

Compliance Document for New Zealand Building Code Clause G4 Ventilation – Second Edition

Prepared by the Department of Building and Housing

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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.

G4: Document History			
	Date	Alterations	
First published	July 1992		
Amendment 1	September 1993	p. 3, 1.1.2	
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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 23 June 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 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 <i>amenity</i> due to lack of fresh air.	
FUNCTIONAL REQUIREMENT	
G4.2 Spaces within <i>buildings</i> shall be provided with <i>adequate</i> ventilation consistent with their maximum occupancy and their <i>intended use</i> .	
PERFORMANCE	
G4.3.1 Spaces within <i>buildings</i> shall have means of ventilation with <i>outdoor air</i> that will provide an <i>adequate</i> 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 <i>Buildings</i> shall have a means of collecting or otherwise removing the following products from the spaces in which they are generated:	
<ul style="list-style-type: none"> (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*.

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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.

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Standards New Zealand

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NZS 4303: 1990	Ventilation for acceptable indoor air quality
NZS 5261: 1996	The installation of gas burning appliances and equipment
AS/NZS 3666:-	Air-handling and water systems of buildings – Microbial control
Part 1: 2002	Design, installation and commissioning
Part 2: 2002	Operation and maintenance

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Standards Australia

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AS 1668:-	The use of mechanical ventilation and air-conditioning in buildings
Part 2: 2002	Ventilation design for indoor-air containment control

New Zealand Government Departments

Occupational Safety and Health

Workplace exposure standards and biological exposure indices for New Zealand 1992

Chartered Institution of Building Services Engineers, London

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CIBSE Code Series A: 1996	Air distribution systems
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Where quoted

AS1 1.3.1 a) d)
AS1 2.3.1 b), 2.4.1 c), 3.0.1
AS1 1.3.1 b)
AS1 1.3.1 a) c) i) ii) d) e) f) g), 1.2.3, 1.3.2
VM1 2.0.1
VM1 1.0.1, AS1 1.3.1 h)

Definitions

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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*.

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.

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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.

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*.

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.

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

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- 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.

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Natural draught The flow produced by the tendency of warmed gases to rise.

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%.

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.

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 for New Zealand 1992".

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 Where natural ventilation is available via adjacent spaces, specific ventilation shall not be required to small spaces such as hallways and lobbies in *household units*.

1.1.3 Ventilation of spaces within *buildings* shall be provided by natural ventilation, mechanical ventilation or a combination of mechanical and natural ventilation.

1.1.4 The natural ventilation of *household units* where there is only one wall with opening windows may not provide enough ventilation for compliance with NZBC G4 and is not part of this Acceptable Solution. Ventilation of these *household units* will be left for *specific design*.

COMMENT:

1. An example where this may apply is to apartments.
2. Solutions for *specific design* may include:
 - Opening windows
 - Trickle ventilation systems
 - Mechanical extract
 - Mechanical supply, or
 - A combination of mechanical ventilation and natural ventilation systems.

1.2 Natural ventilation

1.2.1 Provision for natural ventilation of *occupied spaces* shall be achieved by providing a net openable area of windows or other openings of no less than 5% of the floor area. This 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.

- b) *Household units* where there is only one external wall with opening windows (see Paragraph 1.1.4).

1.2.2 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*.

COMMENT:

1. The net openable area of windows or doors is measured on the face dimensions of the *building element* concerned.
2. Fixing in the 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* should be considered for compliance with NZBC Clause E2 External Moisture.

1.2.3 Natural ventilation of car parks shall comply with the natural ventilation part of AS 1668.2 Section 7.

1.3 Mechanical ventilation

1.3.1 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.

- b) Air-handling systems shall:

Be installed and maintained to the requirements of AS/NZS 3666.1 and AS/NZS 3666.2.

- 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 3.

COMMENT:

Commercial kitchen extract ventilation is included in AS 1668.2 Section 5.

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- ii) where provided to remove moisture and other *contaminants* from kitchens, bathrooms, toilet spaces and laundries in *Housing*, exhaust the air to the outside at flow rates given in AS 1668.2, Table B1.

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.

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e) Recirculated air systems shall:

Comply with AS 1668.2 Clause 4.5.

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f) Contaminated air discharge systems shall:

Discharge contaminated air in a way which complies with AS 1668.2 Clause 4.5.

g) Filtration shall:

Comply with AS1668.2 Clause 4.4.

h) Commissioning shall:

Comply with CIBSE Code Series A.

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1.3.2 Car park ventilation

Mechanical ventilation of car parks shall comply with the mechanical ventilation part of AS 1668.2 Section 7.

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1.3.3 Positive and negative pressure

Building interiors ventilated by mechanical systems incorporating filtration shall, except where Paragraph 1.3.4 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*.

1.3.4 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 m³ 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 mm² for spaces vented directly to the outside, and
- b) 2300 mm² 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 m³/h for *forced or induced draught appliances*, and
 - ii) 7.2 m³/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 mm² 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 NZS 5261 Appendix F, 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.

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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 NZS 5261 Figure 2.

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3.0 Alternative Solution for Gas-fuel Appliances

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3.0.1 NZS 5261 Part 2 Appendices A to H, J and L is an Acceptable Solution, but may exceed the performance criteria of NZBC G4.

Index G4/VM1 & AS1

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

Air-handling systems	AS1 1.3.1 b)
Air purity	VM1 2.0
Car park ventilation	AS1 1.3.2
Contaminated air discharge	AS1 1.3.1 f)
Extract ventilation	AS1 1.3.1 c)
Flues	AS1 2.3, 2.4
Gas-fuel appliances	AS1 2.0, 3.0
Mechanical ventilation	AS1 1.3, 2.2
Natural ventilation	AS1 1.2, 2.1
Outdoor air supply	AS1 1.3.1 a) d)
Positive and negative pressure	AS1 1.3.3
Recirculated air systems	AS1 1.3.1 e)
Ventilation rate	VM1 1.0.1

