shown in Appendix C.

(4) In *roofs* with a *roof* space, where the insulation is installed over a horizontal ceiling, the *roof R-value* may be reduced to R3.3 for a distance of up to 500 mm from the outer edge of the ceiling perimeter where space restrictions do not allow full-thickness insulation to be installed.

H (5) For **housing** only, for *building consent* applications submitted before 1 May 2023, the minimum *construction R-value* for *heated ceilings* in all climate zones is permitted to be reduced to R3.5.

(6) For **housing** only, for *building consent* applications submitted before 1 May 2023, the minimum *construction R-value* for *heated walls* in all climate zones is permitted to be reduced to R2.6.

(7) For **housing** only, for *building consent* applications submitted before 1 May 2023, the minimum *construction R-value* for heated floors in all climate zones is permitted to be reduced to R1.9.

TABLE 2.1.2.2B: Minimum construction R-values for building elements that do not contain embedded heating systems

Paragraph 2.1.2.2 b)

Building element	Construction R-values ($m^2 \cdot K/W$)[1]					
	Climate zone 1	Climate zone 2	Climate zone 3	Climate zone 4	Climate zone 5	Climate zone 6
Roof[2]	R6.6	R6.6	R6.6	R6.6	R6.6	R6.6
Wall	R2.0	R2.0	R2.0	R2.0	R2.0	R2.0
Floor						
Slab-on-ground floors	R1.5	R1.5	R1.5	R1.5	R1.6	R1.7
Floors other than *slab-on-ground*	R2.5	R2.5	R2.5	R2.8	R3.0	R3.0
Windows and doors[3]	R0.46[3]	R0.46[3]	R0.46	R0.46	R0.50	R0.50
Skylights	R0.46	R0.46	R0.54	R0.54	R0.62	R0.62

Notes:

(1) Climate zone boundaries are shown in Appendix C.

(2) In *roofs* with a *roof* space, where the insulation is installed over a horizontal ceiling, the *roof R-value* may be reduced to R3.3 for a distance of up to 500 mm from the outer edge of the ceiling perimeter where space restrictions do not allow the full-thickness of insulation to be installed.

(3) For *building consent* applications submitted before 2 November 2023, the minimum *construction R-values* for windows and doors in climate zones 1 and 2 are permitted to be reduced to R0.37 $m^2 \cdot K/W$.

H

TABLE 2.1.2.2C: Alternative minimum construction R-values for building elements that do not contain embedded heating systems – for housing only where building consent applications are submitted before 1 May 2023

Paragraph 2.1.2.2 b)

Building element	Construction R-values ($m^2 \cdot K/W$)	
	Region A [1]	Region B [2]
Roof	R2.9	R3.3
Wall	R1.9	R2.0
Floor	R1.3	R1.3
Windows and doors	R0.37	R0.37
Skylights	R0.37	R0.37

Notes:

(1) Region A comprises all of the North Island/Te Ika-a-Māui excluding the Taupo District, the Ruapehu District and the part of the Rangitikei District north of 39°50'S (-39.83), and all offshore islands north of 37°15'S (-37.25).

(2) Region B comprises the Taupo District, the Ruapehu District, the part of the Rangitikei District north of 39°50'S (-39.83), the South Island/Te Waipounamu, Stewart Island/Rakiura, the Chatham Islands, and all offshore islands south of 37°15'S (-37.25).

i

COMMENT: Region A in Table 2.1.2.2C and Table 2.1.3.4B is consistent with the previous climate zones 1 and 2 defined in NZS 4218: 2009. Region B is consistent with the previous climate zone 3 defined in NZS 4218: 2009. The NZS 4218 climate zones are different to the current six climate zones defined in Appendix C.

2.1.3 Calculation method

2.1.3.1 This method compares the proposed *building* with the reference *building* which is insulated in accordance with the Schedule method. This method permits *roof*, wall, floor, window, door, and *skylight* insulation combinations which differ from these tables, but the *building* must perform at least as well as the reference *building*.

2.1.3.2 The calculation method shall only be used where the *glazing area* is 40% or less of the *total wall area*.

2.1.3.3 *Building elements* that form part of the *thermal envelope* with *construction R-values* different from those in the Schedule method in Subsection 2.1.2 may be used providing the heat loss of the proposed *building* ($HL_{Proposed}$) is less than or equal to the heat loss of the reference *building* ($HL_{Reference}$) for the relevant climate zone and window *area*.

2.1.3.4 $HL_{Reference}$ shall be calculated using the equations in

a) Table 2.1.3.4A. or

H

b) alternatively, for **housing** only, for *building consent* applications submitted before 1 May 2023, those in Table 2.1.3.4B.

TABLE 2.1.3.4A: Reference building heat loss equations

Paragraph 2.1.3.4 a)

Climate zone[1]	Reference building heat loss equation[3]
1 and 2[2]	$HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.5} + \frac{A_{other\ floor}}{2.5} + \frac{A_{30\% \text{ of total wall area}}}{0.46}$
3	$HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.5} + \frac{A_{other\ floor}}{2.5} + \frac{A_{30\% \text{ of total wall area}}}{0.46}$
4	$HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.5} + \frac{A_{other\ floor}}{2.8} + \frac{A_{30\% \text{ of total wall area}}}{0.46}$
5	$HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.6} + \frac{A_{other\ floor}}{3.0} + \frac{A_{30\% \text{ of total wall area}}}{0.50}$
6	$HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.7} + \frac{A_{other\ floor}}{3.0} + \frac{A_{30\% \text{ of total wall area}}}{0.50}$

Notes:

(1) Climate zone boundaries are shown in Appendix C.

(2) For *building consent* applications submitted before 2 November 2023 for climate zones 1 and 2, $HL_{Reference}$ is permitted to be calculated in accordance with Paragraph 2.1.3.5.

(3) For these equations, $HL_{Reference}$ is the heat loss of the reference *building*, and

A_{roof} is the *roof area* of the proposed *building* (m^2), and
$A_{skylight}$ is the *skylight* area of the proposed *building* (m^2), and
$A_{70\% \text{ of total wall area}}$ equals 70% of the *total wall area* of the proposed *building thermal envelope* (m^2), and
$A_{30\% \text{ of total wall area}}$ equals 30% of the *total wall area* of the proposed *building thermal envelope* (m^2), and
$A_{slab\text{-}on\text{-}ground\ floor}$ is the area of *slab-on-ground floors* in the proposed *building thermal envelope* (m^2), and
$A_{otherfloor}$ is the area of other floors in the *thermal envelope* of the proposed *building* (m^2).

H

TABLE 2.1.3.4B: Alternative reference building heat loss equations – for housing only where building consent applications are submitted before 1 May 2023

Paragraph 2.1.3.4 b)

Location	Reference building heat loss equation[1]
Region A[2]	$HL_{Reference} = \frac{A_{roof} + A_{skylight}}{2.9} + \frac{A_{70\% \text{ of the total wall area}}}{1.9} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.3} + \frac{A_{other\ floor}}{1.3} + \frac{A_{30\% \text{ of total wall area}}}{0.37}$
Region B[3]	$HL_{Reference} = \frac{A_{roof} + A_{skylight}}{3.3} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.3} + \frac{A_{other\ floor}}{1.3} + \frac{A_{30\% \text{ of total wall area}}}{0.37}$

Notes:

(1) For these equations, $HL_{Reference}$ is the heat loss of the reference *building*, and

A_{roof} is the *roof area* of the proposed *building* (m^2), and
$A_{skylight}$ is the *skylight* area of the proposed *building* (m^2), and
$A_{70\% \text{ of total wall area}}$ equals 70% of the *total wall area* of the proposed *building thermal envelope* (m^2), and
$A_{30\% \text{ of total wall area}}$ equals 30% of the *total wall area* of the proposed *building thermal envelope* (m^2), and
$A_{slab\text{-}on\text{-}ground\ floor}$ is the area of *slab-on-ground floors* in the proposed *building thermal envelope* (m^2), and
$A_{otherfloor}$ is the area of other floors in the *thermal envelope* of the proposed *building* (m^2).

(2) Region A comprises all of the North Island/Te Ika-a-Māui excluding the Taupo District, the Ruapehu District and the part of the Rangitikei District north of 39°50'S (-39.83), and all offshore islands north of 37°15'S (-37.25)

(3) Region B comprises the Taupo District, the Ruapehu District, the part of the Rangitikei District north of 39°50'S (-39.83), the South Island/Te Waipounamu, Stewart Island/Rakiura, the Chatham Islands, and all offshore islands south of 37°15'S (-37.25)

i

COMMENT: The reference *building* used in these equations has the minimum *construction R-values* for each climate zone given in the Schedule method. It is assumed that the *reference building* has the same *roof area, skylight area*, and areas of floor as the proposed *building*. The *total wall area* in the reference *building* is assumed to contain a *glazing area* of 30%.

2.1.3.5 For *building consent* applications submitted before 2 November 2023 for climate zones 1 and 2, $HL_{Reference}$ is permitted to be calculated using Equation 1.

Equation 1: $$HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.5} + \frac{A_{other\ floor}}{2.5} + \frac{A_{30\% \text{ of total wall area}}}{0.37}$$

where:

$HL_{Reference}$ is the heat loss of the reference *building*, and
A_{roof} is the *roof area* of the proposed *building* (m^2), and
$A_{skylight}$ is the *skylight area* of the proposed *building* (m^2), and
$A_{70\% \text{ of total wall area}}$ equals 70% of the *total wall area* of the proposed *building* (m^2), and
$A_{30\% \text{ of total wall area}}$ equals 30% of the *total wall area* of the proposed *building* (m^2), and
$A_{slab\text{-}on\text{-}ground\ floor}$ is the area of *slab-on-ground floors* in the *thermal envelope* of the proposed *building* (m^2), and
$A_{otherfloor}$ is the area of other floors in the *thermal envelope* of the proposed *building* (m^2).

i

COMMENT: Paragraph 2.1.3.5 allows for a longer transition period for higher minimum *construction R-values* for windows and doors in climate zones 1 and 2. However, starting on 2 November 2023, all *building consent* applications for climate zones 1 and 2 must use the minimum *construction R-value* for the reference *building* of R0.46 m²·K/W for windows and doors and the equations in Table 2.1.3.4.

2.1.3.6 $HL_{Proposed}$ shall be calculated as the sum of all the *building element* heat losses according to Equation 2.

Equation 2: $$HL_{Proposed} = \frac{A_{roof}}{R_{roof}} + \frac{A_{wall}}{R_{wall}} + \frac{A_{floor}}{R_{floor}} + \frac{A_{glazing}}{R_{window}} + \frac{A_{door,\,opaque}}{R_{door,\,opaque}} + \frac{A_{skylight}}{R_{skylight}}$$

where:
$HL_{Proposed}$ is the heat loss of the proposed *building*, and
A_{roof} is the *roof area* of the proposed *building* (m^2), and
R_{roof} is the *construction R-value* of the *roof* in the proposed *thermal envelope* ($m^2{\cdot}K/W$), and
A_{wall} is the *wall area* of the proposed *building* (m^2), and
R_{wall} is the *construction R-value* of the wall in the proposed *thermal envelope* ($m^2{\cdot}K/W$), and
A_{floor} is the *thermal envelope floor area* of the proposed *building* (m^2), and
R_{floor} is the *construction R-value* of the floor in the proposed *thermal envelope* ($m^2{\cdot}K/W$), and
$A_{glazing}$ is the *glazing area* of the proposed *building* (m^2), and
R_{window} is the *construction R-value* of the vertical windows, and glazing in doors, in the proposed *thermal envelope* ($m^2{\cdot}K/W$) and
$A_{door,opaque}$ is the *opaque door area* of the proposed *building* (m^2) and
$R_{door,opaque}$ is the *construction R-value* of *opaque door areas* in the proposed *thermal envelope* ($m^2{\cdot}K/W$) and
$A_{skylight}$ is the *skylight area* of the proposed *building* (m^2) and
$R_{skylight}$ is the *construction R-value* of the *skylight(s)* in the proposed *thermal envelope* ($m^2{\cdot}K/W$).

2.1.3.7 Where a *building element* is proposed to have parts with different *thermal resistances* (for example walls with different *construction R-values*), the corresponding term in Equation 2 shall be expanded to suit. For example:

$$\frac{A_{wall}}{R_{wall}} \text{ becomes } \frac{A_{wall(1)}}{R_{wall(1)}} + \frac{A_{wall(2)}}{R_{wall(2)}}$$

2.1.3.8 The *construction R-value* in the proposed *building* for *roofs*, walls, and floors, that form part of the *building thermal envelope* shall be at least 50% of the *construction R-value* of the corresponding *building element* in the reference *building* equation.

2.1.3.9 Where the *construction R-value* of a *building element* is not known, default *construction R-values* of 0.18 $m^2{\cdot}K/W$ for an opaque *building element* and 0.15 $m^2{\cdot}K/W$ for windows shall be used in the heat loss equation for the proposed *building*.

2.1.4 Determining the thermal resistance of building elements

2.1.4.1 Acceptable methods for determining the *thermal resistance* (*R-values*) of *building elements* are:

a) For walls, *roofs* and floors other than *slab-on-ground floors*, contained in NZS 4214; and

b) For windows, doors and *skylights*, specified in Appendix E; and

c) For *slab-on-ground floors*, specified in Appendix F.

i

COMMENT: The BRANZ House Insulation Guide provides *thermal resistances* of common *building* components and is based on calculations from NZS 4214. However, the BRANZ House Insulation Guide, 5th edition or earlier, should not be used for determining the *thermal resistances* of *slab-on-ground floors*, windows and doors due to differences in calculation methods and assumptions compared to Appendix E and Appendix F.

2.1.4.2 The *thermal resistance (R-values)* of insulation materials may be verified by using AS/NZS 4859.1.

2.1.4.3 The *construction R-values* of *building elements* shall be calculated as follows:

a) For walls and *roofs*, the *R-value* is of a typical area of the *building element*; and

b) For framed walls, the *R-value* shall include the effects of studs, dwangs, top plates and bottom plates, but may exclude the effects of lintels, sills, additional studs that support lintels and sills, and additional studs at corners and junctions; and

c) For walls without frames, the *R-value* excludes any attachment requirements for windows and doors; and

d) For windows, doors and *skylights*, as specified in Appendix E; and

e) For *slab-on-ground* floors, the *R-value* is as specified in Appendix F; and

f) For floors other than *slab-on-ground floors*, the *R-value* is of a typical area of the floor ignoring the effect of floor coverings (including carpets).

2.1.4.4 The *R-value* of an unconditioned air-space between the *thermal envelope* and the *building envelope* may be included in the *construction R-value*. This can include a subfloor, *roof* space, garage, and/or conservatory.

> COMMENT: Garages should form part of the *unconditioned space* of a *building*, that is, they should be outside the *thermal envelope*. Any *building elements* between attached garages and the *conditioned spaces* of a *building* form part of the *thermal envelope* and should therefore be insulated.

2.2 Airflow

2.2.1 Control of airflow

2.2.1.1 **Housing, communal residential, communal non-residential** assembly care, and **commercial** *buildings* shall have windows, doors, vents or other *building elements* that allow significant movement of air, to be *constructed* in such a way that they are capable of being fixed in the closed position.

> COMMENT:
>
> 1. G4/AS1 provides for the supply of outdoor air for ventilation by way of windows and doors that can be fixed in the open position.
> 2. Measures should be taken to limit the amount of moisture that can migrate from *occupied spaces* into the *roof* or *roof* space. This includes limiting the air permeability of ceilings, including through ceiling linings and penetrations such as recessed luminaires, electrical and plumbing services, and ceiling access hatches.

2.3 Solar heat gains

2.3.1 Control of solar heat gains

2.3.1.1 Requirements to account for heat gains from solar radiation are satisfied by complying with the requirements for *thermal resistance* in Section 2.1.

> COMMENT: Passive measures to prevent overheating from excessive solar heat gains through the *building envelope* should be taken to reduce dependence on active cooling systems. Such measures should include a combination of:
>
> › Providing *adequate thermal resistance* to the *thermal envelope* of the *building*; and
> › Avoiding excessive *window areas* (particularly on the east, north and west-facing facades); and
> › Avoiding excessive *skylight* areas; and
> › Selecting glass types with appropriate *solar heat gain coefficients (SHGC)*; and
> › Providing external shading for windows and *skylights*; and
> › Providing the ability to ventilate the *building* at a sufficient rate to maintain comfortable indoor temperatures in summer.

Part 3. Building services

3.1 Hot water systems

3.1.1 Hot water systems for sanitary fixtures and sanitary appliances

3.1.1.1 Hot water systems for *sanitary fixtures* and *sanitary appliances* having a storage water heater capacity of up to 700 litres shall comply with NZS 4305.

COMMENT:

1. NZS 4305 deals with domestic type electrical and gas systems having a storage water heater capacity of up to 700 litres. Larger systems and their associated piping are not controlled by the Building Code.
2. The manufacture and sale of hot water cylinders and gas water heaters are covered by the Energy Efficiency (Energy Using Products) Regulations 2002. The associated NZ Minimum Energy Performance Standards for electric storage water heaters (MEPS as defined in NZS 4606.1 and the relevant NZ section of AS/NZS 4692.2) are equivalent to the requirements in this acceptable solution (see NZS 4305 clause 2.1.1). Electric storage water heaters that do not comply with NZ MEPS do not comply with this acceptable solution.

Appendix A. References

For the purposes of Building Code compliance, the standards and documents referenced in this acceptable solution must be the editions, along with their specific amendments, listed below.

Standards New Zealand		Where quoted
NZS 4214: 2006	Methods of determining the total thermal resistance of parts of buildings	2.1.4.1, Definitions
NZS 4246: 2016	Energy efficiency – Installing bulk thermal insulation in residential buildings	2.1.1.5
NZS 4305: 1996	Energy efficiency – domestic type hot water systems	3.1.1.1
NZS 4606:-	Storage water heaters	
Part 1: 1989	General requirements	3.1.1.1 Comment
AS/NZS 4692:-	Electric water heaters	
Part 2: 2005	Minimum Energy Performance Standards (MEPS) requirements and energy labelling	3.1.1.1 Comment
AS/NZS 4859:-	Thermal insulation materials for buildings	
Part 1: 2018	General criteria and technical provisions	2.1.4.2

These standards can be accessed from www.standards.govt.nz

British Standards Institute

BS EN 673: 2011	Glass in building – Determination of thermal transmittance (U value) – Calculation method	Table E.1.1.1, E.2.1.2 a)

International Organization for Standardization

ISO 10077:-	Thermal performance of windows, doors and shutters - Calculation of thermal transmittance	
Part 1: 2017	General	Table E.1.1.1, E.2.1.2
Part 2: 2017	Numerical method for frames	E.2.1.2 b)
ISO 13370: 2017	Thermal performance of buildings – Heat transfer via the ground – Calculation methods	F.1.2.2 Comment
ISO 13789: 2017	Thermal performance of buildings – Transmission and ventilation heat transfer coefficients – Calculation method	Equation F.1

These standards can be accessed from www.standards.govt.nz

BRANZ Ltd

ALF 4.0	Annual Loss Factor 4.0, 4th Edition (2018)	1.1.3.3 Comment Definitions
BRANZ House Insulation Guide (5th Edition), 1 July 2014		2.1.4.1 Comment F.1.1.1 Comment
Cox-Smith, I. (2016). Perimeter insulation of concrete slab foundations. Study Report SR352, BRANZ Ltd, Judgeford, New Zealand.		F.1.2.2 Comment

References

These documents can be accessed from www.branz.co.nz

National Institute of Water and Atmospheric Research Ltd (NIWA)

Temperature Normals for New Zealand 1961-1990 by A I Tomlinson and J Sansom (ISBN 0478083343) Definitions

This document can be accessed from www.niwa.co.nz

New Zealand Legislation

Energy Efficiency (Energy Using Products) Regulations 2002 3.1.1.1 Comment

This document can be accessed from www.legislation.govt.nz.

Appendix B. Definitions

These definitions are specific to this acceptable solution. Other defined terms found in italics within the definitions are provided in clause A2 of the Building Code.

Adequate	Means *adequate* to achieve the objectives of the Building Code.
Approved temperature data	Means the temperature data contained in A I Tomlinson and J Sansom, Temperature Normals for New Zealand for period 1961 to 1990 (NIWA, ISBN 0478083343).
Building	Has the meaning given to it by sections 8 and 9 of the Building Act 2004.
Building consent	Means a consent to carry out *building* work granted by a *building consent authority* under section 49 of the Building Act 2004.
Building element	Any structural or non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings, and temporary supports.
Building envelope	The *building thermal envelope* plus the exterior surface of any spaces not requiring conditioning, e.g. garage, floor space (below insulating layer), *roof* space (above any outer surface defining an attic or when there is no attic above the insulating layer).
Building performance index (BPI)	In relation to a *building*, means the *heating energy* of the *building* divided by the product of the *heating degrees total* and the sum of the *floor area* and the *total wall area*, and so is calculated in accordance with the following formula: $\mathrm{BPI} = \dfrac{\text{Heating energy}}{\textit{Heating degrees total} \times (\textit{floor area} + \text{total wall area})}$
Conditioned space	That part of a *building* within the *building thermal envelope* that may be directly or indirectly heated or cooled for occupant comfort. It is separated from *unconditioned space* by *building elements* (walls, windows, *skylights*, doors, *roof*, and floor) to limit uncontrolled airflow and heat loss.
Construct	In relation to a *building*, includes to design, build, erect, prefabricate, and relocate the *building*.
Construction R-value	The *total thermal resistance (R-value)* of a typical area of a *building element*.
Curtain walling	Part of the *building envelope* made of a framework usually consisting of horizontal and vertical profiles, connected together and anchored to the supporting structure of the *building*, and containing fixed and/or openable infills, which provides all the required functions of an internal or *external wall* or part thereof, but does not contribute to the load bearing or the stability of the structure of the *building*.
External wall	Any vertical exterior face of a *building* consisting of primary and/or secondary elements intended to provide protection against the outdoor environment.
Floor area	In relation to a *building*, means the *floor area* (expressed in square metres) of all interior spaces used for activities normally associated with domestic living.
Glazing Area ($A_{glazing}$)	The total area of vertical windows and doors that include glazing in the *thermal envelope* including transparent or translucent glazing, frames and opening tolerances, decorative glazing, and louvres. This excludes opaque panels, opaque doors, and *skylights*.

Definitions

Habitable space	A space used for activities normally associated with domestic living, but excludes any bathroom, laundry, water-closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods.
Heated ceiling, wall or floor	Any ceiling, wall, or floor incorporating embedded pipes, electrical cables, or similar means of raising the temperature of the ceiling, wall, or floor for room heating.
Heating degrees	In relation to a location and a *heating month*, means the degrees obtained by subtracting from a base temperature of 14°C the mean (calculated using the *approved temperature data*) of the outdoor temperatures at that location during that month.
Heating degrees total	In relation to a location and year, means whichever is the greater of the following: a) the value of 12; and b) the sum of all the *heating degrees* (calculated using the *approved temperature data*) for all of the *heating months* of the year.
Heating energy	In relation to a *building*, means the energy from a *network utility operator* or a depletable resource (expressed in kilowatt-hours, and calculated using ALF 4.0, A tool for determining the *Building Performance Index (BPI)* of a house design (2018, BRANZ, Ltd) or some other method that can be correlated with that manual) needed to maintain the *building* at all times within a year at a constant internal temperature under the following standard conditions: a) a continuous temperature of 20°C throughout the *building:* b) an air change rate of 1 change per hour or the actual air leakage rate, whichever is the greater: c) a heat emission contribution arising from internal heat sources for any period in the year of 1000 kilowatt-hours for the first 50 m^2 of *floor area*, and 10 kilowatt-hours for every additional square metre of *floor area:* d) no allowance for— i) carpets; or ii) blinds, curtains, or drapes, on windows: e) windows to have a *shading coefficient* of 0.6 (made up of 0.8 for windows and recesses and 0.75 for site shading).
Heating month	In relation to a location, means a month in which a base temperature of 14°C is greater than the mean (calculated using the *approved temperature data*) of the outdoor temperatures at that location during that month.
HVAC system	For the purposes of performance H1.3.6 and in relation to a *building*, means a mechanical, electrical, or other system for modifying air temperature, modifying air humidity, providing ventilation, or doing all or any of those things, in a space within the *building*.
Insulating glazing unit (IGU)	Two or more panes of glass spaced apart and factory sealed with dry air or special gases in the unit cavity (often abbreviated to IGU or referred to as the unit or double glazing).

Intended use	In relation to a *building*, — a) includes any or all of the following: i) any reasonably foreseeable occasional use that is not incompatible with the intended use; ii) normal maintenance; iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but b) does not include any other maintenance and repairs or rebuilding.
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 purposes of— i) telecommunications 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 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.
Occupied space	Any space within a *building* in which a *person* will be present from time to time during the *intended use* of the *building*.
Opaque door area ($A_{door,opaque}$)	The total area of opaque doors and opaque panels of doors in the *thermal envelope*, including frames and opening tolerances.
Persons	Includes— a) the Crown; and b) a corporation sole; and c) a body of *persons* (whether corporate or unincorporated).
R-value	The common abbreviation for describing the values of both *thermal resistance* and *total thermal resistance*.
Roof	Any roof/ceiling combination where the exterior surface of the *building* is at an angle of 60° or less to the horizontal and has its upper surface exposed to the outside.
Roof area (A_{roof})	The area of the *roof* that is part of the thermal envelope, excluding the *skylight area*.
Sanitary appliance	An appliance which is intended to be used for *sanitation*, but which is not a *sanitary fixture*. Included are machines for washing dishes and clothes.
Sanitary fixture	Any *fixture* which is intended to be used for *sanitation.*
Sanitation	The term used to describe the activities of washing and/or excretion carried out in a manner or condition such that the effect on health is minimised, with regard to dirt and infection.
Shading coefficient	The ratio of the total *solar heat gain coefficient* (SHGC) through a particular glass compared to the total *solar heat gain coefficient* through 3 mm clear float glass.

Definitions

Skylight	Translucent or transparent parts of the *roof*, including frames and glazing.
Skylight area ($A_{skylight}$)	The area of *skylights* that are part of the *roof thermal envelope*, including frames and opening tolerances.
Slab-on-ground floors	Floor *construction* consisting of a concrete slab or concrete raft foundation in contact with the ground over its whole area.
Solar heat gain coefficient (SHGC)	The total solar energy entering a *building* through the glazing, that is, the direct transmission of energy from the sun plus the inwards re-radiation of heat from solar radiation that is absorbed in the glass. The SHGC is also known as the solar factor (SF) or g (glazing factor).
Thermal envelope	The *roof*, wall, window, *skylight*, door, and floor *construction* between *unconditioned spaces* and *conditioned spaces*.
Thermal envelope floor area (A_{floor})	The area of the floor that forms part of the *thermal envelope*.
Thermal resistance	The resistance to heat flow of a given component of a *building element*. It is equal to the air temperature difference (K) needed to produce unit heat flux (W/m^2) through unit area (m^2) under steady conditions. The units are $m^2{\cdot}K/W$.
Total roof area	The *roof* area (A_{roof}) plus the *skylight area* ($A_{skylight}$).
Total thermal resistance	The overall air-to-air *thermal resistance* across all components of a *building element* such as a wall, *roof,* or floor. (This includes the surface resistances which may vary with environmental changes e.g. temperature and humidity, but for most purposes can be regarded as having standard values as given in NZS 4214.)
Total wall area	In relation to a *building,* means the sum (expressed in square metres) of the following: a) the *wall area* of the *building*; and b) the area (expressed in square metres) of all vertical windows and doors in *external walls* of the *building.*
Unconditioned space	Space within the *building envelope* that is not *conditioned space* (for example, this may include a garage, conservatory, atrium, attic, subfloor, and so on). However, where a garage, conservatory, or atrium is expected to be heated or cooled these spaces shall be included in the *conditioned space*.
Wall area	The area of walls that are part of the *thermal envelope*, excluding the *opaque door area* and the *glazing area*.
Wharenui	A communal meeting house having a large open *floor area* used for both assembly and sleeping in the traditional Māori manner.

Appendix C. New Zealand climate zones

C.1 Climate zones

C.1.1 Climate zone boundaries

C.1.1.1 There are six climate zones. The climate zone boundaries are based on climatic data taking into consideration territorial authority boundaries.

C.1.1.2 A list of the climate zones for each territorial authority is provided in Table C.1.1.2 and illustrated in Figure C.1.1.2. The list in the table takes precedence over the figure.

TABLE C.1.1.2: Climate zones by territorial authority

Paragraph C.1.1.2

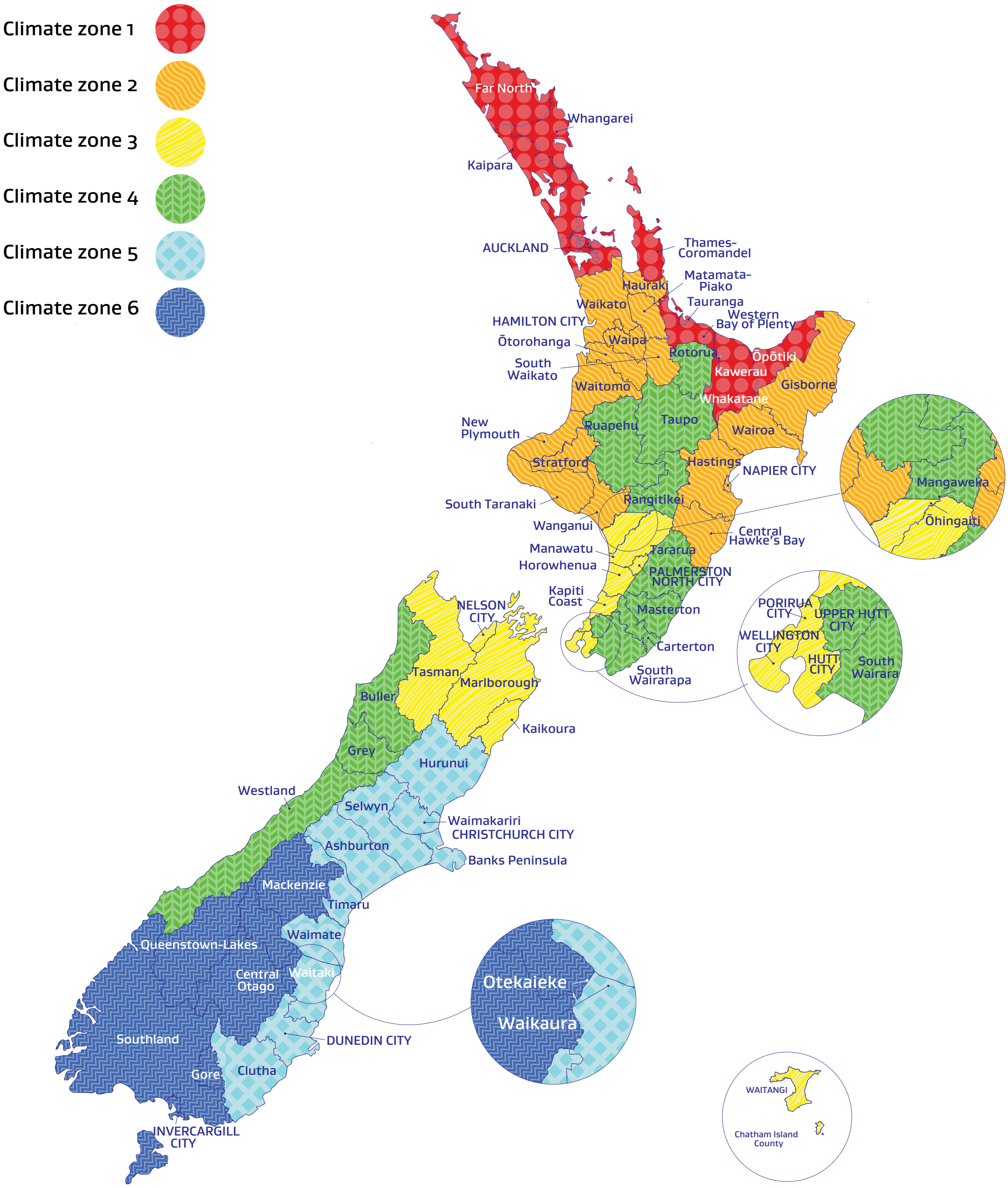
North Island/Te Ika-a-Māui	
Territorial authority	**Climate zone**
Far North District	1
Whangarei District	1
Kaipara District	1
Auckland	1
Thames-Coromandel district	1
Hauraki District	2
Waikato District	2
Matamata-Piako District	2
Hamilton City	2
Waipa District	2
Ōtorohanga District	2
South Waikato District	2
Waitomo District	2
Taupo District	4
Western Bay of Plenty District	1
Tauranga City	1
Rotorua District	4
Whakatane District	1
Kawerau District	1
Ōpōtiki District	1
Gisborne District	2
Wairoa District	2
Hastings District	2
Napier City	2
Central Hawke's Bay District	2
New Plymouth District	2
Stratford District	2
South Taranaki District	2
Ruapehu District	4
Whanganui District	2
Rangitikei District (north of 39°50'S (-39.83))	4
Rangitikei District (south of 39°50'S (-39.83))	3
Manawatu District	3
Palmerston North City	3
Tararua District	4
Horowhenua District	3
Kapiti Coast District	3
Porirua City	3
Upper Hutt City	4
Lower Hutt City	3
Wellington City	3
Masterton District	4
Carterton District	4
South Wairarapa District	4

South Island/Te Waipounamu	
Territorial authority	**Climate zone**
Tasman District	3
Nelson City	3
Marlborough District	3
Kaikoura District	3
Buller District	4
Grey District	4
Westland District	4
Hurunui District	5
Waimakariri District	5
Christchurch City	5
Selwyn District	5
Ashburton District	5
Timaru District	5
Mackenzie District	6
Waimate District	5
Chatham Islands	3
Waitaki District (true left of the Otekaieke river)	6
Waitaki District (true right of the Otekaieke river)	5
Central Otago District	6
Queenstown-Lakes District	6
Dunedin City	5
Clutha District	5
Southland District	6
Gore District	6
Invercargill City	6

New Zealand climate zones

FIGURE C.1.1.2: Map of New Zealand climate zones

Paragraph C.1.1.2



Appendix D. Orientation

D.1 Orientation

D.1.1 Establishing building orientation

D.1.1.1 A *building* wall, including *glazing areas* it contains, shall be considered to face north if it faces any direction in the north orientation sector of Figure D.1.2.1.

D.1.1.2 The orientations of *skylights* and other walls, including the *glazing areas* they contain, shall be determined in a similar way.

D.1.2 Description of sectors

D.1.2.1 Orientation sectors are based on true north and are as follows (see Figure D.1.2.1):

a) North sector lies between north west (more than 315°) and north east (less than 45°); and

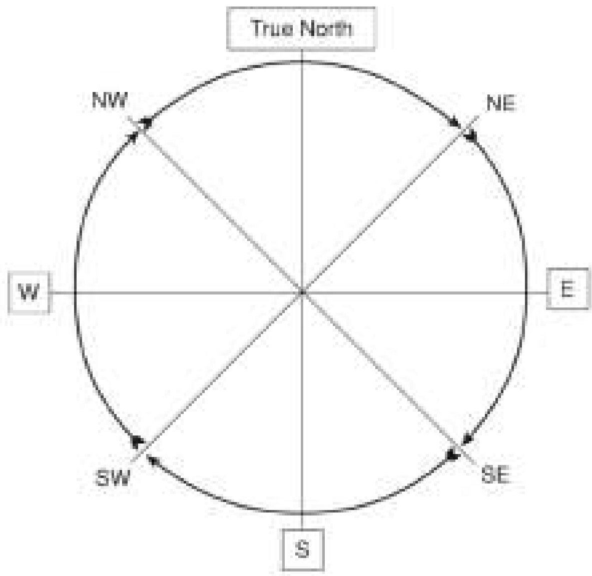
b) East sector lies between north east (45°) and south east (135°); and

c) South sector lies between south east (more than 135°) and south west (less than 225°); and

d) West sector lies between south west (225°) and north west (315°).

FIGURE D.1.2.1: Orientation sector map

Paragraphs D.1.1.1, D.1.2.1



COMMENT: A compass points toward magnetic north. Magnetic north varies from true north by 21° in Auckland, 24° in Wellington and 24° in Christchurch. In New Zealand magnetic north is always east of true north. It is important that true north is used for the orientation rather than magnetic north. The following website calculates the difference between magnetic north and true north (magnetic declination) www.gns.cri.nz/Home/Our-Science/Land-and-Marine-Geoscience/Earth-s-Magnetic-Field/Declination-around-New-Zealand.

Appendix E. Windows, doors, and skylights

E.1 Vertical windows and doors

E.1.1 Methods for determining construction R-values

E.1.1.1 The *construction R-values* for vertical windows and glazing in doors (R_{window}) shall include the effects of both the glazing and the frame. R_{window} shall determined using one of the following methods:

H

a) For **housing** only, from Table E.1.1.1; or

b) Calculation in accordance with Verification Method H1/VM1 Appendix E.

E.1.1.2 Acceptable methods for determining the *construction R-values* of opaque doors and opaque door panels (R_{door}) are contained in NZS 4214.

i

COMMENT:

1. The *R-values* in Table E.1.1.1 are representative *construction R-values* of vertical windows and glazing in doors typical to New Zealand housing. The values provided in this table are not representative of windows and doors in *buildings* other than **housing**.
2. Table E.1.1.1 does not apply to opaque doors, or to opaque door panels.
3. For doors with glazing, the *R-values* in Table E.1.1.1 include the effects of both the glazing and the frame, but not the effect of any opaque parts other than the frames around the glazing. For doors with both glazing and opaque panels, when using Table E.1.1.1, the opaque panel areas need to be treated separately from the areas with glazing (including frames around the glazing), with the *R-value* of the opaque panel areas determined in accordance with Paragraph E.1.1.2.

E.2 Skylights

E.2.1 Construction R-values

E.2.1.1 The *construction R-values* for *skylights* ($R_{skylight}$) shall include the effects of both the glazing materials and the frame materials and shall be calculated in accordance with Equation E.1. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.1: $R_{skylight} = \dfrac{1}{U_w}$

where:

$R_{skylight}$ is the *construction R-value* of the *skylight* ($m^2{\cdot}K/W$); and

U_w is the thermal transmittance of the *skylight* ($W/(m^2{\cdot}K)$), determined in accordance with Paragraph E.2.1.2.

E.2.1.2 The thermal transmittance (U_w) of a *skylight* shall be determined in accordance with ISO 10077-1, with:

a) the thermal transmittance of the glazing (U_g) determined using BS EN 673, considering the effects of horizontal or angled glazing on the heat transfer; and

b) the thermal transmittance of the frame (U_f) determined using ISO 10077-2.

TABLE E.1.1.1: **Construction R-values (R_{Window}) of selected generic vertical windows and doors**

Paragraph E.1.1.1 a)

Type of glazing	U_g (1)	Spacer type (2)	Example IGU(3), (4) (informative)	R_{window} ($m^2 \cdot K/W$) for different frames			
				Aluminium frame	Thermally broken aluminium frame	uPVC frame	Timber frame
Double pane	2.63	Aluminium	Glass: Clear/Clear Gas: Air	R0.26	R0.32	R0.40	R0.44
	1.90	Aluminium	Glass: Low E_1/Clear Gas: Argon	R0.30	R0.39	R0.50	R0.56
	1.60	Thermally improved	Glass: Low E_2/Clear Gas: Argon	R0.33	R0.42	R0.56	R0.63
	1.30	Thermally improved	Glass: Low E_3/Clear Gas: Argon	R0.35	R0.46	R0.63	R0.71
	1.10	Thermally improved	Glass: Low E_4/Clear Gas: Argon	R0.37	R0.50	R0.69	R0.77
	0.90	Thermally improved	Glass: Low E_4/Clear Gas: Krypton	R0.40	R0.54	R0.76	R0.85
Triple pane	1.89	Thermally improved	Glass: Clear/Clear/Clear Gas: Air		R0.38	R0.50	R0.56
	1.20	Thermally improved	Glass: Low E_2/Clear/Clear Gas: Argon		R0.48	R0.66	R0.74
	1.00	Thermally improved	Glass: Low E_3/Clear/Clear Gas: Argon		R0.52	R0.73	R0.81
	0.70	Thermally improved	Glass: Low E_3/Low E_3/ Clear Gas: Argon		R0.59	R0.86	R0.95
	0.60	Thermally improved	Glass: Low E_4/Low E_4/ Clear Gas: Argon		R0.62	R0.91	R1.01

Notes:

(1) Thermal transmittance of the glazing determined using BS EN 673. Where the U_g-value of the proposed glazing is different from the values included in the table, R_{window} shall be determined based on the nearest U_g-value in the table that is greater than the U_g-value of the proposed glazing.

(2) 'Thermally improved' refers to a spacer that meets the definition of thermally improved spacer in ISO 10077-1 Annex G.

(3) The examples provided are informative descriptions only of the *insulated glazing unit (IGU)* types that might be used to deliver the nominated U_g-values. When using this table, R_{window} shall be determined based on U_g, spacer type and frame type.

(4) The properties of each of the glass panes within the *IGU* are provided and separated by '/'. 'Clear' refers to clear float glass. 'Low E_1', 'Low E_2', 'Low E_3' and 'Low E_4' refer to glass with low emissivity coatings at different performance levels.

Appendix F. Thermal resistance of slab-on-ground floors

F.1 Construction R-values

F.1.1 Methods for determining construction R-values for slab-on-ground floors

F.1.1.1 The *construction R-values* for concrete *slab-on-ground floors*, including floors of basements that contain *conditioned spaces*, shall be determined using:

a) The performance tables described in Section F.1.2; or

b) The calculation method in Verification Method H1/VM1 Appendix F.

F.1.1.2 For **housing** only, for *building consent* applications submitted before 1 May 2023, concrete *slab-on-ground floors* are deemed to achieve a construction R-value of R1.3.

COMMENT:

1. The *thermal resistances* for *slab-on-ground floors* provided in the BRANZ House Insulation Guide, 5th edition or earlier, should not be used for determining compliance with the requirements of this acceptable solution. This is because they are based on a different calculation method and different assumptions than those specified in this Appendix.
2. Where a concrete floor is only partially in contact with the ground, with other parts being suspended, the part that is in contact with the ground shall be treated as a *slab-on-ground floor*, and the other part be treated as a suspended floor.

F.1.2 Performance tables for slab-on-ground floor R-values

F.1.2.1 The *construction R-value* for selected generic concrete *slab-on-ground floors* is provided for different floor types, floor insulation types, and *external walls* types. An overview of the *construction R-value* tables included in this subsection for different combinations of these components is provided in Table F.1.2.1.

F.1.2.2 The *construction R-value* of selected generic concrete *slab-on-ground floors* may be determined from:

a) For concrete raft foundation floors without insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2A; and

b) For concrete raft foundation floors without insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2B; and

c) For concrete raft foundation floors with R1.0 vertical edge insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2C; and

d) For concrete raft foundation floors with R1.0 vertical edge insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2D; and

e) For slab-floors without insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2E; and

f) For slab-floors without insulation, where the *external walls* do not have masonry veneer cladding, Table, F.1.2.2F; and

g) For slab-floors with R1.0 vertical edge insulation but without underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2G; and

h) For slab-floors with R1.0 vertical edge insulation but without underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2H; and

i) For slab-floors with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the *external walls* have masonry veneer cladding, Table F.1.2.2I; and

j) For slab-floors with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2J; and

k) For slab-floors with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the *external walls* have masonry veneer cladding, Table F.1.2.2K; and

l) For slab-floors with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2L; and

m) For slab-floors with R1.2 full cover underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2M; and

n) For slab-floors with R1.2 full cover underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2N; and

o) For slab-floors with R2.4 full cover underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2O; and

p) For slab-floors with R2.4 full cover underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2P; and

q) For slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R1.2 underslab insulation along the slab perimeter, where the *external walls* have masonry veneer cladding, Table F.1.2.2Q; and

r) For slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R1.2 underslab insulation along the slab perimeter, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2R; and

s) For slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R2.4 underslab insulation along the slab perimeter, where the *external walls* have masonry veneer cladding, Table F.1.2.2S; and

t) For slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R2.4 underslab insulation along the slab perimeter, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2T; and

u) For slab-floors with R1.0 vertical edge insulation and with R1.2 full cover underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2U; and

v) For slab-floors with R1.0 vertical edge insulation and with R1.2 full cover underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2V; and

w) For slab-floors with R1.0 vertical edge insulation and with R2.4 full cover underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2W; and

x) For slab-floors with R1.0 vertical edge insulation and with R2.4 full cover underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2X.

COMMENT:

1. Any parts of a *slab-on-ground floor* that are not part of the *thermal envelope* (such as the floor of porches, attached garages or storage areas) should be thermally separated by installing vertical edge insulation in between conditioned and unconditioned parts of the floor.
2. Since insulation cannot be easily retrofitted to *slab-on-ground floors*, it is recommended to also insulate the floor of any *unconditioned spaces* of the *building*, where these may become *conditioned spaces* at a later stage during the *building* life. An example is an attached garage that could potentially be converted into a *habitable space* in the future.
3. Tables F.1.2.2A – F.1.2.2X differentiate situations where the *external walls* have a masonry veneer cladding from walls with other types of cladding. With masonry veneer walls, the slab edge has a step-down, resulting in different heat transfer characteristics compared to *slab-on-ground floors* for other *external wall* types.
4. *Construction R-values* are only provided for vertical edge insulation with a *thermal resistance* of 1.0 $m^2{\cdot}K/W$. The thermal benefits of increasing the *R-value* of vertical edge insulation beyond R1.0 are very limited. Refer to BRANZ study report SR352 (2016) for further details.
5. The *construction R-values* provided in Tables F.1.2.2A – F.1.2.2X are based on the calculation method provided in Verification Method H1/VM1 Appendix F, using the default values for the thermal properties of the ground from ISO 13370 Table 7 category 2 (thermal conductivity λ= 2.0 W/(m·K), heat capacity per volume ρc= 2.0 x 10^6 J/(m^3·K)).

F.1.2.3 When determining the slab area-to-perimeter ratio, any parts of the *slab-on-ground floor* that are not part of the *thermal envelope* (such as the floor of patios, porches, attached garages or storage areas) shall be treated as if they were not present.

F.1.2.4 The slab area-to-perimeter ratio of the proposed *building* may be determined using:

a) The overall internal slab dimensions in accordance with Equation F.1; or

b) The external slab dimensions in accordance with Equation F.2.

Equation F.1: $$\text{slab area-to-perimeter ratio} = \frac{A_{\text{slab, internal}}}{P_{\text{slab, internal}}}$$

where:

$A_{\text{slab,internal}}$ is the area of the *slab-on-ground floor* that is part of the *thermal envelope*, measured using overall internal dimensions (ignoring internal partitions, as per ISO 13789) between the interior surfaces of the walls that form the *thermal envelope* (m^2); and

$P_{\text{slab,internal}}$ is the perimeter of the *slab-on-ground floor* that is part of the *thermal envelope*, measured using overall internal dimensions (ignoring internal partitions, as per ISO 13789) along the interior surfaces of the walls that form the *thermal envelope*, including the length of any wall(s) between *conditioned spaces* and *unconditioned spaces* (m).

Equation F.2: $$\text{slab area-to-perimeter ratio} = \frac{A_{\text{slab, external}}}{P_{\text{slab, external}}} - \frac{w}{2}$$

where:

$A_{\text{slab,external}}$ is the area of the *slab-on-ground floor* that is part of the *thermal envelope*, measured between the exterior vertical edges of the slab beneath *external walls* and the unconditioned edges of any wall(s) between *conditioned spaces* and *unconditioned spaces* (m^2); and

$P_{\text{slab,external}}$ is the perimeter of the *slab-on-ground floor* that is part of the *thermal envelope*, measured along the exterior vertical edges of the slab beneath *external walls* and including the length of any wall(s) between *conditioned spaces* and *unconditioned spaces* (m); and

w is the horizontal distance between the outermost exterior concrete slab edge and the interior surface of the *external wall* (m).

COMMENT:
Where the *external walls* do not have masonry veneer cladding, w is the same as the 'Effective thickness of *external walls* on slab' in Tables F.1.2.2A – F.1.2.2X. However, where the *external walls* have masonry veneer cladding, w is to be determined from the exterior concrete slab edge at the bottom of the step-down, whereas the 'Effective thickness of *external walls* on slab' in Tables F.1.2.2A – F.1.2.2X is to be determined from the concrete slab edge at floor level.

Table F.1.2.1: Overview of construction R-value tables for selected slab-on-ground floor scenarios

Paragraph F.1.2.1

Floor type	Floor insulation type	External wall type	Table number
Concrete raft foundation	None	Masonry veneer	Table F1.2.2A
		Other	Table F1.2.2B
	Vertical edge R1.0	Masonry veneer	Table F1.2.2C
		Other	Table F1.2.2D
Slab floor	None	Masonry veneer	Table F1.2.2E
		Other	Table F1.2.2F
	Vertical edge R1.0	Masonry veneer	Table F1.2.2G
		Other	Table F1.2.2H
	Underslab 1.2 m strip R1.2	Masonry veneer	Table F1.2.2I
		Other	Table F1.2.2J
	Underslab 1.2 m strip R2.4	Masonry veneer	Table F1.2.2K
		Other	Table F1.2.2L
	Underslab full cover R1.2	Masonry veneer	Table F1.2.2M
		Other	Table F1.2.2N
	Underslab full cover R2.4	Masonry veneer	Table F1.2.2O
		Other	Table F1.2.2P
	Vertical edge R1.0 and Underslab 1.2 m strip R1.2	Masonry veneer	Table F1.2.2Q
		Other	Table F1.2.2R
	Vertical edge R1.0 and Underslab 1.2 m strip R2.4	Masonry veneer	Table F1.2.2S
		Other	Table F1.2.2T
	Vertical edge R1.0 and Underslab full cover R1.2	Masonry veneer	Table F1.2.2U
		Other	Table F1.2.2V
	Vertical edge R1.0 and Underslab full cover R2.4	Masonry veneer	Table F1.2.2W
		Other	Table F1.2.2X

Table F.1.2.2A: Construction R-values for concrete raft foundation floors without insulation, where the external walls have masonry veneer cladding

Paragraph F.1.2.2 a)

Insulation type	Slab area-to-perimeter ratio [(1)]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[(2)]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
No vertical edge insulation	1.6	R1.2	R1.2	R1.2	R1.3	R1.3
	1.8	R1.3	R1.3	R1.3	R1.4	R1.4
	2.0	R1.3	R1.4	R1.4	R1.4	R1.5
	2.2	R1.4	R1.5	R1.5	R1.5	R1.6
	2.4	R1.5	R1.6	R1.6	R1.6	R1.7
	2.6	R1.6	R1.6	R1.6	R1.7	R1.7
	2.8	R1.7	R1.7	R1.7	R1.8	R1.8
	3.0	R1.7	R1.8	R1.8	R1.9	R1.9
	3.2	R1.8	R1.9	R1.9	R2.0	R2.0
	3.4	R1.9	R1.9	R2.0	R2.0	R2.0
	3.6	R2.0	R2.0	R2.0	R2.1	R2.1
	3.8	R2.0	R2.1	R2.1	R2.2	R2.2
	4.0	R2.1	R2.1	R2.2	R2.2	R2.3
	5.0	R2.5	R2.5	R2.6	R2.6	R2.7
	6.0	R2.8	R2.9	R2.9	R3.0	R3.0
	7.0	R3.2	R3.3	R3.3	R3.4	R3.4
	8.0	R3.6	R3.6	R3.7	R3.8	R3.8
	9.0	R3.9	R4.0	R4.1	R4.2	R4.2
	≥ 10.0	R4.3	R4.4	R4.4	R4.5	R4.6

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

Table F.1.2.2B: Construction R-values for concrete raft foundation floors without insulation, where the external walls do not have masonry veneer cladding

Paragraph F.1.2.2 b)

Insulation type	Slab area-to-perimeter ratio (1)	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab(2)				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
No vertical edge insulation	1.6	R1.0	R1.0	R1.1	R1.1	R1.1
	1.8	R1.1	R1.1	R1.2	R1.2	R1.2
	2.0	R1.2	R1.2	R1.3	R1.3	R1.4
	2.2	R1.2	R1.3	R1.3	R1.4	R1.4
	2.4	R1.3	R1.4	R1.4	R1.5	R1.5
	2.6	R1.4	R1.4	R1.5	R1.5	R1.6
	2.8	R1.4	R1.5	R1.5	R1.6	R1.6
	3.0	R1.5	R1.6	R1.6	R1.7	R1.7
	3.2	R1.6	R1.6	R1.7	R1.8	R1.8
	3.4	R1.6	R1.7	R1.7	R1.8	R1.9
	3.6	R1.7	R1.8	R1.8	R1.9	R1.9
	3.8	R1.8	R1.8	R1.9	R2.0	R2.0
	4.0	R1.9	R1.9	R2.0	R2.0	R2.1
	5.0	R2.2	R2.3	R2.3	R2.4	R2.5
	6.0	R2.5	R2.6	R2.7	R2.7	R2.8
	7.0	R2.8	R2.9	R3.0	R3.1	R3.2
	8.0	R3.2	R3.3	R3.3	R3.5	R3.5
	9.0	R3.5	R3.6	R3.7	R3.8	R3.9
	≥ 10.0	R3.9	R4.0	R4.1	R4.2	R4.3

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

Table F.1.2.2C: Construction R-values for concrete raft foundation floors with R1.0 vertical edge insulation, where the external walls have masonry veneer cladding

Paragraph F.1.2.2 c)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3]	1.6	R1.3	R1.3	R1.3	R1.3	R1.4
	1.8	R1.4	R1.4	R1.4	R1.5	R1.5
	2.0	R1.4	R1.5	R1.5	R1.5	R1.5
	2.2	R1.5	R1.6	R1.6	R1.6	R1.6
	2.4	R1.6	R1.7	R1.7	R1.7	R1.7
	2.6	R1.7	R1.7	R1.7	R1.8	R1.8
	2.8	R1.8	R1.8	R1.8	R1.9	R1.9
	3.0	R1.9	R1.9	R1.9	R2.0	R2.0
	3.2	R2.0	R2.0	R2.0	R2.1	R2.1
	3.4	R2.0	R2.0	R2.1	R2.1	R2.1
	3.6	R2.1	R2.1	R2.2	R2.2	R2.2
	3.8	R2.2	R2.2	R2.2	R2.3	R2.3
	4.0	R2.2	R2.3	R2.3	R2.3	R2.4
	5.0	R2.6	R2.7	R2.7	R2.8	R2.8
	6.0	R3.0	R3.0	R3.1	R3.1	R3.2
	7.0	R3.4	R3.4	R3.5	R3.5	R3.6
	8.0	R3.8	R3.8	R3.9	R3.9	R4.0
	9.0	R4.2	R4.2	R4.3	R4.4	R4.4
	≥ 10.0	R4.5	R4.6	R4.7	R4.8	R4.8

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an R-value of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

Table F.1.2.2D: Construction R-values for concrete raft foundation floors with R1.0 vertical edge insulation, where the external walls do not have masonry veneer cladding

Paragraph F.1.2.2 d)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3]	1.6	R1.3	R1.3	R1.3	R1.3	R1.3
	1.8	R1.4	R1.4	R1.4	R1.4	R1.4
	2.0	R1.5	R1.5	R1.5	R1.6	R1.6
	2.2	R1.5	R1.5	R1.6	R1.6	R1.6
	2.4	R1.6	R1.6	R1.7	R1.7	R1.7
	2.6	R1.7	R1.8	R1.8	R1.8	R1.8
	2.8	R1.8	R1.8	R1.8	R1.8	R1.9
	3.0	R1.9	R1.9	R1.9	R1.9	R2.0
	3.2	R2.0	R2.0	R2.0	R2.0	R2.1
	3.4	R2.0	R2.0	R2.1	R2.1	R2.1
	3.6	R2.1	R2.1	R2.1	R2.2	R2.2
	3.8	R2.2	R2.2	R2.2	R2.3	R2.3
	4.0	R2.3	R2.3	R2.3	R2.3	R2.4
	5.0	R2.6	R2.7	R2.7	R2.7	R2.8
	6.0	R3.0	R3.1	R3.1	R3.1	R3.2
	7.0	R3.4	R3.4	R3.5	R3.5	R3.6
	8.0	R3.8	R3.8	R3.9	R3.9	R4.0
	9.0	R4.2	R4.2	R4.3	R4.3	R4.4
	≥ 10.0	R4.6	R4.6	R4.7	R4.8	R4.8

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an R-value of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

Table F.1.2.2E: Construction R-values for slab-floors without insulation, where the external walls have masonry veneer cladding

Paragraph F.1.2.2 e)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
No insulation	1.6	R0.8	R0.9	R0.9	R0.9	R0.9
	1.8	R0.9	R0.9	R1.0	R1.0	R1.0
	2.0	R1.0	R1.0	R1.0	R1.1	R1.1
	2.2	R1.0	R1.1	R1.1	R1.1	R1.2
	2.4	R1.1	R1.1	R1.2	R1.2	R1.2
	2.6	R1.2	R1.2	R1.2	R1.3	R1.3
	2.8	R1.2	R1.3	R1.3	R1.3	R1.4
	3.0	R1.3	R1.3	R1.4	R1.4	R1.4
	3.2	R1.4	R1.4	R1.4	R1.5	R1.5
	3.4	R1.4	R1.5	R1.5	R1.5	R1.6
	3.6	R1.5	R1.5	R1.6	R1.6	R1.6
	3.8	R1.6	R1.6	R1.6	R1.7	R1.7
	4.0	R1.6	R1.7	R1.7	R1.7	R1.8
	5.0	R1.9	R2.0	R2.0	R2.1	R2.1
	6.0	R2.3	R2.3	R2.4	R2.4	R2.5
	7.0	R2.6	R2.6	R2.7	R2.8	R2.8
	8.0	R2.9	R3.0	R3.0	R3.1	R3.2
	9.0	R3.2	R3.3	R3.4	R3.5	R3.5
	≥ 10.0	R3.5	R3.6	R3.7	R3.8	R3.9

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

Table F.1.2.2F: Construction R-values for slab-floors without insulation, where the external walls do not have masonry veneer cladding

Paragraph F.1.2.2 f)

Insulation type	Slab area-to-perimeter ratio [(1)]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[(2)]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
No insulation	1.6	R0.8	R0.8	R0.8	R0.9	R0.9
	1.8	R0.8	R0.9	R0.9	R0.9	R0.9
	2.0	R0.9	R0.9	R0.9	R1.0	R1.0
	2.2	R0.9	R1.0	R1.0	R1.1	R1.1
	2.4	R1.0	R1.0	R1.1	R1.1	R1.2
	2.6	R1.1	R1.1	R1.1	R1.2	R1.2
	2.8	R1.1	R1.2	R1.2	R1.3	R1.3
	3.0	R1.2	R1.2	R1.3	R1.3	R1.4
	3.2	R1.2	R1.3	R1.3	R1.4	R1.4
	3.4	R1.3	R1.3	R1.4	R1.4	R1.5
	3.6	R1.4	R1.4	R1.4	R1.5	R1.5
	3.8	R1.4	R1.5	R1.5	R1.6	R1.6
	4.0	R1.5	R1.5	R1.6	R1.6	R1.7
	5.0	R1.8	R1.8	R1.9	R2.0	R2.0
	6.0	R2.1	R2.1	R2.2	R2.3	R2.3
	7.0	R2.4	R2.4	R2.5	R2.6	R2.7
	8.0	R2.7	R2.7	R2.8	R2.9	R3.0
	9.0	R2.9	R3.0	R3.1	R3.2	R3.3
	≥ 10.0	R3.3	R3.4	R3.4	R3.6	R3.7

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

Table F.1.2.2G: **Construction R-values for slab-floors with R1.0 vertical edge insulation but without underslab insulation, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 g)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3]	1.6	R0.9	R0.9	R1.0	R1.0	R1.0
	1.8	R1.0	R1.0	R1.0	R1.1	R1.1
	2.0	R1.1	R1.1	R1.1	R1.1	R1.2
	2.2	R1.1	R1.2	R1.2	R1.2	R1.2
	2.4	R1.2	R1.2	R1.3	R1.3	R1.3
	2.6	R1.3	R1.3	R1.3	R1.4	R1.4
	2.8	R1.3	R1.4	R1.4	R1.4	R1.5
	3.0	R1.4	R1.4	R1.5	R1.5	R1.5
	3.2	R1.5	R1.5	R1.5	R1.6	R1.6
	3.4	R1.6	R1.6	R1.6	R1.6	R1.7
	3.6	R1.6	R1.6	R1.7	R1.7	R1.7
	3.8	R1.7	R1.7	R1.7	R1.8	R1.8
	4.0	R1.8	R1.8	R1.8	R1.9	R1.9
	5.0	R2.1	R2.1	R2.2	R2.2	R2.2
	6.0	R2.4	R2.5	R2.5	R2.6	R2.6
	7.0	R2.8	R2.8	R2.9	R2.9	R3.0
	8.0	R3.1	R3.2	R3.2	R3.3	R3.3
	9.0	R3.5	R3.5	R3.6	R3.7	R3.7
	≥ 10.0	R3.8	R3.9	R3.9	R4.0	R4.1

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an R-value of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

Table F.1.2.2H: Construction R-values for slab-floors with R1.0 vertical edge insulation but without underslab insulation, where the external walls do not have masonry veneer cladding

Paragraph F.1.2.2 h)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3]	1.6	R1.0	R1.0	R1.0	R1.0	R1.0
	1.8	R1.0	R1.1	R1.1	R1.1	R1.1
	2.0	R1.1	R1.1	R1.1	R1.2	R1.2
	2.2	R1.2	R1.2	R1.2	R1.2	R1.3
	2.4	R1.3	R1.3	R1.3	R1.3	R1.3
	2.6	R1.3	R1.4	R1.4	R1.4	R1.4
	2.8	R1.4	R1.4	R1.4	R1.5	R1.5
	3.0	R1.5	R1.5	R1.5	R1.5	R1.6
	3.2	R1.5	R1.6	R1.6	R1.6	R1.6
	3.4	R1.6	R1.6	R1.7	R1.7	R1.7
	3.6	R1.7	R1.7	R1.7	R1.8	R1.8
	3.8	R1.8	R1.8	R1.8	R1.8	R1.9
	4.0	R1.8	R1.8	R1.9	R1.9	R1.9
	5.0	R2.2	R2.2	R2.2	R2.3	R2.3
	6.0	R2.5	R2.5	R2.6	R2.6	R2.7
	7.0	R2.9	R2.9	R2.9	R3.0	R3.0
	8.0	R3.2	R3.3	R3.3	R3.4	R3.4
	9.0	R3.6	R3.6	R3.7	R3.7	R3.8
	≥ 10.0	R3.9	R4.0	R4.0	R4.1	R4.2

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an R-value of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

Table F.1.2.2I: **Construction R-values for slab-floors with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 i)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
1.2 m wide strip of R1.2 underslab insulation[3]	1.6	R1.1	R1.2	R1.2	R1.2	R1.2
	1.8	R1.2	R1.2	R1.2	R1.3	R1.3
	2.0	R1.2	R1.3	R1.3	R1.3	R1.4
	2.2	R1.3	R1.3	R1.4	R1.4	R1.4
	2.4	R1.3	R1.4	R1.4	R1.5	R1.5
	2.6	R1.4	R1.4	R1.5	R1.5	R1.6
	2.8	R1.5	R1.5	R1.6	R1.6	R1.6
	3.0	R1.5	R1.6	R1.6	R1.7	R1.7
	3.2	R1.6	R1.6	R1.7	R1.7	R1.8
	3.4	R1.7	R1.7	R1.8	R1.8	R1.8
	3.6	R1.7	R1.8	R1.8	R1.9	R1.9
	3.8	R1.8	R1.9	R1.9	R2.0	R2.0
	4.0	R1.9	R1.9	R2.0	R2.0	R2.1
	5.0	R2.2	R2.3	R2.3	R2.4	R2.4
	6.0	R2.5	R2.6	R2.7	R2.7	R2.8
	7.0	R2.9	R3.0	R3.0	R3.1	R3.2
	8.0	R3.2	R3.3	R3.4	R3.5	R3.5
	9.0	R3.6	R3.7	R3.8	R3.9	R3.9
	≥ 10.0	R3.9	R4.0	R4.1	R4.2	R4.3

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 1.2 $m^2 \cdot K/W$, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2J: Construction R-values for slab-floors with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the external walls do not have masonry veneer cladding

Paragraph F.1.2.2 j)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} (m^2·K/W) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
1.2 m wide strip of R1.2 underslab insulation[3]	1.6	R1.0	R1.0	R1.1	R1.1	R1.2
	1.8	R1.0	R1.1	R1.1	R1.2	R1.2
	2.0	R1.1	R1.1	R1.2	R1.2	R1.3
	2.2	R1.1	R1.2	R1.2	R1.3	R1.3
	2.4	R1.2	R1.3	R1.3	R1.4	R1.4
	2.6	R1.3	R1.3	R1.4	R1.4	R1.5
	2.8	R1.3	R1.4	R1.4	R1.5	R1.5
	3.0	R1.4	R1.4	R1.5	R1.6	R1.6
	3.2	R1.4	R1.5	R1.6	R1.6	R1.7
	3.4	R1.5	R1.6	R1.6	R1.7	R1.7
	3.6	R1.6	R1.6	R1.7	R1.8	R1.8
	3.8	R1.6	R1.7	R1.7	R1.8	R1.9
	4.0	R1.7	R1.8	R1.8	R1.9	R1.9
	5.0	R2.0	R2.1	R2.1	R2.2	R2.3
	6.0	R2.3	R2.4	R2.5	R2.6	R2.6
	7.0	R2.6	R2.7	R2.8	R2.9	R3.0
	8.0	R2.9	R3.1	R3.1	R3.3	R3.4
	9.0	R3.3	R3.4	R3.5	R3.6	R3.7
	≥ 10.0	R3.6	R3.7	R3.8	R4.0	R4.1

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 1.2 m^2·K/W, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2K: Construction R-values for slab-floors with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the external walls have masonry veneer cladding

Paragraph F.1.2.2 k)

Insulation type	Slab area-to-perimeter ratio (1)	R_{floor} (m^2·K/W) for different effective thicknesses of external walls on slab(2)				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
1.2 m wide strip of R2.4 underslab insulation(3)	1.6	R1.2	R1.2	R1.3	R1.3	R1.3
	1.8	R1.2	R1.3	R1.3	R1.4	R1.4
	2.0	R1.3	R1.3	R1.4	R1.4	R1.4
	2.2	R1.3	R1.4	R1.4	R1.5	R1.5
	2.4	R1.4	R1.5	R1.5	R1.5	R1.6
	2.6	R1.5	R1.5	R1.6	R1.6	R1.6
	2.8	R1.5	R1.6	R1.6	R1.7	R1.7
	3.0	R1.6	R1.6	R1.7	R1.7	R1.8
	3.2	R1.7	R1.7	R1.8	R1.8	R1.8
	3.4	R1.7	R1.8	R1.8	R1.9	R1.9
	3.6	R1.8	R1.8	R1.9	R2.0	R2.0
	3.8	R1.9	R1.9	R2.0	R2.0	R2.1
	4.0	R1.9	R2.0	R2.0	R2.1	R2.1
	5.0	R2.3	R2.3	R2.4	R2.5	R2.5
	6.0	R2.6	R2.7	R2.7	R2.8	R2.9
	7.0	R3.0	R3.0	R3.1	R3.2	R3.3
	8.0	R3.3	R3.4	R3.5	R3.6	R3.6
	9.0	R3.7	R3.8	R3.9	R4.0	R4.0
	≥ 10.0	R4.0	R4.1	R4.2	R4.4	R4.4

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 2.4 m^2·K/W, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2L: **Construction R-values for slab-floors with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 l)

Insulation type	Slab area-to-perimeter ratio (1)	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab(2)				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
1.2 m wide strip of R2.4 underslab insulation(3)	1.6	R1.1	R1.1	R1.2	R1.2	R1.3
	1.8	R1.1	R1.1	R1.2	R1.3	R1.3
	2.0	R1.1	R1.2	R1.3	R1.3	R1.4
	2.2	R1.2	R1.3	R1.3	R1.4	R1.4
	2.4	R1.2	R1.3	R1.4	R1.4	R1.5
	2.6	R1.3	R1.4	R1.4	R1.5	R1.5
	2.8	R1.4	R1.4	R1.5	R1.6	R1.6
	3.0	R1.4	R1.5	R1.6	R1.6	R1.7
	3.2	R1.5	R1.6	R1.6	R1.7	R1.7
	3.4	R1.5	R1.6	R1.7	R1.8	R1.8
	3.6	R1.6	R1.7	R1.7	R1.8	R1.9
	3.8	R1.7	R1.7	R1.8	R1.9	R2.0
	4.0	R1.7	R1.8	R1.9	R2.0	R2.0
	5.0	R2.0	R2.1	R2.2	R2.3	R2.4
	6.0	R2.4	R2.5	R2.5	R2.7	R2.7
	7.0	R2.7	R2.8	R2.9	R3.0	R3.1
	8.0	R3.0	R3.1	R3.2	R3.4	R3.5
	9.0	R3.3	R3.5	R3.6	R3.7	R3.8
	≥ 10.0	R3.7	R3.8	R3.9	R4.1	R4.2

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2M: **Construction R-values for slab-floors with R1.2 full cover underslab insulation, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 m)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.2 full cover underslab insulation[3]	1.6	R1.3	R1.4	R1.5	R1.6	R1.6
	1.8	R1.4	R1.5	R1.6	R1.7	R1.7
	2.0	R1.5	R1.6	R1.7	R1.8	R1.8
	2.2	R1.6	R1.7	R1.8	R1.9	R1.9
	2.4	R1.7	R1.8	R1.9	R2.0	R2.0
	2.6	R1.8	R1.9	R1.9	R2.0	R2.1
	2.8	R1.9	R2.0	R2.0	R2.1	R2.2
	3.0	R2.0	R2.0	R2.1	R2.2	R2.3
	3.2	R2.0	R2.1	R2.2	R2.3	R2.4
	3.4	R2.1	R2.2	R2.3	R2.4	R2.4
	3.6	R2.2	R2.3	R2.4	R2.5	R2.5
	3.8	R2.3	R2.4	R2.4	R2.5	R2.6
	4.0	R2.3	R2.4	R2.5	R2.6	R2.7
	5.0	R2.7	R2.8	R2.9	R3.0	R3.1
	6.0	R3.1	R3.2	R3.3	R3.4	R3.5
	7.0	R3.5	R3.6	R3.7	R3.8	R3.9
	8.0	R3.8	R4.0	R4.1	R4.2	R4.3
	9.0	R4.2	R4.3	R4.5	R4.6	R4.7
	≥ 10.0	R4.6	R4.7	R4.9	R5.0	R5.2

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Horizontal underslab insulation with an *R-value* of 1.2 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Table F.1.2.2N: **Construction R-values for slab-floors with R1.2 full cover underslab insulation, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 n)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.2 full cover underslab insulation[3]	1.6	R1.1	R1.2	R1.3	R1.4	R1.5
	1.8	R1.2	R1.3	R1.4	R1.5	R1.6
	2.0	R1.3	R1.4	R1.5	R1.6	R1.7
	2.2	R1.4	R1.5	R1.6	R1.7	R1.8
	2.4	R1.5	R1.6	R1.7	R1.8	R1.9
	2.6	R1.5	R1.6	R1.7	R1.9	R1.9
	2.8	R1.6	R1.7	R1.8	R2.0	R2.0
	3.0	R1.7	R1.8	R1.9	R2.0	R2.1
	3.2	R1.8	R1.9	R2.0	R2.1	R2.2
	3.4	R1.8	R1.9	R2.0	R2.2	R2.3
	3.6	R1.9	R2.0	R2.1	R2.3	R2.4
	3.8	R2.0	R2.1	R2.2	R2.3	R2.4
	4.0	R2.1	R2.2	R2.3	R2.4	R2.5
	5.0	R2.4	R2.5	R2.6	R2.8	R2.9
	6.0	R2.7	R2.9	R3.0	R3.2	R3.3
	7.0	R3.1	R3.2	R3.4	R3.6	R3.7
	8.0	R3.4	R3.6	R3.7	R3.9	R4.1
	9.0	R3.8	R4.0	R4.1	R4.3	R4.5
	≥ 10.0	R4.1	R4.3	R4.5	R4.7	R4.9

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Horizontal underslab insulation with an *R-value* of 1.2 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Table F.1.2.20: Construction R-values for slab-floors with R2.4 full cover underslab insulation, where the external walls have masonry veneer cladding

Paragraph F.1.2.2 o)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R2.4 full cover underslab insulation[3]	1.6	R1.6	R1.7	R1.8	R2.0	R2.1
	1.8	R1.7	R1.8	R2.0	R2.1	R2.2
	2.0	R1.8	R2.0	R2.1	R2.2	R2.3
	2.2	R2.0	R2.1	R2.2	R2.4	R2.5
	2.4	R2.1	R2.2	R2.3	R2.5	R2.6
	2.6	R2.2	R2.3	R2.4	R2.6	R2.7
	2.8	R2.3	R2.4	R2.5	R2.7	R2.8
	3.0	R2.4	R2.5	R2.6	R2.8	R2.9
	3.2	R2.5	R2.6	R2.7	R2.9	R3.0
	3.4	R2.6	R2.7	R2.8	R3.0	R3.1
	3.6	R2.6	R2.8	R2.9	R3.1	R3.2
	3.8	R2.7	R2.9	R3.0	R3.2	R3.3
	4.0	R2.8	R3.0	R3.1	R3.3	R3.4
	5.0	R3.2	R3.4	R3.5	R3.7	R3.8
	6.0	R3.7	R3.8	R4.0	R4.2	R4.3
	7.0	R4.1	R4.2	R4.4	R4.6	R4.7
	8.0	R4.5	R4.6	R4.8	R5.0	R5.2
	9.0	R4.9	R5.1	R5.2	R5.5	R5.6
	≥ 10.0	R5.3	R5.5	R5.7	R5.9	R6.1

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Table F.1.2.2P: **Construction R-values for slab-floors with R2.4 full cover underslab insulation, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 p)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R2.4 full cover underslab insulation[3]	1.6	R1.3	R1.4	R1.5	R1.7	R1.9
	1.8	R1.4	R1.5	R1.7	R1.9	R2.0
	2.0	R1.5	R1.7	R1.8	R2.0	R2.1
	2.2	R1.6	R1.8	R1.9	R2.1	R2.2
	2.4	R1.7	R1.9	R2.0	R2.2	R2.3
	2.6	R1.8	R2.0	R2.1	R2.3	R2.4
	2.8	R1.9	R2.1	R2.2	R2.4	R2.5
	3.0	R2.0	R2.1	R2.3	R2.5	R2.6
	3.2	R2.1	R2.2	R2.4	R2.6	R2.7
	3.4	R2.2	R2.3	R2.5	R2.7	R2.8
	3.6	R2.3	R2.4	R2.6	R2.8	R2.9
	3.8	R2.3	R2.5	R2.7	R2.9	R3.0
	4.0	R2.4	R2.6	R2.7	R3.0	R3.1
	5.0	R2.8	R3.0	R3.2	R3.4	R3.6
	6.0	R3.2	R3.4	R3.6	R3.8	R4.0
	7.0	R3.6	R3.8	R4.0	R4.2	R4.4
	8.0	R3.9	R4.2	R4.4	R4.7	R4.8
	9.0	R4.3	R4.5	R4.8	R5.1	R5.3
	≥ 10.0	R4.7	R4.9	R5.2	R5.5	R5.7

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Table F.1.2.2Q: **Construction R-values for slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R1.2 underslab insulation along the slab perimeter, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 q)

Insulation type	Slab area-to-perimeter ratio [(1)]	R_{floor} ($m^2{\cdot}K/W$) for different effective thicknesses of external walls on slab[(2)]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[(3)] plus 1.2 m wide strip of R1.2 underslab insulation[(4)]	1.6	R1.2	R1.2	R1.3	R1.3	R1.3
	1.8	R1.3	R1.3	R1.3	R1.3	R1.4
	2.0	R1.3	R1.3	R1.4	R1.4	R1.4
	2.2	R1.4	R1.4	R1.4	R1.5	R1.5
	2.4	R1.4	R1.5	R1.5	R1.5	R1.6
	2.6	R1.5	R1.5	R1.6	R1.6	R1.6
	2.8	R1.6	R1.6	R1.6	R1.7	R1.7
	3.0	R1.6	R1.7	R1.7	R1.8	R1.8
	3.2	R1.7	R1.8	R1.8	R1.8	R1.9
	3.4	R1.8	R1.8	R1.9	R1.9	R1.9
	3.6	R1.9	R1.9	R1.9	R2.0	R2.0
	3.8	R1.9	R2.0	R2.0	R2.0	R2.1
	4.0	R2.0	R2.0	R2.1	R2.1	R2.2
	5.0	R2.3	R2.4	R2.4	R2.5	R2.5
	6.0	R2.7	R2.8	R2.8	R2.9	R2.9
	7.0	R3.1	R3.1	R3.2	R3.3	R3.3
	8.0	R3.4	R3.5	R3.6	R3.6	R3.7
	9.0	R3.8	R3.9	R3.9	R4.0	R4.1
	≥ 10.0	R4.2	R4.3	R4.3	R4.4	R4.5

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2{\cdot}K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 1.2 $m^2{\cdot}K/W$, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2R: **Construction R-values for slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R1.2 underslab insulation along the slab perimeter, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 r)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3] plus 1.2 m wide strip of R1.2 underslab insulation[4]	1.6	R1.3	R1.3	R1.3	R1.3	R1.3
	1.8	R1.3	R1.3	R1.3	R1.4	R1.4
	2.0	R1.4	R1.4	R1.4	R1.4	R1.5
	2.2	R1.4	R1.4	R1.5	R1.5	R1.5
	2.4	R1.5	R1.5	R1.5	R1.6	R1.6
	2.6	R1.5	R1.6	R1.6	R1.6	R1.7
	2.8	R1.6	R1.6	R1.7	R1.7	R1.7
	3.0	R1.7	R1.7	R1.8	R1.8	R1.8
	3.2	R1.8	R1.8	R1.8	R1.9	R1.9
	3.4	R1.8	R1.9	R1.9	R1.9	R2.0
	3.6	R1.9	R1.9	R2.0	R2.0	R2.0
	3.8	R2.0	R2.0	R2.0	R2.1	R2.1
	4.0	R2.0	R2.1	R2.1	R2.2	R2.2
	5.0	R2.4	R2.4	R2.5	R2.5	R2.6
	6.0	R2.8	R2.8	R2.9	R2.9	R3.0
	7.0	R3.1	R3.2	R3.2	R3.3	R3.4
	8.0	R3.5	R3.6	R3.6	R3.7	R3.8
	9.0	R3.9	R4.0	R4.0	R4.1	R4.2
	≥ 10.0	R4.3	R4.3	R4.4	R4.5	R4.6

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 1.2 $m^2 \cdot K/W$, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2S: Construction R-values for slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R2.4 underslab insulation along the slab perimeter, where the external walls have masonry veneer cladding

Paragraph F.1.2.2 s)

Insulation type	Slab area-to-perimeter ratio (1)	R_{floor} ($m^2·K/W$) for different effective thicknesses of external walls on slab(2)				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation(3) plus 1.2 m wide strip of R2.4 underslab insulation(4)	1.6	R1.3	R1.3	R1.4	R1.4	R1.4
	1.8	R1.3	R1.4	R1.4	R1.4	R1.4
	2.0	R1.4	R1.4	R1.4	R1.5	R1.5
	2.2	R1.4	R1.5	R1.5	R1.5	R1.6
	2.4	R1.5	R1.5	R1.6	R1.6	R1.6
	2.6	R1.6	R1.6	R1.6	R1.7	R1.7
	2.8	R1.6	R1.7	R1.7	R1.8	R1.8
	3.0	R1.7	R1.7	R1.8	R1.8	R1.8
	3.2	R1.8	R1.8	R1.9	R1.9	R1.9
	3.4	R1.8	R1.9	R1.9	R2.0	R2.0
	3.6	R1.9	R2.0	R2.0	R2.0	R2.1
	3.8	R2.0	R2.0	R2.1	R2.1	R2.1
	4.0	R2.1	R2.1	R2.1	R2.2	R2.2
	5.0	R2.4	R2.5	R2.5	R2.6	R2.6
	6.0	R2.8	R2.8	R2.9	R3.0	R3.0
	7.0	R3.1	R3.2	R3.3	R3.3	R3.4
	8.0	R3.5	R3.6	R3.7	R3.7	R3.8
	9.0	R3.9	R4.0	R4.0	R4.1	R4.2
	≥ 10.0	R4.3	R4.4	R4.4	R4.5	R4.6

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2·K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 2.4 $m^2·K/W$, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2T: **Construction R-values for slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R2.4 underslab insulation along the slab perimeter, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 t)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3] plus 1.2 m wide strip of R2.4 underslab insulation[4]	1.6	R1.3	R1.4	R1.4	R1.4	R1.4
	1.8	R1.4	R1.4	R1.4	R1.5	R1.5
	2.0	R1.4	R1.5	R1.5	R1.5	R1.5
	2.2	R1.5	R1.5	R1.5	R1.6	R1.6
	2.4	R1.5	R1.6	R1.6	R1.7	R1.7
	2.6	R1.6	R1.6	R1.7	R1.7	R1.7
	2.8	R1.7	R1.7	R1.7	R1.8	R1.8
	3.0	R1.7	R1.8	R1.8	R1.9	R1.9
	3.2	R1.8	R1.8	R1.9	R1.9	R2.0
	3.4	R1.9	R1.9	R2.0	R2.0	R2.0
	3.6	R2.0	R2.0	R2.0	R2.1	R2.1
	3.8	R2.0	R2.1	R2.1	R2.2	R2.2
	4.0	R2.1	R2.1	R2.2	R2.2	R2.3
	5.0	R2.5	R2.5	R2.5	R2.6	R2.6
	6.0	R2.8	R2.9	R2.9	R3.0	R3.0
	7.0	R3.2	R3.3	R3.3	R3.4	R3.4
	8.0	R3.6	R3.6	R3.7	R3.8	R3.8
	9.0	R4.0	R4.0	R4.1	R4.2	R4.3
	≥ 10.0	R4.4	R4.4	R4.5	R4.6	R4.7

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2U: Construction R-values for slab-floors with R1.0 vertical edge insulation and with R1.2 full cover underslab insulation, where the external walls have masonry veneer cladding

Paragraph F.1.2.2 u)

Insulation type	Slab area-to-perimeter ratio (1)	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab(2)				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation(3) plus R1.2 full cover underslab insulation(4)	1.6	R1.4	R1.5	R1.6	R1.7	R1.7
	1.8	R1.5	R1.6	R1.7	R1.8	R1.8
	2.0	R1.6	R1.7	R1.8	R1.9	R1.9
	2.2	R1.7	R1.8	R1.9	R2.0	R2.0
	2.4	R1.8	R1.9	R2.0	R2.1	R2.1
	2.6	R1.9	R2.0	R2.1	R2.1	R2.2
	2.8	R2.0	R2.1	R2.1	R2.2	R2.3
	3.0	R2.1	R2.2	R2.2	R2.3	R2.4
	3.2	R2.2	R2.2	R2.3	R2.4	R2.5
	3.4	R2.3	R2.3	R2.4	R2.5	R2.5
	3.6	R2.3	R2.4	R2.5	R2.6	R2.6
	3.8	R2.4	R2.5	R2.6	R2.7	R2.7
	4.0	R2.5	R2.6	R2.6	R2.7	R2.8
	5.0	R2.9	R3.0	R3.1	R3.2	R3.2
	6.0	R3.3	R3.4	R3.5	R3.6	R3.6
	7.0	R3.7	R3.8	R3.9	R4.0	R4.1
	8.0	R4.1	R4.2	R4.3	R4.4	R4.5
	9.0	R4.5	R4.6	R4.7	R4.8	R4.9
	≥ 10.0	R4.9	R5.0	R5.1	R5.3	R5.4

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) Horizontal underslab insulation with an *R-value* of 1.2 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Table F.1.2.2V: Construction R-values for slab-floors with R1.0 vertical edge insulation and with R1.2 full cover underslab insulation, where the external walls do not have masonry veneer cladding

Paragraph F.1.2.2 v)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3] plus R1.2 full cover underslab insulation[4]	1.6	R1.4	R1.5	R1.6	R1.7	R1.7
	1.8	R1.6	R1.6	R1.7	R1.8	R1.8
	2.0	R1.7	R1.7	R1.8	R1.9	R1.9
	2.2	R1.7	R1.8	R1.9	R2.0	R2.0
	2.4	R1.8	R1.9	R2.0	R2.1	R2.1
	2.6	R1.9	R2.0	R2.1	R2.2	R2.2
	2.8	R2.0	R2.1	R2.1	R2.2	R2.3
	3.0	R2.1	R2.2	R2.2	R2.3	R2.4
	3.2	R2.2	R2.3	R2.3	R2.4	R2.5
	3.4	R2.3	R2.3	R2.4	R2.5	R2.6
	3.6	R2.4	R2.4	R2.5	R2.6	R2.7
	3.8	R2.4	R2.5	R2.6	R2.7	R2.7
	4.0	R2.5	R2.6	R2.7	R2.8	R2.8
	5.0	R2.9	R3.0	R3.1	R3.2	R3.2
	6.0	R3.3	R3.4	R3.5	R3.6	R3.7
	7.0	R3.7	R3.8	R3.9	R4.0	R4.1
	8.0	R4.1	R4.2	R4.3	R4.4	R4.5
	9.0	R4.5	R4.6	R4.7	R4.9	R5.0
	≥ 10.0	R4.9	R5.0	R5.2	R5.3	R5.4

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) Horizontal underslab insulation with an *R-value* of 1.2 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Table F.1.2.2W: **Construction R-values for slab-floors with R1.0 vertical edge insulation and with R2.4 full cover underslab insulation, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 w)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3] plus R2.4 full cover underslab insulation[4]	1.6	R1.7	R1.8	R1.9	R2.1	R2.2
	1.8	R1.8	R2.0	R2.1	R2.2	R2.3
	2.0	R2.0	R2.1	R2.2	R2.3	R2.4
	2.2	R2.1	R2.2	R2.3	R2.5	R2.6
	2.4	R2.2	R2.3	R2.4	R2.6	R2.7
	2.6	R2.3	R2.4	R2.5	R2.7	R2.8
	2.8	R2.4	R2.5	R2.7	R2.8	R2.9
	3.0	R2.5	R2.6	R2.8	R2.9	R3.0
	3.2	R2.6	R2.7	R2.9	R3.0	R3.1
	3.4	R2.7	R2.8	R3.0	R3.1	R3.2
	3.6	R2.8	R2.9	R3.1	R3.2	R3.3
	3.8	R2.9	R3.0	R3.1	R3.3	R3.4
	4.0	R3.0	R3.1	R3.2	R3.4	R3.5
	5.0	R3.4	R3.6	R3.7	R3.9	R4.0
	6.0	R3.9	R4.0	R4.1	R4.3	R4.4
	7.0	R4.3	R4.5	R4.6	R4.8	R4.9
	8.0	R4.7	R4.9	R5.0	R5.2	R5.3
	9.0	R5.2	R5.3	R5.5	R5.7	R5.8
	≥ 10.0	R5.6	R5.8	R5.9	R6.1	R6.3

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) Horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Table F.1.2.2X: **Construction R-values for slab-floors with R1.0 vertical edge insulation and with R2.4 full cover underslab insulation, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 x)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3] plus R2.4 full cover underslab insulation[4]	1.6	R1.7	R1.8	R1.9	R2.0	R2.1
	1.8	R1.8	R1.9	R2.0	R2.2	R2.3
	2.0	R1.9	R2.0	R2.1	R2.3	R2.4
	2.2	R2.1	R2.2	R2.3	R2.4	R2.5
	2.4	R2.2	R2.3	R2.4	R2.6	R2.7
	2.6	R2.3	R2.4	R2.5	R2.7	R2.8
	2.8	R2.4	R2.5	R2.6	R2.8	R2.9
	3.0	R2.5	R2.6	R2.7	R2.9	R3.0
	3.2	R2.6	R2.7	R2.8	R3.0	R3.1
	3.4	R2.7	R2.8	R2.9	R3.1	R3.2
	3.6	R2.8	R2.9	R3.0	R3.2	R3.3
	3.8	R2.9	R3.0	R3.1	R3.3	R3.4
	4.0	R3.0	R3.1	R3.2	R3.4	R3.5
	5.0	R3.4	R3.6	R3.7	R3.9	R4.0
	6.0	R3.9	R4.0	R4.1	R4.3	R4.4
	7.0	R4.3	R4.4	R4.6	R4.8	R4.9
	8.0	R4.7	R4.9	R5.0	R5.2	R5.4
	9.0	R5.2	R5.3	R5.5	R5.7	R5.8
	≥ 10.0	R5.6	R5.8	R5.9	R6.2	R6.3

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) Horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Preface

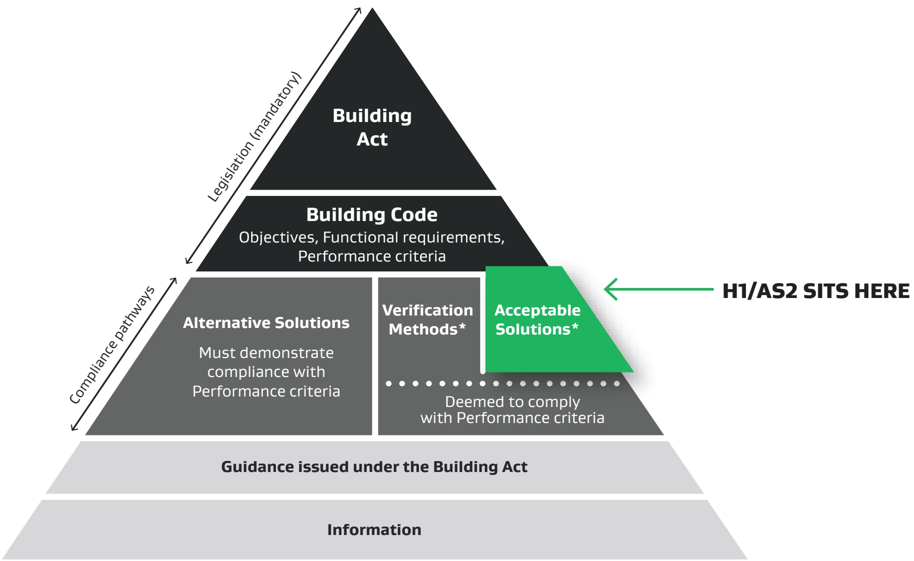
Document status

This document (H1/AS2 First Edition Amendment 1) is an acceptable solution issued under section 22 (1) of the Building Act 2004 and is effective on 4 August 2022. It does not apply to building consent applications submitted before 4 August 2022. The previous Acceptable Solution H1/AS2 First Edition (unamended) can be used to show compliance until 4 August 2022. The previous Acceptable Solution H1/AS1 Fourth Edition Amendment 4, can be used to show compliance until 2 November 2022 and can be used for building consent applications submitted before 3 November 2022.

Building Code regulatory system

Each acceptable solution outlines the provisions of the Building Code that it relates to. Complying with an acceptable solution or verification method is a way of complying with that part of the Building Code. Other options for establishing compliance are listed in section 19 of the Building Act.

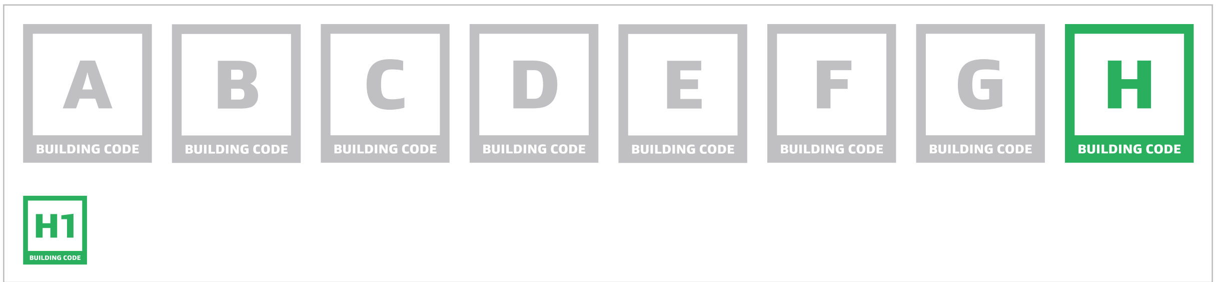
Schematic of the Building Code System



** may include cited standards and information*

A building design must take into account all parts of the Building Code. The Building Code is located in Schedule 1 of the Building Regulations 1992 and available online at www.legislation.govt.nz

The part of the Building Code that this acceptable solution relates to is clause H Energy Efficiency. Further information on the scope of this document is provided in the introduction on page 5.



Further information about the Building Code, the objectives, functional requirements and performance criteria provisions that it contains, and other acceptable solutions and verification methods are available at www.building.govt.nz

Main changes in this version

This is amendment 1 of the first edition of H1/AS2. However, prior to its release, similar requirements were previously found within H1/AS1. The main changes from H1/AS1 Fourth Edition Amendment 4 are:

- The scope of H1/AS1 has been reduced to cover only housing, and buildings other than housing less than 300 m². Requirements applicable to larger buildings have been combined into Acceptable Solution H1/AS2. To reflect the new scope of the documents and the new document layout, a new introduction and scope has been provided in Part 1. General.
- Buildings with curtain walling have been excluded from the scope of H1/AS2.
- Citations of NZS 4218: 2009 "Thermal insulation – Housing and small buildings" and NZS 4243.1: 2007 "Energy Efficiency – large buildings. Building thermal envelope" have been removed from the document. The relevant content from these standards has been adopted into H1/AS1 and H1/AS2 with permission from Standards New Zealand.
- The minimum R-values previously found in NZS 4218 and NZS 4243.1 have been replaced with new values and new text in Part 2. Building thermal envelope.
- The requirements for determining the thermal resistance and construction R-value of building elements have been revised to better reflect the thermal performance of windows, doors, skylights and slab-on-ground floors.
- Portions of text have been re-written to enhance clarity in the document and provide consistent language with other acceptable solutions and verification methods.
- References have been revised to include only documents within the scope of H1/AS2 and have been amended to include the most recent version of AS/NZS 4859.1 in Appendix A.
- Additional references have been added to include BS EN 673, ISO 10077-1 and ISO 10077-2, ISO 13370, and ISO 13789 in Appendix A.
- The definitions page has been revised to include all defined terms used in this document in Appendix B.
- The three-zone climate zone map previously found in NZS 4218 and NZS 4243.1 has been updated with a six-zone climate zone map in Appendix C.
- Requirements for establishing the orientation of a building have been added in Appendix D.
- A new procedure for calculating the construction R-value of windows, doors, and skylights has been added in Appendix E.
- Tables with construction R-values of selected slab-on-ground floor scenarios have been added to a new Appendix F.

The main changes from the unamended version of the first edition of H1/AS2 are:

- Throughout the document some obvious errors in the text, formatting and cross-references have been corrected, and minor text clarifications with minor to no impact have been made.

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 acceptable solution or verification method at any time. Up-to-date versions of acceptable solutions and verification methods are available from www.building.govt.nz

Features of this document

- For the purposes of Building Code compliance, the standards and documents referenced in this acceptable solution must be the editions, along with their specific amendments listed in Appendix A.
- Words in italic are defined at the end of this document in Appendix B.
- Hyperlinks are provided to cross-references within this document and to external websites and appear with a blue underline.
- Classified uses for *buildings*, as described in clause A1 of the Building Code, are printed in **bold** in this document. These are denoted with classified use icons for:

H **Housing**	Com **Commercial**	Out **Outbuildings**
CR **Communal residential**	Ind **Industrial**	Anc **Ancillary**
CN **Communal non-residential**		

- Appendices to this acceptable solution are part of, and have equal status to, the acceptable solution. Figures are informative only and the wording of the paragraphs takes precedence. Text boxes headed 'COMMENT' occur throughout this document and are for guidance purposes only.

Contents

Part 1. General

1.1 Introduction

1.1.1 Scope of this document

1.1.1.1 This document can be used for *buildings* other than **housing** with an area of *occupied space* greater than 300 m^2.

H 1.1.1.2 For all **housing**, and *buildings* other than **housing** with an *occupied space* less than 300 m^2, refer to the Acceptable Solution H1/AS1 or Verification Method H1/VM1 as a means to demonstrate compliance or use an alternative means to demonstrate compliance.

1.1.2 Items outside the scope of this document

1.1.2.1 This acceptable solution does not include the use of foil insulation.

Com 1.1.2.2 This acceptable solution does not apply to *buildings* with *curtain walling*. For these, use Verification Method H1/VM2 or use an alternative means to demonstrate compliance.

1.1.2.3 For **commercial** *buildings*, this acceptable solution does not include requirements to comply with clause H1.3.6 of the Building Code for the energy efficiency of *HVAC systems*. For this clause, use Verification Method H1/VM3 or use an alternative means to demonstrate compliance.

1.1.3 Compliance pathway

1.1.3.1 This acceptable solution is one option that provides a means of establishing compliance with the performance criteria in Building Code clauses H1.3.1, H1.3.3, H1.3.4 and H1.3.5.

1.1.3.2 Options for demonstrating compliance with H1 Energy Efficiency through the use of acceptable solutions and verification methods are summarised in Table 1.1.3.2. Compliance may also be demonstrated using an alternative solution.

1.2 Using this acceptable solution

1.2.1 Determining the classified use

1.2.1.1 Classified uses for *buildings* are described in clause A1 of the Building Code. Where a specific classified use is mentioned within a subheading and/or within the text of a paragraph, this requirement applies only to the specified classified use(s), and does not apply to other classified uses.

Ind 1.2.1.2 In *buildings* containing both **industrial** and other classified uses, the non-industrial portion shall be treated separately according to its classified use. For example, in a *building* containing both **industrial** and **commercial** classified uses, the **commercial** area shall meet the relevant energy efficiency requirements of the Building Code.

General

TABLE 1.1.3.2: Demonstrating compliance with H1 Energy Efficiency through acceptable solutions and verification methods

Paragraph 1.1.3.2

Performance clause	Applies to	Relevant acceptable solutions and verification methods
H1.3.1 (a) and (b) *Thermal Envelope*	H **Housing** CR **Communal residential** CN **Communal non-residential** (assembly care only) Com **Commercial**	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 or H1/VM1 For large *buildings*: H1/AS2 or H1/VM2
H1.3.2E *Building performance index*	H **Housing**	H1/AS1 or H1/VM1
H1.3.3 (a) to (f) Physical conditions	All *buildings*	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 or H1/VM1 For large *buildings*: H1/AS2 or H1/VM2
H1.3.4 (a) Heating of hot water	All *buildings*	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 For large *buildings*: H1/AS2
H1.3.4 (b) Storage vessels and distribution systems	Individual storage vessels ≤ 700 L in capacity and distribution systems	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 For large *buildings*: H1/AS2
H1.3.4 (c) Efficient use of hot water	H **Housing**	H1/AS1
H1.3.5 Artificial lighting	Lighting not provided solely to meet the requirements of Building Code clause F6 in: Com CN **Commercial** and **Communal non-residential** having *occupied space* greater than 300 m^2	H1/AS2
H.1.3.6 *HVAC systems*	Com **Commercial**	H1/VM3

Part 2. Building thermal envelope

2.1 Thermal resistance

2.1.1 Demonstrating compliance

CR CN Com

2.1.1.1 For **communal residential**, **communal non-residential** assembly care, and **commercial** *buildings,* the *building envelope* shall be provided with *construction* that provides *adequate thermal resistance.* The minimum required *construction R-values* shall be determined through the use of:

a) the Schedule method in Subsection 2.1.2, or

b) the Calculation method in Subsection 2.1.3, or

c) the Modelling method in H1/VM2.

2.1.1.2 For mixed-use *buildings* that include **housing**, the H1/AS1 Subsection 2.1.2 “Schedule Method”, or H1/AS1 Subsection 2.1.3 “Calculation Method” shall be used for the parts of the *building* containing **housing**. For the other parts of the *building*, the methods in Paragraph 2.1.1.1 can be used.

> i
>
> COMMENT: To satisfy the Building Code performance requirement E3.3.1 for internal moisture, it may be necessary, depending on the method adopted, to provide more insulation (a greater *R-value*) than that required to satisfy energy efficiency provisions alone.

2.1.1.3 The requirements for the Schedule method and Calculation method are separated based on the relevant climate zone for the *building*. A list of the New Zealand climate zones is provided in Appendix C.

2.1.1.4 For *building elements* with embedded heating systems, the minimum *construction R-values* shall be determined through the Schedule method. These apply whenever *building elements* that are part of the *thermal envelope* include heating systems and may not be reduced by applying the Calculation method in Subsection 2.1.3.

2.1.1.5 The *construction R-values* of individual *building elements* shall be determined in accordance with Subsection 2.1.4.

2.1.1.6 Insulation materials shall be installed in a way that achieves the intended thermal performance in *buildings* without compromising the durability and safety of insulation or *building elements* and the health and safety of installers and *building* occupants. Gaps, tucks, folds, and over compaction of insulation material shall be avoided.

2.1.2 Schedule method

2.1.2.1 The schedule method shall only be used for *buildings* where the sum of the *window area* and *door area* is less than or equal to 50% of the *total wall area*. Otherwise the Calculation method in Subsection 2.1.3 or the Modelling method in H1/VM2 shall be used.

2.1.2.2 *Building elements* that are part of the *thermal envelope* shall have minimum *construction R-values* no less than:

a) For *building elements* that contain embedded heating systems, those in Table 2.1.2.2A; or

b) For *building elements* that do not contain embedded heating systems, Table 2.1.2.2B.

TABLE 2.1.2.2A: Minimum construction R-values for heated roofs, walls or floors

Paragraph 2.1.2.2 a)

Building element	Construction R-values ($m^2 \cdot K/W$)[(1),(2),(3)]					
	Climate zone 1	Climate zone 2	Climate zone 3	Climate zone 4	Climate zone 5	Climate zone 6
Heated roof[(4)]	R6.6	R6.6	R6.6	R6.6	R6.6	R7.0
Heated wall	R2.9	R2.9	R3.0	R3.2	R3.4	R3.6
Heated floor	R2.9	R2.9	R2.9	R3.0	R3.2	R3.4

Notes:

(1) R_{IN}/R-value < 0.1 and R_{IN} is the *thermal resistance* between the heated plane and the inside air.

(2) Floor coverings, for example carpet or cork, will reduce the efficiency of the *heated floor*.

(3) Climate zone boundaries are shown in Appendix C.

(4) In *roofs* with a *roof space*, where the insulation is installed over a horizontal ceiling, the *roof R-value* may be reduced to R3.3 for a distance of up to 500 mm from the outer edge of the ceiling perimeter where space restrictions do not allow full-thickness insulation to be installed.

TABLE 2.1.2.2B: Minimum construction R-values for building elements that do not contain embedded heating systems

Paragraphs 2.1.2.2 b), 2.1.3.11

Building element	Construction R-values ($m^2 \cdot K/W$)[(1)]					
	Climate zone 1	Climate zone 2	Climate zone 3	Climate zone 4	Climate zone 5	Climate zone 6
Roof	R3.5	R4.0	R5.0	R5.4	R6.0	R7.0
Wall	R2.2	R2.4	R2.7	R3.0	R3.0	R3.2
Floor	R2.2	R2.2	R2.2	R2.4	R2.5	R2.6
Windows and doors	R0.33	R0.33	R0.37	R0.37	R0.40	R0.42
Skylights	R0.42	R0.42	R0.46	R0.46	R0.49	R0.51

Notes:

(1) Climate zone boundaries are shown in Appendix C.

(2) In *roofs* with a *roof space*, where the insulation is installed over a horizontal ceiling, the *roof R-value* may be reduced to R3.3 for a distance of up to 500 mm from the outer edge of the ceiling perimeter where space restrictions do not allow full-thickness insulation to be installed.

2.1.3 Calculation method

2.1.3.1 This method allows for increased flexibility in proposed wall *construction* such as more than one type of wall *construction*, a mix of window types, a range of *thermal resistances*, any *window area* and *door area*, or a combination of these. This method does not allow reducing the *thermal resistances* of the *roof*, floor and *skylights* of the proposed *building*.

2.1.3.2 The calculation method shall only be used where the proposed *solar aperture (V)* is less than or equal to 0.5 as given by Equation 1:

Equation 1: $$V = \frac{\sum SC_{glazing} A_{glazing}}{A_{totalwall}}$$

where:

V is the *solar aperture*, and

$SC_{glazing}$ is the *shading coefficient, and*

$A_{glazing}$ is the *glazing area* (m^2), and

$A_{totalwall}$ is the *total wall area* (m^2).

2.1.3.3 The thermal performance of the proposed *building* wall, as defined by the total wall *thermal resistance* (R_{total}), shall be at least equal to the reference *building* wall.

2.1.3.4 *Building elements* that form part of the *thermal envelope* with *construction R-values* and conditions different from those given in the Schedule method in Subsection 2.1.2 may be used providing the heat loss of the proposed *building* is less than or equal to the heat loss of the reference *building* for the relevant climate zone as per Equation 2.

Equation 2: $HL_{Proposed} \leq HL_{Reference}$

where:

$HL_{Proposed}$ is the heat loss of the proposed total wall (W/K), and

$HL_{Reference}$ is the heat loss of the reference total wall (W/K).

2.1.3.5 $HL_{Reference}$ shall be calculated from Equation 4b in Paragraph 2.1.3.8 using the *thermal resistance* and conditions from Subsection 2.1.2 as appropriate.

2.1.3.6 $HL_{Proposed}$ shall be calculated from Equation 4a in Paragraph 2.1.3.8 using the actual proposed areas and *R-values* from Paragraph 2.1.3.8.

2.1.3.7 The reference *building wall area*, *window area*, and *door area* shall be determined using Equation 3.

Equation 3:

If ($A_{window,proposed} + A_{door,proposed}$) $\leq A_{wall,proposed}$ then:

$$A_{wall,reference} = A_{wall,proposed}$$

$$A_{window,reference} = A_{window,proposed}$$

$$A_{door,reference} = A_{door,proposed}$$

Otherwise,

$$A_{wall,reference} = \tfrac{1}{2} A_{totalwall,proposed}$$

$$A_{window,reference} + A_{door,reference} = \tfrac{1}{2} A_{totalwall,proposed}$$

where:

$A_{wall,reference}$ is the *wall area* (m^2) of the reference *building*, and

$A_{wall,proposed}$ is the *wall area* (m^2) of the proposed *building*, and

$A_{window,reference}$ is the *window area* (m^2) of the reference *building*, and

$A_{window,proposed}$ is the *window area* (m^2) of the proposed *building*, and

$A_{door,reference}$ is the *door area* (m^2) of the reference *building*, and

$A_{door,proposed}$ is the *door area* (m^2) of the proposed *building*, and

$A_{totalwall,proposed}$ is the total *wall area* (m^2) of the proposed *building*.

2.1.3.8 The heat flow (HL) through the *thermal envelope* shall be determined using:

a) For the proposed *building*, Equation 4a, and

b) For the reference *building*, Equation 4b.

Equation 4a: $$HL_{proposed} = \frac{A_{wall,proposed}}{R_{wall,proposed}} + \frac{A_{window,proposed}}{R_{window,proposed}} + \frac{A_{door,proposed}}{R_{door,proposed}}$$

Equation 4b: $$HL_{reference} = \frac{A_{wall,reference}}{R_{wall,reference}} + \frac{A_{window,reference} + A_{door,reference}}{R_{window,reference}}$$

where:

$HL_{proposed}$ is the heat loss of the total wall (W/K) of the proposed *building*, and

$A_{wall,proposed}$ is the *wall area* (m^2) of the proposed *building*, and

$A_{window,proposed}$ is the *window area* (m^2) of the proposed *building*, and

$A_{door,proposed}$ is the *door area* (m^2) of the proposed *building*, and

$R_{wall,proposed}$, $R_{window,proposed}$ and $R_{door,proposed}$ are the *R-values* ($m^2 \cdot K/W$) of the corresponding *thermal envelope* components for the proposed *building*, and

$HL_{reference}$ is the heat loss of the total wall (W/K) of the reference building, and

$A_{wall,reference}$ is the *wall area* (m^2) of the reference *building*, and

$A_{window,reference} + A_{door,reference}$ is the sum of the *window area* (m^2) and *door area* (m^2) of the reference *building*, and

$R_{wall,reference}$ and $R_{window,reference}$ are the *R-values* ($m^2 \cdot K/W$) of the corresponding *thermal envelope* components for the reference *building*.

2.1.3.9 The *total wall area* used shall be the same for both the proposed and reference *building*.

2.1.3.10 Where a *building thermal envelope* component is proposed to have two or more methods of *construction* with different *thermal resistances*, the corresponding term in the proposed *building* thermal characteristic shall be expanded to suit. For example:

$$\frac{A_{wall}}{R_{wall}} \text{ becomes } \frac{A_{wall(1)}}{R_{wall(1)}} + \frac{A_{wall(2)}}{R_{wall(2)}}$$

2.1.3.11 The *roof*, floor, and *skylights* that are part of the proposed *building thermal envelope* shall have minimum *construction R-values* no less than:

a) For *building elements* that contain embedded heating systems, those in Table 2.1.2.2A; or

b) For *building elements* that do not contain embedded heating systems, Table 2.1.2.2B.

2.1.4 Determining the thermal resistance of building elements

2.1.4.1 Acceptable methods for determining the *thermal resistance (R-values)* of *building elements* are:

a) For walls, *roofs*, and floors other than *slab-on-ground floors*, contained in NZS 4214; and

b) For windows, doors, and *skylights*, specified in Appendix E; and

c) For *slab-on-ground floors*, specified in Appendix F.

COMMENT: The BRANZ House Insulation Guide provides *thermal resistances* of common *building* components and is based on calculations from NZS 4214. However, the BRANZ House Insulation Guide, 5th edition or earlier, should not be used for determining the *thermal resistances* of *slab-on-ground floors*, windows and doors due to differences in calculation methods and assumptions compared to Appendix E and Appendix F.

2.1.4.2 The *thermal resistance (R-values)* of insulation materials may be verified by using AS/NZS 4859.1.

2.1.4.3 The *construction R-values* of *building elements* shall be calculated as follows:

a) For walls and *roofs*, the *R-value* is of a typical area of the *building element*; and

b) For framed walls, the *R-value* shall include the effects of studs, dwangs, top plates and bottom plates, but may exclude the effects of lintels, sills, additional studs that support lintels and sills, and additional studs at corners and junctions; and

c) For walls without frames, the *R-value* excludes any attachment requirements for windows and doors; and

d) For windows, doors and *skylights*, as specified in Appendix E; and

e) For *slab-on-ground floors*, the *R-value* is as specified in Appendix F; and

f) For floors other than *slab-on-ground floors*, the *R-value* is of a typical area of the floor ignoring the effect of floor coverings (including carpets).

2.1.4.4 The *R-value* of an unconditioned air-space between the *thermal envelope* and the *building envelope* may be included in the *construction R-value*. This can include a subfloor, *roof* space, garage, and/or conservatory.

i

COMMENT: Garages should form part of the *unconditioned space* of a *building*, that is, they should be outside the *thermal envelope*. Any *building elements* between attached garages and the *conditioned spaces* of a *building* form part of the *thermal envelope* and should therefore be insulated.

2.2 Airflow

2.2.1 Control of airflow

CR CN Com

2.2.1.1 **Communal residential**, **communal non-residential** assembly care, and **commercial** *buildings* shall have windows, doors, vents or other *building elements* that allow significant movement of air, to be *constructed* in such a way that they are capable of being fixed in the closed position.

i

COMMENT:
1. G4/AS1 provides for the supply of outdoor air for ventilation by way of windows and doors that can be fixed in the open position.
2. Measures should be taken to limit the amount of moisture that can migrate from *occupied spaces* into the *roof* or *roof* space. This includes limiting the air permeability of ceilings, including through ceiling linings and penetrations such as recessed luminaires, electrical and plumbing services, and ceiling access hatches.

2.3 Solar heat gains

2.3.1 Control of solar heat gains

2.3.1.1 Requirements to account for heat gains from solar radiation are satisfied by complying with the requirements for *thermal resistance* in Section 2.1.

i

COMMENT: Passive measures to prevent overheating from excessive solar heat gains through the *building envelope* should be taken to reduce dependence on active cooling systems. Such measures should include a combination of:

› Providing *adequate thermal resistance* to the *thermal envelope* of the *building*; and
› Avoiding excessive *window areas* (particularly on the east, north and west-facing facades); and
› Avoiding excessive *skylight areas*; and
› Selecting glass types with appropriate *solar heat gain coefficients (SHGC)*; and
› Providing external shading for windows and *skylights*; and
› Providing the ability to ventilate the *building* at a sufficient rate to maintain comfortable indoor temperatures in summer.

Part 3. Building services

3.1 Hot water systems

3.1.1 Hot water systems for sanitary fixtures and sanitary appliances

3.1.1.1 Hot water systems for *sanitary fixtures* and *sanitary appliances* having a storage water heater capacity of up to 700 litres shall comply with NZS 4305.

COMMENT:

1. NZS 4305 deals with domestic type electrical and gas systems having a storage water heater capacity of up to 700 litres. Larger systems and their associated piping are not controlled by the Building Code.
2. The manufacture and sale of hot water cylinders and gas water heaters are covered by the Energy Efficiency (Energy Using Products) Regulations 2002. The associated NZ Minimum Energy Performance Standards for electric storage water heaters (MEPS as defined in NZS 4606.1 and the relevant NZ section of AS/NZS 4692.2) are equivalent to the requirements in this acceptable solution (see NZS 4305 clause 2.1.1). Electric storage water heaters that do not comply with NZ MEPS do not comply with this acceptable solution.

3.2 Artificial lighting

3.2.1 Communal Non-residential and Commercial Buildings

CN Com 3.2.1.1 Artificial lighting energy consumption in **communal non-residential** and **commercial** *buildings* having *occupied space* greater than 300 m^2 shall comply with NZS 4243.2 section 3.3.

Appendix A. References

For the purposes of Building Code compliance, the standards and documents referenced in this acceptable solution must be the editions, along with their specific amendments, listed below.

Standards New Zealand		Where quoted
NZS 4214: 2006	Methods of determining the total thermal resistance of parts of buildings	2.1.4.1, Definitions
NZS 4243:-	Energy efficiency – large buildings	
Part 2: 2007	Lighting Amend 1	3.2.1.1
NZS 4305: 1996	Energy efficiency – domestic type hot water systems	3.1.1.1
NZS 4606:-	Storage water heaters	
Part 1: 1989	General requirements	3.1.1.1 Comment
AS/NZS 4692:-	Electric water heaters	
Part 2: 2005	Minimum Energy Performance Standards (MEPS) requirements and energy labelling	3.1.1.1 Comment
AS/NZS 4859:-	Thermal insulation materials for buildings	
Part 1: 2018	General criteria and technical provisions	2.1.4.2
British Standards Institute		
BS EN 673: 2011	Glass in building – Determination of thermal transmittance (U value) – Calculation method	E.1.2.2 a), E.1.2.4 a), E.2.1.2 a)
International Organization for Standardization		
ISO 10077:-	Thermal performance of windows, doors and shutters - Calculation of thermal transmittance	
Part 1: 2017	General	E.1.2.2, E.1.2.4, Equation 3, E.2.1.2
Part 2: 2017	Numerical method for frames	E.1.2.2, E.1.2.4, Equation 3, E.2.1.2
ISO 13370: 2017	Thermal performance of buildings – Heat transfer via the ground – Calculation methods	F.1.2.2 Comment
ISO 13789: 2017	Thermal performance of buildings – Transmission and ventilation heat transfer coefficients – Calculation method	Equation F.1

These standards can be accessed from www.standards.govt.nz.

References

BRANZ Ltd.

BRANZ House Insulation Guide (5th Edition), 1 July 2014 — 2.1.4.1 Comment, F.1.1.1 Comment

Cox-Smith, I. (2016). Perimeter insulation of concrete slab foundations. Study Report SR352, BRANZ Ltd, Judgeford, New Zealand. — F.1.2.2 Comment

These documents can be accessed from www.branz.co.nz.

New Zealand Legislation

Energy Efficiency (Energy Using Products) Regulations 2002 — 3.1.1.1 Comment

This document can be accessed from www.legislation.govt.nz

Appendix B. Definitions

These definitions are specific to this acceptable solution. Other defined terms found in italics within the definitions are provided in clause A2 of the Building Code.

Adequate	Means *adequate* to achieve the objectives of the Building Code.
Building	Has the meaning given to it by sections 8 and 9 of the Building Act 2004.
Building element	Any structural or non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.
Building envelope	The *building thermal envelope* plus the exterior surface of any spaces not requiring conditioning, e.g. garage, floor space (below insulating layer), *roof* space (above any outer surface defining an attic or when there is no attic above the insulating layer).
Conditioned space	That part of a *building* within the *building thermal envelope* that may be directly or indirectly heated or cooled for occupant comfort. It is separated from *unconditioned space* by *building elements* (walls, windows, *skylights*, doors, *roof*, and floor) to limit uncontrolled airflow and heat loss.
Construct	In relation to a *building*, includes to design, build, erect, prefabricate, and relocate the *building*; and *construction* has a corresponding meaning.
Construction R-value	The *total thermal resistance (R-value)* of a typical area of a *building element*.
Curtain walling	Part of the *building envelope* made of a framework usually consisting of horizontal and vertical profiles, connected together and anchored to the supporting structure of the *building*, and containing fixed and/or openable infills, which provides all the required functions of an internal or *external wall* or part thereof, but does not contribute to the load bearing or the stability of the structure of the *building*.
Door area (A_{door})	The total area of doors in the *thermal envelope*, including frames and opening tolerances, and including any opaque panels, glazing, decorative glazing and louvres.
External wall	Any vertical exterior face of a *building* consisting of primary and/or secondary elements intended to provide protection against the outdoor environment
Glazing Area ($A_{glazing}$)	The total area of vertical windows and doors that include glazing in the *thermal envelope* including transparent or translucent glazing, frames and opening tolerances, decorative glazing, and louvres. This excludes opaque panels, opaque doors, and *skylights*.
Habitable space	A space used for activities normally associated with domestic living, but excludes any bathroom, laundry, water-closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods.
Heated roof, wall, or floor	Any *roof*, *wall*, or floor incorporating embedded pipes, electrical cables, or similar means of raising the temperature of the *roof*, wall, or floor for room heating.
HVAC system	For the purposes of performance H1.3.6 and in relation to a *building*, means a mechanical, electrical, or other system for modifying air temperature, modifying air humidity, providing ventilation, or doing all or any of those things, in a space within the *building*.
Insulating glazing unit (IGU)	Two or more panes of glass spaced apart and factory sealed with dry air or special gases in the unit cavity. (Often abbreviated to IGU or referred to as the unit or double glazing).

Definitions

Intended use	In relation to a *building*, — a) includes any or all of the following: i) any reasonably foreseeable occasional use that is not incompatible with the intended use; ii) normal maintenance; iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but b) does not include any other maintenance and repairs or rebuilding.
Occupied space	Any space within a *building* in which a person will be present from time to time during the *intended use* of the *building*
Persons	Includes— a) the Crown; and b) a corporation sole; and c) a body of *persons* (whether corporate or unincorporated).
R-value	The common abbreviation for describing the values of both *thermal resistance* and *total thermal resistance*.
Roof	Any *roof*-ceiling combination where the exterior surface of the *building* is at an angle of 60° or less to the horizontal and has its upper surface exposed to the outside.
Roof area (A_{roof})	The area of the *roof* that is part of the *thermal envelope*, excluding the *skylight area*.
Sanitary appliance	An appliance which is intended to be used for *sanitation*, but which is not a *sanitary fixture*. Included are machines for washing dishes and clothes.
Sanitary fixture	Any *fixture* which is intended to be used for *sanitation.*
Sanitation	The term used to describe the activities of washing and/or excretion carried out in a manner or condition such that the effect on health is minimised, with regard to dirt and infection
Shading coefficient (SC)	The ratio of the total *solar heat gain coefficient* (SHGC) through a particular glass compared to the total *solar heat gain coefficient* through 3 mm clear float glass.
Slab-on-ground floors	Floor *construction* consisting of a concrete slab or concrete raft foundation in contact with the ground over its whole area.
Skylight	Translucent or transparent parts of the *roof*, including frames and glazing.
Skylight area ($A_{skylight}$)	The area of *skylights* that are part of the *roof thermal envelope*, including frames and opening tolerances.
Solar aperture (V)	The fraction of total solar radiation received on the vertical *wall* (opaque and glazed) that actually enters the perimeter space being considered.
Solar heat gain coefficient (SHGC)	The total solar energy entering a *building* through the glazing, that is, the direct transmission of energy from the sun plus the inwards re-radiation of heat from solar radiation that is absorbed in the glass. The SHGC is also known as the solar factor (SF) or g (glazing factor).
Surface (of glass)	The glass surfaces of single glazing and double glazing are numbered from the outside to the inside. The outside face of the outer pane is surface one, the inside face of the outer pane is surface two. In single glazing there are only two surfaces. With double glazing the outer surface of the inner pane is surface three, and the inner surface of the inner pane is surface four.
Thermal envelope	The *roof*, wall, window, *skylight*, door and floor *construction* between *unconditioned spaces* and *conditioned spaces*.
Thermal envelope floor area (A_{floor})	The area of the floor that forms part of the *thermal envelope*.

Definitions

Thermal resistance	The resistance to heat flow of a given component of a *building element*. It is equal to the air temperature difference (K) needed to produce unit heat flux (W/m^2) through unit area (m^2) under steady conditions. The units are m^2·K/W.
Total roof area	The *roof* area (A_{roof}) plus the *skylight area* ($A_{skylight}$)
Total thermal resistance	The overall air-to-air *thermal resistance* across all components of a *building element* such as a wall, *roof* or floor. (This includes the surface resistances which may vary with environmental changes e.g. temperature and humidity, but for most purposes can be regarded as having standard values as given in NZS 4214.)
Total wall area	In relation to a *building,* means the sum (expressed in square metres) of the following: a) the *wall area* of the *building*; and b) the area (expressed in square metres) of all vertical windows and doors in *external walls* of the *building.*
Unconditioned space	Space within the *building envelope* that is not *conditioned space* (for example, this may include a garage, conservatory, atrium, attic, subfloor, and so on). However, where a garage, conservatory or atrium is expected to be heated or cooled these spaces shall be included in the *conditioned space*.
Wall area	The area of walls that are part of the *thermal envelope*, excluding the *door area* and the *window area*.
Window area (A_{window})	The total area of windows in the *thermal envelope*, including transparent or translucent glazing, frames and opening tolerances and decorative glazing and louvres, but excluding glazing in doors and *skylights*.

Appendix C. New Zealand climate zones

C.1 Climate zones

C.1.1 Climate zone boundaries

C.1.1.1 There are six climate zones. These climate zone boundaries are based on climatic data taking into consideration territorial authority boundaries.

C.1.1.2 A list of the climate zones for each territorial authority is provided in Table C.1.1.2 and illustrated in Figure C.1.1.2. The list in the table takes precedence over the figure.

TABLE C.1.1.2: Climate zones by territorial authority
Paragraph C.1.1.2

North Island/Te Ika-a-Māui	
Territorial authority	**Climate zone**
Far North District	1
Whangarei District	1
Kaipara District	1
Auckland	1
Thames-Coromandel district	1
Hauraki District	2
Waikato District	2
Matamata-Piako District	2
Hamilton City	2
Waipa District	2
Ōtorohanga District	2
South Waikato District	2
Waitomo District	2
Taupo District	4
Western Bay of Plenty District	1
Tauranga City	1
Rotorua District	4
Whakatane District	1
Kawerau District	1
Ōpōtiki District	1
Gisborne District	2
Wairoa District	2
Hastings District	2
Napier City	2
Central Hawke's Bay District	2
New Plymouth District	2
Stratford District	2
South Taranaki District	2
Ruapehu District	4
Whanganui District	2
Rangitikei District (north of 39°50'S (-39.83))	4
Rangitikei District (south of 39°50'S (-39.83))	3
Manawatu District	3
Palmerston North City	3
Tararua District	4
Horowhenua District	3
Kapiti Coast District	3
Porirua City	3
Upper Hutt City	4
Lower Hutt City	3
Wellington City	3
Masterton District	4
Carterton District	4
South Wairarapa District	4

South Island/Te Waipounamu	
Territorial authority	**Climate zone**
Tasman District	3
Nelson City	3
Marlborough District	3
Kaikoura District	3
Buller District	4
Grey District	4
Westland District	4
Hurunui District	5
Waimakariri District	5
Christchurch City	5
Selwyn District	5
Ashburton District	5
Timaru District	5
Mackenzie District	6
Waimate District	5
Chatham Islands	3
Waitaki District (true left of the Otekaieke river)	6
Waitaki District (true right of the Otekaieke river)	5
Central Otago District	6
Queenstown-Lakes District	6
Dunedin City	5
Clutha District	5
Southland District	6
Gore District	6
Invercargill City	6

Appendix D. Orientation

D.1 Orientation

D.1.1 Establishing building orientation

D.1.1.1 A *building* wall, including the windows it contains, shall be considered to face north if it faces any direction in the north orientation sector of Figure D.1.2.1.

D.1.1.2 The orientations of *skylights* and other walls, including the windows they contain, shall be determined in a similar way.

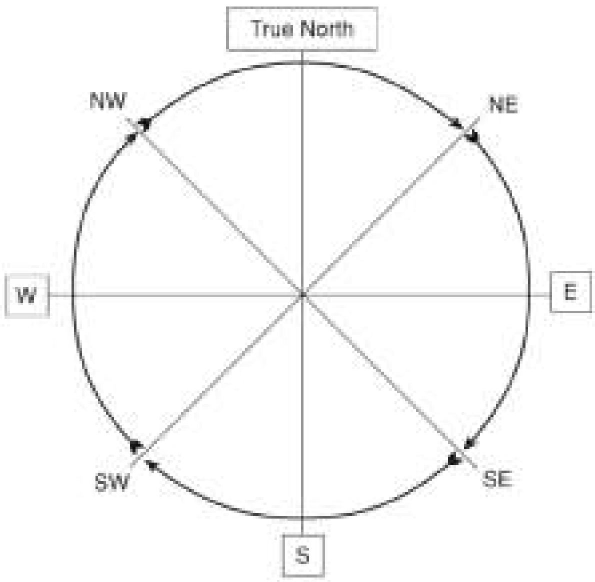
D.1.2 Description of sectors

D.1.2.1 Orientation sectors are based on true north and are as follows (see Figure D.1.2.1):

a) North sector lies between north west (more than 315°) and north east (less than 45°); and
b) East sector lies between north east (45°) and south east (135°); and
c) South sector lies between south east (more than 135°) and south west (less than 225°); and
d) West sector lies between south west (225°) and north west (315°).

FIGURE D.1.2.1: Orientation sector map

Paragraphs D.1.1.1, D.1.2.1



COMMENT: A compass points toward magnetic north. Magnetic north varies from true north by 21° in Auckland, 24° in Wellington and 24° in Christchurch. In New Zealand magnetic north is always east of true north. It is important that true north is used for the orientation rather than magnetic north. The following website calculates the difference between magnetic north and true north (magnetic declination) www.gns.cri.nz/Home/Our-Science/Land-and-Marine-Geoscience/Earth-s-Magnetic-Field/Declination-around-New-Zealand.

Appendix E. Windows, doors, and skylights

E.1 Vertical windows and doors

E.1.1 Methods for determining construction R-values

E.1.1.1 The *construction R-values* for vertical windows and doors shall be determined using one of the following methods:

a) Calculation of the *construction R-value* of each individual window and door that is part of the *thermal envelope*, in accordance with Section E.1.2; or

b) Calculation of the representative *construction R-value* of all windows and doors that are part of the *thermal envelope* of the proposed *building*, which is then deemed to apply to all windows and doors of the proposed *building*, in accordance with Section E.1.3.

> COMMENT: The window size and frame material have a major impact on the *construction R-value* of a window as a *building element*. Often the *thermal resistances* of the glazing and the frames are dissimilar. For large windows, the *thermal resistance* of the glazing will have more impact on the overall window *construction R-value* than in a small window, which is dominated by the frame performance. This means that the *construction R-values* of two differently-sized windows consisting of identical frame and glazing materials will usually be dissimilar.

E.1.2 Calculation of the construction R-value of each individual window and door that is part of the thermal envelope

E.1.2.1 For each window that is part of the *thermal envelope* of the proposed *building*, the window *construction R-value* (R_W) shall be calculated in accordance with Equation E.1. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.1: $$R_w = \frac{1}{U_w}$$

where:
R_W is the *construction R-value* of the window ($m^2 \cdot K/W$); and
U_W is the thermal transmittance of the window ($W/(m^2 \cdot K)$), determined in accordance with Paragraph E.1.2.2.

E.1.2.2 The thermal transmittance (U_W) of each vertical window that is part of the *thermal envelope* of the proposed *building* shall be determined in accordance with ISO 10077-1, with:

a) The thermal transmittance of the glazing (U_g) determined using BS EN 673; and

b) The thermal transmittance of the frame (U_f) determined using ISO 10077-2. For frames with special extensions overlapping the wall or other *building elements*, such as frames with flanges to the cladding, the following deviations from ISO 10077-2 Section 6.3.1, are permitted:

   i) Special extensions may be disregarded or included in the calculation model, but shall be disregarded when determining the projected width of the frame section (b_f) as per ISO 10077-2: 2017 Appendix F; and

   ii) Window reveal liners that are integral with the window unit may either be disregarded or included in the calculation model.

E.1.2.3 For each door that is part of the *thermal envelope* of the proposed *building*, the door *construction R-value* (R_D) shall be calculated in accordance with Equation E.2. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.2: $$R_D = \frac{1}{U_D}$$

where:
R_D is the *construction R-value* of the door (m²·K/W); and
U_D is the thermal transmittance of the door (W/(m²·K)), determined in accordance with Paragraph E.1.2.4.

COMMENT: The door *construction R-value* (R_D) includes the effects of the frame, any glazing and any opaque panels.

E.1.2.4 The thermal transmittance (U_D) of each door that is part of the *thermal envelope* of the proposed *building* shall be determined in accordance with ISO 10077-1, with:

a) the thermal transmittance of any glazing (U_g) determined using BS EN 673; and

b) the thermal transmittance of the frame (U_f) determined using ISO 10077-2. For frames with special extensions overlapping the wall or other *building elements*, such as frames with flanges to the cladding, deviating from ISO 10077-2 Section 6.3.1, the special extensions may either be disregarded or included in the calculation model, but shall be disregarded when determining the projected width of the frame section (b_f) as per ISO 10077-2: 2017 Appendix F. Door reveal liners that are integral with the door unit may either be disregarded or included in the calculation model.

E.1.3 Calculation of the representative construction R-value of all windows and doors that are part of the thermal envelope

E.1.3.1 The representative window and door *construction R-value* (R_{WD}) shall be calculated in accordance with Equation E.3. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.3: $$R_{WD}=\frac{\Sigma A_w + \Sigma A_D}{\Sigma\frac{A_w}{R_w} + \Sigma\frac{A_D}{R_D}}$$

where:

R_W is the *construction R-value* of each vertical window that is part of the *thermal envelope* of the proposed *building* (m²·K/W), calculated in accordance with Section E.1.2.1; and
A_W is the *window area* of each vertical window that is part of the *thermal envelope* of the proposed *building* (m²), calculated in accordance with ISO 10077-1 Section 6.3.1; and
R_D is the *construction R-value* of each door that is part of the *thermal envelope* of the proposed *building* (m²·K/W), calculated in accordance with Section E.1.2.3; and
A_D is the *door area* of each door that is part of the *thermal envelope* of the proposed *building* (m²), calculated in accordance with ISO 10077-1 Section 6.3.1.

E.2 Skylights

E.2.1 Construction R-values

E.2.1.1 The *construction R-values* for *skylights* ($R_{skylight}$) shall include the effects of both the glazing materials and the frame materials and shall be calculated in accordance with Equation E.4. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.4: $$R_{skylight}=\frac{1}{U_w}$$

where:
$R_{skylight}$ is the *construction R-value* of the *skylight* (m²·K/W); and
U_w is the thermal transmittance of the *skylight* (W/(m²K)), determined in accordance with Paragraph E.2.1.2.

E.2.1.2 The thermal transmittance (U_w) of a *skylight* shall be determined in accordance with ISO 10077-1, with:

a) the thermal transmittance of the glazing (U_g) determined using BS EN 673, considering the effects of horizontal or angled glazing on the heat transfer; and

b) the thermal transmittance of the frame (U_f) determined using ISO 10077-2.

Appendix F. Thermal resistance of slab-on-ground floors

F.1 Construction R-values

F.1.1 Methods for determining construction R-values for slab-on-ground floors

F.1.1.1 The *construction R-values* for concrete *slab-on-ground floors*, including floors of basements that contain *conditioned spaces*, shall be determined using:

a) The performance tables described in Section F.1.2; or

b) The calculation method in Verification Method H1/VM2 Appendix F.

COMMENT:

1. The *thermal resistances* for *slab-on-ground floors* provided in the BRANZ House Insulation Guide, 5th edition or earlier, should not be used for determining compliance with the requirements of this acceptable solution. This is because they are based on a different calculation method and different assumptions than those specified in this Appendix.
2. Where a concrete floor is only partially in contact with the ground, with other parts being suspended, the part that is in contact with the ground shall be treated as a *slab-on-ground floor*, and the other part be treated as a suspended floor.

F.1.2 Performance tables for slab-on-ground floor R-values

F.1.2.1 The *construction R-value* for selected generic concrete *slab-on-ground floors* is provided for different floor types, floor insulation types, and *external walls* types. An overview of the *construction R-value* tables included in this subsection for different combinations of these components is provided in Table F.1.2.1.

F.1.2.2 The *construction R-value* of selected generic concrete *slab-on-ground floors* may be determined from:

a) For concrete raft foundation floors without insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2A; and

b) For concrete raft foundation floors without insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2B; and

c) For concrete raft foundation floors with R1.0 vertical edge insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2C; and

d) For concrete raft foundation floors with R1.0 vertical edge insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2D; and

e) For slab-floors without insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2E; and

f) For slab-floors without insulation, where the *external walls* do not have masonry veneer cladding, Table, F.1.2.2F; and

g) For slab-floors with R1.0 vertical edge insulation but without underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2G; and

h) For slab-floors with R1.0 vertical edge insulation but without underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2H; and

i) For slab-floors with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the *external walls* have masonry veneer cladding, Table F.1.2.2I; and

j) For slab-floors with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2J; and

k) For slab-floors with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the *external walls* have masonry veneer cladding, Table F.1.2.2K; and

l) For slab-floors with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2L; and

m) For slab-floors with R1.2 full cover underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2M; and

n) For slab-floors with R1.2 full cover underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2N; and

o) For slab-floors with R2.4 full cover underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2O; and

p) For slab-floors with R2.4 full cover underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2P; and

q) For slab-floors with R1.0 vertical edge insulation and with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the *external walls* have masonry veneer cladding, Table F.1.2.2Q; and

r) For slab-floors with R1.0 vertical edge insulation and with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2R; and

s) For slab-floors with R1.0 vertical edge insulation and with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the *external walls* have masonry veneer cladding, Table F.1.2.2S; and

t) For slab-floors with R1.0 vertical edge insulation and with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2T; and

u) For slab-floors with R1.0 vertical edge insulation and with R1.2 full cover underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2U; and

v) For slab-floors with R1.0 vertical edge insulation and with R1.2 full cover underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2V; and

w) For slab-floors with R1.0 vertical edge insulation and with R2.4 full cover underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2W; and

x) For slab-floors with R1.0 vertical edge insulation and with R2.4 full cover underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2X.

COMMENT:

1. Any parts of a *slab-on-ground floor* that are not part of the *thermal envelope* (such as the floor of porches, attached garages or storage areas) should be thermally separated by installing vertical edge insulation in between conditioned and unconditioned parts of the floor.
2. Since insulation cannot be easily retrofitted to *slab-on-ground floors*, it is recommended to also insulate the floor of any *unconditioned spaces* of the *building*, where these may become *conditioned spaces* at a later stage during the *building* life. An example is an attached garage that could potentially be converted into a *habitable space* in the future.
3. Tables F.1.2.2A – F.1.2.2X differentiate situations where the *external walls* have a masonry veneer cladding from walls with other types of cladding. With masonry veneer walls, the slab edge has a step-down, resulting in different heat transfer characteristics compared to *slab-on-ground floors* for other *external wall* types.
4. *Construction R-values* are only provided for vertical edge insulation with a *thermal resistance* of 1.0 $m^2{\cdot}K/W$. The thermal benefits of increasing the *R-value* of vertical edge insulation beyond R1.0 are very limited. Refer to BRANZ study report SR352 (2016) for further details.
5. The *construction R-values* provided in Tables F.1.2.2A – F.1.2.2X are based on the calculation method provided in Verification Method H1/VM2 Appendix F, using the default values for the thermal properties of the ground from ISO 13370 Table 7 category 2 (thermal conductivity λ= 2.0 W/(m·K), heat capacity per volume ρc= 2.0 x 10^6 J/(m^3·K)).

F.1.2.3 When determining the slab area-to-perimeter ratio, any parts of the *slab-on-ground floor* that are not part of the *thermal envelope* (such as the floor of patios, porches, attached garages or storage areas) shall be treated as if they were not present.

F.1.2.4 The slab area-to-perimeter ratio of the proposed *building* may be determined using:

a) The overall internal slab dimensions in accordance with Equation F.1; or

b) The external slab dimensions in accordance with Equation F.2.

Equation F.1: $$\text{slab area-to-perimeter ratio} = \frac{A_{slab,\ internal}}{P_{slab,\ internal}}$$

where:

$A_{slab,internal}$ is the area of the *slab-on-ground floor* that is part of the *thermal envelope*, measured using overall internal dimensions (ignoring internal partitions, as per ISO 13789) between the interior surfaces of the walls that form the *thermal envelope* (m^2); and

$P_{slab,internal}$ is the perimeter of the *slab-on-ground floor* that is part of the *thermal envelope*, measured using overall internal dimensions (ignoring internal partitions, as per ISO 13789) along the interior surfaces of the walls that form the *thermal envelope*, including the length of any wall(s) between *conditioned spaces* and *unconditioned spaces* (m).

Equation F.2: $$\text{slab area-to-perimeter ratio} = \frac{A_{slab,\ external}}{P_{slab,\ external}} - \frac{w}{2}$$

where:

$A_{slab,external}$ is the area of the *slab-on-ground floor* that is part of the *thermal envelope*, measured between the exterior vertical edges of the slab beneath *external walls* and the unconditioned edges of any wall(s) between *conditioned spaces* and *unconditioned spaces* (m^2); and

$P_{slab,external}$ is the perimeter of the *slab-on-ground floor* that is part of the *thermal envelope*, measured along the exterior vertical edges of the slab beneath *external walls* and including the length of any wall(s) between *conditioned spaces* and *unconditioned spaces* (m); and w is the horizontal distance between the outermost exterior concrete slab edge and the interior surface of the *external wall* (m).

COMMENT:
Where the *external walls* do not have masonry veneer cladding, w is the same as the 'Effective thickness of *external walls* on slab' in Tables F.1.2.2A – F.1.2.2X. However, where the *external walls* have masonry veneer cladding, w is to be determined from the exterior concrete slab edge at the bottom of the step-down, whereas the 'Effective thickness of *external walls* on slab' in Tables F.1.2.2A – F.1.2.2X is to be determined from the concrete slab edge at floor level.

Table F.1.2.1: Overview of construction R-value tables for selected slab-on-ground floor scenarios

Paragraph F.1.2.1

Floor type	Floor insulation type	External wall type	Table number
Concrete raft foundation	None	Masonry veneer	Table F.1.2.2A
		Other	Table F.1.2.2B
	Vertical edge R1.0	Masonry veneer	Table F.1.2.2C
		Other	Table F.1.2.2D
Slab floor	None	Masonry veneer	Table F.1.2.2E
		Other	Table F.1.2.2F.
	Vertical edge R1.0	Masonry veneer	Table F.1.2.2G
		Other	Table F.1.2.2H
	Underslab 1.2 m strip R1.2	Masonry veneer	Table F.1.2.2I
		Other	Table F.1.2.2J
	Underslab 1.2 m strip R2.4	Masonry veneer	Table F.1.2.2K
		Other	Table F.1.2.2L
	Underslab full cover R1.2	Masonry veneer	Table F.1.2.2M
		Other	Table F.1.2.2N
	Underslab full cover R2.4	Masonry veneer	Table F.1.2.2O
		Other	Table F.1.2.2P
	Vertical edge R1.0 and Underslab 1.2 m strip R1.2	Masonry veneer	Table F.1.2.2Q
		Other	Table F.1.2.2R
	Vertical edge R1.0 and Underslab 1.2 m strip R2.4	Masonry veneer	Table F.1.2.2S
		Other	Table F.1.2.2T
	Vertical edge R1.0 and Underslab full cover R1.2	Masonry veneer	Table F.1.2.2U
		Other	Table F.1.2.2V
	Vertical edge R1.0 and Underslab full cover R2.4	Masonry veneer	Table F.1.2.2W
		Other	Table F.1.2.2X

Table F.1.2.2A: Construction R-values for concrete raft foundation floors without insulation, where the external walls have masonry veneer cladding

Paragraph F.1.2.2 a)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
No vertical edge insulation	1.6	R1.2	R1.2	R1.2	R1.3	R1.3
	1.8	R1.3	R1.3	R1.3	R1.4	R1.4
	2.0	R1.3	R1.4	R1.4	R1.4	R1.5
	2.2	R1.4	R1.5	R1.5	R1.5	R1.6
	2.4	R1.5	R1.6	R1.6	R1.6	R1.7
	2.6	R1.6	R1.6	R1.6	R1.7	R1.7
	2.8	R1.7	R1.7	R1.7	R1.8	R1.8
	3.0	R1.7	R1.8	R1.8	R1.9	R1.9
	3.2	R1.8	R1.9	R1.9	R2.0	R2.0
	3.4	R1.9	R1.9	R2.0	R2.0	R2.0
	3.6	R2.0	R2.0	R2.0	R2.1	R2.1
	3.8	R2.0	R2.1	R2.1	R2.2	R2.2
	4.0	R2.1	R2.1	R2.2	R2.2	R2.3
	5.0	R2.5	R2.5	R2.6	R2.6	R2.7
	6.0	R2.8	R2.9	R2.9	R3.0	R3.0
	7.0	R3.2	R3.3	R3.3	R3.4	R3.4
	8.0	R3.6	R3.6	R3.7	R3.8	R3.8
	9.0	R3.9	R4.0	R4.1	R4.2	R4.2
	≥ 10.0	R4.3	R4.4	R4.4	R4.5	R4.6

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

Table F.1.2.2B: **Construction R-values for concrete raft foundation floors without insulation, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 b)

Insulation type	Slab area-to-perimeter ratio (1)	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab(2)				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
No vertical edge insulation	1.6	R1.0	R1.0	R1.1	R1.1	R1.1
	1.8	R1.1	R1.1	R1.2	R1.2	R1.2
	2.0	R1.2	R1.2	R1.3	R1.3	R1.4
	2.2	R1.2	R1.3	R1.3	R1.4	R1.4
	2.4	R1.3	R1.4	R1.4	R1.5	R1.5
	2.6	R1.4	R1.4	R1.5	R1.5	R1.6
	2.8	R1.4	R1.5	R1.5	R1.6	R1.6
	3.0	R1.5	R1.6	R1.6	R1.7	R1.7
	3.2	R1.6	R1.6	R1.7	R1.8	R1.8
	3.4	R1.6	R1.7	R1.7	R1.8	R1.9
	3.6	R1.7	R1.8	R1.8	R1.9	R1.9
	3.8	R1.8	R1.8	R1.9	R2.0	R2.0
	4.0	R1.9	R1.9	R2.0	R2.0	R2.1
	5.0	R2.2	R2.3	R2.3	R2.4	R2.5
	6.0	R2.5	R2.6	R2.7	R2.7	R2.8
	7.0	R2.8	R2.9	R3.0	R3.1	R3.2
	8.0	R3.2	R3.3	R3.3	R3.5	R3.5
	9.0	R3.5	R3.6	R3.7	R3.8	R3.9
	≥ 10.0	R3.9	R4.0	R4.1	R4.2	R4.3

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

Table F.1.2.2C: Construction R-values for concrete raft foundation floors with R1.0 vertical edge insulation, where the external walls have masonry veneer cladding

Paragraph F.1.2.2 c)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3]	1.6	R1.3	R1.3	R1.3	R1.3	R1.4
	1.8	R1.4	R1.4	R1.4	R1.5	R1.5
	2.0	R1.4	R1.5	R1.5	R1.5	R1.5
	2.2	R1.5	R1.6	R1.6	R1.6	R1.6
	2.4	R1.6	R1.7	R1.7	R1.7	R1.7
	2.6	R1.7	R1.7	R1.7	R1.8	R1.8
	2.8	R1.8	R1.8	R1.8	R1.9	R1.9
	3.0	R1.9	R1.9	R1.9	R2.0	R2.0
	3.2	R2.0	R2.0	R2.0	R2.1	R2.1
	3.4	R2.0	R2.0	R2.1	R2.1	R2.1
	3.6	R2.1	R2.1	R2.2	R2.2	R2.2
	3.8	R2.2	R2.2	R2.2	R2.3	R2.3
	4.0	R2.2	R2.3	R2.3	R2.3	R2.4
	5.0	R2.6	R2.7	R2.7	R2.8	R2.8
	6.0	R3.0	R3.0	R3.1	R3.1	R3.2
	7.0	R3.4	R3.4	R3.5	R3.5	R3.6
	8.0	R3.8	R3.8	R3.9	R3.9	R4.0
	9.0	R4.2	R4.2	R4.3	R4.4	R4.4
	≥ 10.0	R4.5	R4.6	R4.7	R4.8	R4.8

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

Table F.1.2.2D: Construction R-values for concrete raft foundation floors with R1.0 vertical edge insulation, where the external walls do not have masonry veneer cladding

Paragraph F.1.2.2 d)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3]	1.6	R1.3	R1.3	R1.3	R1.3	R1.3
	1.8	R1.4	R1.4	R1.4	R1.4	R1.4
	2.0	R1.5	R1.5	R1.5	R1.6	R1.6
	2.2	R1.5	R1.5	R1.6	R1.6	R1.6
	2.4	R1.6	R1.6	R1.7	R1.7	R1.7
	2.6	R1.7	R1.8	R1.8	R1.8	R1.8
	2.8	R1.8	R1.8	R1.8	R1.8	R1.9
	3.0	R1.9	R1.9	R1.9	R1.9	R2.0
	3.2	R2.0	R2.0	R2.0	R2.0	R2.1
	3.4	R2.0	R2.0	R2.1	R2.1	R2.1
	3.6	R2.1	R2.1	R2.1	R2.2	R2.2
	3.8	R2.2	R2.2	R2.2	R2.3	R2.3
	4.0	R2.3	R2.3	R2.3	R2.3	R2.4
	5.0	R2.6	R2.7	R2.7	R2.7	R2.8
	6.0	R3.0	R3.1	R3.1	R3.1	R3.2
	7.0	R3.4	R3.4	R3.5	R3.5	R3.6
	8.0	R3.8	R3.8	R3.9	R3.9	R4.0
	9.0	R4.2	R4.2	R4.3	R4.3	R4.4
	≥ 10.0	R4.6	R4.6	R4.7	R4.8	R4.8

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

Table F.1.2.2E: **Construction R-values for slab-floors without insulation, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 e)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
No insulation	1.6	R0.8	R0.9	R0.9	R0.9	R0.9
	1.8	R0.9	R0.9	R1.0	R1.0	R1.0
	2.0	R1.0	R1.0	R1.0	R1.1	R1.1
	2.2	R1.0	R1.1	R1.1	R1.1	R1.2
	2.4	R1.1	R1.1	R1.2	R1.2	R1.2
	2.6	R1.2	R1.2	R1.2	R1.3	R1.3
	2.8	R1.2	R1.3	R1.3	R1.3	R1.4
	3.0	R1.3	R1.3	R1.4	R1.4	R1.4
	3.2	R1.4	R1.4	R1.4	R1.5	R1.5
	3.4	R1.4	R1.5	R1.5	R1.5	R1.6
	3.6	R1.5	R1.5	R1.6	R1.6	R1.6
	3.8	R1.6	R1.6	R1.6	R1.7	R1.7
	4.0	R1.6	R1.7	R1.7	R1.7	R1.8
	5.0	R1.9	R2.0	R2.0	R2.1	R2.1
	6.0	R2.3	R2.3	R2.4	R2.4	R2.5
	7.0	R2.6	R2.6	R2.7	R2.8	R2.8
	8.0	R2.9	R3.0	R3.0	R3.1	R3.2
	9.0	R3.2	R3.3	R3.4	R3.5	R3.5
	≥ 10.0	R3.5	R3.6	R3.7	R3.8	R3.9

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

Table F.1.2.2F: Construction R-values for slab-floors without insulation, where the external walls do not have masonry veneer cladding

Paragraph F.1.2.2 f)

Insulation type	Slab area-to-perimeter ratio (1)	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab(2)				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
No insulation	1.6	R0.8	R0.8	R0.8	R0.9	R0.9
	1.8	R0.8	R0.9	R0.9	R0.9	R0.9
	2.0	R0.9	R0.9	R0.9	R1.0	R1.0
	2.2	R0.9	R1.0	R1.0	R1.1	R1.1
	2.4	R1.0	R1.0	R1.1	R1.1	R1.2
	2.6	R1.1	R1.1	R1.1	R1.2	R1.2
	2.8	R1.1	R1.2	R1.2	R1.3	R1.3
	3.0	R1.2	R1.2	R1.3	R1.3	R1.4
	3.2	R1.2	R1.3	R1.3	R1.4	R1.4
	3.4	R1.3	R1.3	R1.4	R1.4	R1.5
	3.6	R1.4	R1.4	R1.4	R1.5	R1.5
	3.8	R1.4	R1.5	R1.5	R1.6	R1.6
	4.0	R1.5	R1.5	R1.6	R1.6	R1.7
	5.0	R1.8	R1.8	R1.9	R2.0	R2.0
	6.0	R2.1	R2.1	R2.2	R2.3	R2.3
	7.0	R2.4	R2.4	R2.5	R2.6	R2.7
	8.0	R2.7	R2.7	R2.8	R2.9	R3.0
	9.0	R2.9	R3.0	R3.1	R3.2	R3.3
	≥ 10.0	R3.3	R3.4	R3.4	R3.6	R3.7

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

Thermal resistance of slab-on-ground floors

Table F.1.2.2G: **Construction R-values for slab-floors with R1.0 vertical edge insulation but without underslab insulation, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 g)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3]	1.6	R0.9	R0.9	R1.0	R1.0	R1.0
	1.8	R1.0	R1.0	R1.0	R1.1	R1.1
	2.0	R1.1	R1.1	R1.1	R1.1	R1.2
	2.2	R1.1	R1.2	R1.2	R1.2	R1.2
	2.4	R1.2	R1.2	R1.3	R1.3	R1.3
	2.6	R1.3	R1.3	R1.3	R1.4	R1.4
	2.8	R1.3	R1.4	R1.4	R1.4	R1.5
	3.0	R1.4	R1.4	R1.5	R1.5	R1.5
	3.2	R1.5	R1.5	R1.5	R1.6	R1.6
	3.4	R1.6	R1.6	R1.6	R1.6	R1.7
	3.6	R1.6	R1.6	R1.7	R1.7	R1.7
	3.8	R1.7	R1.7	R1.7	R1.8	R1.8
	4.0	R1.8	R1.8	R1.8	R1.9	R1.9
	5.0	R2.1	R2.1	R2.2	R2.2	R2.2
	6.0	R2.4	R2.5	R2.5	R2.6	R2.6
	7.0	R2.8	R2.8	R2.9	R2.9	R3.0
	8.0	R3.1	R3.2	R3.2	R3.3	R3.3
	9.0	R3.5	R3.5	R3.6	R3.7	R3.7
	≥ 10.0	R3.8	R3.9	R3.9	R4.0	R4.1

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

Table F.1.2.2H: **Construction R-values for slab-floors with R1.0 vertical edge insulation but without underslab insulation, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 h)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3]	1.6	R1.0	R1.0	R1.0	R1.0	R1.0
	1.8	R1.0	R1.1	R1.1	R1.1	R1.1
	2.0	R1.1	R1.1	R1.1	R1.2	R1.2
	2.2	R1.2	R1.2	R1.2	R1.2	R1.3
	2.4	R1.3	R1.3	R1.3	R1.3	R1.3
	2.6	R1.3	R1.4	R1.4	R1.4	R1.4
	2.8	R1.4	R1.4	R1.4	R1.5	R1.5
	3.0	R1.5	R1.5	R1.5	R1.5	R1.6
	3.2	R1.5	R1.6	R1.6	R1.6	R1.6
	3.4	R1.6	R1.6	R1.7	R1.7	R1.7
	3.6	R1.7	R1.7	R1.7	R1.8	R1.8
	3.8	R1.8	R1.8	R1.8	R1.8	R1.9
	4.0	R1.8	R1.8	R1.9	R1.9	R1.9
	5.0	R2.2	R2.2	R2.2	R2.3	R2.3
	6.0	R2.5	R2.5	R2.6	R2.6	R2.7
	7.0	R2.9	R2.9	R2.9	R3.0	R3.0
	8.0	R3.2	R3.3	R3.3	R3.4	R3.4
	9.0	R3.6	R3.6	R3.7	R3.7	R3.8
	≥ 10.0	R3.9	R4.0	R4.0	R4.1	R4.2

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

Table F.1.2.2I: **Construction R-values for slab-floors with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 i)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
1.2 m wide strip of R1.2 underslab insulation[3]	1.6	R1.1	R1.2	R1.2	R1.2	R1.2
	1.8	R1.2	R1.2	R1.2	R1.3	R1.3
	2.0	R1.2	R1.3	R1.3	R1.3	R1.4
	2.2	R1.3	R1.3	R1.4	R1.4	R1.4
	2.4	R1.3	R1.4	R1.4	R1.5	R1.5
	2.6	R1.4	R1.4	R1.5	R1.5	R1.6
	2.8	R1.5	R1.5	R1.6	R1.6	R1.6
	3.0	R1.5	R1.6	R1.6	R1.7	R1.7
	3.2	R1.6	R1.6	R1.7	R1.7	R1.8
	3.4	R1.7	R1.7	R1.8	R1.8	R1.8
	3.6	R1.7	R1.8	R1.8	R1.9	R1.9
	3.8	R1.8	R1.9	R1.9	R2.0	R2.0
	4.0	R1.9	R1.9	R2.0	R2.0	R2.1
	5.0	R2.2	R2.3	R2.3	R2.4	R2.4
	6.0	R2.5	R2.6	R2.7	R2.7	R2.8
	7.0	R2.9	R3.0	R3.0	R3.1	R3.2
	8.0	R3.2	R3.3	R3.4	R3.5	R3.5
	9.0	R3.6	R3.7	R3.8	R3.9	R3.9
	≥ 10.0	R3.9	R4.0	R4.1	R4.2	R4.3

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 1.2 $m^2 \cdot K/W$, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2J: **Construction R-values for slab-floors with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 j)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2{\cdot}K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
1.2 m wide strip of R1.2 underslab insulation[3]	1.6	R1.0	R1.0	R1.1	R1.1	R1.2
	1.8	R1.0	R1.1	R1.1	R1.2	R1.2
	2.0	R1.1	R1.1	R1.2	R1.2	R1.3
	2.2	R1.1	R1.2	R1.2	R1.3	R1.3
	2.4	R1.2	R1.3	R1.3	R1.4	R1.4
	2.6	R1.3	R1.3	R1.4	R1.4	R1.5
	2.8	R1.3	R1.4	R1.4	R1.5	R1.5
	3.0	R1.4	R1.4	R1.5	R1.6	R1.6
	3.2	R1.4	R1.5	R1.6	R1.6	R1.7
	3.4	R1.5	R1.6	R1.6	R1.7	R1.7
	3.6	R1.6	R1.6	R1.7	R1.8	R1.8
	3.8	R1.6	R1.7	R1.7	R1.8	R1.9
	4.0	R1.7	R1.8	R1.8	R1.9	R1.9
	5.0	R2.0	R2.1	R2.1	R2.2	R2.3
	6.0	R2.3	R2.4	R2.5	R2.6	R2.6
	7.0	R2.6	R2.7	R2.8	R2.9	R3.0
	8.0	R2.9	R3.1	R3.1	R3.3	R3.4
	9.0	R3.3	R3.4	R3.5	R3.6	R3.7
	≥ 10.0	R3.6	R3.7	R3.8	R4.0	R4.1

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 1.2 $m^2{\cdot}K/W$, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2K: **Construction R-values for slab-floors with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 k)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
1.2 m wide strip of R2.4 underslab insulation[3]	1.6	R1.2	R1.2	R1.3	R1.3	R1.3
	1.8	R1.2	R1.3	R1.3	R1.4	R1.4
	2.0	R1.3	R1.3	R1.4	R1.4	R1.4
	2.2	R1.3	R1.4	R1.4	R1.5	R1.5
	2.4	R1.4	R1.5	R1.5	R1.5	R1.6
	2.6	R1.5	R1.5	R1.6	R1.6	R1.6
	2.8	R1.5	R1.6	R1.6	R1.7	R1.7
	3.0	R1.6	R1.6	R1.7	R1.7	R1.8
	3.2	R1.7	R1.7	R1.8	R1.8	R1.8
	3.4	R1.7	R1.8	R1.8	R1.9	R1.9
	3.6	R1.8	R1.8	R1.9	R2.0	R2.0
	3.8	R1.9	R1.9	R2.0	R2.0	R2.1
	4.0	R1.9	R2.0	R2.0	R2.1	R2.1
	5.0	R2.3	R2.3	R2.4	R2.5	R2.5
	6.0	R2.6	R2.7	R2.7	R2.8	R2.9
	7.0	R3.0	R3.0	R3.1	R3.2	R3.3
	8.0	R3.3	R3.4	R3.5	R3.6	R3.6
	9.0	R3.7	R3.8	R3.9	R4.0	R4.0
	≥ 10.0	R4.0	R4.1	R4.2	R4.4	R4.4

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2L: **Construction R-values for slab-floors with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 l)

Insulation type	Slab area-to-perimeter ratio (1)	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab(2)				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
1.2 m wide strip of R2.4 underslab insulation(3)	1.6	R1.1	R1.1	R1.2	R1.2	R1.3
	1.8	R1.1	R1.1	R1.2	R1.3	R1.3
	2.0	R1.1	R1.2	R1.3	R1.3	R1.4
	2.2	R1.2	R1.3	R1.3	R1.4	R1.4
	2.4	R1.2	R1.3	R1.4	R1.4	R1.5
	2.6	R1.3	R1.4	R1.4	R1.5	R1.5
	2.8	R1.4	R1.4	R1.5	R1.6	R1.6
	3.0	R1.4	R1.5	R1.6	R1.6	R1.7
	3.2	R1.5	R1.6	R1.6	R1.7	R1.7
	3.4	R1.5	R1.6	R1.7	R1.8	R1.8
	3.6	R1.6	R1.7	R1.7	R1.8	R1.9
	3.8	R1.7	R1.7	R1.8	R1.9	R2.0
	4.0	R1.7	R1.8	R1.9	R2.0	R2.0
	5.0	R2.0	R2.1	R2.2	R2.3	R2.4
	6.0	R2.4	R2.5	R2.5	R2.7	R2.7
	7.0	R2.7	R2.8	R2.9	R3.0	R3.1
	8.0	R3.0	R3.1	R3.2	R3.4	R3.5
	9.0	R3.3	R3.5	R3.6	R3.7	R3.8
	≥ 10.0	R3.7	R3.8	R3.9	R4.1	R4.2

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2M: Construction R-values for slab-floors with R1.2 full cover underslab insulation, where the external walls have masonry veneer cladding

Paragraph F.1.2.2 m)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.2 full cover underslab insulation[3]	1.6	R1.3	R1.4	R1.5	R1.6	R1.6
	1.8	R1.4	R1.5	R1.6	R1.7	R1.7
	2.0	R1.5	R1.6	R1.7	R1.8	R1.8
	2.2	R1.6	R1.7	R1.8	R1.9	R1.9
	2.4	R1.7	R1.8	R1.9	R2.0	R2.0
	2.6	R1.8	R1.9	R1.9	R2.0	R2.1
	2.8	R1.9	R2.0	R2.0	R2.1	R2.2
	3.0	R2.0	R2.0	R2.1	R2.2	R2.3
	3.2	R2.0	R2.1	R2.2	R2.3	R2.4
	3.4	R2.1	R2.2	R2.3	R2.4	R2.4
	3.6	R2.2	R2.3	R2.4	R2.5	R2.5
	3.8	R2.3	R2.4	R2.4	R2.5	R2.6
	4.0	R2.3	R2.4	R2.5	R2.6	R2.7
	5.0	R2.7	R2.8	R2.9	R3.0	R3.1
	6.0	R3.1	R3.2	R3.3	R3.4	R3.5
	7.0	R3.5	R3.6	R3.7	R3.8	R3.9
	8.0	R3.8	R4.0	R4.1	R4.2	R4.3
	9.0	R4.2	R4.3	R4.5	R4.6	R4.7
	≥ 10.0	R4.6	R4.7	R4.9	R5.0	R5.2

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Horizontal underslab insulation with an *R-value* of 1.2 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Table F.1.2.2N: **Construction R-values for slab-floors with R1.2 full cover underslab insulation, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 n)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.2 full cover underslab insulation[3]	1.6	R1.1	R1.2	R1.3	R1.4	R1.5
	1.8	R1.2	R1.3	R1.4	R1.5	R1.6
	2.0	R1.3	R1.4	R1.5	R1.6	R1.7
	2.2	R1.4	R1.5	R1.6	R1.7	R1.8
	2.4	R1.5	R1.6	R1.7	R1.8	R1.9
	2.6	R1.5	R1.6	R1.7	R1.9	R1.9
	2.8	R1.6	R1.7	R1.8	R2.0	R2.0
	3.0	R1.7	R1.8	R1.9	R2.0	R2.1
	3.2	R1.8	R1.9	R2.0	R2.1	R2.2
	3.4	R1.8	R1.9	R2.0	R2.2	R2.3
	3.6	R1.9	R2.0	R2.1	R2.3	R2.4
	3.8	R2.0	R2.1	R2.2	R2.3	R2.4
	4.0	R2.1	R2.2	R2.3	R2.4	R2.5
	5.0	R2.4	R2.5	R2.6	R2.8	R2.9
	6.0	R2.7	R2.9	R3.0	R3.2	R3.3
	7.0	R3.1	R3.2	R3.4	R3.6	R3.7
	8.0	R3.4	R3.6	R3.7	R3.9	R4.1
	9.0	R3.8	R4.0	R4.1	R4.3	R4.5
	≥ 10.0	R4.1	R4.3	R4.5	R4.7	R4.9

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Horizontal underslab insulation with an *R-value* of 1.2 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Table F.1.2.20: Construction R-values for slab-floors with R2.4 full cover underslab insulation, where the external walls have masonry veneer cladding

Paragraph F.1.2.2 o)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R2.4 full cover underslab insulation[3]	1.6	R1.6	R1.7	R1.8	R2.0	R2.1
	1.8	R1.7	R1.8	R2.0	R2.1	R2.2
	2.0	R1.8	R2.0	R2.1	R2.2	R2.3
	2.2	R2.0	R2.1	R2.2	R2.4	R2.5
	2.4	R2.1	R2.2	R2.3	R2.5	R2.6
	2.6	R2.2	R2.3	R2.4	R2.6	R2.7
	2.8	R2.3	R2.4	R2.5	R2.7	R2.8
	3.0	R2.4	R2.5	R2.6	R2.8	R2.9
	3.2	R2.5	R2.6	R2.7	R2.9	R3.0
	3.4	R2.6	R2.7	R2.8	R3.0	R3.1
	3.6	R2.6	R2.8	R2.9	R3.1	R3.2
	3.8	R2.7	R2.9	R3.0	R3.2	R3.3
	4.0	R2.8	R3.0	R3.1	R3.3	R3.4
	5.0	R3.2	R3.4	R3.5	R3.7	R3.8
	6.0	R3.7	R3.8	R4.0	R4.2	R4.3
	7.0	R4.1	R4.2	R4.4	R4.6	R4.7
	8.0	R4.5	R4.6	R4.8	R5.0	R5.2
	9.0	R4.9	R5.1	R5.2	R5.5	R5.6
	≥ 10.0	R5.3	R5.5	R5.7	R5.9	R6.1

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Table F.1.2.2P: Construction R-values for slab-floors with R2.4 full cover underslab insulation, where the external walls do not have masonry veneer cladding

Paragraph F.1.2.2 p)

Insulation type	Slab area-to-perimeter ratio (1)	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab(2)				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R2.4 full cover underslab insulation(3)	1.6	R1.3	R1.4	R1.5	R1.7	R1.9
	1.8	R1.4	R1.5	R1.7	R1.9	R2.0
	2.0	R1.5	R1.7	R1.8	R2.0	R2.1
	2.2	R1.6	R1.8	R1.9	R2.1	R2.2
	2.4	R1.7	R1.9	R2.0	R2.2	R2.3
	2.6	R1.8	R2.0	R2.1	R2.3	R2.4
	2.8	R1.9	R2.1	R2.2	R2.4	R2.5
	3.0	R2.0	R2.1	R2.3	R2.5	R2.6
	3.2	R2.1	R2.2	R2.4	R2.6	R2.7
	3.4	R2.2	R2.3	R2.5	R2.7	R2.8
	3.6	R2.3	R2.4	R2.6	R2.8	R2.9
	3.8	R2.3	R2.5	R2.7	R2.9	R3.0
	4.0	R2.4	R2.6	R2.7	R3.0	R3.1
	5.0	R2.8	R3.0	R3.2	R3.4	R3.6
	6.0	R3.2	R3.4	R3.6	R3.8	R4.0
	7.0	R3.6	R3.8	R4.0	R4.2	R4.4
	8.0	R3.9	R4.2	R4.4	R4.7	R4.8
	9.0	R4.3	R4.5	R4.8	R5.1	R5.3
	≥ 10.0	R4.7	R4.9	R5.2	R5.5	R5.7

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Table F.1.2.2Q: **Construction R-values for slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R1.2 underslab insulation along the slab perimeter, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 q)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3] plus 1.2 m wide strip of R1.2 underslab insulation[4]	1.6	R1.2	R1.2	R1.3	R1.3	R1.3
	1.8	R1.3	R1.3	R1.3	R1.3	R1.4
	2.0	R1.3	R1.3	R1.4	R1.4	R1.4
	2.2	R1.4	R1.4	R1.4	R1.5	R1.5
	2.4	R1.4	R1.5	R1.5	R1.5	R1.6
	2.6	R1.5	R1.5	R1.6	R1.6	R1.6
	2.8	R1.6	R1.6	R1.6	R1.7	R1.7
	3.0	R1.6	R1.7	R1.7	R1.8	R1.8
	3.2	R1.7	R1.8	R1.8	R1.8	R1.9
	3.4	R1.8	R1.8	R1.9	R1.9	R1.9
	3.6	R1.9	R1.9	R1.9	R2.0	R2.0
	3.8	R1.9	R2.0	R2.0	R2.0	R2.1
	4.0	R2.0	R2.0	R2.1	R2.1	R2.2
	5.0	R2.3	R2.4	R2.4	R2.5	R2.5
	6.0	R2.7	R2.8	R2.8	R2.9	R2.9
	7.0	R3.1	R3.1	R3.2	R3.3	R3.3
	8.0	R3.4	R3.5	R3.6	R3.6	R3.7
	9.0	R3.8	R3.9	R3.9	R4.0	R4.1
	≥ 10.0	R4.2	R4.3	R4.3	R4.4	R4.5

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 1.2 $m^2 \cdot K/W$, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Thermal resistance of slab-on-ground floors

Table F.1.2.2R: Construction R-values for slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R1.2 underslab insulation along the slab perimeter, where the external walls do not have masonry veneer cladding

Paragraph F.1.2.2 r)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} (m^2·K/W) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3] plus 1.2 m wide strip of R1.2 underslab insulation[4]	1.6	R1.3	R1.3	R1.3	R1.3	R1.3
	1.8	R1.3	R1.3	R1.3	R1.4	R1.4
	2.0	R1.4	R1.4	R1.4	R1.4	R1.5
	2.2	R1.4	R1.4	R1.5	R1.5	R1.5
	2.4	R1.5	R1.5	R1.5	R1.6	R1.6
	2.6	R1.5	R1.6	R1.6	R1.6	R1.7
	2.8	R1.6	R1.6	R1.7	R1.7	R1.7
	3.0	R1.7	R1.7	R1.8	R1.8	R1.8
	3.2	R1.8	R1.8	R1.8	R1.9	R1.9
	3.4	R1.8	R1.9	R1.9	R1.9	R2.0
	3.6	R1.9	R1.9	R2.0	R2.0	R2.0
	3.8	R2.0	R2.0	R2.0	R2.1	R2.1
	4.0	R2.0	R2.1	R2.1	R2.2	R2.2
	5.0	R2.4	R2.4	R2.5	R2.5	R2.6
	6.0	R2.8	R2.8	R2.9	R2.9	R3.0
	7.0	R3.1	R3.2	R3.2	R3.3	R3.4
	8.0	R3.5	R3.6	R3.6	R3.7	R3.8
	9.0	R3.9	R4.0	R4.0	R4.1	R4.2
	≥ 10.0	R4.3	R4.3	R4.4	R4.5	R4.6

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 m^2·K/W, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 1.2 m^2·K/W, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2S: **Construction R-values for slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R2.4 underslab insulation along the slab perimeter, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 s)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2{\cdot}K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3] plus 1.2 m wide strip of R2.4 underslab insulation[4]	1.6	R1.3	R1.3	R1.4	R1.4	R1.4
	1.8	R1.3	R1.4	R1.4	R1.4	R1.4
	2.0	R1.4	R1.4	R1.4	R1.5	R1.5
	2.2	R1.4	R1.5	R1.5	R1.5	R1.6
	2.4	R1.5	R1.5	R1.6	R1.6	R1.6
	2.6	R1.6	R1.6	R1.6	R1.7	R1.7
	2.8	R1.6	R1.7	R1.7	R1.8	R1.8
	3.0	R1.7	R1.7	R1.8	R1.8	R1.8
	3.2	R1.8	R1.8	R1.9	R1.9	R1.9
	3.4	R1.8	R1.9	R1.9	R2.0	R2.0
	3.6	R1.9	R2.0	R2.0	R2.0	R2.1
	3.8	R2.0	R2.0	R2.1	R2.1	R2.1
	4.0	R2.1	R2.1	R2.1	R2.2	R2.2
	5.0	R2.4	R2.5	R2.5	R2.6	R2.6
	6.0	R2.8	R2.8	R2.9	R3.0	R3.0
	7.0	R3.1	R3.2	R3.3	R3.3	R3.4
	8.0	R3.5	R3.6	R3.7	R3.7	R3.8
	9.0	R3.9	R4.0	R4.0	R4.1	R4.2
	≥ 10.0	R4.3	R4.4	R4.4	R4.5	R4.6

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2{\cdot}K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 2.4 $m^2{\cdot}K/W$, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2T: **Construction R-values for slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R2.4 underslab insulation along the slab perimeter, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 t)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3] plus 1.2 m wide strip of R2.4 underslab insulation[4]	1.6	R1.3	R1.4	R1.4	R1.4	R1.4
	1.8	R1.4	R1.4	R1.4	R1.5	R1.5
	2.0	R1.4	R1.5	R1.5	R1.5	R1.5
	2.2	R1.5	R1.5	R1.5	R1.6	R1.6
	2.4	R1.5	R1.6	R1.6	R1.7	R1.7
	2.6	R1.6	R1.6	R1.7	R1.7	R1.7
	2.8	R1.7	R1.7	R1.7	R1.8	R1.8
	3.0	R1.7	R1.8	R1.8	R1.9	R1.9
	3.2	R1.8	R1.8	R1.9	R1.9	R2.0
	3.4	R1.9	R1.9	R2.0	R2.0	R2.0
	3.6	R2.0	R2.0	R2.0	R2.1	R2.1
	3.8	R2.0	R2.1	R2.1	R2.2	R2.2
	4.0	R2.1	R2.1	R2.2	R2.2	R2.3
	5.0	R2.5	R2.5	R2.5	R2.6	R2.6
	6.0	R2.8	R2.9	R2.9	R3.0	R3.0
	7.0	R3.2	R3.3	R3.3	R3.4	R3.4
	8.0	R3.6	R3.6	R3.7	R3.8	R3.8
	9.0	R4.0	R4.0	R4.1	R4.2	R4.3
	≥ 10.0	R4.4	R4.4	R4.5	R4.6	R4.7

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed along the entire slab perimeter, placed on the interior side of the wall footing.

Table F.1.2.2U: Construction R-values for slab-floors with R1.0 vertical edge insulation and with R1.2 full cover underslab insulation, where the external walls have masonry veneer cladding

Paragraph F.1.2.2 u)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3] plus R1.2 full cover underslab insulation[4]	1.6	R1.4	R1.5	R1.6	R1.7	R1.7
	1.8	R1.5	R1.6	R1.7	R1.8	R1.8
	2.0	R1.6	R1.7	R1.8	R1.9	R1.9
	2.2	R1.7	R1.8	R1.9	R2.0	R2.0
	2.4	R1.8	R1.9	R2.0	R2.1	R2.1
	2.6	R1.9	R2.0	R2.1	R2.1	R2.2
	2.8	R2.0	R2.1	R2.1	R2.2	R2.3
	3.0	R2.1	R2.2	R2.2	R2.3	R2.4
	3.2	R2.2	R2.2	R2.3	R2.4	R2.5
	3.4	R2.3	R2.3	R2.4	R2.5	R2.5
	3.6	R2.3	R2.4	R2.5	R2.6	R2.6
	3.8	R2.4	R2.5	R2.6	R2.7	R2.7
	4.0	R2.5	R2.6	R2.6	R2.7	R2.8
	5.0	R2.9	R3.0	R3.1	R3.2	R3.2
	6.0	R3.3	R3.4	R3.5	R3.6	R3.6
	7.0	R3.7	R3.8	R3.9	R4.0	R4.1
	8.0	R4.1	R4.2	R4.3	R4.4	R4.5
	9.0	R4.5	R4.6	R4.7	R4.8	R4.9
	≥ 10.0	R4.9	R5.0	R5.1	R5.3	R5.4

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) Horizontal underslab insulation with an *R-value* of 1.2 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Table F.1.2.2V: Construction R-values for slab-floors with R1.0 vertical edge insulation and with R1.2 full cover underslab insulation, where the external walls do not have masonry veneer cladding

Paragraph F.1.2.2 v)

Insulation type	Slab area-to-perimeter ratio (1)	R_{floor} (m^2·K/W) for different effective thicknesses of external walls on slab(2)				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation(3) plus R1.2 full cover underslab insulation(4)	1.6	R1.4	R1.5	R1.6	R1.7	R1.7
	1.8	R1.6	R1.6	R1.7	R1.8	R1.8
	2.0	R1.7	R1.7	R1.8	R1.9	R1.9
	2.2	R1.7	R1.8	R1.9	R2.0	R2.0
	2.4	R1.8	R1.9	R2.0	R2.1	R2.1
	2.6	R1.9	R2.0	R2.1	R2.2	R2.2
	2.8	R2.0	R2.1	R2.1	R2.2	R2.3
	3.0	R2.1	R2.2	R2.2	R2.3	R2.4
	3.2	R2.2	R2.3	R2.3	R2.4	R2.5
	3.4	R2.3	R2.3	R2.4	R2.5	R2.6
	3.6	R2.4	R2.4	R2.5	R2.6	R2.7
	3.8	R2.4	R2.5	R2.6	R2.7	R2.7
	4.0	R2.5	R2.6	R2.7	R2.8	R2.8
	5.0	R2.9	R3.0	R3.1	R3.2	R3.2
	6.0	R3.3	R3.4	R3.5	R3.6	R3.7
	7.0	R3.7	R3.8	R3.9	R4.0	R4.1
	8.0	R4.1	R4.2	R4.3	R4.4	R4.5
	9.0	R4.5	R4.6	R4.7	R4.9	R5.0
	≥ 10.0	R4.9	R5.0	R5.2	R5.3	R5.4

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 m^2·K/W, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) Horizontal underslab insulation with an *R-value* of 1.2 m^2·K/W, installed in between footings underneath the entire floor slab.

Table F.1.2.2W: Construction R-values for slab-floors with R1.0 vertical edge insulation and with R2.4 full cover underslab insulation, where the external walls have masonry veneer cladding

Paragraph F.1.2.2 w)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3] plus R2.4 full cover underslab insulation[4]	1.6	R1.7	R1.8	R1.9	R2.1	R2.2
	1.8	R1.8	R2.0	R2.1	R2.2	R2.3
	2.0	R2.0	R2.1	R2.2	R2.3	R2.4
	2.2	R2.1	R2.2	R2.3	R2.5	R2.6
	2.4	R2.2	R2.3	R2.4	R2.6	R2.7
	2.6	R2.3	R2.4	R2.5	R2.7	R2.8
	2.8	R2.4	R2.5	R2.7	R2.8	R2.9
	3.0	R2.5	R2.6	R2.8	R2.9	R3.0
	3.2	R2.6	R2.7	R2.9	R3.0	R3.1
	3.4	R2.7	R2.8	R3.0	R3.1	R3.2
	3.6	R2.8	R2.9	R3.1	R3.2	R3.3
	3.8	R2.9	R3.0	R3.1	R3.3	R3.4
	4.0	R3.0	R3.1	R3.2	R3.4	R3.5
	5.0	R3.4	R3.6	R3.7	R3.9	R4.0
	6.0	R3.9	R4.0	R4.1	R4.3	R4.4
	7.0	R4.3	R4.5	R4.6	R4.8	R4.9
	8.0	R4.7	R4.9	R5.0	R5.2	R5.3
	9.0	R5.2	R5.3	R5.5	R5.7	R5.8
	≥ 10.0	R5.6	R5.8	R5.9	R6.1	R6.3

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) Horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Table F.1.2.2X: Construction R-values for slab-floors with R1.0 vertical edge insulation and with R2.4 full cover underslab insulation, where the external walls do not have masonry veneer cladding

Paragraph F.1.2.2 x)

Insulation type	Slab area-to-perimeter ratio [1]	R_{floor} ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2]				
		≥ 90 mm to < 140 mm	≥ 140 mm to < 180 mm	≥ 180 mm to < 250 mm	≥ 250 mm to < 300 mm	≥ 300 mm
R1.0 vertical edge insulation[3] plus R2.4 full cover underslab insulation[4]	1.6	R1.7	R1.8	R1.9	R2.0	R2.1
	1.8	R1.8	R1.9	R2.0	R2.2	R2.3
	2.0	R1.9	R2.0	R2.1	R2.3	R2.4
	2.2	R2.1	R2.2	R2.3	R2.4	R2.5
	2.4	R2.2	R2.3	R2.4	R2.6	R2.7
	2.6	R2.3	R2.4	R2.5	R2.7	R2.8
	2.8	R2.4	R2.5	R2.6	R2.8	R2.9
	3.0	R2.5	R2.6	R2.7	R2.9	R3.0
	3.2	R2.6	R2.7	R2.8	R3.0	R3.1
	3.4	R2.7	R2.8	R2.9	R3.1	R3.2
	3.6	R2.8	R2.9	R3.0	R3.2	R3.3
	3.8	R2.9	R3.0	R3.1	R3.3	R3.4
	4.0	R3.0	R3.1	R3.2	R3.4	R3.5
	5.0	R3.4	R3.6	R3.7	R3.9	R4.0
	6.0	R3.9	R4.0	R4.1	R4.3	R4.4
	7.0	R4.3	R4.4	R4.6	R4.8	R4.9
	8.0	R4.7	R4.9	R5.0	R5.2	R5.4
	9.0	R5.2	R5.3	R5.5	R5.7	R5.8
	≥ 10.0	R5.6	R5.8	R5.9	R6.2	R6.3

Notes:

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) Horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

Preface

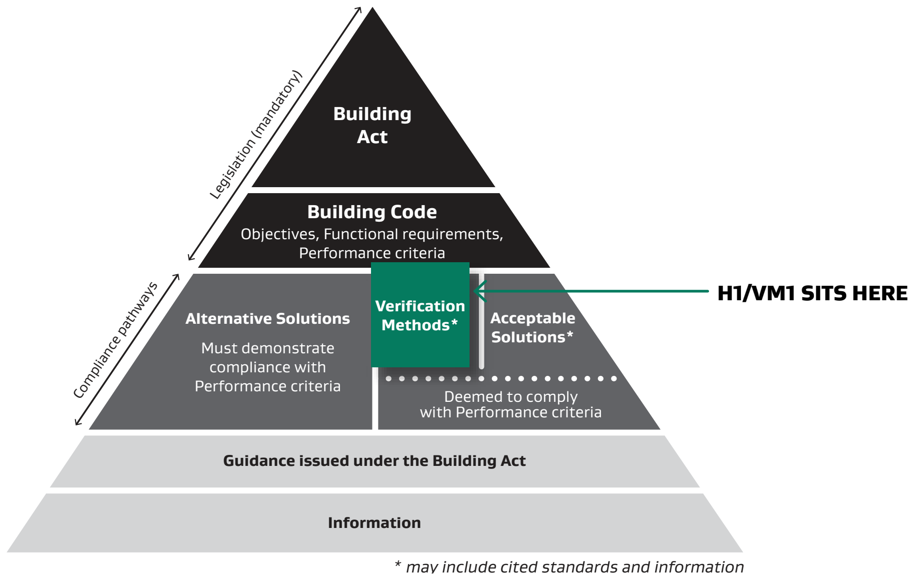
Document status

This document (H1/VM1 Fifth Edition Amendment 1) is a verification method issued under section 22 (1) of the Building Act 2004 and is effective on 4 August 2022. It does not apply to building consent applications submitted before 4 August 2022. The previous Verification Method H1/VM1 Fifth Edition (unamended) can be used to show compliance until 4 August 2022. The previous Verification Method H1/VM1 Fourth Edition Amendment 4, can be used to show compliance until 2 November 2022 and can be used for building consent applications submitted before 3 November 2022.

Building Code regulatory system

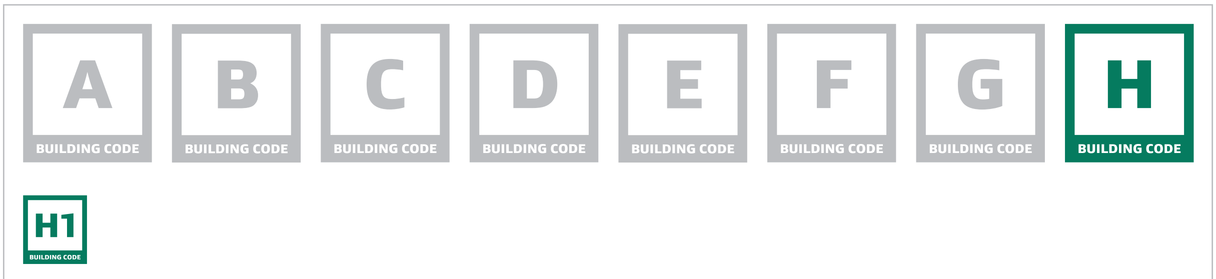
Each verification method outlines the provisions of the Building Code that it relates to. Complying with an acceptable solution or verification method is a way of complying with that part of the Building Code. Other options for establishing compliance are listed in [section 19 of the Building Act.]

Schematic of the Building Code System



A building design must take into account all parts of the Building Code. The Building Code is located in Schedule 1 of the Building Regulations 1992 and available online at www.legislation.govt.nz

The part of the Building Code that this verification method relates to is clause H1 Energy Efficiency. Further information on the scope of this document is provided in Part 1. General.



Further information about the Building Code, the objectives, functional requirements and performance criteria provisions that it contains, and other acceptable solutions and verification methods are available at www.building.govt.nz.

Main changes in this version

This verification method is amendment 1 of the fifth edition of H1/VM1. The main changes from the previous fourth edition are:

- The scope of H1/VM1 has been reduced to cover only housing and buildings less than 300 m^2. Requirements applicable for large buildings have been combined into the new Verification Method H1/VM2. To reflect the new scope of the documents and the new document layout, a new introduction and scope has been provided in Part 1. General.
- Citation of NZS 4218: 2009 "Thermal insulation - Housing and small buildings" has been removed from the document. The relevant content from this standard has been adopted into H1/VM1 with permission from Standards New Zealand.
- The minimum R-values previously found in NZS 4218 are replaced with new values and new text in Part 2. Building thermal envelope.
- The requirements for determining the thermal resistance and construction R-value of building elements have been revised to better reflect the thermal performance of windows, doors, skylights, and slab-on-ground floors.
- Portions of text have been re-written to enhance clarity in the document and provide consistent language with other acceptable solutions and verification methods.
- References have been revised to include only documents within the scope of H1/VM1 and have been amended to include the most recent versions of AS/NZS 4859.1, NZS 4246, and ALF in Appendix A.
- Additional references have been added to include BS EN 673, ISO 10077-1 and -2, ISO 10211, ISO 10456, ISO 12631, ISO 13370, and ISO 13789 in Appendix A.
- The definitions page has been revised to include all defined terms used in this document in Appendix B.
- The three-zone climate zone map previously found in NZS 4218 has been updated with a six-zone climate zone map in Appendix C.
- The computer modelling method for determining the building energy use has been provided in Appendix D.
- A new procedure for calculating the construction R-value of windows, doors, skylights, and curtain walling has been added in Appendix E.
- A new procedure for calculating the construction R-value of slab-on-ground floors has been added in Appendix F.

The main changes from the unamended version of the fifth edition of H1/VM1 are:

- Alternate thermal resistance requirements have been added for housing where building consent applications are submitted before 1 May 2023.
- An additional option for determining the construction R-value of concrete slab-on-ground floors has been added to Appendix F, which is only permitted to be used for housing, where building consent applications are submitted before 1 May 2023. This additional option is consistent with the fourth edition of H1/AS1.
- Throughout the document some obvious errors in the text, formatting and cross-references have been corrected, and minor text clarifications with minor to no impact have been made.

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 acceptable solution or verification method at any time. Up-to-date versions of acceptable solutions and verification methods are available from www.building.govt.nz.

Features of this document

- For the purposes of Building Code compliance, the standards and documents referenced in this verification method must be the editions, along with their specific amendments listed in Appendix A.
- Words in *italic* are defined at the end of this document in Appendix B.
- Hyperlinks are provided to cross-references within this document and to external websites and appear with a blue underline.
- Classified uses for *buildings*, as described in clause A1 of the Building Code, are printed in **bold** in this document. These are denoted with classified use icons for:

H **Housing**	Com **Commercial**	Out **Outbuildings**
CR **Communal residential**	Ind **Industry**	Anc **Ancillary**
CN **Communal non-residential**		

- Appendices to this verification method are part of, and have equal status to, the verification method. Figures are informative only and the wording of the paragraphs takes precedence. Text boxes headed 'COMMENT' occur throughout this document and are for guidance purposes only.

Contents

Part 1. General

1.1 Introduction

1.1.1 Scope of this document

1.1.1.1 This document applies to:

H CR CN Com

a) **Housing**; and

b) Other *buildings* with an area of *occupied space* no greater than 300 m^2, that are **communal residential***,* **communal non-residential** (assembly care only), and **commercial** *buildings*.

i

COMMENT: **Housing** includes *detached dwellings*, *multi-unit dwellings* such as *buildings* which contain more than one separate household or family, e.g. an apartment *building*, and also group dwellings, e.g. a *wharenui*.

1.1.1.2 For *buildings* that do not meet these characteristics, refer to the Acceptable Solution H1/AS2 or Verification Method H1/VM2 as a means to demonstrate compliance or use an alternative means to demonstrate compliance.

1.1.2 Items outside the scope of this document

1.1.2.1 This verification method does not include the use of foil insulation.

1.1.2.2 This verification method does not include requirements to comply with Building Code clauses H.1.3.1(b), H1.3.4, H1.3.5, or H1.3.6. For these clauses, use an alternative means to demonstrate compliance.

1.1.3 Compliance pathway

1.1.3.1 This verification method is one option that provides a means of establishing compliance with the performance criteria in Building Code clauses H.1.3.1(a), H1.3.2E, and H1.3.3.

1.1.3.2 Options for demonstrating compliance with H1 Energy Efficiency through the use of acceptable solutions and verification methods are summarised in Table 1.1.3.2. Compliance may also be demonstrated using an alternative solution.

1.1.3.3 Compliance with Building Code clause H1.3.1(a) (*adequate thermal resistance*) satisfies clause H1.3.2E (*Building Performance Index* or *BPI*).

i

COMMENT:

1. The modelling method described in Part 2. is a verification method for Building Code clause H1.3.1(a) (*adequate thermal resistance*). However, compliance with clause H1.3.2E (*Building Performance Index or BPI*) is not sufficient for demonstrating compliance with clause H1.3.1(a) (*adequate thermal resistance*).
2. ALF 4.0, published by BRANZ, calculates the *BPI*. Note that the ALF procedures are intended for detached dwellings and are not suitable for multi-unit dwellings.
3. The 20°C stated in the definition of *heating energy* is for calculation purposes only.

TABLE 1.1.3.2: **Demonstrating compliance with H1 Energy Efficiency through acceptable solutions and verification methods**

Paragraph 1.1.3.2

Performance clause	Applies to	Relevant acceptable solutions and verification methods
H1.3.1 (a) and (b) *Thermal Envelope*	H **Housing** CR **Communal residential** CN **Communal non-residential** (assembly care only) Com **Commercial**	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 or H1/VM1 For large *buildings*: H1/AS2 or H1/VM2
H1.3.2E *Building performance index*	H **Housing**	H1/AS1 or H1/VM1
H1.3.3 (a) to (f) Physical conditions	All *buildings*	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 or H1/VM1 For large *buildings*: H1/AS2 or H1/VM2
H1.3.4 (a) Heating of hot water	All *buildings*	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 For large *buildings*: H1/AS2
H1.3.4 (b) Storage vessels and distribution systems	Individual storage vessels ≤ 700 L in capacity and distribution systems	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 For large *buildings*: H1/AS2
H1.3.4 (c) Efficient use of hot water	H **Housing**	H1/AS1
H1.3.5 Artificial lighting	Lighting not provided solely to meet the requirements of Building Code clause F6 in: Com CN **Commercial** and **Communal non-residential** having *occupied space* greater than 300 m^2	H1/AS2
H.1.3.6 *HVAC systems*	Com **Commercial**	H1/VM3

1.2 Using this verification method

1.2.1 Determining the classified use

1.2.1.1 Classified uses for *buildings* are described in clause A1 of the Building Code. Where a specific classified use is mentioned within a subheading and/or within the text of a paragraph, this requirement applies only to the specified classified use(s), and does not apply to other classified uses.

Ind 1.2.1.2 In *buildings* containing both **industrial** and other classified uses, the non-industrial portion shall be treated separately according to its classified use. For example, in a *building* containing both **industrial** and **commercial** classified uses, the **commercial** area shall meet the relevant NZBC energy efficiency requirements.

1.2.2 Determining the area of the building

H 1.2.2.1 For **housing**, use the *floor area* of the *building*.

1.2.2.2 For *buildings* other than **housing**, calculate the area based on the *occupied space* of the *building*.

Part 2. Building thermal envelope

2.1 Thermal resistance

2.1.1 Demonstrating compliance

2.1.1.1 The *building* envelope shall be *constructed* to provide *adequate thermal resistance.* This is demonstrated through the use of the *building* energy use modelling method described in Subsection 2.1.2.

i

COMMENT:

1) To satisfy the Building Code performance requirement E3.3.1 for internal moisture, it may be necessary, depending on the method adopted, to provide more insulation (*greater R-value*) than that required to satisfy energy efficiency provisions alone.

2) Passive measures to prevent overheating from excessive solar heat gains through the *building envelope* should be taken to reduce dependence on active cooling systems. Such measures should include a combination of:

› Providing *adequate thermal resistance* to the *thermal envelope* of the *building*; and

› Avoiding excessive *window* areas (particularly on the east, north, and west facing facades); and

› Avoiding excessive *skylight areas*; and

› Selecting glass types with appropriate *solar heat gain coefficients (SHGC)*; and

› Providing external shading for windows and *skylights*; and

› Providing the ability to ventilate the *building* at a sufficient rate to maintain comfortable indoor temperatures in summer.

2.1.2 Modelling method for verification of the design

2.1.2.1 Verification of the design is achieved by demonstrating that the energy use of the proposed *building* design does not exceed the energy use of the reference *building* using computer modelling described in Appendix D.

2.1.2.2 The sum of the calculated annual *heating load* and annual *cooling load* of the proposed *building* shall not exceed that of the reference *building*. The reference *building* shall have *construction R-values* from:

a) For *building elements* that contain embedded heating systems, Table 2.1.2.2A; or

b) For *building elements* that do not contain embedded heating systems,

i) Table 2.1.2.2B or

H **ii)** alternatively, for **housing** only, for *building consent* applications submitted before 1 May 2023, those in Table 2.1.2.2C.

2.1.2.3 The requirements for the reference *building* are separated based on the relevant climate zone for the *building*. A list of the New Zealand climate zones is provided in Appendix C.

2.1.2.4 For *building elements* that contain embedded heating systems, the proposed *building* must, as a minimum, meet the *construction R-values* of Table 2.1.2.2A.

TABLE 2.1.2.2A: **Minimum construction R-values for heated ceilings, walls, or floors**

Paragraphs 2.1.2.2 a), 2.1.2.4

Building element	Construction R-values $(m^2 \cdot K/W)$ [(1), (2), (3)]					
	Climate zone 1	Climate zone 2	Climate zone 3	Climate zone 4	Climate zone 5	Climate zone 6
Heated ceiling[(4), (5)]	R6.6	R6.6	R6.6	R6.6	R6.6	R6.6
Heated wall[(6)]	R2.9	R2.9	R2.9	R2.9	R2.9	R2.9
Heated floor[(7)]	R2.5	R2.5	R2.5	R2.8	R3.0	R3.0

Notes:

(1) R_{IN}/*R-value* < 0.1 and R_{IN} is the *thermal resistance* between the heated plane and the inside air.

(2) Floor coverings, for example carpet or cork, will reduce the efficiency of the *heated floor*.

(3) Climate zone boundaries are shown in Appendix C.

(4) In *roofs* with a *roof* space, where the insulation is installed over a horizontal ceiling, the *roof R-value* may be reduced to R3.3 for a distance of up to 500 mm from the outer edge of the ceiling perimeter where space restrictions do not allow full-thickness insulation to be installed.

(5) For **housing** only, for *building consent* applications submitted before 1 May 2023, the minimum *construction R-value* for *heated ceilings* in all climate zones is permitted to be reduced to R3.5.

(6) For **housing** only, for *building consent* applications submitted before 1 May 2023, the minimum *construction R-value* for *heated walls* in all climate zones is permitted to be reduced to R2.6.

(7) For **housing** only, for *building consent* applications submitted before 1 May 2023, the minimum *construction R-value* for heated floors in all climate zones is permitted to be reduced to R1.9.

TABLE 2.1.2.2B: **Reference building construction R-values for building elements not containing embedded heating systems**

Paragraph 2.1.2.2 b)

Building element	Construction R-values $(m^2 \cdot K/W)$ [(1)]					
	Climate zone 1	Climate zone 2	Climate zone 3	Climate zone 4	Climate zone 5	Climate zone 6
Roof[(2)]	R6.6	R6.6	R6.6	R6.6	R6.6	R6.6
Wall	R2.0	R2.0	R2.0	R2.0	R2.0	R2.0
Floor *Slab-on-ground* floors	R1.5	R1.5	R1.5	R1.5	R1.6	R1.7
Floors other than *slab-on-ground*	R2.5	R2.5	R2.5	R2.8	R3.0	R3.0
Windows and doors[(3)]	R0.46[(3)]	R0.46[(3)]	R0.46	R0.46	R0.50	R0.50
Skylights	R0.46	R0.46	R0.54	R0.54	R0.62	R0.62

Note:

(1) Climate zone boundaries are shown in Appendix C.

(2) In *roofs* with a *roof* space, where the insulation is installed over a horizontal ceiling, the *roof R-value* may be reduced to R3.3 for a distance of up to 500 mm from the outer edge of the ceiling perimeter where space restrictions do not allow full-thickness insulation to be installed.

(3) For *building consent* applications submitted before 2 November 2023, the minimum *construction R-values* for windows and doors in climate zones 1 and 2 for the reference *building* are permitted to be reduced to R0.37 $m^2 \cdot K/W$.

H **TABLE 2.1.2.2C: Alternative minimum construction R-values for building elements that do not contain embedded heating systems – for housing only where building consent applications are submitted before 1 May 2023**

Paragraphs 2.1.2.2 b), 2.1.3.1

Building element	Construction R-values ($m^2 \cdot K/W$)	
	Region A (1)	Region B (2)
Roof	R2.9	R3.3
Wall	R1.9	R2.0
Floor	R1.3	R1.3
Windows and doors	R0.37	R0.37
Skylights	R0.37	R0.37

Notes:

(1) Region A comprises all of the North Island/Te Ika-a-Māui excluding the Taupo District, the Ruapehu District and the part of the Rangitikei District north of 39°50'S (-39.83), and all offshore islands north of 37°15'S (-37.25).

(2) Region B comprises the Taupo District, the Ruapehu District, the part of the Rangitikei District north of 39°50'S (-39.83), the South Island/Te Waipounamu, Stewart Island/Rakiura, the Chatham Islands, and all offshore islands south of 37°15'S (-37.25).

i

COMMENT: Region A in Table 2.1.2.2C is consistent with the previous climate zones 1 and 2 defined in NZS 4218: 2009. Region B is consistent with the previous climate zone 3 defined in NZS 4218: 2009. The NZS 4218 climate zones are different to the current six climate zones defined in Appendix C.

2.1.3 Determining the thermal resistance

2.1.3.1 The *thermal resistance* (*R-values*) of *building elements* may be verified:

a) For walls, *roofs* and floors other than *slab-on-ground floors*, by using NZS 4214; and

b) For windows, doors, *skylights* and *curtain walling*, as specified in Appendix E; and

c) For *slab-on-ground floors*, as specified in Appendix F.

i

COMMENT: The BRANZ 'House Insulation Guide' provides *thermal resistances* of common *building* components and is based on calculations from NZS 4214. However, the BRANZ House Insulation Guide, 5th edition or earlier, should not be used for determining the *thermal resistances* of *slab-on-ground floors*, windows, and doors due to differences in calculation methods and assumptions compared to Appendix E and Appendix F.

2.1.3.2 The *thermal resistance (R-values)* of insulation materials may be verified by using AS/NZS 4859.1.

2.1.3.3 The *construction R-values* of *building elements* shall be calculated as follows:

a) For walls and *roofs*, the *R-value* is of a typical area of the *building element*; and

b) For framed walls, the *R-value* shall include the effects of studs, dwangs, top plates and bottom plates, but may exclude the effects of lintels, sills, additional studs that support lintels and sills, and additional studs at corners and junctions; and

c) For walls without frames, the *R-value* excludes any attachment requirements for windows and doors; and

d) For windows, doors and *skylights*, as specified in Appendix E; and

e) For *slab-on-ground* floors, the *R-value* is as specified in Appendix F; and

f) For floors other than *slab-on-ground floors*, the *R-value* is of a typical area of the floor ignoring the effect of floor coverings (including carpets).

Appendix A. References

For the purposes of Building Code compliance, the Standards and documents referenced in this Verification Method must be the editions, along with their specific amendments, listed below.

Standards New Zealand		Where quoted
NZS 4214: 2006	Methods of determining the total thermal resistance of parts of buildings	2.1.3.1 a), Definitions
NZS 4303: 1990	Ventilation for acceptable indoor air quality	D.3.2.1.b)
AS/NZS 4859:-	Thermal insulation materials for buildings	
Part 1: 2018	General criteria and technical provisions	2.1.3.2

British Standards Institute

BS EN 673: 2011	Glass in building – Determination of thermal transmittance (U value) – Calculation method	E.1.2.2 a), E.1.2.4 a), E.2.1.2 a), Equation E.5

International Organization for Standardization

ISO 10077:-	Thermal performance of windows, doors and shutters - Calculation of thermal transmittance	D.3.2.1.b)
Part 1: 2017	General	E.1.2.2 a), E.1.2.4 a), E.1.3.1, E.2.1.2
Part 2: 2017	Numerical method for frames	E.1.2.2 b), E.1.2.4 b), E.2.1.2 b)
ISO 10211: 2017	Thermal bridges in building construction – Heat flows and surface temperatures – Detailed calculations	F.1.2.3
ISO 10456: 2007	Building materials and products – Hygrothermal properties – Tabulated design values and procedures for determining declared and design thermal values	F.1.2.6
ISO 12631: 2017	Thermal performance of curtain walling – Calculation of thermal transmittance	Equation E.5
ISO 13370: 2017	Thermal performance of buildings – Heat transfer via the ground – Calculation methods	F.1.2.2, F.1.2.3, F.1.2.4, F.1.2.6
ISO 13789: 2017	Thermal performance of buildings – Transmission and ventilation heat transfer coefficients – Calculation method	F.1.2.3

This standard can be accessed from www.standards.govt.nz

American National Standards Institute

ANSI/ASHRAE 140: 2017	Standard method of test for the evaluation of building energy analysis computer programs	D.1.3.1

This standard can be accessed from webstore.ansi.org/

References

International Energy Agency

Building Energy Simulation Test (BESTEST) and Diagnostic Method (1995)	D.1.3.1

This document can be accessed from www.nrel.gov

BRANZ Ltd

ALF 4.0	Annual Loss Factor version 4.0, 4th Edition (2018)	Definitions
BRANZ House Insulation Guide (5th Edition), 1 July 2014		2.1.3.1 Comment, F.1.1.1 Comment

These documents can be accessed from www.branz.co.nz

National Institute of Water and Atmospheric Research Ltd (NIWA)

Temperature Normals for New Zealand 1961-1990 by A I Tomlinson and J Sansom (ISBN 0478083343)	Definitions

This document can be accessed from www.niwa.co.nz

i

Appendix B. Definitions

These definitions are specific to this verification method. Other defined terms found in italics within the definitions are provided in clause A2 of the Building Code.

Adequate	Means adequate to achieve the objectives of the Building Code.
Approved temperature data	Means the temperature data contained in A I Tomlinson and J Sansom, Temperature Normals for New Zealand for period 1961 to 1990 (NIWA, ISBN 0478083343).
Building	Has the meaning given to it by sections 8 and 9 of the Building Act 2004.
Building element	Any structural or non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.
Building envelope	The *building thermal envelope* plus the exterior surface of any spaces not requiring conditioning, e.g. garage, floor space (below insulating layer), *roof* space (above any outer surface defining an attic or when there is no attic above the insulating layer).
Building performance index (BPI)	In relation to a *building*, means the *heating energy* of the *building* divided by the product of the *heating degrees total* and the sum of the *floor area* and the *total wall area*, and so is calculated in accordance with the following formula: $$\text{BPI} = \frac{\text{Heating energy}}{\text{Heating degrees total x (floor area + total wall area)}}$$
Conditioned space	That part of a *building* within the *building thermal envelope* that may be directly or indirectly heated or cooled for occupant comfort. It is separated from *unconditioned space* by *building elements* (walls, windows, *skylights*, doors, *roof*, and floor) to limit uncontrolled airflow and heat loss.
Construct	In relation to a *building*, includes to design, build, erect, prefabricate, and relocate the *building*.
Construction R-value	The *total thermal resistance (R-value)* of a typical area of a *building element*.
Cooling load	The amount of heat energy removed from the *building* to maintain it below the required maximum temperature (the amount of heat removed by the chosen appliances, not the amount of fuel required to run them).
Curtain walling	Part of the *building envelope* made of a framework usually consisting of horizontal and vertical profiles, connected together and anchored to the supporting structure of the *building*, and containing fixed and/or openable infills, which provides all the required functions of an internal or *external wall* or part thereof, but does not contribute to the load bearing or the stability of the structure of the *building*.
Default value	Value(s) to be used for modelling purposes, unless the designer can demonstrate that a different assumption better characterises the *building*'s use over its expected life.
External wall	Any vertical exterior face of a *building* consisting of primary and/or secondary elements intended to provide protection against the outdoor environment.
Floor area	In relation to a *building*, means the *floor area* (expressed in square metres) of all interior spaces used for activities normally associated with domestic living.

Glazing Area ($A_{glazing}$)	The total area of vertical windows and doors that include glazing in the *thermal envelope* including transparent or translucent glazing, frames and opening tolerances, decorative glazing, and louvres. This excludes opaque panels, opaque doors, and *skylights*.
Heated ceilings, walls, or floors	Any ceiling, wall, or floor incorporating embedded pipes, electrical cables, or similar means of raising the temperature of the ceiling, wall, or floor for room heating.
Heating degrees	In relation to a location and a *heating month*, means the degrees obtained by subtracting from a base temperature of 14°C the mean (calculated using the *approved temperature data*) of the outdoor temperatures at that location during that month.
Heating degrees total	In relation to a location and year, means whichever is the greater of the following: a) the value of 12 and b) the sum of all the *heating degrees* (calculated using the *approved temperature data*) for all of the *heating months* of the year.
Heating energy	In relation to a *building*, means the energy from a *network utility operator* or a depletable resource (expressed in kilowatt-hours, and calculated using ALF 4.0, A tool for determining the *Building performance index* (BPI) of a house design (2018, BRANZ, Ltd) or some other method that can be correlated with that manual) needed to maintain the *building* at all times within a year at a constant internal temperature under the following standard conditions: a) a continuous temperature of 20°C throughout the *building:* b) an air change rate of 1 change per hour or the actual air leakage rate, whichever is the greater: c) a heat emission contribution arising from internal heat sources for any period in the year of 1000 kilowatt-hours for the first 50 m^2 of *floor area*, and 10 kilowatt-hours for every additional square metre of *floor area:* d) no allowance for— i) carpets; or ii) blinds, curtains, or drapes, on windows: e) windows to have a *shading coefficient* of 0.6 (made up of 0.8 for windows and recesses and 0.75 for site shading).
Heating load	The amount of heat energy supplied to the *building* to maintain it at the required temperature (the amount of heat delivered by the chosen appliances, not the amount of fuel required to run them).
Heating month	In relation to a location, means a month in which a base temperature of 14°C is greater than the mean (calculated using the *approved temperature data*) of the outdoor temperatures at that location during that month.
HVAC system	For the purposes of performance H1.3.6 and in relation to a *building*, means a mechanical, electrical, or other system for modifying air temperature, modifying air humidity, providing ventilation, or doing all or any of those things, in a space within the *building*.

Definitions

Intended use	In relation to a *building*, — a) includes any or all of the following: i) any reasonably foreseeable occasional use that is not incompatible with the *intended use*; ii) normal maintenance; iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but b) does not include any other maintenance and repairs or rebuilding.
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 purposes of— i) telecommunications 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 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.
Occupied space	Any space within a *building* in which a person will be present from time to time during the *intended use* of the *building*.
Opaque door area ($A_{door,opaque}$)	The total area of opaque doors and opaque panels of doors in the *thermal envelope*, including frames and opening tolerances.
Persons	Includes— a) the Crown; and b) a corporation sole; and c) a body of *persons* (whether corporate or unincorporated).
Plug load	The electrical load drawn by electrical appliances connected to the *building* electrical reticulation system by way of general purpose socket outlets.
R-value	The common abbreviation for describing the values of both *thermal resistance* and *total thermal resistance*.
Roof	Any *roof*/ceiling combination where the exterior surface of the *building* is at an angle of 60° or less to the horizontal and has its upper surface exposed to the outside.
Roof area (A_{roof})	The area of the *roof* that is part of the *thermal envelope*, excluding the *skylight area*.
Shading coefficient	The ratio of the total *solar heat gain coefficient* (SHGC) through a particular glass compared to the total *solar heat gain coefficient* through 3 mm clear float glass.
Skylight	Translucent or transparent parts of the *roof*, including frames and glazing.

Skylight area ($A_{skylight}$)	The area of *skylights* that are part of the *roof thermal envelope*, including frames and opening tolerances.
Slab-on-ground floor	Floor *construction* consisting of a concrete slab or concrete raft foundation in contact with the ground over its whole area.
Solar heat gain coefficient (SHGC)	The total solar energy entering a *building* through the glazing, that is, the direct transmission of energy from the sun plus the inwards re-radiation of heat from solar radiation that is absorbed in the glass. The SHGC is also known as the solar factor (SF) or g (glazing factor).
Thermal envelope	The *roof*, wall, window, *skylight*, door and floor *construction* between *unconditioned spaces* and *conditioned spaces*.
Thermal envelope floor area (A_{floor})	The area of the floor that forms part of the *thermal envelope*.
Thermal mass	The heat capacity of the materials of the *building* affecting *building* energy loads by storing and releasing heat as the interior and/or exterior temperature and radiant conditions fluctuate.
Thermal resistance	The resistance to heat flow of a given component of a *Building element*. It is equal to the air temperature difference (K) needed to produce unit heat flux (W/m^2) through unit area (m^2) under steady conditions. The units are $m^2 \cdot K/W$.
Total roof area	The *roof area* (A_{roof}) plus the *skylight area* ($A_{skylight}$).
Total thermal resistance	The overall air-to-air *thermal resistance* across all components of a *building element* such as a wall, *roof,* or floor. (This includes the surface resistances which may vary with environmental changes e.g. temperature and humidity, but for most purposes can be regarded as having standard values as given in NZS 4214.)
Total wall area	In relation to a *building,* means the sum (expressed in square metres) of the following: a) the *wall area* of the *building*; and b) the area (expressed in square metres) of all vertical windows and doors in *external walls* of the *building.*
Unconditioned space	Space within the *building envelope* that is not *conditioned space* (for example, this may include a garage, conservatory, atrium, attic, subfloor, and so on). However, where a garage, conservatory or atrium is expected to be heated or cooled these spaces shall be included in the *conditioned space*.
Wall area	The area of walls that are part of the *thermal envelope*, excluding the *opaque door area* and the *glazing area*.
Wharenui	A communal meeting house having a large open *floor area* used for both assembly and sleeping in the traditional Māori manner.

Appendix C. New Zealand climate zones

C.1 Climate zones

C.1.1 Climate zone boundaries

C.1.1.1 There are six climate zones. The climate zone boundaries are based on climatic data taking into consideration territorial authority boundaries.

C.1.1.2 A list of the climate zones for each territorial authority is provided in Table C.1.1.2 and illustrated in Figure C.1.1.2. The list in the table takes precedence over the figure.

TABLE C.1.1.2: **Climate zones by territorial authority**
Paragraph C.1.1.2

North Island/Te Ika-a-Māui	
Territorial authority	**Climate zone**
Far North District	1
Whangarei District	1
Kaipara District	1
Auckland	1
Thames-Coromandel district	1
Hauraki District	2
Waikato District	2
Matamata-Piako District	2
Hamilton City	2
Waipa District	2
Ōtorohanga District	2
South Waikato District	2
Waitomo District	2
Taupo District	4
Western Bay of Plenty District	1
Tauranga City	1
Rotorua District	4
Whakatane District	1
Kawerau District	1
Ōpōtiki District	1
Gisborne District	2
Wairoa District	2
Hastings District	2
Napier City	2
Central Hawke's Bay District	2
New Plymouth District	2
Stratford District	2
South Taranaki District	2
Ruapehu District	4
Whanganui District	2
Rangitikei District (north of 39°50'S (-39.83))	4
Rangitikei District (south of 39°50'S (-39.83))	3
Manawatu District	3
Palmerston North City	3
Tararua District	4
Horowhenua District	3
Kapiti Coast District	3
Porirua City	3
Upper Hutt City	4
Lower Hutt City	3
Wellington City	3
Masterton District	4
Carterton District	4
South Wairarapa District	4

South Island/Te Waipounamu	
Territorial authority	**Climate zone**
Tasman District	3
Nelson City	3
Marlborough District	3
Kaikoura District	3
Buller District	4
Grey District	4
Westland District	4
Hurunui District	5
Waimakariri District	5
Christchurch City	5
Selwyn District	5
Ashburton District	5
Timaru District	5
Mackenzie District	6
Waimate District	5
Chatham Islands	3
Waitaki District (true left of the Otekaieke river)	6
Waitaki District (true right of the Otekaieke river)	5
Central Otago District	6
Queenstown-Lakes District	6
Dunedin City	5
Clutha District	5
Southland District	6
Gore District	6
Invercargill City	6

Appendix D. Modelling method – Building energy use comparison

D.1 Modelling requirements

D.1.1 Overview

D.1.1.1 This modelling method is used to assess the energy performance of a proposed *building* by using a simulation of the *building* to predict its space *heating loads* and *cooling loads*. This is compared with the space *heating loads* and *cooling loads* of a reference *building* that is the same shape, dimensions, and orientation as the proposed *building*, but has *building elements* with *construction R-values* from:

a) For *building elements* that contain embedded heating systems, Table 2.1.2.2A; or

b) For *building elements* that do not contain embedded heating systems,

i) Table 2.1.2.2B or

H

ii) alternatively, for **housing** only, for *building consent* applications submitted before 1 May 2023, those in Table 2.1.2.2C.

D.1.1.2 Both *buildings* shall be simulated using the same method.

D.1.2 Modelling principles

D.1.2.1 The proposed *building* and reference *building* shall both be analysed using the same techniques and assumptions except where differences in energy efficiency features that are specified in this appendix require a different approach.

D.1.2.2 The specifications of the proposed *building* used in the analysis shall be as similar as is reasonably practicable to those in the plans submitted for a building consent.

D.1.2.3 The reference *building* shall have the same number of storeys, *floor area* for each storey, orientation and three dimensional form as the proposed *building*. Each floor shall be orientated exactly as the proposed *building*. The geometric form shall be the same as the proposed *building*. The floor(s) that form part of the *thermal envelope* shall be of the same type (*slab-on-ground floor* or other types of floors) in both the reference *building* and the proposed *building*.

D.1.2.4 Features that may differ between the proposed *building* and the reference *building* are:

a) Wall *construction R-value* and *thermal mass*; and/or

b) Floor *construction R-value*; and/or

c) *Roof construction R-value* and *thermal mass*; and/or

d) Window, door and *skylight* size and orientation, *construction R-value*, *solar heat gain coefficient* (*SHGC*), and external shading devices; and/or

e) Heating, cooling, and ventilation plant (sizing only).

D.1.2.5 The results of the thermal modelling should not be construed as a guarantee of the actual energy use of the *building*.

D.1.3 Modelling software

D.1.3.1 If the application for which the software is to be used has been documented according to the ANSI/ASHRAE Standard 140 procedure, then the method shall pass the ANSI/ASHRAE Standard 140 test. If the application for which the software is to be used has not been documented according to the ANSI/ASHRAE Standard 140 procedure, the method shall be tested to the BESTEST and pass the BESTEST.

D.1.4 Default values

D.1.4.1 The *default values* and schedules included in this appendix shall be used unless the designer can demonstrate that different assumptions better characterise the *building's* use over its expected life. Any modification of default assumptions shall be used in simulating both the proposed *building* and the reference *building*.

D.1.4.2 Other aspects of the *building's* performance for which no *default values* are provided may be simulated according to the designer's discretion as is most appropriate for the *building*, but they must be the same for both the proposed *building* and the reference *building.*

D.1.4.3 In all the following cases, modelling is to be identical for both the proposed *building* and the reference *building*. Some of these items have limitations on the input values and others have default schedules that may be used when actual figures are not known. In all cases these values shall be reasonable approximations of the requirements of the *building* and its use during its expected life:

a) Heating, set-points, and schedules; and
b) Cooling, set-points, and schedules; and
c) Ventilation, set-points, and schedules; and
d) Fresh air ventilation, air change rates, and schedules; and
e) Internal gains loads and schedules; and
f) Occupancy loads and schedules; and
g) The location and *R-values* of carpets and floor coverings; and
h) Incidental shading.

D.1.5 Climate data

D.1.5.1 Both the proposed *building* and the reference *building* shall be modelled using the same climate data. The climate data shall be from a weather station that best represents the climate at the *building* site. The climate data shall represent an average year for the site, over at least a 10-year period.

> i
>
> COMMENT: Using the relevant NIWA Typical Meterological Year climate files is one way to achieve this requirement.

D.1.6 Thermal zones

D.1.6.1 For *buildings* with multi-unit dwellings, the model of the proposed *building* and the reference *building* shall be identically and suitably divided into separate thermal zones. Each *household unit* shall be represented by at least one thermal zone.

D.1.6.2 For all other *buildings*, the model of the proposed *building* and the reference *building* shall be identically and suitably divided into separate thermal zones if the modelling software is capable of dividing the model into multiple thermal zones. If the modelling software is only capable of modelling a single thermal zone, the requirements in Paragraph D.1.6.3 to D.1.6.9 do not apply.

D.1.6.3 Spaces that are likely to have significantly different space conditioning requirements shall be modelled as separate zones.

D.1.6.4 The *conditioned space* shall be divided into a minimum of three thermal zones.

D.1.6.5 *Roof* spaces and enclosed subfloor spaces shall be modelled as thermal zones.

D.1.6.6 The model shall have a representation of internal conductive heat flows between thermal zones. Internal partitions between thermal zones require modelling and shall be described in terms of their location, surface area, pitch, and *construction R-value*.

D.1.6.7 The same internal partitions as modelled in the proposed *building* shall be modelled in the reference *building*.

D.1.6.8 Internal partitions within a thermal zone which may affect the thermal performance of the *building* shall be modelled.

D.1.6.9 Airflow between thermal zones need not be modelled unless desired.

D.1.7 Adjoining spaces

D.1.7.1 *Building element*s that separate adjoining *conditioned space*s of dwellings may be assumed to have no heat transfer.

D.1.7.2 *Building element*s separating *conditioned space* from adjacent *unconditioned space* (for example, a garage) may be modelled with a *construction R-value* that is 0.5 higher than the *actual construction R-value* and zero solar absorptance. This adjustment to the *construction R-value* takes into account the insulation from the still air in the *unconditioned space*.

D.1.8 Thermal mass

D.1.8.1 The *thermal mass* may either be modelled:

a) The same way for both the proposed *building* and the reference *building*; or

b) As proposed for the proposed *building* and modelled as lightweight for the reference *building*.

D.1.9 Thermal mass of contents

D.1.9.1 The *thermal mass* of the contents shall be the same for both models, and may be regarded as zero for modelling purposes.

D.1.10 Floor coverings

D.1.10.1 Floor coverings shall be modelled as proposed in both the proposed *building* and the reference *building*. If no floor coverings are specified, ceramic tiles shall be modelled in wet areas (kitchens, bathrooms, toilets, and laundries) and carpet to all other areas.

D.1.11 Shading

D.1.11.1 Exterior shading such as fins and overhangs shall be modelled as proposed in the proposed *building*, but need not be modelled in the reference *building*.

D.1.11.2 No account shall be taken of internal shading devices such as blinds, drapes, and other non-permanent window treatments.

D.1.12 Incidental shading

D.1.12.1 Shading by structures and terrain that have a significant effect on the *building* shall be modelled in the same way for the proposed *building* and the reference *building*.

D.1.12.2 No account shall be taken of trees or vegetation.

D.1.13 Infiltration

D.1.13.1 Infiltration assumptions for the proposed *building* and the reference *building* shall be the same, and shall be reasonable for the *building construction*, location, and use.

D.2 Thermal envelope

D.2.1 Thermal envelope building elements

D.2.1.1 All *building elements* shall be described in terms of surface area, orientation, pitch, and *construction R-value*. *Glazing areas* shall have their *solar heat gain coefficient (SHGC)* specified.

D.2.1.2 The solar absorption of external *building elements*, except as specified in Paragraph D.1.11.2, shall be modelled in both the proposed *building* and reference *building* as proposed. If solar absorption is not specified, they shall be modelled in both the proposed *building* and reference *building* as 0.5.

D.2.1.3 When the modelling program calculates and adds its own surface resistances to the input resistance, the input resistances shall be the *R-values* derived as specified in this method less the standardised surface resistances of 0.03 $m^2 \cdot K/W$ outside and 0.09 $m^2 \cdot K/W$ inside (0.12 $m^2 \cdot K/W$ total). The same method of calculation shall be used for the proposed *building* and the reference *building*.

D2.1.4 When using a modelling program that uses inputs for describing the *thermal resistance* of *slab-on-ground floors* that are different to the *construction R-value* of *slab-on-ground floors* as defined in Paragraph 2.1.3.3 e) (e.g. not from the inside air to the outside air):

a) In the reference *building*, any *slab-on-ground floor* shall be modelled with a *construction* type selected from Tables F.1.2.2A to F.1.2.2X in Acceptable Solution H1/AS1 Appendix F. For the slab area-to-perimeter ratio, *external wall* cladding type and *external wall* effective thickness of the reference *building*, the selected *construction* type must have a *construction R-value* that is equal to or greater than the minimum *R-value* for *slab-on-ground floors* specified in Paragraph 2.1.2.2; and

b) In the proposed *building*, using the methods specified in Appendix F, any *slab-on-ground* floor must, as a minimum, meet the *construction R-value* for *slab-on-ground* floors in:

   i) For floors that contain embedded heating systems, Table 2.1.2.2A; or

   ii) For floors that do not contain embedded heating systems,

      i) Table 2.1.2.2B or

      H ii) alternatively, for **housing** only, for *building consent* applications submitted before 1 May 2023, those in Table 2.1.2.2C.

D.2.2 Glazing

D.2.2.1 If the *glazing area* in the proposed *building* is more than 30% of the *total wall area*, then the *glazing area* of the reference *building* shall be 30% of the *total wall area*. If the *glazing area* of the proposed *building* is 30% or less of the *total wall area*, then the *glazing area* of the reference *building* shall either be the same as the proposed *building* or 30% of the *total wall area* (at the discretion of the modeller).

D.2.2.2 If the *glazing areas* in the proposed *building* and the reference *building* are different, then the *glazing area* in the reference *building* shall either be distributed evenly around the *building*, or the size of each glazed unit be changed by the same proportion to achieve a *glazing area* of 30% and be modelled in the same location with the same head height as in the proposed *building.*

D.2.3 Skylights

D.2.3.1 In the reference *building* the *roof area* (A_{roof}) shall be set equal to the *total roof area* and the *skylight area* ($A_{skylight}$) shall be set to zero.

D.2.4 Door area

D.2.4.1 In the reference *building*:

a) The *opaque door area* that is no more than either 6 m^2 or 6% of the *total wall area* (whichever is greater) shall have the same *construction R-value* as the reference *building* windows (or higher at the designer's discretion); and

b) Any remaining *opaque door area* shall have the same *construction R-value* as the reference *building* wall.

D.3 Space conditioning

D.3.1 Control temperatures

H D.3.1.1 For **housing**, a minimum temperature of 18°C or higher at any time, and a maximum temperature of 25°C or lower at any time, is required to be modelled. Prior to the use of artificial cooling, natural ventilation shall be modelled at a set point of 24°C provided the outdoor air temperature is lower than the indoor air temperature. The ventilation rate shall be reasonable for the amount of available venting area for each zone and shall be the same for the proposed *building* and reference *building*.

H D.3.1.2 For *buildings* other than **housing**, a minimum temperature of 18°C and a maximum temperature of 25°C from 8am – 6pm, five days a week, shall be modelled unless a different schedule can be justified for the life of the *building*.

D.3.2 Fresh air ventilation

D.3.2.1 The fresh air ventilation rate and schedule shall be the same for both the proposed *building* and the reference *building*. The minimum fresh air ventilation rate shall be:

H a) 0.5 air changes per hour for **housing**; and

b) As specified in NZS 4303 for other *buildings*.

D.3.3 Conditioning system modelling

D.3.3.1 The calculation of the annual loads for space heating and cooling does not include an assessment of heating, cooling, and ventilating equipment. A simulation of the heating, cooling, and ventilating equipment is not required, but shall be the same for the proposed *building* and reference *building* if modelled. Sizing is the only feature that may be changed in response to load requirements.

D.4 Internal loads

D.4.1 Lighting

D.4.1.1 Lighting need not be modelled. However, if it is, it shall be the same for both the proposed *building* and the reference *building.*

D.4.2 Domestic hot water

D.4.2.1 For both the proposed *building* and the reference *building*, the power density for an internal cylinder shall either be ignored, or the *default value* from Table D.5.1.1 shall be used.

D.4.3 Occupant and plug loads

D.4.3.1 The maximum heat release into a *building* from occupants and *plug loads* is provided in Table D.5.1.1. and is modified to provide *default values* for heat release at different times of day. The modification factors are provided for:

H CR CN Com

a) **Housing** in Table D.5.1.2A; and
b) **Communal residential** including hotels, motels, and health consultancies in Table D.5.1.2B; and
c) **Communal non-residential** assembly care including schools in Table D.5.1.2C; and
d) **Commercial** including offices, restaurants, and retail shops in Table D.5.1.2D.

D.4.3.2 These *default values* shall be used unless other suitable parameters specific to the *building's* use are shown to be more appropriate. All internal gains are regarded as sensible heat.

> i
>
> COMMENT: For **housing**, other suitable *default values* are available in the Passive House Planning Package (PHPP), version 9, 2015 or the New Zealand Green Building Council Energy and Carbon Calculator for Homes (ECCHO), 2021. These tools can be accessed from www.passivehouse.com and www.nzgbc.org.nz.

D.4.3.3 *Unconditioned spaces* shall be assigned zero internal gains.

D.4.4 Process loads

D.4.4.1 Process loads are those *heat loads* that result from the production of goods within a *building*.

D.4.4.2 Only in circumstances where process loads are significant, and it can be shown that they will continue for the expected life of the *building*, may they be modelled. Process loads shall be the same in both the proposed *building* and reference *building*s.

D.5 Reference building

D.5.1 Schedules

D.5.1.1 The default power densities for internal gains from occupants and *plug load* are provided in Table D.5.1.1.

TABLE D.5.1.1: Default power densities for internal gains from occupants and plug loads

Paragraphs D.4.3.1, D.5.1.1

Classified use	Applies to[1]	Occupancy (W/m^2)	Plug load (W/m^2)
H	**Housing**	[2]	24.5
CR	Community service – hotels and motels	2.9	2.7
	Community care – Unrestrained – health/institutional	3.6	10.7
CN	Assembly care – schools	9.7	5.4
Com	Office	2.7	8.1
	Restaurant	7.3	1.1
	Retail shop	2.4	2.7
	Car park	N/A	N/A

Notes:

(1) If an activity for the proposed *building* is not specifically described, use the nearest description for both the proposed *building* and the reference *building*.

(2) **Housing** modelling assumptions:

(a) Domestic hot water (DHW) contribution (per *building* for each internal cylinder) is 100 W
(b) Occupants (up to 50 m^2 *floor area*) (sensible heat) are 150 W
(c) Occupants (per m^2 over 50 m^2 *floor area*) (sensible heat) are 3 W/m^2

D.5.1.2 The default schedules for occupancy and *plug loads* are provided for:

H CR CN Com

a) **Housing** in Table D.5.1.2A; and
b) **Communal residential** including hotels, motels, and health consultancies in Table D.5.1.2.B; and
c) **Communal non-residential** assembly care including schools in Table D.5.1.2C; and
d) **Commercial** including offices, restaurants, and retail shops in Table D.5.1.2D.

TABLE D.5.1.2A: Default schedules for occupancy and plug loads – Percentage of maximum load or percentage of power density for housing

Paragraphs D.4.3.1 a), D.5.1.2 a)

Housing					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	100	60	60	100	100
Saturday	100	100	50	70	100
Sunday	100	100	50	70	100
Plug load					
Week	3	23	23	27	20
Saturday	3	23	23	27	20
Sunday	3	23	23	27	20

TABLE D.5.1.2B: **Default schedules for occupancy and plug loads – Percentage of maximum load or percentage of power density for communal residential**

Paragraphs D.4.3.1 b), D.5.1.2 b)

Community service – Hotels and motels					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	90	40	20	70	90
Saturday	90	50	30	60	70
Sunday	70	70	30	60	80
Plug load					
Week	10	40	25	60	60
Saturday	10	40	25	60	60
Sunday	10	30	30	50	50
Community service – residential care such as retirement village					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	70	90	90	85	70
Saturday	70	90	90	85	70
Sunday	70	90	90	85	70
Plug load					
Week	20	90	85	80	20
Saturday	20	90	85	80	20
Sunday	20	90	85	80	20
Community care – Health/medical specialist					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	0	80	80	30	0
Saturday	0	40	40	0	0
Sunday	0	5	5	0	0
Plug load					
Week	10	90	90	30	10
Saturday	10	40	40	10	10
Sunday	5	10	10	5	5

TABLE D.5.1.2C: **Default schedules for occupancy and plug loads – Percentage of maximum load or percentage of power density for communal non-residential – assembly care**

Paragraphs D.4.3.1 c), D.5.1.2 c)

Schools					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	0	95	95	10	0
Saturday	0	10	10	0	0
Sunday	0	0	0	0	0
Plug load					
Week	5	95	95	30	5
Saturday	5	15	15	5	5
Sunday	5	5	5	5	5

TABLE D.5.1.2D: **Default schedules for occupancy and plug loads – Percentage of maximum load or percentage of power density for commercial buildings**

Paragraphs D.4.3.1 d), D.5.1.2 d)

Office					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	0	95	95	5	0
Saturday	0	10	5	0	0
Sunday	0	5	5	0	0
Plug load					
Week	5	90	90	30	5
Saturday	5	30	15	5	5
Sunday	5	5	5	5	5
Restaurant					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	0	5	50	80	35
Saturday	0	0	45	70	55
Sunday	0	0	20	55	20
Plug load					
Week	15	40	90	90	50
Saturday	15	30	80	90	50
Sunday	15	30	70	60	50
Retail shop					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	0	60	70	40	0
Saturday	0	60	80	20	0
Sunday	0	10	40	0	0
Plug load					
Week	5	90	90	50	5
Saturday	5	90	90	30	5
Sunday	5	40	40	5	5

D.6 Documentation

D.6.1 Documentation of analysis

D.6.1.1.1 Documentation of computer modelling analysis shall contain:

a) The name of the modeller;

b) The thermal modelling program name, version number, and supplier;

c) Technical detail on the proposed *building* and reference *building* designs and the differences between the designs;

d) The sum of the *heating load* and *cooling load* for the proposed *building* and reference *building*;

e) Where possible, the *heating load* and *cooling load* for the proposed *building* and the reference *building*.

Appendix E. Windows, doors, skylights, and curtain walling

E.1 Vertical windows and doors

E.1.1 Methods for determining construction R-values

E.1.1.1 The *construction R-values* for vertical windows and doors shall be determined using one of the following methods:

a) Calculation of the *construction R-value* of each individual window and door that is part of the *thermal envelope*, in accordance with Section E.1.2; or

b) Calculation of the representative *construction R-value* of all windows and doors that are part of the *thermal envelope* of the proposed *building*, which is then deemed to apply to all windows and doors of the proposed *building*, in accordance with Section E.1.3; or

c) For **housing** only, based on the performance tables in Acceptable Solution H1/AS1 Appendix E.

> COMMENT: The window size and frame material have a major impact on the *construction R-value* of a window as a *building element*. Often the *thermal resistances* of the glazing and the frames are dissimilar. For large windows, the *thermal resistance* of the glazing will have more impact on the overall window *construction R-value* than in a small window, which is dominated by the frame performance. This means that the *construction R-values* of two differently-sized windows consisting of identical frame and glazing materials will usually be dissimilar.

E.1.2 Calculation of the construction R-value of each individual window and door that is part of the thermal envelope

E.1.2.1 For each window that is part of the *thermal* envelope of the proposed *building*, the window *construction R-value* (R_W) shall be calculated in accordance with Equation E.1. *The construction R-value* shall be rounded down to no less than two significant figures.

Equation E.1.: $R_w = \frac{1}{U_w}$

where:

R_W is the *construction R-value* of the window ($m^2 \cdot K/W$); and

U_W is the thermal transmittance of the window ($W/(m^2 K)$), determined in accordance with Paragraph E.1.2.2.

E.1.2.2 The thermal transmittance (U_W) of each vertical window that is part of the *thermal envelope* of the proposed *building* shall be determined in accordance with ISO 10077-1, with:

a) The thermal transmittance of the glazing (U_g) determined using BS EN 673; and

b) The thermal transmittance of the frame (U_f) determined using ISO 10077-2. For frames with special extensions overlapping the wall or other *building elements*, such as frames with flanges to the cladding, the following deviations from ISO 10077-2 Section 6.3.1, are permitted:

i) Special extensions may be disregarded or included in the calculation model, but shall be disregarded when determining the projected width of the frame section (b_f) as per ISO 10077-2: 2017 Appendix F; and

ii) Window reveal liners that are integral with the window unit may either be disregarded or included in the calculation model.

E.1.2.3 For each door that is part of the *thermal envelope* of the proposed *building*, the door *construction R-value* (R_D) shall be calculated in accordance with Equation E.2. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.2: $R_D = \frac{1}{U_D}$

where:

R_D is the *construction R-value* of the door (m²·K/W); and

U_D is the thermal transmittance of the door (W/(m²·K)), determined in accordance with Paragraph E.1.2.4.

> COMMENT: The door *construction R-value* (R_D) includes the effects of the frame, any glazing and any opaque panels.

E.1.2.4 The thermal transmittance (U_D) of each door that is part of the *thermal envelope* of the proposed *building* shall be determined in accordance with ISO 10077-1, with:

a) The thermal transmittance of any glazing (U_g) determined using BS EN 673; and

b) The thermal transmittance of the frame (U_f) determined using ISO 10077-2. For frames with special extensions overlapping the wall or other *building elements*, such as frames with flanges to the cladding, the following deviations from ISO 10077-2 Section 6.3.1, are permitted:

i) special extensions may be disregarded or included in the calculation model, but shall be disregarded when determining the projected width of the frame section (b_f) as per ISO 10077-2 Appendix F; and

ii) door reveal liners that are integral with the door unit may either be disregarded or included in the calculation model.

E.1.3 Calculation of the representative construction R-value of all windows and doors that are part of the thermal envelope

E.1.3.1 The representative window and door *construction R-value* (R_{WD}) shall be calculated in accordance with Equation E.3. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.3: $R_{WD} = \frac{\Sigma A_W + \Sigma A_D}{\Sigma \frac{A_W}{R_W} + \Sigma \frac{A_D}{R_D}}$

where:

R_W is the *construction R-value* of each vertical window that is part of the *thermal envelope* of the proposed *building* (m²·K/W), calculated in accordance with Section E.1.2.1; and

A_W is the window area of each vertical window that is part of the *thermal envelope* of the proposed *building* (m²), calculated in accordance with ISO 10077-1 Section 6.3.1; and

R_D is the *construction R-value* of each door that is part of the *thermal envelope* of the proposed *building* (m²·K/W), calculated in accordance with Section E.1.2.3.; and

A_D is the *door area* of each door that is part of the *thermal envelope* of the proposed *building* (m²), calculated in accordance with ISO 10077-1 Section 6.3.1.

E.2 Skylights

E.2.1 Construction R-values

E.2.1.1 The *construction R-values* for *skylights* ($R_{skylight}$) shall include the effects of both the glazing materials and the frame materials and shall be calculated in accordance with Equation E.4. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.4: $R_{skylight} = \frac{1}{U_w}$

where:

$R_{skylight}$ is the *construction R-value* of the *skylight* ($m^2 \cdot K/W$); and

U_w is the thermal transmittance of the *skylight* ($W/(m^2\ K)$), determined in accordance with Paragraph E.2.1.2.

E.2.1.2 The thermal transmittance (U_w) of a *skylight* shall be determined in accordance with ISO 10077-1, with:

a) the thermal transmittance of the glazing (U_g) determined using BS EN 673, considering the effects of horizontal or angled glazing on the heat transfer; and

b) the thermal transmittance of the frame (U_f) determined using ISO 10077-2.

E.3 Curtain walling

E.3.1 Construction R-value

E.3.1.1 The *construction R-values for curtain walling* (R_{CW}) shall be calculated in accordance with Equation E.5. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.5: $R_{CW} = \frac{1}{U_{CW}}$

where:

R_{CW} is the *construction R-value* of the *curtain walling* ($m^2 \cdot K/W$); and

U_{CW} is the thermal transmittance of the *curtain walling* ($W/(m^2\ K)$), determined in accordance with ISO 12631, with the thermal transmittance of the glazing (U_g) determined using BS EN 673.

Appendix F. Thermal resistance of slab-on-ground floors

F.1 Construction R-values

F.1.1 Methods for determining construction R-values for slab-on-ground floors

F.1.1.1 The *construction R-values* for concrete *slab-on-ground floors*, including floors of basements that contain *conditioned* spaces, shall be determined using:

a) The calculation method described in Section F.1.2; or

b) The performance tables in Acceptable Solution H1/AS1 Appendix F.

H F.1.1.2 For **housing** only, for *building consent* applications submitted before 1 May 2023, concrete *slab-on-ground floors* are deemed to achieve a *construction R-value* of R1.3.

i

COMMENT:

1. The *thermal resistances* for *slab-on-ground floors* provided in the BRANZ House Insulation Guide, 5th edition or earlier, should not be used for determining compliance with the requirements of this verification method. This is because they are based on a different calculation method and different assumptions than those specified in this Appendix.
2. Where a concrete floor is only partially in contact with the ground, with other parts being suspended, the part that is in contact with the ground shall be treated as a slab-on-ground floor, and the other part be treated as a suspended floor.

F.1.2 Calculating slab-on-ground floor R-values

F.1.2.1 The *construction R-value* of *slab-on-ground floors* shall be calculated from the inside air to the outside air. The effect of floor coverings (including carpets) shall be ignored.

F.1.2.2 The calculation shall be based on a three-dimensional numerical calculation in accordance with ISO 13370 Section 5.2a), or a two-dimensional numerical calculation in accordance with ISO 13370 Section 5.2b). The formulae provided in ISO 13370 Section 7 and Annex D shall not be used for determining the *construction R-value* of *slab-on-ground floors*.

F.1.2.3 When using a two-dimensional numerical calculation in accordance with ISO 13370 Section 5.2b), a geometrical model in accordance with ISO 10211 Sections 7.3, 12.4.1 and 12.4.2 shall be used. The model shall have a floor width equal to half the characteristic dimension of the floor. The characteristic dimension of the floor shall be determined using overall internal dimensions (ignoring internal partitions, as per ISO 13789).

i

COMMENT:

1. The characteristic dimension of the floor (B as defined in ISO 13370) equals the area of the floor divided by half the perimeter of the floor.
2. Paragraph F1.2.3. requires a two-dimensional geometrical model with a floor width equal to half the characteristic dimension of the floor. This represents a floor that is infinitely long and has a width equal to the characteristic dimension of the floor.

F.1.2.4 For *slab-on-ground floors* of inhomogeneous *construction*, such as concrete raft foundation floors, the results of any two-dimensional numerical calculation in accordance with ISO 13370 Section 5.2b) shall be validated by three-dimensional numerical calculations in accordance with ISO 13370 Section 5.2a).

Thermal resistance of slab-on-ground floors

COMMENT:

ISO 13370 Sections 5.2 a) and b) specify that the result of a three-dimensional numerical calculation is applicable only for the actual floor dimensions modelled, whereas the result of a two-dimensional numerical calculation is applicable to floors having the characteristic dimension that was modelled. Therefore, the result of a two-dimensional numerical calculation can have wider application, but, depending on the floor *construction*, may need to be validated by comparing the result against the result of a three-dimensional numerical calculation. This should be done for a sample across a range of floor dimensions that the resulting *construction R-value* is to be applied to.

F.1.2.5 The *external wall* shall be included in the model and extend 500 mm above the internal floor surface. For framed walls, the only framing member to be included in the model shall be the bottom plate.

F.1.2.6 The calculation shall use the *default values* for the thermal properties of the ground from ISO 13370 Table 7 category 2 (thermal conductivity λ=2.0 W/(m·K), heat capacity per volume pc=2.0 x 10^6 J/(m^3K)). For other materials, thermal conductivity values from ISO 10456 shall be used and, for materials used below ground level, reflect the moisture and temperature conditions of the application. Values of surface resistance shall conform to ISO 13370 Section 6.4.3.

F.1.2.7 The *construction R-value* of the *slab-on-ground floor* shall be calculated according to Equation F.1. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation F.1: $R_{floor} = \frac{1}{U}$

where:

R_{floor} is the *construction R-value* of the *slab-on-ground floor* (m^2·K/W); and

U is the temperature-specific heat flux through the internal floor surface of the two- or three-dimensional geometrical model, with the internal floor surface extending from the internal surface of the *external wall* to the cut-off plane of the floor (W/(m^2 ·K)), determined by a numerical calculation as per F.1.2.1 to F.1.2.6.

COMMENT:

A commonly used two-dimensional heat-transfer analysis software tool is THERM, developed at the Lawrence Berkeley National Laboratory (LBNL). When using THERM, the temperature specific heat flux U (required by Equation F.1) is the 'U-factor' of the internal floor surface of the two-dimensional geometrical model.

Preface

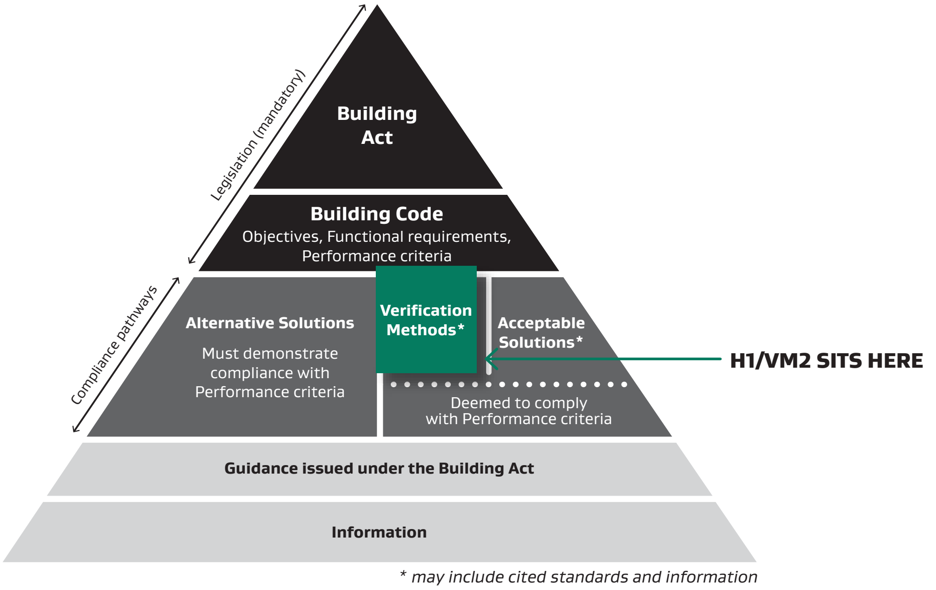
Document status

This document (H1/VM2 First Edition Amendment 1) is a verification method issued under section 22 (1) of the Building Act 2004 and is effective on 4 August 2022. It does not apply to building consent applications submitted before 4 August 2022. The previous Verification Method H1/VM2 First Edition (unamended) can be used to show compliance until 4 August 2022. The previous Verification Method H1/VM1 Fourth Edition Amendment 4, can be used to show compliance until 2 November 2022 and can be used for building consent applications submitted before 3 November 2022.

Building Code regulatory system

Each verification method outlines the provisions of the Building Code that it relates to. Complying with an acceptable solution or verification method is a way of complying with that part of the Building Code. Other options for establishing compliance are listed in [section 19 of the Building Act.]()

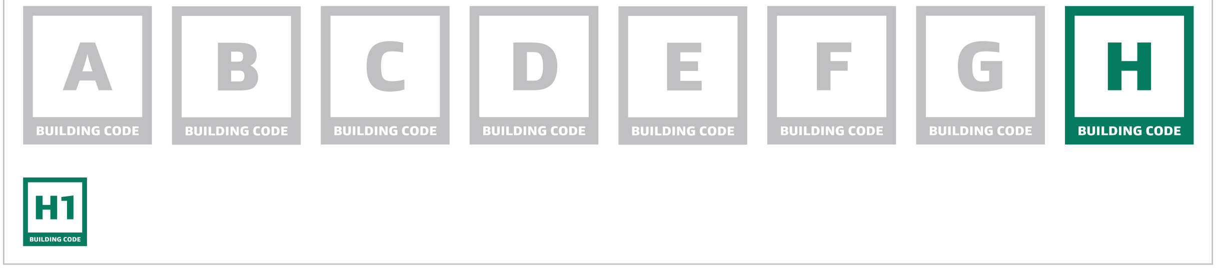
Schematic of the Building Code System



** may include cited standards and information*

A building design must take into account all parts of the Building Code. The Building Code is located in Schedule 1 of the Building Regulations 1992 and available online at [www.legislation.govt.nz]()

The part of the Building Code that this verification method relates to is clause H1 Energy Efficiency. Further information on the scope of this document is provided in [Part 1. General.]()



Further information about the Building Code, the objectives, functional requirements and performance criteria provisions that it contains, and other acceptable solutions and verification methods are available at [www.building.govt.nz]()

Main changes in this version

This is amendment 1 of the first edition of H1/VM2. However, prior to its release, similar requirements were previously found within H1/VM1. The main changes from H1/VM1 Fourth Edition Amendment 4 are:

› The scope of H1/VM1 has been reduced to cover only housing, and buildings other than housing less than 300 m². Requirements applicable to large buildings have been combined into the new Verification Method H1/VM2. To reflect the new scope of the documents and the new document layout, a new introduction and scope has been provided in Part 1. General.

› Citation of NZS 4243.1: 2007 "Energy Efficiency – Large Buildings Part 1: Building Thermal Envelope" has been removed from the document. The relevant content from this standard has been adopted into H1/VM2 with permission from Standards New Zealand.

› The minimum *R-values* previously found in NZS 4218 and NZS 4243.1 have been updated with new values found in Part 2. Building.

› The requirements for determining the thermal resistance and construction R-value of building elements have been revised to better reflect the thermal performance of windows, doors, skylights and slab-on-ground floors.

› Portions of text have been re-written to enhance clarity in the document and provide consistent language with other acceptable solutions and verification methods.

› References have been revised to include only documents within the scope of H1/VM2 in Appendix A.

› Additional references have been added to include AS/NZS 4859.1, BS EN 673, ISO 10077-1 and ISO 10077-2, ISO 10211, ISO 10456, ISO 12631, ISO 13370 and ISO 13789 in Appendix A.

› The definitions page has been revised to include all defined terms used in this document in Appendix B.

› The three-zone climate zone map previously found in NZS 4218 and NZS 4243.1 has been replaced with a six-zone climate zone map in Appendix C.

› The computer modelling method for determining the building energy use has been provided in Appendix D.

› A new procedure for calculating the construction R-value of windows, doors, skylights and curtain walling has been added in Appendix E.

› A new procedure for calculating the construction R-value of slab-on-ground floors has been added in Appendix F.

The main changes from the unamended version of the first edition of H1/VM2 are:

› Throughout the document some obvious errors in the text, formatting and cross-references have been corrected, and minor text clarifications with minor to no impact have been made.

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 acceptable solution or verification method at any time. Up-to-date versions of acceptable solution and verification methods are available from www.building.govt.nz

Features of this document

› For the purposes of Building Code compliance, the standards and documents referenced in this verification method must be the editions, along with their specific amendments listed in Appendix A.

› Words in *italic* are defined at the end of this document in Appendix B.

› Hyperlinks are provided to cross-references within this document and to external websites and appear with a blue underline.

› Classified uses for buildings, as described in clause A1 of the Building Code, are printed in **bold** in this document. These are denoted with classified use icons for:

H Housing	CR Commercial	Out Outbuildings
CR Communal residential	Ind Industrial	Anc Ancillary
CN Communal non- residential		

› Appendices to this verification method are part of, and have equal status to, the verification method. Figures are informative only and the wording of the paragraphs takes precedence. Text boxes headed 'COMMENT' occur throughout this document and are for guidance purposes only.

Contents

Part 1. General

1.1 Introduction

1.1.1 Scope of this document

CR CN Com 1.1.1.1 This document applies to **communal residential**, **communal non-residential** (assembly care only) and **commercial** *buildings* with an area of *occupied space* greater than 300 m^2.

H 1.1.1.2 For all **housing**, and *buildings* other than **housing** with an *occupied space* less than 300 m^2, refer to the Acceptable Solution H1/AS1 or Verification Method H1/VM1 as a means to demonstrate compliance or use an alternative means to demonstrate compliance.

1.1.2 Items outside the scope of this document

1.1.2.1 This verification method does not include the use of foil insulation.

1.1.2.2 This verification method does not include requirements to comply with Building Code clauses H.1.3.1(b), H1.3.4, H1.3.5 or H1.3.6. For these clauses, use an alternative means to demonstrate compliance.

1.1.3 Compliance pathway

1.1.3.1 This verification method is one option that provides a means of establishing compliance with the performance criteria in Building Code clauses H1.3.1 (a), and H1.3.3.

1.1.3.2 Options for demonstrating compliance with H1 Energy Efficiency through the use of acceptable solutions and verification methods are summarised in Table 1.1.3.2. Compliance may also be demonstrated using an alternative solution.

1.2 Using this verification method

1.2.1 Determining the classified use

1.2.1.1 Classified uses for *buildings* are described in clause A1 of the Building Code. Where a specific classified use is mentioned within a subheading and/or within the text of a paragraph, this requirement applies only to the specified classified use(s), and does not apply to other classified uses.

Ind 1.2.1.2 In *buildings* containing both **industrial** and other classified uses, the non-industrial portion shall be treated separately according to its classified use. For example, in a *building* containing both **industrial** and **commercial** classified uses, the **commercial** area shall meet the relevant energy efficiency requirements of the Building Code.

TABLE 1.1.3.2: **Demonstrating compliance with H1 Energy Efficiency through acceptable solutions and verification methods**

Paragraph 1.1.3.2

Performance clause	Applies to	Relevant acceptable solutions and verification methods
H1.3.1 (a) and (b) *Thermal Envelope*	H **Housing** CR **Communal residential** CN **Communal non-residential** (assembly care only) Com **Commercial**	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 or H1/VM1 For large *buildings*: H1/AS2 or H1/VM2
H1.3.2E *Building performance index*	H **Housing**	H1/AS1 or H1/VM1
H1.3.3 (a) to (f) Physical conditions	All *buildings*	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 or H1/VM1 For large *buildings*: H1/AS2 or H1/VM2
H1.3.4 (a) Heating of hot water	All *buildings*	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 For large *buildings*: H1/AS2
H1.3.4 (b) Storage vessels and distribution systems	Individual storage vessels ≤ 700 L in capacity and distribution systems	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 For large *buildings*: H1/AS2
H1.3.4 (c) Efficient use of hot water	H **Housing**	H1/AS1
H1.3.5 Artificial lighting	Lighting not provided solely to meet the requirements of Building Code clause F6 in: Com CN **Commercial** and **Communal non-residential** having *occupied space* greater than 300 m^2	H1/AS2
H.1.3.6 *HVAC systems*	Com **Commercial**	H1/VM3

Part 2. Building thermal envelope

2.1 Thermal resistance

2.1.1 Demonstrating compliance

2.1.1.1 The *building envelope* shall be *constructed* to provide *adequate thermal resistance*. This is demonstrated through the use of the *building* energy use modelling method described in Subsection 2.1.2.

COMMENT:

1) To satisfy the Building Code performance requirement E3.3.1 for internal moisture, it may be necessary, depending on the method adopted, to provide more insulation (greater *R-value*) than that required to satisfy energy efficiency provisions alone.

2) Passive measures to prevent overheating from excessive solar heat gains through the *building envelope* should be taken to reduce dependence on active cooling systems. Such measures should include a combination of:

› Providing *adequate thermal resistance* to the *thermal envelope* of the *building*; and
› Avoiding excessive *window areas* (particularly on the east, north and west facing facades); and
› Avoiding excessive *skylight areas*; and
› Selecting glass types with appropriate *solar heat gain coefficients (SHGC)*; and
› Providing external shading for windows and *skylights*; and
› Providing the ability to ventilate the *building* at a sufficient rate to maintain comfortable indoor temperatures in summer.

2.1.2 Modelling method for verification of the design

2.1.2.1 Verification of the design is achieved by demonstrating that the energy use of the *proposed building* design does not exceed the energy use of the *reference building* using computer modelling described in Appendix D.

2.1.2.2 The sum of the calculated annual *heating load* and annual *cooling load* of the *proposed building* shall not exceed that of the *reference building*. The *reference building* shall have *construction R-values* from:

a) For *building elements* that contain embedded heating systems Table 2.1.2.2A; or

b) For *building elements* that do not contain embedded heating systems, Table 2.1.2.2B.

2.1.2.3 The requirements for the *reference building* are separated based on the relevant climate zone for the *building*. A list of the New Zealand climate zones is provided in Appendix C.

2.1.2.4 For *building elements* that contain embedded heating systems, the *proposed building* must, as a minimum, meet the *construction R-values* of Table 2.1.2.2A.

TABLE 2.1.2.2A: Minimum construction R-values for heated roofs, walls or floors

Paragraph 2.1.2.2 a), 2.1.2.4

Building element	Minimum construction R-values ($m^2 \cdot K/W$) (1), (2), (3)					
	Climate zone 1	Climate zone 2	Climate zone 3	Climate zone 4	Climate zone 5	Climate zone 6
Heated roof (4)	R6.6	R6.6	R6.6	R6.6	R6.6	R7.0
Heated wall	R2.9	R2.9	R3.0	R3.2	R3.4	R3.6
Heated floor	R2.9	R2.9	R2.9	R3.0	R3.2	R3.4

Notes:

(1) R_{IN}/R-value < 0.1 and R_{IN} is the *thermal resistance* between the heated plane and the inside air.

(2) Floor coverings, for example carpet or cork, will reduce the efficiency of the *heated floor*.

(3) Climate zone boundaries are shown in Appendix C.

(4) In *roofs* with a *roof* space, where the insulation is installed over a horizontal ceiling, the *roof R-value* may be reduced to R3.3 for a distance of up to 500 mm from the outer edge of the ceiling perimeter where space restrictions do not allow full-thickness insulation to be installed.

TABLE 2.1.2.2B: Minimum construction R-values for building elements not containing embedded heating systems

Paragraph 2.1.2.2 a)

Building element	Construction R-values ($m^2 \cdot K/W$) (1)					
	Climate zone 1	Climate zone 2	Climate zone 3	Climate zone 4	Climate zone 5	Climate zone 6
Roof (2)	R3.5	R4.0	R5.0	R5.4	R6.0	R7.0
Wall	R2.2	R2.4	R2.7	R3.0	R3.0	R3.2
Floor	R2.2	R2.2	R2.2	R2.4	R2.5	R2.6
Windows and doors	R0.33	R0.33	R0.37	R0.37	R0.40	R0.42
Skylights	R0.42	R0.42	R0.46	R0.46	R0.49	R0.51

Note:

(1) Climate zone boundaries are shown in Appendix C.

(2) In *roofs* with a *roof* space, where the insulation is installed over a horizontal ceiling, the *roof R-value* may be reduced to R3.3 for a distance of up to 500 mm from the outer edge of the ceiling perimeter where space restrictions do not allow full-thickness insulation to be installed.

2.1.3 Determining the thermal resistance of building elements

2.1.3.1 Verification of the *thermal resistance* (*R-values*) of *building elements* is achieved by:

a) For walls, *roofs* and floors other than *slab-on-ground* floors, using NZS 4214; and

b) For windows, doors, *skylights* and *curtain walling*, using Appendix E; and

c) For *slab-on-ground floors*, using Appendix F.

COMMENT: The BRANZ House Insulation Guide provides *thermal resistances* of common *building* components and is based on calculations from NZS 4214. However, the BRANZ House Insulation Guide, 5th edition or earlier, should not be used for determining the *thermal resistances* of *slab-on-ground floors*, windows, and doors due to differences in calculation methods and assumptions compared to Appendix D and Appendix E.

2.1.3.2 The *thermal resistance* (R-values) of insulation materials may be verified by using AS/NZS 4859.1.

2.1.3.3 The *construction R-values* of *building elements* shall be calculated as follows:

a) For walls and *roofs*, the *R-value* is of a typical area of the *building element*; and

b) For framed walls, the *R-value* shall include the effects of studs, dwangs, top plates and bottom plates, but may exclude the effects of lintels, sills, additional studs that support lintels and sills, and additional studs at corners and junctions; and

c) For walls without frames, the *R-value* excludes any attachment requirements for windows and doors; and;

d) For windows, doors and *skylights*, as specified in Appendix E; and

e) For *slab-on-ground* floors, the *R-value* is as specified in Appendix F; and

f) For floors other than *slab-on-ground floors*, the *R-value* is of a typical area of the floor ignoring the effect of floor coverings (including carpets).

Appendix A. References

For the purposes of Building Code compliance, the standards and documents referenced in this verification method must be the editions, along with their specific amendments, listed below.

Standards New Zealand		Where quoted
NZS 4214: 2006	Methods of determining the total thermal resistance of parts of buildings	2.1.3.1, Definitions
AS/NZS 4859:	Thermal insulation materials for buildings	
Part 1: 2018	General criteria and technical provisions	2.1.3.2
British Standards Institute		
BS EN 673: 2011	Glass in building – Determination of thermal transmittance (U value) – Calculation method	E.1.2.2 a), E.1.2.4 a), E.2.1.2 a), Equation E.5
International Organization for Standardization		
ISO 10077:	Thermal performance of windows, doors and shutters – Calculation of thermal transmittance	
Part 1: 2017	General	E.1.2.2, E.1.2.4 a), E.1.3.1, E.2.1.2, Equation E.3
Part 2: 2017	Numerical method for frames	E.1.2.2 b), E.1.2.4 b), E.2.1.2 b)
ISO 10211: 2017	Thermal bridges in building construction – Heat flows and surface temperatures – Detailed calculations	F.1.2.3
ISO 10456: 2007	Building materials and products – Hygrothermal properties – Tabulated design values and procedures for determining declared and design thermal values	F.1.2.6
ISO 12631: 2017	Thermal performance of curtain walling – Calculation of thermal transmittance	Equation E.5
ISO 13370: 2017	Thermal performance of buildings – Heat transfer via the ground – Calculation methods	F.1.2.2, F.1.2.3, F.1.2.4, F.1.2.6
ISO 13789: 2017	Thermal performance of buildings – Transmission and ventilation heat transfer coefficients – Calculation method	F.1.2.3

These standards can be accessed from www.standards.govt.nz.

American National Standards Institute		
ANSI/ASHRAE 140: 2017	Standard method of test for the evaluation of building energy analysis computer programs	D.1.3.1

This standard can be accessed from webstore.ansi.org/

References

BRANZ Ltd

BRANZ House Insulation Guide (5th Edition), 1 July 2014	2.1.3.1 Comment, F.1.1.1 Comment

This document can be accessed from www.branz.co.nz.

International Energy Agency

Building Energy Simulation Test (BESTEST) and Diagnostic Method (1995)	D.1.3.1

This document can be accessed from www.nrel.gov

Appendix B. Definitions

These definitions are specific to this verification method. Other defined terms found in italics within the definitions are provided in clause A2 of the Building Code.

Adequate	Means *adequate* to achieve the objectives of the Building Code.
Building	Has the meaning given to it by sections 8 and 9 of the Building Act 2004.
Building element	Any structural or non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.
Building envelope	The *building thermal envelope* plus the exterior surface of any spaces not requiring conditioning, e.g. garage, floor space (below insulating layer), *roof* space (above any outer surface defining an attic or when there is no attic above the insulating layer).
Conditioned space	That part of a *building* within the *building thermal envelope* that may be directly or indirectly heated or cooled for occupant comfort. It is separated from *unconditioned space* by *building elements* (walls, windows, *skylights*, doors, *roof*, and floor) to limit uncontrolled airflow and heat loss.
Construct	In relation to a *building*, includes to design, build, erect, prefabricate, and relocate the *building*; and *construction* has a corresponding meaning.
Construction R-value	The *total thermal resistance (R-value)* of a typical area of a *building element*.
Cooling load	The amount of heat energy removed from the *building* to maintain it below the required maximum temperature (the amount of heat removed by the chosen appliances, not the amount of fuel required to run them).
Curtain walling	Part of the *building envelope* made of a framework usually consisting of horizontal and vertical profiles, connected together and anchored to the supporting structure of the *building*, and containing fixed and/or openable infills, which provides all the required functions of an internal or *external wall* or part thereof, but does not contribute to the load bearing or the stability of the structure of the *building*.
Door area (A_{door})	The total area of doors in the thermal envelope, including frames and opening tolerances, and including any opaque panels, glazing, decorative glazing and louvres.
External wall	Any vertical exterior face of a *building* consisting of primary and/or secondary elements intended to provide protection against the outdoor environment
Floor area	In relation to a *building*, means the *floor area* (expressed in square metres) of all interior spaces used for activities normally associated with domestic living.
Glazing Area ($A_{glazing}$)	The total area of vertical windows and doors that include glazing in the *thermal envelope* including transparent or translucent glazing, frames and opening tolerances, decorative glazing, and louvres. This excludes opaque panels, opaque doors, and *skylights*.
Heated roof, wall, or floor	Any *roof*, wall, or floor incorporating embedded pipes, electrical cables, or similar means of raising the temperature of the *roof*, wall, or floor for room heating.
Heating load	The amount of heat energy supplied to the *building* to maintain it at the required temperature (the amount of heat delivered by the chosen appliances, not the amount of fuel required to run them).

Definitions

HVAC system	For the purposes of performance H1.3.6 and in relation to a *building*, means a mechanical, electrical, or other system for modifying air temperature, modifying air humidity, providing ventilation, or doing all or any of those things, in a space within the *building*.
Insulation plane	The plane within a *building envelope component* where the predominant *R-value* is achieved.
Intended use	In relation to a *building*, — a) includes any or all of the following: i) any reasonably foreseeable occasional use that is not incompatible with the intended use; ii) normal maintenance; iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but b) does not include any other maintenance and repairs or rebuilding.
Occupied space	Any space within a *building* in which a person will be present from time to time during the *intended use* of the *building.*
Persons	Includes— a) the Crown; and b) a corporation sole; and c) a body of *persons* (whether corporate or unincorporated).
Plug load	The electrical load drawn by electrical appliances connected to the *building* electrical reticulation system by way of general purpose socket outlets.
R-value	The common abbreviation for describing the values of both *thermal resistance* and *total thermal resistance*.
Roof	Any *roof*-ceiling combination where the exterior surface of the *building* is at an angle of 60° or less to the horizontal and has its upper surface exposed to the outside.
Shading coefficient (SC)	The ratio of the total *solar heat gain coefficient* (SHGC) through a particular glass compared to the total *solar heat gain coefficient* through 3 mm clear float glass.
Slab-on-ground floors	Floor *construction* consisting of a concrete slab or concrete raft foundation in contact with the ground over its whole area.
Skylight	Translucent or transparent parts of the *roof*, including frames and glazing.
Skylight area ($A_{skylight}$)	The area of *skylights* that are part of the *roof thermal envelope*, including frames and opening tolerances.
Solar Heat Gain Coefficient (SHGC)	The total solar energy entering a *building* through the glazing, that is, the direct transmission of energy from the sun plus the inwards re-radiation of heat from solar radiation that is absorbed in the glass. The SHGC is also known as the solar factor (SF) or g (glazing factor).
Thermal envelope	The *roof*, wall, window, *skylight*, door and floor *construction* between *unconditioned spaces* and *conditioned spaces*.
Thermal mass	The heat capacity of the materials of the *building* affecting *building* heat loads by storing and releasing heat as the interior and/or exterior temperature and radiant conditions fluctuate.
Thermal resistance	The resistance to heat flow of a given component of a *building element*. It is equal to the air temperature difference (K) needed to produce unit heat flux (W/m^2) through unit area (m^2) under steady conditions. The units are $m^2{\cdot}K/W$.

Definitions

Total thermal resistance	The overall air-to-air *thermal resistance* across all components of a *building element* such as a wall, *roof* or floor. (This includes the surface resistances which may vary with environmental changes eg temperature and humidity, but for most purposes can be regarded as having standard values as given in NZS 4214.)
Total wall area	In relation to a *building,* means the sum (expressed in square metres) of the following: a) the *wall area* of the *building*; and b) the area (expressed in square metres) of all vertical windows and doors in *external walls* of the *building.*
Unconditioned space	Space within the *building envelope* that is not *conditioned space* (for example, this may include a garage, conservatory, atrium, attic, subfloor, and so on). However, where a garage, conservatory or atrium is expected to be heated or cooled these spaces shall be included in the *conditioned space*.
Wall area	The area of walls that are part of the *thermal envelope*, excluding the *door area* and the *window area*.
Window area (A_{window})	The total area of windows in the *thermal envelope*, including transparent or translucent glazing, frames and opening tolerances and decorative glazing and louvres, but excluding glazing in doors and *skylights*.

Appendix C. New Zealand climate zones

C.1 Climate zones

C.1.1 Climate zone boundaries

C.1.1.1 There are six climate zones. The climate zone boundaries are based on climatic data taking into consideration territorial authority boundaries.

C.1.1.2 A list of the climate zones for each territorial authority is provided in Table C.1.1.2 and illustrated in Figure C.1.1.2. The list in the table takes precedence over the figure.

TABLE C.1.1.2: Climate zones by territorial authority
Paragraph C.1.1.2

North Island/Te Ika-a-Māui	
Territorial authority	**Climate zone**
Far North District	1
Whangarei District	1
Kaipara District	1
Auckland	1
Thames-Coromandel district	1
Hauraki District	2
Waikato District	2
Matamata-Piako District	2
Hamilton City	2
Waipa District	2
Ōtorohanga District	2
South Waikato District	2
Waitomo District	2
Taupo District	4
Western Bay of Plenty District	1
Tauranga City	1
Rotorua District	4
Whakatane District	1
Kawerau District	1
Ōpōtiki District	1
Gisborne District	2
Wairoa District	2
Hastings District	2
Napier City	2
Central Hawke's Bay District	2
New Plymouth District	2
Stratford District	2
South Taranaki District	2
Ruapehu District	4
Whanganui District	2
Rangitikei District (north of 39°50'S (-39.83))	4
Rangitikei District (south of 39°50'S (-39.83))	3
Manawatu District	3
Palmerston North City	3
Tararua District	4
Horowhenua District	3
Kapiti Coast District	3
Porirua City	3
Upper Hutt City	4
Lower Hutt City	3
Wellington City	3
Masterton District	4
Carterton District	4
South Wairarapa District	4

South Island/Te Waipounamu	
Territorial authority	**Climate zone**
Tasman District	3
Nelson City	3
Marlborough District	3
Kaikoura District	3
Buller District	4
Grey District	4
Westland District	4
Hurunui District	5
Waimakariri District	5
Christchurch City	5
Selwyn District	5
Ashburton District	5
Timaru District	5
Mackenzie District	6
Waimate District	5
Chatham Islands	3
Waitaki District (true left of the Otekaieke river)	6
Waitaki District (true right of the Otekaieke river)	5
Central Otago District	6
Queenstown-Lakes District	6
Dunedin City	5
Clutha District	5
Southland District	6
Gore District	6
Invercargill City	6

Appendix D. Modelling method – Building energy use comparison

D.1 Modelling requirements

D.1.1 Overview

D.1.1.1 This modelling method is used to assess the energy performance of a proposed *building* by using a simulation of the *building* to predict its space *heating loads* and *cooling loads*. This is compared with the space *heating loads* and *cooling loads* of a reference *building* that is the same shape, dimensions, and orientation as the proposed *building*, but has *building elements* with *construction R-values* from:

a) For *building elements* that contain embedded heating systems Table 2.1.2.2A; or

b) For *building elements* that do not contain embedded heating systems, Table 2.1.2.2B.

D.1.1.2 Both *buildings* shall be simulated using the same method.

D.1.2 Modelling principles

D.1.2.1 The proposed *building* and reference *building* shall both be analysed using the same techniques and assumptions except where differences in energy efficiency features that are specified in this appendix require a different approach.

D.1.2.2 The specifications of the proposed *building* used in the analysis shall be as similar as is reasonably practicable to those in the plans submitted for a building consent.

D.1.2.3 The reference *building* shall have the same number of storeys, floor area for each storey, orientation and three dimensional form as the proposed *building*. Each floor shall be orientated exactly as the proposed *building*. The geometric form shall be the same as the proposed *building*.

D.1.2.4 Features that may differ between the proposed *building* and the reference *building* are:

a) Wall *construction R-value* and *thermal mass*; and/or

b) Floor *construction R-value*; and/or

c) *Roof construction R-value* and *thermal mass*; and/or

d) Window size and orientation, *construction R-value*, *solar heat gain coefficient* (*SHGC*), and external shading devices; and/or

e) Heating, cooling, and ventilation plant (sizing only).

D.1.2.5 The results of the thermal modelling should not be construed as a guarantee of the actual energy use of the *building*.

D.1.3 Modelling software

D.1.3.1 If the application for which the software is to be used has been documented according to the ANSI/ASHRAE Standard 140 procedure, then the method shall pass the ANSI/ASHRAE Standard 140 test. If the application for which the software is to be used has not been documented according to the ANSI/ASHRAE Standard 140 procedure, the method shall be tested to BESTEST and pass the BESTEST.

D.1.4 Default values

D.1.4.1 The default values and schedules included in this appendix shall be used unless the designer can demonstrate that different assumptions better characterise the *building's* use over its expected life. Any modification of default assumptions shall be used in simulating both the proposed *building* and the reference *building*.

D.1.4.2 Other aspects of the *building's* performance for which no default values are provided may be simulated according to the designer's discretion as is most appropriate for the *building*, but they must be the same for both the proposed *building* and the reference *building*.

D.1.4.3 In all the following cases, modelling is to be identical for both the proposed *building* and the reference *building*. Some of these items have limitations on the input values and others have default schedules that may be used when actual figures are not known. In all cases these values shall be reasonable approximations of the requirements of the *building* and its use during its expected life:

a) Heating set-points, and schedules; and
b) Cooling set-points, and schedules; and
c) Ventilation set-points, and schedules; and
d) Fresh air ventilation air change rates and schedules; and
e) Internal gains loads and schedules; and
f) Occupancy loads and schedules; and
g) Lighting schedules; and
h) The location and *R-value*s of carpets and floor coverings; and
i) Incidental shading; and
j) Heating, cooling and ventilation plant, type and modelling method.

D.1.5 Climate data

D.1.5.1 Both the proposed *building* and the reference *building* shall be modelled using the same climate data. The analysis shall use the closest climate data available for the location in which the *building* project is to be *construct*ed. The climate data shall represent an average year for the location.

> COMMENT: Using the relevant NIWA Typical Meterological Year climate files is one way to achieve this requirement.

D.1.6 Thermal zones

D.1.6.1 The model of the proposed *building* and the reference *building* shall be identically and suitably divided into separate thermal zones.

D.1.6.2 Spaces that are likely to have significantly different space conditioning requirements shall be modelled as separate zones.

D.1.6.3 The *conditioned space* shall be divided into a minimum of three thermal zones.

D.1.6.4 *Roof* spaces and enclosed subfloor spaces shall be modelled as thermal zones.

D.1.6.5 The model shall have a representation of internal conductive heat flows between thermal zones. Internal partitions between thermal zones require modelling and shall be described in terms of their location, surface area, pitch, and *construction R-value*.

D.1.6.6 The same internal partitions as modelled in the proposed *building* shall be modelled in the reference *building*.

D.1.6.7 Internal partitions within a thermal zone which may affect the thermal performance of the *building* shall be modelled.

D.1.6.8 Airflow between thermal zones need not be modelled unless desired.

D.1.7 Unconditioned space

D.1.7.1 An *unconditioned space* attached to the *building* (e.g. conservatory, atrium, car park, storage, plant room etc.) may be considered outside the *building thermal envelope* providing there is a separating wall between it and the rest of the *building*. The wall (inclusive of any windows) between it and the rest of the *building* forms part of the *building thermal envelope* and in the reference *building* it shall meet the requirements of Subsection 2.1.2.

D.1.7.2 An *unconditioned space* outside the *building thermal envelope* need not be modelled.

D.1.8 Units and group buildings

D.1.8.1 Walls and other surfaces that separate occupied units may be assumed to have no heat transfer.

D.1.9 Thermal mass

D.1.9.1 The *thermal mass* may either be modelled:

a) The same way for both the proposed *building* and the reference *building*; or

b) As proposed for the proposed *building* and modelled as lightweight for the reference *building*.

D.1.10 Thermal mass of contents

D.1.10.1 The *thermal mass* of the contents shall be the same for both models, and may be regarded as zero for modelling purposes.

D.1.11 Shading

D.1.11.1 Exterior attached shading such as fins and overhangs should be modelled as proposed in the proposed *building* but need not be modelled in the reference *building*.

D.1.11.2 No account shall be taken of internal shading devices such as blinds, drapes and other non-permanent window treatments.

D.1.12 Incidental shading

D.1.12.1 Shading by structures and terrain that have a significant effect on the *building* shall be modelled in the same way for the proposed *building* and the reference *building*.

D.1.12.2 No account shall be taken of trees or vegetation.

D.1.13 Infiltration

D.1.13.1 Infiltration assumptions for proposed *building*s and the reference *building* shall be the same, and shall be reasonable for the *building construction*, location, and use.

D.1.14 Internal air flows

D.1.14.1 Interzone air flow does not require modelling.

D.1.15 Internal doors

D.1.15.1 Internal doors need not be modelled.

D.2 Thermal envelope

D.2.1 Thermal envelope building elements

D.2.1.1 All *building element*s shall be described in terms of surface area, orientation, pitch, and *construction R-value*. *Glazing areas* shall have their *solar heat gain coefficient* (*SHGC*) specified.

D.2.1.2 The solar absorption of external *building elements*, except as specified in Paragraph D1.11.2, shall be modelled in both the proposed *building* and reference *building* as proposed. If solar absorption is not specified, they shall be modelled in both the proposed *building* and reference *building* as 0.7.

D.2.1.3 When the modelling program calculates and adds its own surface resistances to the input *thermal resistance*, the input *thermal resistances* shall be the *construction R-values* derived as specified in this method less the standardised surface resistances of 0.03 $m^2 \cdot K/W$ outside and 0.09 $m^2 \cdot K/W$ inside (0.12 $m^2 \cdot K/W$ total). The same method of calculation shall be used for the proposed *building* and the reference *building*.

D.2.2 External walls

D.2.2.1 *External walls* of the proposed *building* shall be modelled as proposed.

D.2.2.2 *External walls* for the reference *building* shall have an *R-value* equal to the values specified in Paragraph 2.1.2.2.

D.2.2.3 *External walls* for the reference *building* shall have the same orientation, tilt and area as the proposed *building*, except as provided in Paragraph D.2.6.3.

D.2.3 Internal walls

D.2.3.1 Walls separating different thermal zones or *conditioned space* and *unconditioned spaces* of the proposed *building* and reference *building* shall be modelled as proposed. Other internal walls need not be modelled.

D.2.3.2 The same internal walls as modelled in the proposed *building* shall be modelled in the reference *building*. Other internal *walls* need not be modelled. In the reference *building*, the *construction R-values* of walls between *conditioned space* and *unconditioned spaces* shall be those specified in Paragraph 2.1.2.2.

D.2.4 Roofs

D.2.4.1 *Roofs* of the proposed *building* shall be modelled as proposed.

D.2.4.2 *Roofs* for the reference *building* shall have the same area as those for the proposed *building* except where *skylight areas* are modified according to Subsection D.2.7.

D.2.4.3 In all cases the total *roof area* shall be the same as for the proposed *building*.

D.2.4.4 The *roof* of the reference *building* shall have an *R-value* equal to the value specified in Paragraph 2.1.2.2.

D.2.4.5 The *roofs* of the proposed *building* and reference *building* shall have the same solar absorption (0.7 is an acceptable *default value*).

D.2.5 Floors

D.2.5.1 Floors for the proposed *building* shall be modelled as proposed.

D.2.5.2 Floors for the reference *building* shall have the same area as those in the proposed *building* but shall be modelled with a *construction R-value* as specified in Paragraph 2.1.2.2.

D.2.5.3 Floors for the reference *building* shall be of the same type as for the proposed *building*. For example, floors in contact with the ground may not be substituted with suspended floors or vice versa.

D.2.5.4 Carpets and other floor coverings shall be the same in both the proposed *building* and reference *building* and shall be modelled if present. Any *thermal resistance* provided by carpets or floor coverings shall be in addition to the *R-values* specified in Paragraph 2.1.2.2.

D.2.5.5 When using a modelling program that uses inputs for describing the *thermal resistance* of *slab-on-ground floors* that are different to the *construction R-value* of *slab-on-ground floors* as defined in Paragraph 2.1.3.3 e) (e.g. not from the inside air to the outside air):

a) In the reference *building*, any *slab-on-ground floor* shall be modelled with a construction type selected from Tables F.1.2.2A to F.1.2.2X in Acceptable Solution H1/AS2 Appendix F. For the slab area-to-perimeter ratio, *external wall* cladding type and *external* wall effective thickness of the reference *building*, the selected construction type must have a *construction R-value* that is equal to or greater than the minimum *R-value* for *slab-on-ground floors* specified in Paragraph 2.1.2.2.; and

b) In the proposed *building*, using the methods specified in Appendix F, any *slab-on-ground* floor must, as a minimum, meet the *construction R-value* for *slab-on-ground floors* in:

i) For floors that contain embedded heating systems, Table 2.1.2.2A; or

ii) For floors that do not contain embedded heating systems, Table 2.1.2.2B.

D.2.6 Window and doors

D.2.6.1 Windows and doors that are part of the *thermal envelope* in the proposed *building* shall be modelled as proposed.

D.2.6.2 Windows and doors that are part of the *thermal envelope* in the reference *building* shall have the same distribution, orientation, tilt, and area, as the proposed *building* except as provided in Paragraph D.2.6.3.

D.2.6.3 The *glazing area* of the reference *building* shall equal that of the proposed *building* unless the proposed *building* has *glazing area* which exceeds 50% of the *total wall area*, in which case the reference *building* shall use a *glazing area* of 50% of the *total wall area*. The glazing distribution shall be modelled as equal to the distribution in the proposed *building* or shall constitute an equal percentage of *wall area* for each zone and orientation's *external wall*.

D.2.6.4 Glazing for the reference *building* shall assume a *shading coefficient* of 0.8 and a site shading of 0.7. (except for glazing where a lower site shading factor is appropriate in accordance with Paragraph D.1.12.1)

D.2.6.5 In the reference *building*, windows and doors that are part of the *thermal envelope* shall be modelled with *construction R-values* as specified in Table 2.1.2.2B.

D.2.7 Skylights

D.2.7.1 *Skylights* of the proposed *building* shall be modelled as proposed. A total *skylight area* of less than 0.6 m^2 may be ignored for calculation purposes.

D.2.7.2 *Skylights* and *roof*s for the reference *building* shall be modelled such that the total *R-value* of the *roof* is equivalent to a *roof* meeting the requirements specified in Paragraph 2.1.2.2.

D.2.7.3 The total *R-value* of the *roof* shall be determined in accordance with Equation D.1:

Equation D.1: $$R_{roof,\ total} = \frac{A_{roof} + A_{skylight}}{\frac{A_{roof}}{R_{roof}} + \frac{A_{skylight}}{R_{skylight}}}$$

where: $R_{roof,total}$ is the total *R-value* of the *roof* including *skylights* in the reference *building thermal envelope* ($m^2{\cdot}K/W$) and
A_{roof} is the *roof* area of the reference *building* (m^2); and
R_{roof} is the *construction R-value* of the *roof* in the reference *building thermal envelope* ($m^2{\cdot}K/W$); and
$A_{skylight}$ is the *skylight area* of the reference *building* (m^2); and
$R_{skylight}$ is the *construction R-value* of the *skylight*(s) in the reference *building thermal envelope* ($m^2{\cdot}K/W$).

D.2.7.4. This shall be achieved while the *R-value* and *shading coefficient* of the glass remain the same as that proposed. This provision effectively limits the amount of *skylight* that can be included in the reference *building*.

D.3 Space conditioning

D.3.1 Control temperatures

D.3.1.1 In all cases temperatures modelled shall be the same for the proposed *building* and the reference *building*.

D.3.1.2 This specification does not deal specifically with internal conditions, and it is for the designer to judge what appropriate comfort conditions are. It is advisable that the designer considers the maximum acceptable temperature and checks that this is not exceeded. A temperature of between 20°C and 24°C is often used for air-conditioned **commercial** *building*s during occupied hours.

D.3.1.3 Unless a different schedule can be justified as a likely schedule for the foreseeable life of the *building*, occupancy for **commercial** *building*s shall be 10 hours per day, 5 days per week or as provided for:

CR a) **Communal residential** including hotels, motels, and health consultancies in Table D.5.1.2A; and

CN b) **Communal non-residential** assembly care including schools in Table D.5.1.2B; and

Com c) **Commercial** including offices, restaurants, and retail shops in Table D.5.1.2C.

D.3.2 Fresh air ventilation

D.3.2.1 The fresh air ventilation rate and schedule shall be the same for both the proposed *building* and the reference *building*.

D.3.2.2 Constant ventilation may be modelled.

D.3.2.3 The minimum ventilation rate should be according to G4/AS1 or G4/VM1.

D.3.2.4 Ventilation may be provided mechanically or by natural means.

D.3.3 Conditioning system modelling

Com D.3.3.1 For **commercial** *buildings*, *HVAC systems* shall be simulated in an identical manner in both the proposed *building* and the reference *building* and be consistent with the requirements of Verification Method H1/VM3. Sizing is the only feature that may be changed in response to load requirements.

D.3.3.2 The type of plant in the proposed *building* should represent the type of system proposed. Where such a model is unavailable, use the closest that is available.

D.3.3.3 Plant type shall be the same for both the reference *building* and proposed *building*. All devices that supply space heating or ventilation shall be accounted for. Assumptions made must be clearly and fully stated. The program shall be suitable for the type of system proposed.

D.3.3.4 Sizing of plant (for modelling purposes) shall be according to the automatic sizing if this feature is provided by the software. Alternatively the plant should be of sufficient capacity to meet loads without incurring significant energy penalty due to prolonged part-load operation.

D.3.3.5 Modelling shall use reasonable assumptions as to equipment performance and control.

D.3.3.6 Sufficient information shall be input to describe the proposed *building*'s plant to permit modelling by the program.

D.4 Internal loads

D.4.1 Lighting

D.4.1.1 For the proposed *building*, the connected lighting load shall be modelled as proposed.

D.4.1.2 For the reference *building*, the connected lighting load shall be modelled as the lighting load permitted in NZS 4243 Part 2. Alternatively, the lighting load of the proposed *building* may be used if this is less than the load permitted by NZS 4243 Part 2. The load from lighting not covered by *lighting power density limits* specified in NZS 4243 Part 2 shall be the same in the proposed *building*.

D.4.1.3 The lighting use schedule shall be the same for both the proposed *building* and the reference *building*. Any assumption regarding the proportion of lights in use shall be reasonable, and shall be recorded. The default lighting schedule is 90% of total lighting connected load during hours of occupancy, and 10% of total connected lighting load on during other hours. Hours of occupancy for the *building* shall be a reasonable approximation of how the *building* is expected to be used. *Default value* is ten hours per day, five days per week for commercial *building*s.

D.4.1.4 Lighting schedules shall use the same references throughout for both the proposed *building* and the reference *building*. Lighting schedules are provided for:

CR a) **Communal residential** including hotels, motels, and health consultancies in Table D.5.1.2A; and

CN b) **Communal non-residential** assembly care including schools in Table D.5.1.2B; and

CR c) **Commercial** including offices, restaurants, and retail shops in Table D.5.1.2C.

D.4.1.5 The lighting schedule may be altered to reflect the type of controls in the proposed *building*, but both the proposed *building* and reference *building* lighting schedules shall be identical. No credit shall be given for the use of any controls, automatic or otherwise.

D.4.1.6 Thermal simulations shall include the heat released into the proposed *building* and reference *building* from lighting. The same loads and schedules as the modelled lighting shall be used in each case.

D.4.2 Domestic hot water

D.4.2.1 Hot water systems shall not be modelled.

D.4.3 Occupants and plug loads

D.4.3.1 The maximum power densities into a *building* from occupants and *plug loads* is provided in Table D.5.1.1 and is modified to provide default values for heat release at different times of day. The modification factors are provided for:

a) **Communal residential** including hotels, motels, and health consultancies in Table D.5.1.2A; and

b) **Communal non-residential** assembly care including schools in Table D.5.1.2B; and

c) **Commercial** including offices, restaurants, and retail shops in Table D.5.1.2C.

D.4.3.2 These values should be used unless other suitable parameters specific to the *building*'s use can be shown to be more appropriate. These internal loads shall be the same for both the proposed *building* and reference *building*. All internal loads are regarded as sensible heat.

D.4.3.3 *Unconditioned space* shall be assigned zero internal loads.

D.4.4 Process loads

D.4.4.1 Process loads are those heat loads that result from the production of goods within a *building*.

D.4.4.2 Only in circumstances where process loads are significant, and it can be shown that they will continue for the expected life of the *building*, may modelling occur. Process loads shall be the same in both the proposed *building* and reference *building*.

D.5 Reference building

D.5.1 Schedules

The default power densities for internal gains from occupants and *plug loads* are provided in Table D.5.1.1.

TABLE D.5.1.1: Default power densities for internal gains from occupants and plug loads

Paragraph D.5.1.1

Classified use	Applies to[1]	Occupancy (W/m^2)	Plug load (W/m^2)
CR	Community service – hotels and motels	2.9	2.7
	Community care – Unrestrained – such as health/institutional	3.6	10.7
CN	Assembly care – schools	9.7	5.4
Com	Office	2.7	8.1
	Restaurant	7.3	1.1
	Retail shop	2.4	2.7
	Car park	N/A	N/A

Note:

(1) If an activity for the proposed *building* is not specifically described, use the nearest description for both the proposed *building* and the reference *building*.

D.5.1.2 The default schedules for occupancy and *plug loads* are provided for:

a) **Communal residential** including hotels, motels, and health consultancies in Table D.5.1.2A; and

b) **Communal non-residential** assembly care including schools in Table D.5.1.2B; and

c) **Commercial** including offices, restaurants, and retail shops in Table D.5.1.2C.

TABLE D.5.1.2A: Default schedules for occupancy, plug loads and lighting – Percentage of maximum load or percentage of power density for communal residential

Paragraphs D.3.1.3 a), D.4.1.4 a), D.4.3.1 a), D.5.1.2 a)

Community service – hotels and motels					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	90	40	20	70	90
Saturday	90	50	30	60	70
Sunday	70	70	30	60	80
Plug load and lighting					
Week	10	40	25	60	60
Saturday	10	40	25	60	60
Sunday	10	30	30	50	50
Community service – residential care such as retirement village					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	70	90	90	85	70
Saturday	70	90	90	85	70
Sunday	70	90	90	85	70
Plug load and lighting					
Week	20	90	85	80	20
Saturday	20	90	85	80	20
Sunday	20	90	85	80	20
Community care – Health/ medical specialist					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	0	80	80	30	0
Saturday	0	40	40	0	0
Sunday	0	5	5	0	0
Plug load and lighting					
Week	10	90	90	30	10
Saturday	10	40	40	10	10
Sunday	5	10	10	5	5

TABLE D.5.1.2B: **Default schedules for occupancy, plug loads and lighting – Percentage of maximum load or percentage of power density for communal non-residential – assembly care**

Paragraphs D.3.1.3 b), D.4.1.4 b), D.4.3.1 b), D.5.1.2 b)

Schools					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	0	95	95	10	0
Saturday	0	10	10	0	0
Sunday	0	0	0	0	0
Plug load and lighting					
Week	5	95	95	30	5
Saturday	5	15	15	5	5
Sunday	5	5	5	5	5

TABLE D.5.1.2C: Default schedules for occupancy, plug loads and lighting – Percentage of maximum load or percentage of power density for commercial buildings

Paragraphs D.3.1.3 c), D.4.1.4 c), D.4.3.1 c), D.5.1.2 c)

Office					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	0	95	95	5	0
Saturday	0	10	5	0	0
Sunday	0	5	5	0	0
Plug load and lighting					
Week	5	90	90	30	5
Saturday	5	30	15	5	5
Sunday	5	5	5	5	5
Restaurant					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	0	5	50	80	35
Saturday	0	0	45	70	55
Sunday	0	0	20	55	20
Plug load and lighting					
Week	15	40	90	90	50
Saturday	15	30	80	90	50
Sunday	15	30	70	60	50
Retail shop					
Occupancy	**12 am – 8 am**	**8 am – 11 am**	**11 am – 6 pm**	**6 pm – 10 pm**	**10 pm – 12 am**
Week	0	60	70	40	0
Saturday	0	60	80	20	0
Sunday	0	10	40	0	0
Plug load and lighting					
Week	5	90	90	50	5
Saturday	5	90	90	30	5
Sunday	5	40	40	5	5

D.6 Documentation

D.6.1 Documentation of analysis

D.6.1.1 Documentation of computer modelling analysis shall contain:

a) The name of the modeller; and

b) The thermal modelling program name, version number, and supplier; and

c) Technical detail on the proposed *building* and reference *building* designs and the differences between the designs; and

d) The sum of the *heating load* and *cooling load* for the proposed *building* and reference *building*; and

e) Where possible, the *heating load* and *cooling load* for the proposed *building* and the reference *building*; and

f) The calculated annual energy consumption for space heating, space cooling, ventilation/fans, and lighting.

Appendix E. Windows, doors, skylights, and curtain walling

E.1 Vertical windows and doors

E.1.1 Methods for determining construction R-values

E.1.1.1 The *construction R-values* for vertical windows and doors shall be determined using one of the following methods:

a) Calculation of the *construction R-value* of each individual window and door that is part of the *thermal envelope*, in accordance with Section E.1.2; or

b) Calculation of the representative *construction R-value* of all windows and doors that are part of the *thermal envelope* of the proposed *building*, which is then deemed to apply to all windows and doors of the proposed *building*, in accordance with Section E.1.3.

> COMMENT: The window size and frame material have a major impact on the *construction R-value* of a window as a *building element*. Often the *thermal resistances* of the glazing and the frames are dissimilar. For large windows, the *thermal resistance* of the glazing will have more impact on the overall window *construction R-value* than in a small window, which is dominated by the frame performance. This means that the *construction R-values* of two differently-sized windows consisting of identical frame and glazing materials will usually be dissimilar.

E.1.2 Calculation of the construction R-value of each individual window and door that is part of the thermal envelope

E.1.2.1 For each window that is part of the *thermal envelope* of the proposed *building*, the window *construction R-value* (R_W) shall be calculated in accordance with Equation E.1. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.1: $R_w = \frac{1}{U_w}$

where:

R_W is the *construction R-value* of the window ($m^2 \cdot K/W$); and

U_W is the thermal transmittance of the window ($W/(m^2 \cdot K)$), determined in accordance with Paragraph E.1.2.2.

E.1.2.2 The thermal transmittance (U_W) of each vertical window that is part of the *thermal envelope* of the proposed *building* shall be determined in accordance with ISO 10077-1, with:

a) The thermal transmittance of the glazing (U_g) determined using BS EN 673; and

b) The thermal transmittance of the frame (U_f) determined using ISO 10077-2. For frames with special extensions overlapping the wall or other *building elements*, such as frames with flanges to the cladding, the following deviations from ISO 10077-2 Section 6.3.1, are permitted:

i) special extensions may be disregarded or included in the calculation model, but shall be disregarded when determining the projected width of the frame section (b_f) as per ISO 10077-2: 2017 Appendix F; and

ii) window reveal liners that are integral with the window unit may either be disregarded or included in the calculation model.

E.1.2.3 For each door that is part of the *thermal envelope* of the proposed *building*, the door *construction R-value* (R_D) shall be calculated in accordance with Equation E.2. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.2: $R_D = \frac{1}{U_D}$

where:

R_D is the *construction R-value* of the door (m²·K/W); and

U_D is the thermal transmittance of the door (W/(m²·K)), determined in accordance with Paragraph E.1.2.4.

> COMMENT: The door *construction R-value* (R_D) includes the effects of the frame, any glazing and any opaque panels.

E.1.2.4 The thermal transmittance (U_D) of each door that is part of the *thermal envelope* of the proposed *building* shall be determined in accordance with ISO 10077-1, with:

a) The thermal transmittance of any glazing (U_g) determined using BS EN 673; and

b) The thermal transmittance of the frame (U_f) determined using ISO 10077-2. For frames with special extensions overlapping the wall or other building elements, such as frames with flanges to the cladding, the following deviations from ISO 10077-2 Section 6.3.1, are permitted:

   i) special extensions may be disregarded or included in the calculation model, but shall be disregarded when determining the projected width of the frame section (b_f) as per ISO 10077-2 Appendix F; and

   ii) door reveal liners that are integral with the door unit may either be disregarded or included in the calculation model.

E.1.3 Calculation of the representative construction R-value of all windows and doors that are part of the thermal envelope

E.1.3.1 The representative window and door *construction R-value* (R_{WD}) shall be calculated in accordance with Equation E.3. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.3: $R_{WD} = \frac{\Sigma A_W + \Sigma A_D}{\Sigma \frac{A_W}{R_W} + \Sigma \frac{A_D}{R_D}}$

where:

R_W is the *construction R-value* of each vertical window that is part of the *thermal envelope* of the proposed *building* (m²·K/W), calculated in accordance with Section E.1.2.1; and

A_W is the window area of each vertical window that is part of the *thermal envelope* of the proposed *building* (m^2), calculated in accordance with ISO 10077-1 Section 6.3.1; and

R_D is the *construction R-value* of each door that is part of the *thermal envelope* of the proposed *building* (m²·K/W), calculated in accordance with Section E.1.2.3.; and

A_D is the *door area* of each door that is part of the *thermal envelope* of the proposed *building* (m^2), calculated in accordance with ISO 10077-1 Section 6.3.1.

E.2 Skylights

E.2.1 Construction R-values

E.2.1.1 The *construction R-values* for *skylights* ($R_{skylight}$) shall include the effects of both the glazing materials and the frame materials and shall be calculated in accordance with Equation E.4. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.4: $R_{skylight} = \frac{1}{U_w}$

where:

$R_{skylight}$ is the *construction R-value* of the *skylight* ($m^2{\cdot}K/W$); and

U_w is the thermal transmittance of the *skylight* ($W/(m^2\,K)$), determined in accordance with Paragraph E.2.1.2.

E.2.1.2 The thermal transmittance (U_w) of a *skylight* shall be determined in accordance with ISO 10077-1, with:

a) The thermal transmittance of the glazing (U_g) determined using BS EN 673, considering the effects of horizontal or angled glazing on the heat transfer; and

b) The thermal transmittance of the frame (U_f) determined using ISO 10077-2.

E.3 Curtain walling

E.3.1 Construction R-value

E.3.1.1 The *construction R-values for curtain walling* (R_{CW}) shall be calculated in accordance with Equation E.5. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.5: $R_{CW} = \frac{1}{U_{CW}}$

where:

R_{CW} is the *construction R-value* of the *curtain walling* ($m^2{\cdot}K/W$); and

U_{CW} is the thermal transmittance of the *curtain walling* ($W/(m^2\,K)$), determined in accordance with ISO 12631, with the thermal transmittance of the glazing (U_g) determined using BS EN 673.

Appendix F. Thermal resistance of slab-on-ground floors

F.1 Construction R-values

F.1.1 Methods for determining construction R-values for slab-on-ground floors

F.1.1.1 The *construction R-values* for concrete *slab-on-ground floors*, including floors of basements that contain *conditioned* spaces, shall be determined using:

a) The calculation method described in Section F.1.2; or

b) The performance tables in Acceptable Solution H1/AS2 Appendix F.

COMMENT:

1. The *thermal resistances* for *slab-on-ground floors* provided in the BRANZ House Insulation Guide, 5th edition or earlier, should not be used for determining compliance with the requirements of this verification method. This is because they are based on a different calculation method and different assumptions than those specified in this Appendix.
2. Where a concrete floor is only partially in contact with the ground, with other parts being suspended, the part that is in contact with the ground shall be treated as a slab-on-ground floor, and the other part be treated as a suspended floor.

F.1.2 Calculating slab-on-ground floor R-values

F.1.2.1 The *construction R-value* of *slab-on-ground floors* shall be calculated from the inside air to the outside air. The effect of floor coverings (including carpets) shall be ignored.

F.1.2.2 The calculation shall be based on a three-dimensional numerical calculation in accordance with ISO 13370 Section 5.2a), or a two-dimensional numerical calculation in accordance with ISO 13370 Section 5.2b). The formulae provided in ISO 13370 Section 7 and Annex D shall not be used for determining the *construction R-value* of *slab-on-ground floors*.

F.1.2.3 When using a two-dimensional numerical calculation in accordance with ISO 13370 Section 5.2b), a geometrical model in accordance with ISO 10211 Sections 7.3, 12.4.1 and 12.4.2 shall be used. The model shall have a floor width equal to half the characteristic dimension of the floor. The characteristic dimension of the floor shall be determined using overall internal dimensions (ignoring internal partitions, as per ISO 13789).

COMMENT:

1. The characteristic dimension of the floor (B as defined in ISO 13370) equals the area of the floor divided by half the perimeter of the floor.
2. Paragraph F1.2.3. requires a two-dimensional geometrical model with a floor width equal to half the characteristic dimension of the floor. This represents a floor that is infinitely long and has a width equal to the characteristic dimension of the floor.

F.1.2.4 For *slab-on-ground floors* of inhomogeneous *construction*, such as concrete raft foundation floors, the results of any two-dimensional numerical calculation in accordance with ISO 13370 Section 5.2b) shall be validated by three-dimensional numerical calculations in accordance with ISO 13370 Section 5.2a).

Thermal resistance of slab-on-ground floors

COMMENT: ISO 13370 Sections 5.2 a) and b) specify that the result of a three-dimensional numerical calculation is applicable only for the actual floor dimensions modelled, whereas the result of a two-dimensional numerical calculation is applicable to floors having the characteristic dimension that was modelled. Therefore, the result of a two-dimensional numerical calculation can have wider application, but, depending on the floor *construction*, may need to be validated by comparing the result against the result of a three-dimensional numerical calculation. This should be done for a sample across a range of floor dimensions that the resulting *construction R-value* is to be applied to.

F.1.2.5 The *external wall* shall be included in the model and extend 500 mm above the internal floor surface. For framed walls, the only framing member to be included in the model shall be the bottom plate.

F.1.2.6 The calculation shall use the default values for the thermal properties of the ground from ISO 13370 Table 7 category 2 (thermal conductivity λ=2.0 W/(m·K), heat capacity per volume $\rho c = 2.0 \times 10^6$ J/(m³·K)). For other materials, thermal conductivity values from ISO 10456 shall be used and, for materials used below ground level, reflect the moisture and temperature conditions of the application. Values of surface resistance shall conform to ISO 13370 Section 6.4.3.

F.1.2.7 The *construction R-value* of the *slab-on-ground floor* shall be calculated according to Equation F.1. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation F.1: $R_{floor} = \frac{1}{U}$

where:

R_{floor} is the *construction R-value* of the *slab-on-ground floor* (m²·K/W); and

U is the temperature-specific heat flux through the internal floor surface of the two- or three-dimensional geometrical model, with the internal floor surface extending from the internal surface of the *external wall* to the cut-off plane of the floor (W/(m²·K)), determined by a numerical calculation as per F.1.2.1 to F.1.2.6.

COMMENT: A commonly used two-dimensional heat-transfer analysis software tool is THERM, developed at the Lawrence Berkeley National Laboratory (LBNL). When using THERM, the temperature specific heat flux U (required by Equation F.1) is the 'U-factor' of the internal floor surface of the two-dimensional geometrical model.

Preface

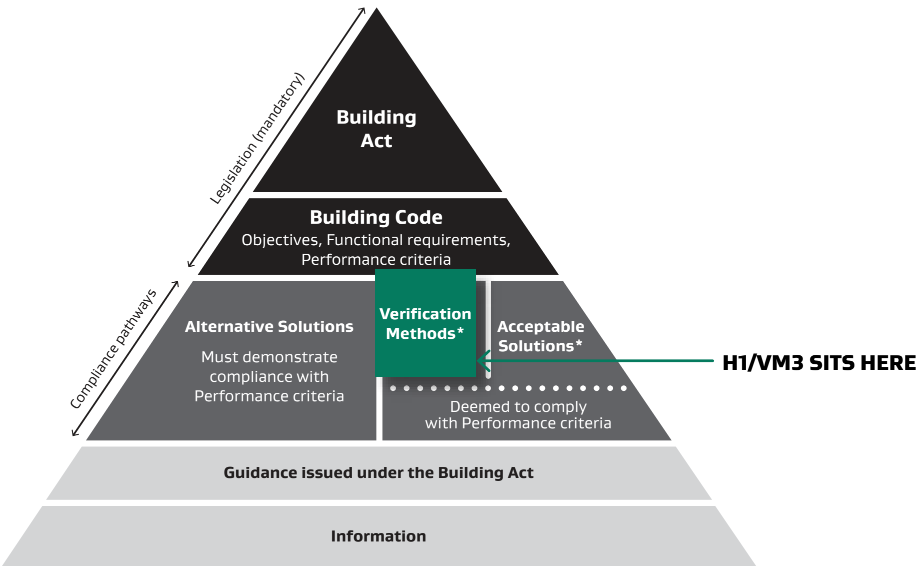
Document status

This document (H1/VM3) is a verification method issued under section 22 (1) of the Building Act 2004 and is effective on 29 November 2021. It does not apply to building consent applications submitted before 29 November 2021.

Building Code regulatory system

Each verification method outlines the provisions of the Building Code that it relates to. Complying with an acceptable solution or verification method is a way of complying with that part of the Building Code. Other options for establishing compliance are listed in section 19 of the Building Act.

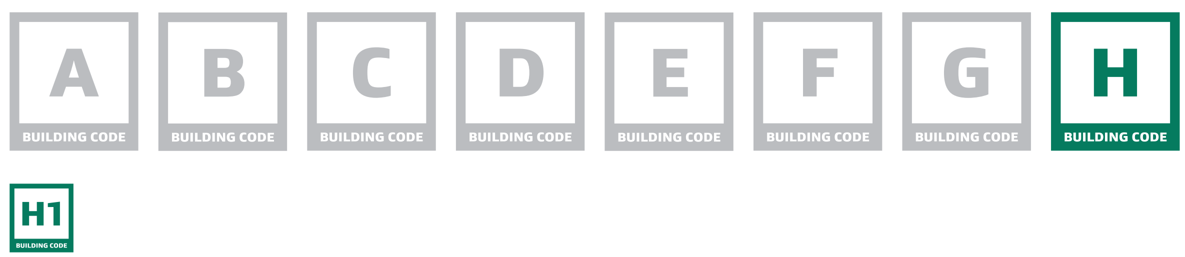
Schematic of the Building Code System



** may include cited standards and information*

A building design must take into account all parts of the Building Code. The Building Code is located in Schedule 1 of the Building Regulations 1992 and available online at www.legislation.govt.nz

The part of the Building Code that this verification method relates to is clause H1 Energy Efficiency. Further information on the scope of this document is provided in Part 1. General.



Further information about the Building Code, the objectives, functional requirements and performance criteria provisions that it contains, and other acceptable solutions and verification methods are available at www.building.govt.nz

Features of this document

- For the purposes of Building Code compliance, the standards and documents referenced in this verification method must be the editions, along with their specific amendments listed in Appendix A.
- Words in *italic* are defined at the end of this document in Appendix B.
- Hyperlinks are provided to cross-references within this document and to external websites and appear with a blue underline.
- Classified uses for buildings, as described in clause A1 of the Building Code, are printed in **bold** in this document. These are denoted with classified use icons for:

  - H **Housing**
  - Com **Commercial**
  - Out **Outbuildings**
  - CR **Communal residential**
  - Ind **Industrial**
  - Anc **Ancillary**
  - CN **Communal non-residential**

- Appendices to this verification method are part of, and have equal status to the verification method. Figures are informative only and the wording of the paragraphs takes precedence. Text boxes headed 'COMMENT' occur throughout this document and are for guidance purposes only.

Contents

Part 1. General

1.1 Introduction

1.1.1 Scope of this document

Com 1.1.1.1 This verification method can be used for *HVAC systems* in **commercial** *buildings*. It contains requirements for:

a) Air conditioning system controls, and
b) Mechanical ventilation system controls, and
c) Fans, and
d) Ductwork insulation and sealing, and
e) Pumps, and
f) Pipework insulation, and
g) Space heating, and
h) Refrigerant chillers, and
i) Unitary air conditioning equipment, and
j) Heat rejection equipment, and
k) Facilities for energy monitoring, and
l) Maintenance access.

1.1.2 Items outside the scope of this document

1.1.2.1 This verification method does not include requirements for:

a) *HVAC systems* that directly cool cold rooms or heat hot rooms (such as in a butcher's shop, fruit storage rooms or in laboratories); or
b) *HVAC systems* that maintain specialised conditions for equipment or processes, where this is the main purpose of the *HVAC system*.

1.1.2.2 For these, compliance may be demonstrated using an alternative solution.

1.1.3 Compliance pathway

1.1.3.1 This verification method is one option that provides a means of establishing compliance with the performance criteria in Building Code clause H1.3.6.

1.1.3.2 Options for demonstrating compliance with H1 Energy Efficiency through the use of acceptable solutions and verification methods are summarised in Table 1.1.3.2. Compliance may also be demonstrated using an alternative solution.

1.2 Using this Verification Method

1.2.1 Determining the classified use

1.2.1.1 Classified uses for *buildings* are described in clause A1 of the Building Code. Where a specific classified use is mentioned within a subheading and/or within the text of a paragraph, this requirement applies only to the specified classified use(s), and does not apply to other classified uses.

Ind 1.2.1.2 In *buildings* containing both **industrial** and other classified uses, the non-industrial portion shall be treated separately according to its classified use. For example, in a *building* containing both **industrial** and **commercial** classified uses, the **commercial** area shall meet the relevant NZBC energy efficiency requirements.

TABLE 1.1.3.2: Demonstrating compliance with H1 Energy Efficiency through acceptable solutions and verification methods

Paragraph 1.1.3.2

Performance clause	Applies to	Relevant acceptable solutions and verification methods
H1.3.1 (a) and (b) *Thermal Envelope*	H **Housing** CR **Communal residential** CN **Communal non-residential** (assembly care only) Com **Commercial**	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 or H1/VM1 For large *buildings*: H1/AS2 or H1/VM2
H1.3.2E *Building performance index*	H **Housing**	H1/AS1 or H1/VM1
H1.3.3 (a) to (f) Physical conditions	All *buildings*	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 or H1/VM1 For large *buildings*: H1/AS2 or H1/VM2
H1.3.4 (a) Heating of hot water	All *buildings*	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 For large *buildings*: H1/AS2
H1.3.4 (b) Storage vessels and distribution systems	Individual storage vessels ≤ 700 L in capacity and distribution systems	For **housing**, and *buildings* no greater than 300 m^2: H1/AS1 For large *buildings*: H1/AS2
H1.3.4 (c) Efficient use of hot water	H **Housing**	H1/AS1
H1.3.5 Artificial lighting	Lighting not provided solely to meet the requirements of Building Code clause F6 in: Com CN **Commercial** and **Communal non-residential** having *occupied space* greater than 300 m^2	H1/AS2
H.1.3.6 *HVAC systems*	Com **Commercial**	H1/VM3

Part 2. Air conditioning system control

2.1 Demonstrating compliance

2.1.1 System design objectives

2.1.1.1 Energy consumption of an *air conditioning* system is to be limited by providing active and passive controls. The control requirements limit the use of energy during the operation of the *air conditioning* system by reducing the energy that would be otherwise wasted.

2.2 Verification of the design

2.2.1 Overview

2.2.1.1 The verification of the design is achieved by providing an *air conditioning* system that complies with the requirements of:

a) Deactivation, and

b) Zoning, and

c) Operating times, and

d) *Outdoor air economy cycle*, and

e) Control of central plant and of the heating and cooling energy medium flow, and

f) Variable speed of fans, and

g) Commissioning.

2.2.2 Deactivation

2.2.2.1 An *air conditioning* system shall be capable of being deactivated when the *building* or the part of a *building* served by that system is not occupied.

> i
>
> COMMENT: If an *air conditioning* system serves a whole *building*, it is only required to be capable of being deactivated when the whole *building* is unoccupied. However, if an *air conditioning* system only serves a part of a *building*, the system must be capable of being deactivated when that part of the *building* is unoccupied. The design of the operational arrangements of the *air conditioning* system should be based on logical *building* areas, segments and activities.

2.2.2.2 When deactivated, an *air conditioning* system shall close any motorised damper that is installed within an air pathway between the *air conditioned space* and outside and that is not otherwise being actively controlled.

> i
>
> COMMENT: This requirement is to reduce the infiltration of unconditioned *outdoor air* when the system is not in use, and reduce the start-up load when the system is next needed.

2.2.3 Zoning

2.2.3.1 When defining *air conditioning* zones, consideration shall be given to how different rooms or areas may require heating or cooling at different rates throughout the day.

COMMENT: For example, if there is only one temperature sensor and it is located in an east-facing room which has become too hot from the morning sun, it may activate more cooling than is needed in other rooms that do not receive morning sun. Using multiple temperature control devices will help prevent this, and mean the *building* uses less energy overall.

2.2.3.2 When serving more than one *air conditioning* zone or area with different heating or cooling needs, an *air conditioning system* shall:

a) Thermostatically control the temperature of each zone or area; and

b) Not control the temperature by mixing actively heated air and actively cooled air; and

c) Limit reheating to not more than:

   i) for a fixed supply air rate, a 7.5K rise in temperature; or

   ii) for a variable supply air rate, a 7.5K rise in temperature at the nominal supply air rate but increased or decreased at the same rate that the supply air rate is respectively decreased or increased.

COMMENT:

1. The limits on reheating are intended to encourage the grouping of areas with similar heating and cooling demand, rather than sub-cooling all the supply air and reheating excessively to achieve the desired temperature.
2. The limit on reheating for systems with a variable supply air rate constitutes an inverse relationship between allowable temperature rise and supply air rate. During the reheating, if the supply air rate is also reduced then the temperature rise can be proportionally increased above 7.5K at the same rate that the supply air rate has been reduced. For example, the reheat temperature could be increased to 10K when the supply air rate is reduced by 25% or increased to 15K if the supply air rate is reduced by 50%.

2.2.3.3 When two or more *air conditioning* systems serve the same *air conditioning* zone they shall use control sequences that prevent the systems from operating in opposing heating and cooling modes within the same *air conditioning* zone.

2.2.3.4 An *air conditioning* system shall have a control dead band of not less than 2°C, except where a smaller range is required for specialised applications.

2.2.4 Operating times

2.2.4.1 To allow for different operating times, an *air conditioning* system shall have the ability to terminate airflow of each independently operating space of more than 1000 m^2 and of every separate floor of the *building* independently of the remainder of the system.

2.2.4.2 Except where *air conditioning* is needed for 24 hour continuous use, a time switch shall be provided to control:

a) An *air conditioning* system of more than 2 kW_r (kilowatts of refrigeration); and

b) A heater of more than 1 $kW_{heating}$ (kilowatt of heating) used for *air conditioning*.

2.2.4.3 The time switch shall be capable of switching electric power on and off at variable pre-programmed times and on variable pre-programmed days.

2.2.5 Outdoor air economy cycle

2.2.5.1 If providing mechanical ventilation, other than where dehumidification control is needed, an *air conditioning* system shall have an *outdoor air economy cycle* if the total air flow rate of any single airside component of an *air conditioning* system is greater than or equal to 2500 L/s.

2.2.6 Control of central plant and of the heating and cooling energy medium flow

2.2.6.1 An *air conditioning* system shall be capable of automatically stopping the flow of water to system components that have no heating or cooling demand, except for the purpose of residual heat dissipation where required to prevent damage of system components.

> COMMENT: This requirement aims to reduce the amount of pump energy needed and reduce the thermal loss through system components like *piping*.

2.2.6.2 An *air conditioning* system shall have the ability to regulate the operation of the central plant in accordance with the heating or cooling demand by using direct signals from the control components responsible for maintaining the internal environmental conditions in the *building*.

> COMMENT: This requirement enables regulating the operation and set-points of central plant in coordination with the needs of the *building*, rather than operating central services as a continuous provision.

2.2.7 Variable speed of fans

2.2.7.1 The fan of an *air conditioning* system with an airflow of more than 1000 L/s shall vary its speed in accordance to the required airflow rates.

> COMMENT: A variable speed fan is a more energy efficient method of reducing air flow than throttling the air supply with dampers.

2.2.8 Commissioning

2.2.8.1 An *air conditioning* system shall be provided with balancing dampers, balancing valves and/or variable speed fans that ensure the maximum design air or fluid flow is achieved but not exceeded by more than 15% above design at each:

a) Component; or

b) Group of components operating under a common control in a system containing multiple components, as required to meet the needs of the system at its maximum operating condition.

Part 3. Mechanical ventilation system control

3.1 Demonstrating compliance

3.1.1 System design objectives

3.1.1.1 Energy consumption of a mechanical ventilation system is to be limited by providing active and passive controls. The control requirements limit the use of energy during the operation of the mechanical ventilation system by reducing the energy which would be otherwise wasted.

3.2 Verification of the design

3.2.1 Overview

3.2.1.1 The verification of the design is achieved by providing a mechanical ventilation system that complies with the requirements of:

a) Deactivation; and

b) Operating times; and

c) Limiting *outdoor air* flow; and

d) Variable speed of fans.

3.2.2 Deactivation

3.2.2.1 A mechanical ventilation system for the provision of *outdoor air*, including one that is part of an *air conditioning* system, shall be capable of being deactivated when the *building* or the part of the *building* served by that system is not occupied.

> COMMENT: If a mechanical ventilation system serves a whole *building*, it is only required to be capable of being deactivated when the whole *building* is unoccupied. However, if a mechanical ventilation system only serves a part of a *building*, the system must be capable of being deactivated when that part of the *building* is unoccupied. The design of the operational arrangements of the mechanical ventilation system should be based on logical building areas, segments and activities.

3.2.2.2 An exhaust system with an air flow rate of more than 250 L/s shall be capable of stopping the motor when the system is not needed.

> COMMENT:
>
> 1. Examples for exhaust systems include toilet extracts, kitchen hoods, and laundry hoods.
> 2. Consideration should be given to situations where safety is an issue, such as the exhaust from a chemical storage cabinet. In some situations, it may be more appropriate for fume hoods to operate on a reduced flow rather than stop entirely. An alternative solution may be considered more appropriate in such situations.

3.2.3 Operating times

3.2.3.1 Except where mechanical ventilation is needed for 24 hour continuous use, a time switch shall be provided to a mechanical ventilation system with an air flow rate of more than 250 L/s.

3.2.3.2 Where required, the time switch shall be capable of switching electric power on and off at variable pre-programmed times and on variable pre-programmed days.

3.2.4 Limiting outdoor air flow

3.2.4.1 When serving an *air conditioned space*, except in periods when evaporative cooling is being used, a mechanical ventilation system, including one that is part of an *air conditioning* system, shall:

a) If the design *outdoor air* flow rate is more than 1000 L/s, have demand control ventilation in accordance with AS 1668.2 if appropriate to the application, except where an energy reclaiming system preconditions all the *outdoor air* at a minimum sensible heat transfer effectiveness of 60%; and

b) Not exceed the minimum *outdoor air* quantity required by G4/AS1 by more than 20%, except where:

   i) additional unconditioned *outdoor air* is supplied for free cooling; or

   ii) additional mechanical ventilation is needed to balance the required exhaust or process exhaust; or

   iii) an energy reclaiming system preconditions all the *outdoor air* at a minimum sensible heat transfer effectiveness of 60%.

COMMENT:

1. Common situations that require additional mechanical ventilation to balance the required exhaust include areas such as toilets or bathrooms which have high exhaust rates to remove contaminated air or to balance process exhausts. In such situations, an equivalent level of supply air may be required to balance the system.
2. Where demand control ventilation is used, the design peak *outdoor air* flow rate should be determined on the basis of peak occupancy, not average occupancy.
3. A common situation where demand control ventilation may not be appropriate is where a centralised mechanical ventilation or air conditioning system serves multiple spaces that have different ventilation demand profiles throughout the day. In this situation:

   a) Demand control ventilation based on the average of occupancy demands from all spaces may result in some spaces being under-ventilated at times.

   b) Where there is a high probability of at least one space being at or near maximum occupancy throughout normal operating hours, demand control ventilation based on the highest occupancy demand from all spaces may not provide significant annual energy savings.

3.2.5 Variable speed of fans

3.2.5.1 Where a mechanical ventilation system, including one that is part of an *air conditioning system*, has a design airflow greater than 1000 L/s, its fan shall vary its speed in accordance to the required airflow rates unless the downstream airflow is required to be constant.

3.2.5.2 *Car park* exhaust systems shall have a control system in accordance with AS 1668.2 Section 4.11.2 using a variable speed fan, or in accordance with AS 1668.2 Section 4.11.3.

Part 4. Fans

4.1 Demonstrating compliance

4.1.1 System design objectives

4.1.1.1 Energy consumption of fans in *air conditioning* systems or mechanical ventilation systems is to be limited. This is to be achieved by the use of energy efficient motors with a maximum allowable *fan motor power* and by limiting pressure drops throughout the ductwork.

4.1.2 Design applications and exemptions

4.1.2.1 These requirements apply to fans and ductwork used as part of an *air conditioning* system or a mechanical ventilation system.

4.1.2.2 The requirements do not apply to:

a) Fans in unducted *air conditioning* systems with a supply air capacity of less than 1000 L/s; and

b) Smoke spill fans, except where also used for *air conditioning* or ventilation; and

c) Kitchen exhaust systems; and

d) Fans for specialised applications including process-related components.

4.1.2.3 The fan efficiency requirements of Subsection 4.2.2 do not apply to fans that need to be explosion-proof.

4.2 Verification of the design

4.2.1 Overview

4.2.1.1 Fans, ductwork, and duct components that form part of an *air conditioning* system or mechanical ventilation system must:

a) Comply with the requirements of Subsections 4.2.2, 4.2.3, and 4.2.4; or

b) Demonstrate that the fan motor input power-per-unit-of-flowrate for the proposed design does not exceed the fan motor input power-per-unit-of-flowrate achieved when applying Subsections 4.2.2, 4.2.3, and 4.2.4 together.

4.2.2 Fan efficiency

4.2.2.1 The fan efficiency is separated for different static pressures and installation arrangements where:

a) Installation type A means an arrangement where the fan is installed with free inlet and outlet conditions; and

b) Installation type B means an arrangement where the fan is installed with a free inlet and a duct at its outlet; and

c) Installation type C means an arrangement where the fan is installed with a duct fitted to its inlet and with free outlet conditions; and

d) Installation type D means an arrangement where the fan is installed with a duct fitted to its inlet and outlet.

4.2.2.2 Fans in systems that have a static pressure of not more than 200 Pa must have an efficiency at the full load operating point not less than the efficiency calculated with Equation 1.

Equation 1: $\eta_{min} = 0.13 \times \ln(p) - 0.3$

where:

η_{min} is the minimum required system static efficiency for installation type A or C or the minimum required system total efficiency for installation type B or D; and
p is the static pressure of the system (Pa); and
In is the natural logarithm.

4.2.2.3 Fans in systems that have a static pressure above 200 Pa must have an efficiency at the full load operating point not less than the efficiency calculated with Equation 2.

Equation 2: $$\eta_{min} = 0.85 \times \frac{a \times \ln(P) - b + N}{100}$$

where:

η_{min} is the minimum required system static efficiency for installation type A or C or the minimum required system total efficiency for installation type B or D; and
P is the motor input power of the fan (kW); and
N is the minimum performance grade obtained from Table 4.2.2.3A; and
a is the regression coefficient a obtained from Table 4.2.2.3B; and
b is the regression coefficient b obtained from Table 4.2.2.3C; and
ln is the natural logarithm.

TABLE 4.2.2.3A: Minimum fan performance grade

Paragraph 4.2.2.3

Fan type	Minimum fan performance grade	
	Installation type A or C	Installation type B or D
Axial – as a component of an air handling unit or fan coil unit	46.0	51.5
Axial – other	42.0	61.0
Mixed flow – as a component of an air handling unit or fan coil unit	46.0	51.5
Mixed flow – other	52.5	65.0
Centrifugal forward-curved	46.0	51.5
Centrifugal radial bladed	46.0	51.5
Centrifugal backward-curved	64.0	64.0

TABLE 4.2.2.3B: Fan regression coefficient a

Paragraph 4.2.2.3

Fan type	Fan regression coefficient a	
	Fan motor input power < 10 kW	Fan motor input power ≥ 10 kW
Axial	2.74	0.78
Mixed flow	4.56	1.1
Centrifugal forward-curved	2.74	0.78
Centrifugal radial bladed	2.74	0.78
Centrifugal backward-curved	4.56	1.1

TABLE 4.2.2.3C: Fan regression coefficient b

Paragraph 4.2.2.3

Fan type	Fan regression coefficient b	
	Fan motor input power < 10 kW	Fan motor input power ≥ 10 kW
Axial	6.33	1.88
Mixed flow	10.5	2.60
Centrifugal forward-curved	6.33	1.88
Centrifugal radial bladed	6.33	1.88
Centrifugal backward-curved	10.5	2.60

4.2.3 Ductwork

4.2.3.1 The pressure drop in the index run across all straight sections of rigid ductwork and all sections of flexible ductwork must not exceed 1 Pa/m when averaged over the entire length of straight rigid duct and flexible duct. The pressure drop of flexible ductwork sections may be calculated as if the flexible ductwork is laid straight.

4.2.3.2 Flexible ductwork must not account for more than 6 m in length in any duct run.

4.2.3.3 The upstream connection to ductwork bends, elbows and tees in the index run must have an equivalent diameter to the connected duct.

4.2.3.4 Turning vanes must be included in all rigid ductwork elbows of 90° or more acute than 90° in the index run except where:

a) The inclusion of turning vanes presents a fouling risk; or

b) A long radius bend in accordance with AS 4254.2 is used.

4.2.4 Ductwork components in the index run

4.2.4.1 The pressure drop across a coil must not exceed the value specified in Table 4.2.4.1.

TABLE 4.2.4.1: Maximum coil pressure drop

Paragraph 4.2.4.1

Number of rows	Maximum pressure drop (Pa)
1	30
2	50
4	90
6	130
8	175
10	220

4.2.4.2 A high-efficiency particulate arrestance (HEPA) air filter must not exceed the higher of:

a) A pressure drop of 200 Pa when clean; or

b) The filter design pressure drop when clean at an air velocity of 1.5 m/s.

4.2.4.3 Any other air filter must not exceed:

a) The pressure drop specified in Table 4.2.4.3 when clean; or

b) The filter design pressure drop when clean at an air velocity of 2.5 m/s.

TABLE 4.2.4.3: Maximum clean filter pressure drop

Paragraph 4.2.4.3

Filter minimum efficiency reporting value	Maximum pressure drop (Pa)
9	55
11	65
13	95
14	110

4.2.4.4 The pressure drop across intake louvres must not exceed:

a) For single stage louvres, 30 Pa; and

b) For two stage louvres, 60 Pa; and

c) For acoustic louvres, 50 Pa; and

d) For other non-weatherproof louvres, 30 Pa.

4.2.4.5 The pressure drop across a variable air volume box, with the damper in the fully open position, must not exceed:

a) For units with electric reheat, 100 Pa; and

b) For other units, 25 Pa not including coil pressure losses.

4.2.4.6 The maximum pressure drop across other ductwork components must not exceed the values in Table 4.2.4.6.

TABLE 4.2.4.6: Maximum pressure drop for other ductwork components

Paragraph 4.2.4.6

Ductwork component	Maximum pressure drop (Pa)
Rooftop cowls	30
Attenuators	40
Fire dampers (when fully open)	15
Balancing and control dampers in the index run (when fully open)	25
Supply air diffusers and grilles	40
Exhaust grilles	30
Transfer ducts	12
Door grilles	12
Active chilled beams	150

Part 5. Ductwork insulation and sealing

5.1 Demonstrating compliance

5.1.1 System design objectives

5.1.1.1 Energy losses through ductwork are to be limited by providing insulation and sealing of ductwork and fittings in an *air conditioning* system.

5.1.2 Design applications and exemptions

5.1.2.1 The ductwork insulation requirements apply to passive and static components of a ductwork system, but do not apply to:

a) Ductwork and fittings located within and exposed to the only or last room served by the system, provided that the temperature of the air inside the ductwork or fitting is above the dew point of the room air; and

b) Fittings that form part of the interface with the *air conditioned space*; and

c) Return air ductwork in, or passing through, an *air conditioned space*; and

d) Ductwork for *outdoor air* and exhaust air that is either located outside the *thermal envelope* or where the temperature of the air inside the ductwork is above the dew point of the air in the space where the ductwork is located; and

e) The floor of an in-situ air handling unit; and

f) Packaged air conditioners, split systems, and variable refrigerant flow *air conditioning* equipment complying with *Minimum Energy Performance Standards (MEPS)*; and

g) Flexible fan connections; and

h) Active components of a ductwork system that are either located outside the *thermal envelope* or where the temperature of the air inside the ductwork or fitting is above the dew point of air in the space where the active ductwork component is located.

COMMENT:

1. The exemption in Paragraph 5.1.2.1 a) does not apply to ductwork that is located inside a plenum or above a ceiling because, in this case, the ductwork is not exposed to the only or last room.
2. Ductwork insulation is recommended for ductwork for *outdoor air* that is located in spaces outside the *thermal envelope* that may experience extreme temperatures, such as *roof* spaces.

5.1.2.2 The ductwork sealing requirements apply to active, passive and static components of a ductwork system, but do not apply to:

a) *Air conditioning* systems with a capacity of less than 1000 L/s; and

b) Ductwork and fittings located within the only or last room served by the system.

5.1.2.3 Active components of a ductwork system may include air-handling unit components, electric duct heaters, actuated volume control dampers, access panels and doors, fire and smoke dampers, fans or humidifiers.

5.1.2.4 Passive or static components of a ductwork system may include plenums, bends, branches, transitions, reducers, offsets, spigots, cushion heads, attenuators or fixed air balance dampers.

5.2 Verification of the design

5.2.1 Ductwork insulation

5.2.1.1 Verification of the design is achieved by providing ductwork and fittings in an *air conditioning system* with insulation that:

a) Complies with AS/NZS 4859.1; and

b) Has an insulation *R-value* greater than or equal to:

   i) for flexible ductwork, 1.0 m^2K/W; and

   ii) for cushion boxes, that of the connecting ductwork; and

   iii) for rigid ductwork and fittings that specified in Table 5.2.1.1; and

c) Is protected against the effects of weather and sunlight to reduce the likelihood of affecting the insulation properties over time; and

d) Is installed so that it:

   i) abuts adjoining insulation to form a continuous barrier; and

   ii) maintains its position and thickness, other than at flanges and supports; and

e) When conveying cooled air:

   i) is protected by a vapour barrier on the outside of the insulation to avoid condensation forming within the insulation; and

   ii) where the vapour barrier is a membrane, is installed so that adjoining sheets of the membrane overlap by at least 50 mm and are bonded or taped together.

TABLE 5.2.1.1: Ductwork and fittings – Minimum insulation R-value

Paragraph 5.2.1.1

Location of ductwork and fittings	Minimum insulation R-value ($m^2{\cdot}K/W$)
Within an *air conditioned space*	1.2
Where exposed to direct sunlight	3.0
All other locations	2.0

COMMENT:

The *R-value* of ductwork insulation can be calculated using the following equations:

a) For ductwork with flat surfaces such as rectangular ducts:

$$R = \frac{t}{k}$$

and

b) For tubular ductwork:

$$R = \frac{d + 2t}{2k} \ln\left(\frac{d + 2t}{d}\right)$$

where:

R is the *R-value* of ductwork insulation ($m^2{\cdot}K/W$); and

d is the diameter of the ductwork (m); and

t is the thickness of insulation (m); and

k is the thermal conductivity of the insulation material ($W/m{\cdot}K$).

5.2.2 Ductwork sealing

5.2.2.1 Verification of the design is achieved by providing ductwork sealing to ductwork and fittings in an *air conditioning* system in accordance with the duct sealing requirements of AS 4254.1 and AS 4254.2 for the static pressure in the system.

Part 6. Pumps

6.1 Demonstrating compliance

6.1.1 System design objectives

6.1.1.1 Energy consumption of pumps that form part of an *air conditioning* system is to be limited by the use of energy efficient motors and by keeping within a limited pipework average pressure drop.

6.1.2 Design applications and exemptions

6.1.2.1 The average pipework pressure drop requirements do not apply:

a) To valves and fittings; and

b) Where the smallest pipe size compliant with Paragraph 6.2.2.1 results in a velocity of 0.7 m/s or less at design flow.

6.2 Verification of the design

6.2.1 Pump motor efficiency

6.2.1.1 The verification of the design of pumps that form part of an *air conditioning* system is achieved when:

a) Circulator pumps that are glandless impeller pumps with a rated hydraulic power output of less than 2.5 kW and used in closed loop systems meet an energy efficiency index (EEI) of 0.27 or less when calculated in accordance with European Union Commission Regulation No. 622/2012.

b) Other pumps that are in accordance with Articles 1 and 2 of European Union Commission Regulation No. 547/2012 meet a minimum efficiency index (MEI) of 0.4 or more when calculated in accordance with European Union Commission Regulation No. 547/2012.

6.2.2 Pipework pressure loss

6.2.2.1 The verification of the design of a pipework network that forms part of an *air conditioning* system is achieved by providing pipework that:

a) In pipework systems that do not have branches and have the same flow rate throughout the entire pipe network, achieve an average pressure drop in straight segments along the index run of not more than:

i) for constant speed systems, the values nominated in Table 6.2.2.1A; or

ii) for variable speed systems, the values nominated in Table 6.2.2.1B; and

b) In any other pipework system, achieve an average pressure drop in straight segments along the index run of not more than:

i) for constant speed systems, the values nominated in Table 6.2.2.1C; or

ii) for variable speed systems, the values nominated in Table 6.2.2.1D.

TABLE 6.2.2.1A: **Maximum pipework pressure drop – Non-distributive constant speed systems**

Paragraph 6.2.2.1 a) i)

Nominal pipe diameter (mm)	Maximum pressure drop (Pa/m)	
	Systems operating ≤ 5000 hours/annum	Systems operating > 5000 hours/annum
≤ 20	400	400
25	400	400
32	400	400
40	400	400
50	400	350
65	400	350
80	400	350
100	400	200
125	400	200
≥ 150	400	200

TABLE 6.2.2.1B: **Maximum pipework pressure drop – Non-distributive variable speed systems**

Paragraph 6.2.2.1 a) ii)

Nominal pipe diameter (mm)	Maximum pressure drop (Pa/m)	
	Systems operating ≤ 5000 hours/annum	Systems operating > 5000 hours/annum
≤ 20	400	400
25	400	400
32	400	400
40	400	400
50	400	400
65	400	400
80	400	400
100	400	300
125	400	300
≥ 150	400	300

TABLE 6.2.2.1C: **Maximum pipework pressure drop – Distributive constant speed systems**

Paragraph 6.2.2.1 b) i)

Nominal pipe diameter (mm)	Maximum pressure drop (Pa/m)		
	Systems operating ≤2000 hours/annum	Systems operating > 2000 hours/annum and ≤ 5000 hours/annum	Systems operating > 5000 hours/annum
≤ 20	400	300	150
25	400	220	100
32	400	220	100
40	400	220	100
50	400	220	100
65	400	400	170
80	400	400	170
100	400	400	170
125	400	400	170
≥ 150	400	400	170

TABLE 6.2.2.1D: **Maximum pipework pressure drop – Distributive variable speed systems**

Paragraph 6.2.2.1 b) ii)

Nominal pipe diameter (mm)	Maximum pressure drop (Pa/m)	
	Systems operating ≤ 5000 hours/annum	Systems operating > 5000 hours/annum
≤ 20	400	250
25	400	180
32	400	180
40	400	180
50	400	180
65	400	300
80	400	300
100	400	300
125	400	300
≥ 150	400	300

Part 7. Pipework insulation

7.1 Demonstrating compliance

7.1.1 System design objectives

7.1.1.1 Energy losses through pipework that forms part of an *air conditioning* system are to be limited by providing insulation to *piping*, vessels, heat exchangers and tanks that contain heating or cooling fluid or refrigerant.

7.1.2 Design applications and exemptions

7.1.2.1 For the purposes of these requirements, heating fluids include heated water, steam and condensate. Cooling fluids include chilled water, brines and glycol mixtures, but do not include condenser cooling water.

7.1.2.2 Condenser cooling water is exempt from the minimum insulation requirements of this section due to the limited temperature difference between the *piping* contents and the surrounding space. However, insulation may be installed for reasons other than energy efficiency such as for acoustics, or to minimise the risk of condensation forming.

7.1.2.3 The required *R-value* is that of the insulation and not the total *R-value* of the wall, air film and insulation of the item.

> COMMENT:
>
> The *R-value* of pipework insulation can be calculated using the following equation:
>
> $$R = \frac{d + 2t}{2k} \ln\left(\frac{d + 2t}{d}\right)$$
>
> where:
>
> R is the *R-value* of pipework insulation ($m^2 \cdot K/W$); and
>
> d is the diameter of the pipe (m); and
>
> t is the thickness of the insulation (m); and
>
> k is the thermal conductivity of the insulation material ($W/m \cdot K$); and
>
> ln is the natural logarithm.

7.1.2.4 The requirements for pipework insulation do not apply to *piping*, vessels, heat exchangers and tanks that are in appliances covered by *Minimum Energy Performance Standards (MEPS)* or for *piping*, vessels or heat exchangers that are:

a) Located within and exposed to the only or last room served by the system, provided they do not contain cooling fluid or are used for a minimum water flow strategy; or

b) Encased within a concrete slab or panel which is part of a heating or cooling system; or

c) Supplied as an integral part of a chiller, boiler or *unitary air conditioner* complying with the requirements of Part 8, Part 9, and Part 10; or

d) Inside an air handling unit, fan-coil unit, or the like.

7.2 Verification of the design

7.2.1 Piping, vessels, heat exchangers, and tanks insulation

7.2.1.1 Verification of the design is achieved by providing insulation to *piping*, vessels, heat exchangers and tanks that form part of an *air conditioning* system and that contain heating or cooling fluid or refrigerant, where the fluid or refrigerant is held at a heated or cooled temperature.

Pipework insulation

7.2.1.2 The insulation shall:

a) Comply with AS/NZS 4859.1; and

b) For *piping* of heating and cooling fluids or refrigerants, have an insulation *R-value* in accordance with Table 7.2.1.2A; and

c) For vessels, heat exchangers or tanks, have an insulation *R-value* in accordance with Table 7.2.1.2B; and

d) For refill or pressure relief *piping*, have an insulation *R-value* equal to the required insulation *R-value* of the connected pipe, vessel or tank within 500 mm of the connection; and

e) Be protected against the effects of weather and sunlight; and

f) Be able to withstand the temperatures within the *piping*, vessel, heat exchanger or tank; and

g) When containing cooling fluid or refrigerant, be protected by a vapour barrier on the outside of the insulation.

TABLE 7.2.1.2A: Piping — Minimum insulation R-value

Paragraph 7.2.1.2 b)

Fluid / refrigerant temperature range	Minimum insulation R-value			
	Nominal pipe diameter ≤ 40 mm	Nominal pipe diameter > 40 mm and ≤ 80 mm	Nominal pipe diameter between > 80 mm and ≤ 150 mm	Nominal pipe diameter > 150 mm
≤ 2°C	1.3	1.7	2.0	2.7
> 2°C but ≤ 20°C	1.0	1.5	2.0	2.0
> 30°C but ≤ 85°C	1.7	1.7	1.7	1.7
> 85°C but ≤ 120°C	2.7	2.7	2.7	2.7
> 120°C	4.0	4.0	4.0	4.0

Note: The minimum required *R-value* may be halved for *piping* penetrating a structural member.

TABLE 7.2.1.2B: Vessels, heat exchangers and tanks — Minimum insulation R-value

Paragraph 7.2.1.2 c)

Fluid / refrigerant temperature range	Minimum insulation R-value
≤ 2°C	2.3
> 2°C but ≤ 20°C	1.8
> 30°C but ≤ 85°C	2.3
> 85°C but ≤ 120°C	3.0
> 120°C	4.0

Part 8. Space heating

8.1 Demonstrating compliance

8.1.1 System design objectives

8.1.1.1 The use of energy that is sourced from a network utility operator or depletable energy resource and used for space heating is to be limited by the selection of appropriate space heating equipment.

8.1.2 Design applications and exemptions

8.1.2.1 These requirements apply to heaters that provide heat directly or indirectly to the space(s) or area(s) they serve.

8.1.2.2 Where a heater is an in-duct heater, the amount of reheat is limited by Paragraph 2.2.3.2 c).

8.2 Verification of the design

8.2.1 Heaters

8.2.1.1 Verification of the design is achieved by providing space heaters that directly use renewable energy, efficient combustion of gas, electricity, biomass, reclaimed heat or a combination of those, and control their operation when used in an outdoor space.

8.2.1.2 A heater used for *air conditioning* or as part of an *air conditioning* system must be:

a) A solar heater, or

b) A flued gas heater, or

c) A heat pump heater, or

d) A biomass heater, or

e) A heater using reclaimed heat from another process such as reject heat from a refrigeration plant, or

f) An electric heater, or

g) Any combination of a) to f).

8.2.1.3 A fixed heating appliance that moderates the temperature of an outdoor space shall be configured to automatically shut down when:

a) There are no occupants in the space served; or

b) A period of one hour has elapsed since the last activation of the heater; or

c) The space served has reached the design temperature.

> COMMENT: Automatic shutdown may be achieved by an outdoor temperature sensor, timer, motion detector, or the like.

8.2.1.4 A gas water heater that is used as part of an *air conditioning system* shall achieve a minimum gross thermal efficiency of 90% when tested under conditions that mirror the expected typical operating conditions, including the expected water inlet/outlet temperatures.

> COMMENT: There are a number of testing standards that can be used to demonstrate compliance with the gross thermal efficiency requirement for gas water heaters. These include BS 7190, ANSI/AHRI 1500 and AS/NZS 5263.1.2. Testing under the expected typical operating conditions is especially important for condensing boilers, where the inlet/outlet temperature of water will greatly impact the overall efficiency.

Part 9. Refrigerant chillers

9.1 Demonstrating compliance

9.1.1 System design objectives

9.1.1.1 Energy consumption by refrigerant chillers is to be limited by the selection of equipment that meets *Minimum Energy Performance Standards (MEPS)* and certain energy efficiency ratio requirements.

9.1.1.2 This applies to air-cooled and water-cooled refrigerant chillers that form part of an *air conditioning* system.

9.2 Verification of the design

9.2.1 Air-cooled and water-cooled refrigerant chillers

9.2.1.1 Verification of the design is achieved by providing a refrigerant chiller that:

a) Complies with *Minimum Energy Performance Standards (MEPS);* and

b) Complies with the minimum full load operation energy efficiency ratio and the minimum integrated part load energy efficiency ratio in Table 9.2.1.1A or Table 9.2.1.1B when determined in accordance with AHRI 551/591.

i

COMMENT: Table 9.2.1.1A contains higher full-load performance values, intended to be applicable to chillers which are more likely to operate at full load, while Table 9.2.1.1B contains higher part-load performance values, intended to be applicable to chillers which are more likely to operate at part-load. A designer may choose whether to comply with Table 9.2.1.1A or Table 9.2.1.1B.

Refrigerant chillers

TABLE 9.2.1.1A: **Minimum energy efficiency ratio for refrigerant chillers — Option 1**

Paragraph 9.2.1.1 b)

Chiller type	Full load operation (W_r / $W_{input\ power}$)	Integrated part load (W_r / $W_{input\ power}$)
Air-cooled chiller with a capacity ≤ 528 kW_r	2.985	4.048
Air-cooled chiller with a capacity > 528 kW_r	2.985	4.137
Water-cooled positive displacement chiller with a capacity ≤ 264 kW_r	4.694	5.867
Water-cooled positive displacement chiller with a capacity > 264 kW_r but ≤ 528 kW_r	4.889	6.286
Water-cooled positive displacement chiller with a capacity > 528 kW_r but ≤ 1055 kW_r	5.334	6.519
Water-cooled positive displacement chiller with a capacity > 1055 kW_r but ≤ 2110 kW_r	5.800	6.770
Water-cooled positive displacement chiller with a capacity > 2110 kW_r	6.286	7.041
Water-cooled centrifugal chiller with a capacity ≤ 528 kW_r	5.771	6.401
Water-cooled centrifugal chiller with a capacity > 528 kW_r but ≤ 1055 kW_r	5.771	6.519
Water-cooled centrifugal chiller with a capacity > 1055 kW_r but ≤ 1407 kW_r	6.286	6.770
Water-cooled centrifugal chiller with a capacity > 1407 kW_r	6.286	7.041

Note: W_r means watt(s) of refrigeration

TABLE 9.2.1.1B: **Minimum energy efficiency ratio for refrigerant chillers — Option 2**

Paragraph 9.2.1.1 b)

Chiller type	Full load operation (W_r / $W_{input\ power}$)	Integrated part load (W_r / $W_{input\ power}$)
Air-cooled chiller with a capacity ≤ 528 kW_r	2.866	4.669
Air-cooled chiller with a capacity > 528 kW_r	2.866	4.758
Water-cooled positive displacement chiller with a capacity ≤ 264 kW_r	4.513	7.041
Water-cooled positive displacement chiller with a capacity > 264 kW_r but ≤ 528 kW_r	4.694	7.184
Water-cooled positive displacement chiller with a capacity > 528 kW_r but ≤ 1055 kW_r	5.177	8.001
Water-cooled positive displacement chiller with a capacity > 1055 kW_r but ≤ 2110 kW_r	5.633	8.586
Water-cooled positive displacement chiller with a capacity > 2110 kW_r	6.018	9.264
Water-cooled centrifugal chiller with a capacity ≤ 528 kW_r	5.065	8.001
Water-cooled centrifugal chiller with a capacity > 528 kW_r but ≤ 1055 kW_r	5.544	8.001
Water-cooled centrifugal chiller with a capacity > 1055 kW_r but ≤ 1407 kW_r	5.917	9.027
Water-cooled centrifugal chiller with a capacity > 1407 kW_r	6.018	9.264

Note: W_r means watt(s) of refrigeration

Part 10. Unitary air conditioning equipment

10.1 Demonstrating compliance

10.1.1 System design objectives

10.1.1.1 Energy consumption is to be limited by the use of u*nitary air conditioners* that meet *Minimum Energy Performance Standards (MEPS)* and certain energy efficiency ratio requirements.

10.1.2 Design applications and exemptions

10.1.2.1 These requirements apply to air-cooled and water-cooled *unitary air conditioners* including packaged air conditioners, split systems, and variable refrigerant flow systems.

10.2 Verification of the design

10.2.1 Air-cooled and water-cooled unitary air conditioners

10.2.1.1 Verification of the design is achieved by providing *unitary air conditioners* that:

a) Comply with *Minimum Energy Performance Standards (MEPS)*; and

b) For a capacity greater than or equal to 65 kW_r (kilowatts of refrigeration), when tested in accordance with AS/NZS 3823.1.2 at test condition T1, have a minimum energy efficiency ratio of:

  i) 4.0 W_r / $W_{input\ power}$ when water-cooled; and

  ii) 2.9 W_r / $W_{input\ power}$ where air-cooled.

10.2.1.2 The input power includes both compressor and fan input power.

Part 11. Heat rejection equipment

11.1 Demonstrating compliance

11.1.1 System design objectives

11.1.1.1 Energy consumption is to be limited by the use of heat rejection equipment with a fan that does not exceed a maximum allowable fan motor input power.

11.1.2 Design applications and exemptions

11.1.2.1 These requirements apply to fans of cooling towers, closed circuit coolers, evaporative condensers and air-cooled condensers.

11.1.2.2 These requirements exclude:

a) A refrigerant chiller in an *air conditioning* system that complies with the energy efficiency ratios in Part 9; and

b) Packaged air conditioners, split systems, and variable refrigerant flow *air conditioning* equipment that complies with the energy efficiency ratios in Part 10.

11.2 Verification of the design

11.2.1 Fan of heat rejection equipment

11.2.1.1 Verification of the design is achieved by providing heat rejection equipment with a fan that:

a) For a cooling tower, closed circuit cooler and evaporative condenser does not exceed the relevant maximum *fan motor power* in Table 11.2.1.1; and

b) For an air-cooled condenser, does not exceed a maximum *fan motor power* of 42 W for each kW of heat rejected from the refrigerant, when determined in accordance with AHRI 460.

i

COMMENT: The performance of cooling tower fans, closed circuit cooler fans and evaporative condenser fans can be determined using any nationally or internationally accepted standard such as:

a) CTI STD-201RS(19) and ATC-105(19) which can be used to determine the performance of cooling tower fans; and

b) CTI STD-201RS(19) and ATC-105S(11) which can be used for closed circuit cooler fans; and

c) ATC-106(11) can be used to determine the performance of evaporative condenser fans.

TABLE 11.2.1.1: Maximum fan motor power — Cooling towers, closed circuit coolers and evaporative condensers

Paragraph 11.2.1.1 a)

Type	Maximum fan motor input power (W/kW_{rej})[1]		
	Cooling tower	Closed circuit cooler	Evaporative condenser
Induced draft	10.4	16.9	11.0
Forced draft	19.5	[2]	11.0

Note:

(1) kW_{rej} means kilowatt(s) of heat rejected from the refrigerant.

(2) A closed circuit, forced draft cooling tower shall not be used.

Part 12. Facilities for energy monitoring

12.1 Demonstrating compliance

12.1.1 System design objectives

12.1.1.1 To enable the required level of energy efficiency of *HVAC systems* to be maintained, certain equipment is to be provided that enables excessive energy use to be detected.

12.2 Verification of the design

12.2.1 Energy meters and energy recording

12.2.1.1 For *buildings* with a floor area of *occupied space* greater than 500 m^2 but less than 2500 m^2, verification of the design is achieved by providing energy meters configured to record the time-of-use consumption of gas and electricity.

12.2.1.2 For *buildings* with a floor area of *occupied space* equal to or greater than 2500 m^2, verification of the design is achieved by:

a) Providing energy meters configured to enable individual time-of-use energy consumption data recording of *air conditioning* plant including, where appropriate:
   i) individual time-of-use energy consumption data recording of heating plant; and
   ii) individual time-of-use energy consumption data recording of cooling plant; and
   iii) individual time-of-use energy consumption data recording of air handling fans; and

b) Interlinking the required energy meters by a communication system that collates the time-of-use energy consumption data to a single interface monitoring system where it can be stored, analysed and reviewed; and

c) Ensuring the single interface monitoring system is able to store the individual time-of-use energy consumption data records of *air conditioning* plant over a minimum period of 12 months.

Part 13. Maintenance access

13.1 Demonstrating compliance

13.1.1 System design objectives

13.1.1.1 To enable the required level of energy efficiency of *HVAC systems* to be maintained, sufficient access for commissioning, maintenance and replacement of equipment is to be provided.

13.2 Verification of the design

13.2.1 Equipment access

13.2.1.1 Verification of the design is achieved by providing sufficient access for commissioning and maintenance of *HVAC system* equipment.

> COMMENT: Good practice guidance on space requirements for equipment access can be found in the UK Defence Works Functional Standard, Design & Maintenance Guide 08: Space requirements for plant access operation and maintenance.

Appendix A. References

For the purposes of Building Code compliance, the Standards and documents referenced in this verification method must be the editions, along with their specific amendments, listed below.

Standards New Zealand		**Where quoted**
AS/NZS 3823:-	Performance of electrical appliances – Airconditioners and heat pumps	10.2.1.1 b)
Part 1.2: 2012	Ducted airconditioners and air-to-air heat pumps - Testing and rating for performance	
AS/NZS 4859:-	Thermal insulation materials for buildings	
Part 1: 2018	General criteria and technical provisions	5.2.1.1 a), 7.2.1.2 a)
AS/NZS 5263:-	Gas appliances	
Part 1.2: 2020	Gas fired water heaters for hot water supply and/or central heating	8.1.2.4 Comment

These standards can be accessed from standards.govt.nz

Standards Australia		
AS 1668:-	The use of ventilation and airconditioning in buildings	
Part 2: 2012	Mechanical ventilation in buildings Amend 1 and 2	3.2.4.1 a), 3.2.5.2
AS 4254:-	Ductwork for air handling systems in buildings	
Part 1: 2012	Flexible duct	5.2.2.1
Part 2: 2012	Rigid duct	4.2.3.2 b), 5.2.2.1

These standards can be accessed from standards.org.au

British Standards		
BS 7190: 1989	Method for assessing thermal performance of low temperature hot water boilers using a test rig	8.2.1.4 Comment

This standard can be accessed from standards.govt.nz

Air Conditioning, Heating and Refrigeration Institute		
AHRI 460: 2005	Performance rating of remote mechanical-draft air cooled refrigerant condensers	11.2.1.1 b)
AHRI 551/591: 2015	Performance rating of water-chilling and heat pump water-heating packages using the vapour compression cycle.	9.2.1.1 b)
ANSI/AHRI 1500: 2015	Performance rating of commercial space heating boilers	8.1.2.4 Comment

These standards can be accessed from ahrinet.org

References

Cooling Technology Institute		Where quoted
CTI STD 201 RS: 2019	Performance Rating of Evaporative Heat Rejection Equipment	11.2.1.1 Comment
CTI ATC 105S: 2019	Acceptance Test Code for Closed Circuit Cooling Towers	11.2.1.1 Comment
CTI 106: 2011	Acceptance Test Code for Mechanical Draft Evaporative Vapor Condensers	11.2.1.1 Comment

These standards can be accessed from coolingtechnology.org

Defence Estate Organisation (Works)

Defence Works Function Standard, Design and Maintenance Guide 08: Space requirements for plant access operation and maintenance. 1996	13.2.1.1 Comment

This document can be accessed from cibse.org

European Union

Commission Regulation (EU) No. 547/2012	6.2.1.1 b)
Commission Regulation (EU) No. 622/2012	6.2.1.1 a)

These regulations can be accessed from eur-lex.europa.eu

Appendix B. Definitions

These definitions are specific to this verification method. Other defined terms found in italics within the definitions are provided in clause A2 of the Building Code.

Air conditioned space	Means a space within a *building*, including a ceiling or underfloor supply air plenum or return air plenum, where the environment is likely, by the *intended use* of the space, to have its temperature controlled by *air conditioning*.
Air conditioning	Means an *HVAC system* that actively cools or heats the air within a space, but does not include an *HVAC system* that directly: a) cools cold rooms or heats hot rooms (such as in a butcher's shop, fruit storage rooms or in laboratories); or b) maintains specialised conditions for equipment or processes, where this is the main purpose of the *HVAC system*. The *air conditioning* may be achieved without treating the air forced into and through the space. The air in the space may also be conditioned by hot or cool surfaces. This includes residential-type heating systems, such as gas and combustion appliances, that are not always considered to be *air conditioning* in the traditional sense. The conditioning may also be achieved by evaporative coolers.
Building	Has the meaning given to it by sections 8 and 9 of the Building Act 2004.
Car park	Means a *building* that is used for the parking of motor vehicles but is not used for the servicing of vehicles, other than washing, cleaning, or polishing.
Conditioned space	That part of a *building* within the *building thermal envelope* that may be directly or indirectly heated or cooled for occupant comfort. It is separated from *unconditioned space* by *building elements* (walls, windows, *skylights*, doors, *roof*, and floor) to limit uncontrolled airflow and heat loss.
Fan motor power	Means the power delivered to a motor of a fan, including the power needed for any drive and impeller losses.
HVAC system	For the purposes of performance NZBC H1.3.6 and in relation to a *building*, means a mechanical, electrical, or other system for modifying air temperature, modifying air humidity, providing ventilation, or doing all or any of those things, in a space within the building.
Intended use	In relation to a *building*, — a) includes any or all of the following: i) any reasonably foreseeable occasional use that is not incompatible with the intended use; ii) normal maintenance; iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but b) does not include any other maintenance and repairs or rebuilding.
Minimum Energy Performance Standards (MEPS)	Means the minimum energy performance standards for energy using products established through the Energy Efficiency (Energy Using Products) Regulations 2002, amended by the Energy Efficiency (Energy Using Products) Amendment Regulations 2020.
Occupied space	Any space within a *building* in which a person will be present from time to time during the *intended use* of the *building*.
Outdoor air	Means air outside the *building*, typically comprising by volume: i) oxygen 20.94%, and ii) carbon dioxide 0.03%, and iii) nitrogen and other inert gases 79.03%.

Definitions

Outdoor air economy cycle	Means a mode of operation of an *air conditioning* system that, when the *outdoor air* thermodynamic properties are favourable, increases the quantity of *outdoor air* used to condition the space.
Piping	Means an assembly of pipes, with or without valves or other fittings, connected together for the conveyance of liquids and gases.
Roof	Any roof/ceiling combination where the exterior surface of the *building* is at an angle of 60° or less to the horizontal and has its upper surface exposed to the outside.
R-value	The common abbreviation for describing the *thermal resistance*.
Skylight	Translucent or transparent parts of the *roof*.
Thermal envelope	The *roof*, wall, window, *skylight*, door and floor *construction* between *unconditioned spaces* and *conditioned spaces*.
Thermal resistance	The resistance to heat flow of a given component of a *building element*. It is equal to the air temperature difference (K) needed to produce unit heat flux (W/m^2) through unit area (m^2) under steady conditions. The units are $m^2{\cdot}K/W$.
Unconditioned space	Space within the *building envelope* that is not *conditioned space* (for example, this may include a garage, conservatory, atrium, attic, subfloor, and so on). However, where a garage, conservatory or atrium is expected to be heated or cooled these spaces shall be included in the *conditioned space*.
Unitary air conditioner	Means a modular factory assembled *air conditioning* unit. These units are self-contained and include within the unit all the components for heating and/or cooling such as fans, controls, a refrigeration system, heating coil and sometimes the heater. Split systems, packaged air conditioners, variable refrigerant flow and variable refrigerant volume air conditioners are all types of *unitary air conditioners*.