Approved Document for New Zealand Building Code Piped Services Clause G10

Prepared by the Building Industry Authority
This Approved Document is prepared by the Building Industry Authority, which is a statutory body established by the Building Act 1991.

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Status of Approved Documents

Approved Documents are prepared by the Building Industry Authority in accordance with section 49 of the Building Act 1991. They are non-mandatory guidance documents offering only one method of compliance with specific performance criteria of the New Zealand Building Code.

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

Classified uses and defined words which are italicised in the text are explained in clauses A1 and A2 of the New Zealand Building Code.

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

Note:

Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

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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 compliance, acceptable reference documents include only the quoted edition and specific amendments as listed below. Dates in brackets indicate that the Standard was revised and reissued without change that year.

Amend 2 Dec 1995

		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)	AS1 Table 1
NZS/BS 143 and 1256: 1993	Specification for malleable cast iron and cast copper alloy threaded pipe fittings *Amend: 1, 2, 3*	AS1 Table 1
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	AS1 Table 1
NZS/BS 1560:-	Circular flanges for pipes, valves and fittings (Class designated)	
Part 3:-	Steel, cast iron and copper alloy flanges	AS1 Table 1
Section 3.1: 1989	Specification for steel flanges	
Section 3.2: 1989	Specification for cast iron flanges	
NZS/BS 1740:-	Specification for wrought steel pipe fittings (screwed BS 21 R-series thread)	
Part 1: 1971 (1990)	Metric units *Amend: 1, 2, 3*	AS1 Table 1
NZS/BS 2971: 1991	Specification for Class II arc welding of carbon steel pipework for carrying fluids	AS1 1.3.1 a), Table 1
NZS 3501: 1976	Specification for copper tubes for water, gas, and sanitation	AS1 Table 1
NZS 3502: 1976	Specification for copper and copper alloy tubes for general engineering purposes	AS1 Table 1
NZS/BS 3601: 1987 (1993)	Specification for carbon steel pipes and tubes with specified room temperature properties for pressure purposes	AS1Table 1
NZS 4203: 1984	Code of practice for general structural design and design loadings for buildings *Amend: 1*	AS1 1.0.1 a)
NZS 4219: 1983	Specification for seismic resistance of engineering systems in buildings *Amend: 1, 2*	AS1 1.0.1 a)

Amend 1 Sep 1993

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Amend 1 Sep 1993

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		Where quoted	
NZS/BS 4504:-	Circular flanges for pipes, valves and fittings (PN designated)		
Part 3:-	Steel, cast iron and copper alloy flanges	AS1 Table 1	
Section 3.2: 1989	Specification for cast iron flanges		
NZS 5261: 1996	The installation of gas burning appliances and equipment	VM1 1.0.1, AS1 5.0.1	Amend 2 Dec 1995 Amends 1 & 3
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	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			
BS 10: 1962	Specification for flanges and bolting for pipe, valves and fittings	AS1 Table 1	
BS 1640:-	Specification for steel butt-welding pipe fittings for the petroleum industry		
Part 3: 1968	Wrought carbon and ferritic alloy steel fittings. Metric units *Amend: 905*	AS1 Table 1	Amend 1 Sep 1993
Part 4: 1968	Wrought and cast austenitic chromium-nickel steel fittings. Metric units	AS1 Table 1	
BS 1723:-	Brazing		
Part 1: 1986	Specification for brazing	AS1 Table 1	
BS 1845: 1984	Specification for filler metals for brazing	AS1 Table 1	
BS 2640: 1982	Specification for Class II oxy-acetylene 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
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: 1993	Filler metal for brazing and braze welding	AS1 Table 1	Amend 2 Dec 1995
AS 1432: 1990	Copper tubes for plumbing, gasfitting and drainage applications	AS1 Table 1	
AS 3688: 1994	Water supply – Copper and copper alloy compression and capillary fittings and threaded connectors	AS1 Table 1	Amend 2 Dec 1995

		Where quoted
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

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.*

Building has the meaning ascribed to it by the Building Act 1991.

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.

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

1.0.1 NZS 5261 Appendix B 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:

a) Be designed in accordance with NZS 4203, and comply with the seismic design and installation requirements of NZS 4219,

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:

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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.

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

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 NZS/BS 143 and 1256 or ANSI B16.3. Wrought steel to NZS/BS 1740, 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. 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.
		Socket-welding pipe fittings, sockets to NZS/BS 3799 or ANSI B16.11. Butt-welding fittings to BS 1640 or ANSI B16.9.	Welding to BS 2640, NZS/BS 2971 or API 1104.	
		Flanges to BS 10, NZS/BS 1560, NZS/BS 4504 or ANSI B16.1 and B16.5.		
Copper	Copper tube to NZS 3501, NZS 3502 or AS 1432.	Copper tube expanded with proper forming tools to provide capillary tolerances.	Brazing in accordance with BS 1723 using copper-phosphorous brazing alloy to AS 1167-1 or BS 1845, 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.

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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:

a) BS 2640 or NZS/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.

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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 Alternative Solution

5.0.1 NZS 5261: Part 2 is an alternative acceptable solution for Paragraphs 1.0 to 4.0 but may exceed the performance criteria of NZBC G10.

Amend 3
Feb 1998

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.