

Dear Customer

Please find enclosed Amendment 3, effective 14 February 2014, to the Acceptable Solution and Verification Method for Clause G4 Ventilation of the New Zealand Building Code. The previous amendment to G4 (Amendment 2) was in October 2011.

Section	Old G4	February 2014 Amendments to G4
Title pages	Remove title page and document history page 1/2	Replace with new title page and document history pages 1–2B
References	Remove page 7/8	Replace with new page 7/8
Definitions	Remove page 9/10	Replace with new page 9/10
G4/AS1	Remove pages 13/14, 19/20	Replace with new pages 13/14, 19/20
Appendix 1	Remove pages 21–24	Replace with new pages 21–24



**MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT**
HĪKINA WHAKATUTUKI

Acceptable Solutions and Verification Methods

For New Zealand Building Code Clause
G4 Ventilation

Third Edition



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.

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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.

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

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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 14 February 2014 and supersedes all previous versions of this document.

The previous version of this document (Amendment 2) 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

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	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
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 (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.

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Standards New Zealand

AS/NZS 3666:– Air-handling and water systems of buildings –
Microbial control

Part 1: 2011 Design, installation and commissioning

Part 2: 2011 Operation and maintenance

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NZS 4303: 1990 Ventilation for acceptable indoor air quality

AS/NZS 4740: 2000 Natural ventilators – Classification and performance

AS/NZS 5601:– Gas installations

Part 1: 2010 General installations

Amends
2 and 3

Amend: 1

Standards Australia

AS 1668:– The use of mechanical ventilation and air-conditioning
in buildings

Part 2: 2002 Ventilation design for indoor-air contaminant control

Amend 2
Oct 2011

Amends: 1, 2

New Zealand Government Departments

Department of Labour (Occupational Safety and Health) Workplace
exposure standards and biological exposure indices for
New Zealand 1992

Chartered Institution of Building Services Engineers, London

CIBSE Code Series A: 1996 Air distribution systems

Where quoted

AS1 1.5.1 b)

AS1 1.5.1 b)

AS1 1.5.1 a) d)

AS1 1.3.7 c)

AS1 2.3.1 b), 2.4.1 c),
3.0.1

AS1 1.2.4, 1.3.7 d)
1.5.1 a) c) i) ii) d)
e), f), g),

VM1 2.0.1

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 Handbook.

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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%.

Passive stack ventilator A system including a ventilation shaft which uses natural draught to ventilate spaces.

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.

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.

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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).

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*.

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.

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

1.3 Natural ventilation of household units and accommodation units with one external wall

Scope

1.3.1 Paragraphs 1.3.2 to 1.3.9 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 have an external wall

1.3.2 For kitchens, bathrooms, toilets and laundries located on the external wall, moisture and other contaminants must be ventilated to the outside by natural ventilation using either:

- a) windows and/or other openings to the outside with a *net openable area* of no less than 5% of the floor area, or
- b) high level *trickle ventilators* located through the external wall or *building elements* within the external wall (see Paragraph 1.3.9 for *trickle ventilators*), where the distance between the external wall and opposing wall is less than 6 metres.

Kitchens, bathrooms, toilets and laundries without an external wall

1.3.3 For kitchens, bathrooms, toilets and laundries **not** located on the external wall, moisture and other contaminants must be ventilated to the outside by natural ventilation having:

- a) a *passive stack ventilator*, located in the kitchen, bathroom, toilet or laundry, designed to extract a continuous airflow through the surrounding *habitable spaces* (see Paragraph 1.3.7 for *passive stack ventilators*), and
- b) high level *trickle ventilators*, located within the external wall or in *building elements* that are integrated within the external wall (see Paragraph 1.3.9 for *trickle ventilators*), and
- c) *permanent openings* for airflow between the surrounding *habitable spaces* and the kitchen, bathroom, toilet or laundry of no less than 5% of the combined floor area of the spaces, and not compromising the privacy of the toilet or bathroom, and
- d) a combined distance of the *habitable space* and the kitchen, bathroom, toilet or laundry measured between the external wall and furthest opposing wall of less than 10 metres.

Habitable spaces that have an external wall and open to a kitchen, bathroom, toilet or laundry with a passive stack ventilator

1.3.4 For *habitable spaces* with both an external wall and a *permanent opening* to a kitchen, bathroom, toilet or laundry, ventilation shall be achieved by:

- a) installing high level *trickle ventilators*, located within the external wall or *building elements* within the external wall (see Paragraph 1.3.9 for *trickle ventilators*), and
- b) having a *passive stack ventilator* installed in the kitchen, bathroom, toilet or laundry, and

- c) having an area of *permanent opening* between the two spaces of no less than 5% of the combined floor area of the *habitable space* and the kitchen, bathroom, toilet or laundry, and not compromising the privacy of the toilet or bathroom, and
- d) windows and/or other openings to the outside with an *net openable area* of no less than 5% of the floor area, and
- e) 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 less than 10 metres.

Habitable spaces that have an external wall and do not open to a kitchen, bathroom, toilet or laundry with a passive stack ventilator

1.3.5 For *habitable spaces* with an external wall and no *permanent opening* to surrounding spaces, ventilation must be achieved by having:

- a) windows and/or other openings to the outside with an *net openable area* of no less than 5% of the floor area, and
- b) high level *trickle ventilators*, located within the external wall or in *building elements* within the external wall (see Paragraph 1.3.9 for *trickle ventilators*), and
- c) a distance between the external wall and opposing wall of the *habitable spaces* of less than 6 metres.

Habitable spaces ventilated via another habitable space

1.3.6 Ventilation of a *habitable space* without openings to the exterior via another *habitable space* must be achieved 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

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 AS/NZS 5601.1, section 6.7 and Appendix H, and
- c) If a *draught diverter* is not fitted:

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- 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 2.

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3.0 Another Solution for Gas-fuel Appliances

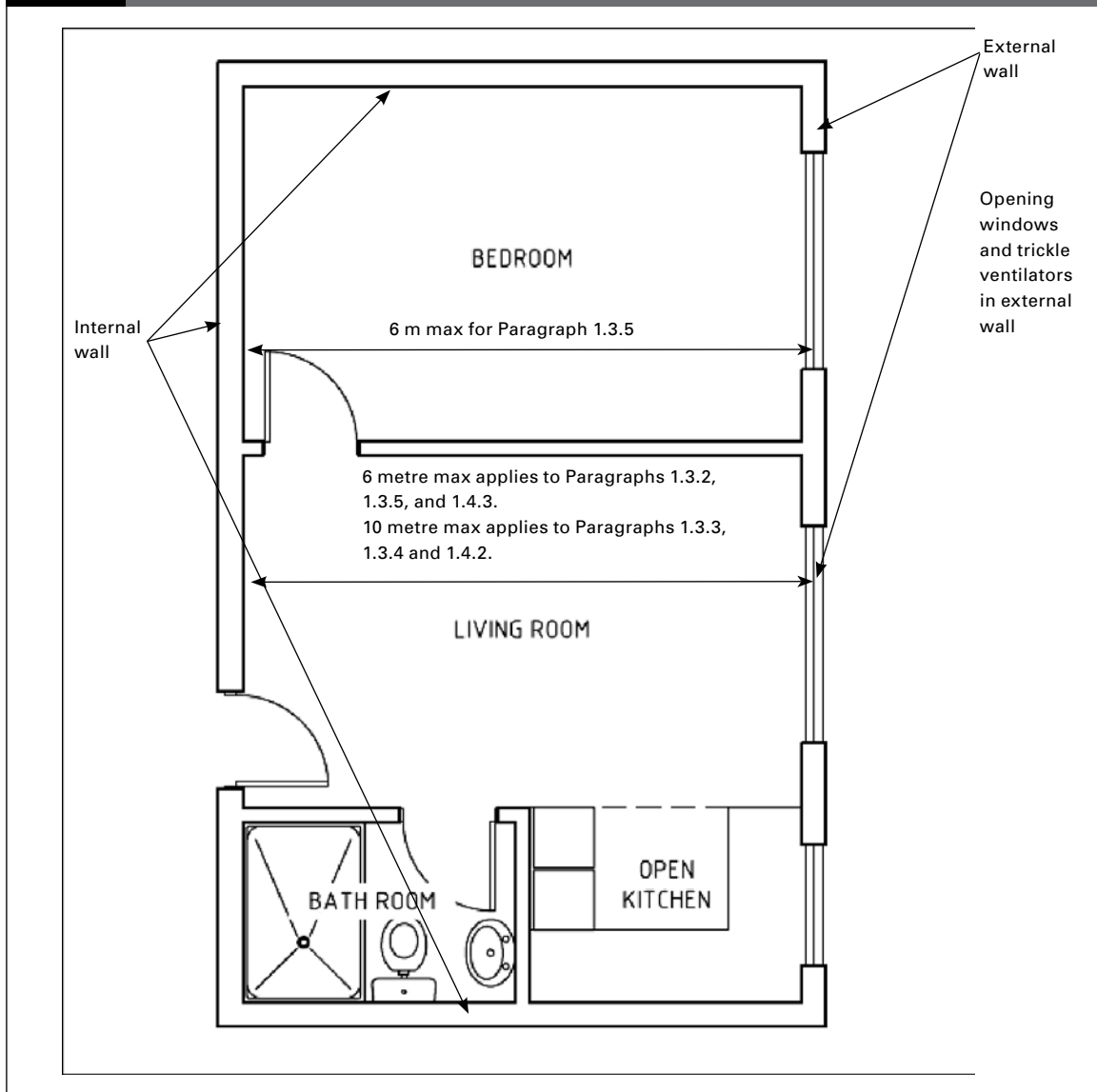
3.0.1 AS/NZS 5601.1 Sections 1, 3, 4, 5 and 6 Appendices A to K is an Acceptable Solution, but may exceed the performance criteria of NZBC G4.

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Appendix 1 Typical apartment layouts and ventilation options

Figure 2:

Layout 1
Table 3



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Table 3:

Ventilation options – Layout 1
Figure 2

Room	Natural ventilation (Paragraph)	Mechanical ventilation (Paragraph)	Combined ventilation (Paragraph)
Bedroom	1.3.5	1.5	–
Living	1.3.4	1.5	1.4.2 (10 m max dist) or 1.4.3 (6 m max dist)
Kitchen	1.3.2	1.5	1.4.2 (10 m max dist) or 1.4.3 (6 m max dist)
Bathroom	1.3.3	1.5	1.4.2 (10 m max dist) or 1.4.3 (6 m max dist)

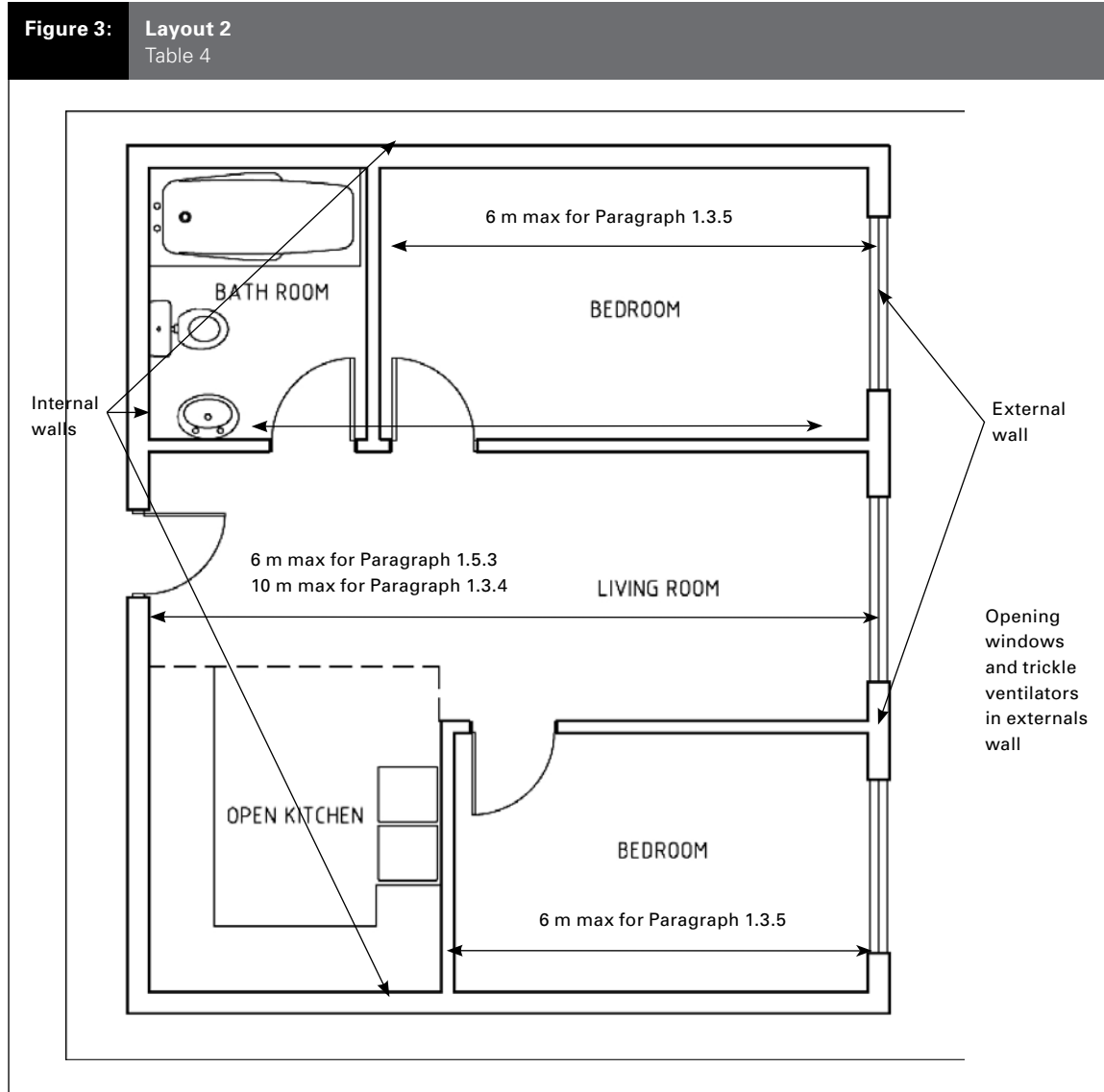
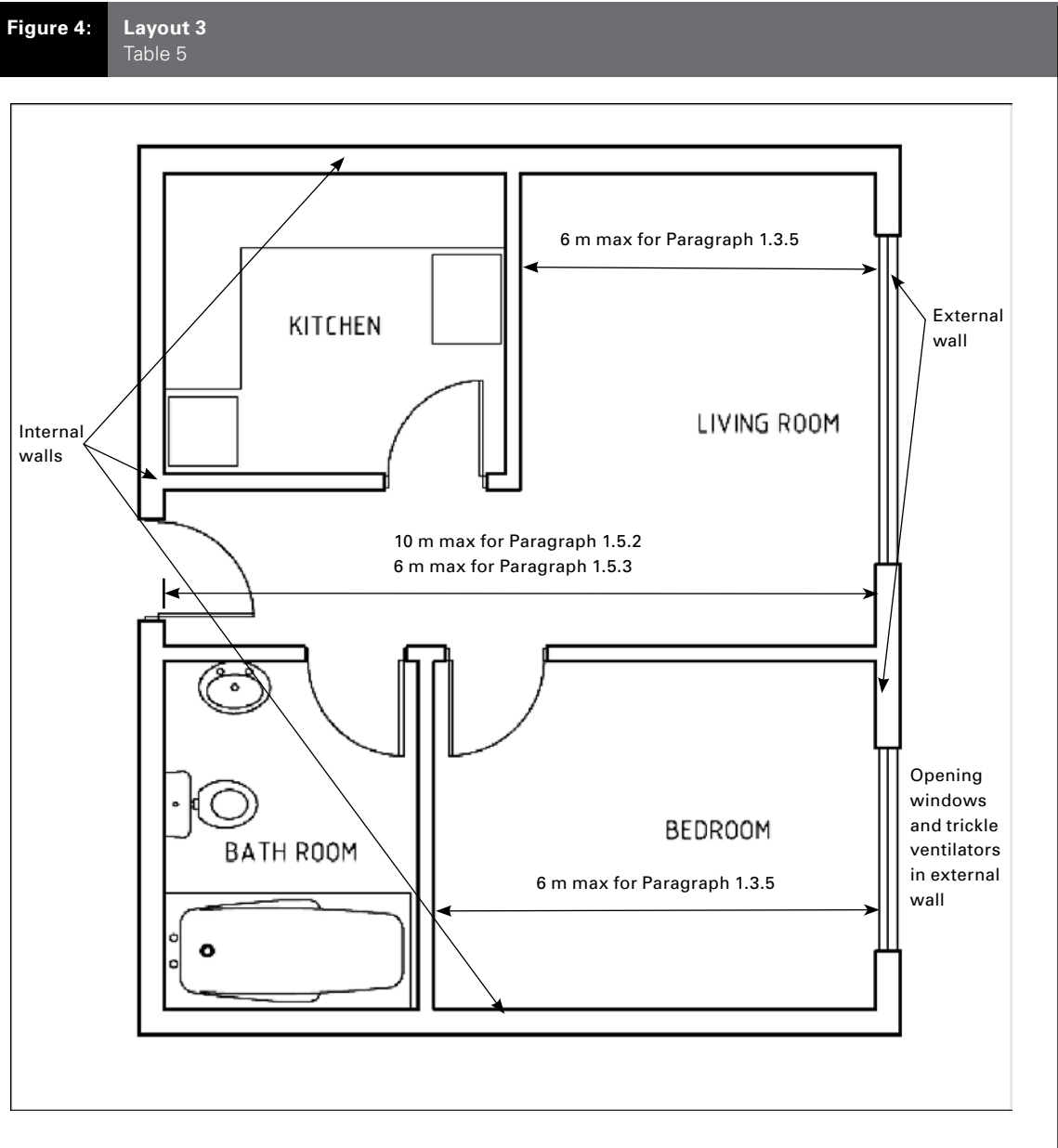


Table 4: Ventilation options – Layout 2
Figure 3

Room	Natural ventilation (Paragraph)	Mechanical ventilation (Paragraph)	Combined ventilation (Paragraph)
Bedrooms	1.3.5	1.5	–
Living	1.3.4	1.5	1.4.2 (10 m max dist) or 1.4.3 (6 m max dist)
Kitchen	1.3.3	1.5	1.4.2 (10 m max dist) or 1.4.3 (6 m max dist)
Bathroom	1.3.3	1.5	1.4.2 (10 m max dist) or 1.4.3 (6 m max dist)



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Table 5: Ventilation options – Layout 3
Figure 4

Room	Natural ventilation (Paragraph)	Mechanical ventilation (Paragraph)	Combined ventilation (Paragraph)
Bedrooms	1.3.5	1.5	–
Living	1.3.5	1.5	1.4.2 (10 m max dist) or 1.4.3 (6 m max dist)
Kitchen	1.3.3	1.5	1.4.2 (10 m max dist) or 1.4.3 (6 m max dist)
Bathroom	1.3.3	1.5	1.4.2 (10 m max dist) or 1.4.3 (6 m max dist)

