MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Acceptable Solutions and Verification Methods

For New Zealand Building Code Clauses

G10 Piped Services

G10
BUILDING CODE

Status of Verification Methods and Acceptable Solutions

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

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

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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**			
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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
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Amendment 3	28 February 1998	p. ii, Document History p. vii, References	p. 8, 5.0.1
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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
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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.			

2B

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

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 7 Feb 2014

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	Gas installations	VM1 1.0.1, AS1 5.0.1	Amend 2 Dec 1995 Amends 1 and 3
	Part 1:	General installations *Amends: 1, 2*		
	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	AS1 Table 1	Amend 2 Dec 1995
Amend 6 Oct 2011		*Amend: 1*		
	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 pipe	AS1 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

Amend 4 Jun 2007

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

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

a) Be designed in accordance with B1/VM1, Paragraphs 2.0 and 13.0,

Amend 7 Feb 2014

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.

COMMENT:

Amend 1 Sep 1993

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.

Table 1: Acceptable Standards for Piping Systems
Paragraph 1.0.1 b)

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.	Screwing/socketing to NZS/BS 21.	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.
		Socket-welding pipe fittings, sockets to NZS/BS 3799 or ANSI B16.11.	Welding to BS 2971 or API 1104.	
		Butt-welding fittings to BS EN 10253-2, BS EN 10253-3 or ANSI B16.9.		2. All joints in locations below ground shall be externally protected against corrosion.
		Flanges to BS 10, AS/NZS 4331		3. Welding shall be by welders certified in accordance with API 1104.
		ANSI B16.1 and B16.5.		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.	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.	1. Not for installation below ground, unless in protective ducting.
		Copper and copper alloy capillary fittings to AS 3688.		
		Copper alloy compression fittings to AS 3688 or AS D26.	Flares formed with proprietary flaring tools.	
Plastic	Polyethylene to NZS 7646.	Fittings to NZS 7646.		Below ground use only.

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

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

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All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.