

AS 1668.4:2024



STANDARDS
Australia



The use of ventilation and airconditioning in buildings

Part 4: Natural ventilation of buildings



AS 1668.4:2024

This Australian Standard® was prepared by ME-062, Ventilation and Airconditioning. It was approved on behalf of the Standards Australia's Standards Development and Accreditation Committee on 13 June 2024.

This Standard was published on 28 June 2024.

The following are represented on Committee ME-062:

- Air Conditioning & Mechanical Contractors Association
- Australasian Fire and Emergency Service Authorities Council
- Australian Building Codes Board
- Australian Industry Group
- Australian Institute of Refrigeration Air Conditioning and Heating
- Chartered Institution of Building Services Engineers
- Construction Information Systems Limited (NATSPEC)
- Consumer Electronics Suppliers Association
- Engineers Australia
- Facility Management Association of Australia
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This Standard was issued in draft form for comment as DR AS 1668.4:2022.

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ISBN 978 1 76139 702 8

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Part 4: Natural ventilation of buildings

First published as AS 1668.2—1976.
Fourth edition 2002.
AS 1668.2—2002 revised (in part) and redesignated as AS 1668.4—2012.
Fifth edition 2024.

Standards Australia Ltd 2024

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Preface

This Standard was prepared by the Standards Australia Committee ME-062, Ventilation and Airconditioning, to supersede AS 1668.4:2012 *The use of ventilation and airconditioning in buildings, Part 4: Natural ventilation of buildings*.

This document covers —

- (a) natural ventilation of occupied enclosures; and
- (b) natural ventilation within car parks and vehicle facilities.

In accordance with the philosophy of adopting a complementary approach to building regulations, this document provides a deemed to satisfy solution, for the natural ventilation of parts of buildings where nominated by the National Construction Code (NCC). The document also provides guidance that can assist with developing a performance solution for the design of natural ventilation systems for occupied enclosures and carparks, outside of the NCC deemed to satisfy requirements.

During the preparation of this document, consideration was given to many international and national Standards, design guides, technical papers, manuals and other publications.

This document is prescriptive, and calculations are presented as simple and detailed procedures.

The terms “normative” and “informative” are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

This document includes a commentary on some of the clauses. The commentary directly follows the relevant clause, is designated by ‘C’ preceding the clause number and is printed in italics in a box. The commentary is for information and guidance and does not form part of the document.

Contents

Preface	ii
Section 1 Scope and general	1
1.1 Scope	1
1.2 Application — Ventilation system	1
1.3 Normative references	1
1.4 Terms and definitions	2
Section 2 Building attributes and ventilation openings	3
2.1 Scope of section	3
2.2 Building attributes	3
2.3 Openings	3
2.3.1 General	3
2.3.2 Type of openings	3
2.3.3 External openings	4
2.3.4 Internal openings	4
Section 3 Ventilation of occupied enclosures	5
3.1 Scope of section	5
3.2 Ventilation arrangements	5
3.2.1 Direct ventilation	5
3.2.2 Borrowed ventilation	5
3.2.3 Flowthrough ventilation	5
3.3 System requirements	7
3.4 Natural ventilation — simple procedure	8
3.4.1 Direct ventilation systems	8
3.4.2 Borrowed ventilation systems	8
3.5 Natural ventilation — detailed procedure	8
3.5.1 Direct ventilation systems	8
3.5.2 Crossflow ventilation systems	8
Section 4 Ventilation of enclosures used by vehicle with combustion engines	10
4.1 Scope of section	10
4.2 Application of section	10
4.3 Car parks — natural ventilation	10
4.3.1 General	10
4.3.2 Natural ventilation openings	11
4.3.3 Simple procedure	11
4.3.4 Detailed procedure	17
4.4 Enclosures other than car parks	20
4.4.1 Enclosed driveways associated with buildings	20
4.4.2 Loading docks	20
4.4.3 Queuing areas	20
4.5 Other occupancies	21
Appendix A (informative) Suitability of natural ventilation	22
Appendix B (informative) A performance-based approach to natural ventilation systems design	24
Appendix C (informative) Metabolic rates	25
Bibliography	26

NOTES

Australian Standard®

The use of ventilation and airconditioning in buildings

Part 4: Natural ventilation of buildings

Section 1 Scope and general

1.1 Scope

This document sets out minimum design requirements for natural ventilation systems that ventilate enclosures, and requirements for the natural ventilation of car parks.

This document does not prescribe requirements associated with comfort, such as temperature, humidity, air movement or noise, nor does it include requirements for the maintenance of ventilation systems.

NOTE 1 The objective of this document is to provide users with —

- (a) minimum ventilation openings required to provide natural ventilation; and
- (b) minimum requirements for the design of natural ventilation systems.

NOTE 2 This document does not cover requirements for:

- (i) Ventilation of vehicle tunnels not forming part of a building.
- (ii) Fire and smoke control aspects of air-handling systems, covered in AS 1668.1.
- (iii) Mechanical ventilation, covered in AS 1668.2.
- (iv) System design in respect of microbial control, covered in AS/NZS 3666.1.
- (v) The provision of ventilation for gas appliances, covered in AS/NZS 5601.
- (vi) The provision of ventilation for refrigeration systems, covered in AS/NZS 5149.3.
- (vii) The provision of ventilation for unsealed lead acid batteries, covered in AS 2676.1.

1.2 Application — Ventilation system

The design of ventilation systems shall be applied as follows:

- (a) Natural ventilation — Natural ventilation provisions shall conform with [Section 3](#) for occupied enclosures and [Section 4](#) for enclosures accommodating vehicles with internal combustion engines.
- (b) Combination ventilation systems — For combinations of natural and mechanical ventilation provisions, the provisions shall conform with the appropriate sections of this document, in conjunction with the requirements of AS 1668.2.

NOTE For mechanical ventilation, system selection (supply or exhaust) is specified in AS 1668.2.

1.3 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS 1668.2, *The use of ventilation and airconditioning in buildings, Part 2: Mechanical ventilation in buildings*

1.4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

1.4.1

airflow rate

flow rate

volumetric flow rate of air derived from the mass flow rate by dividing it by the density, normalized to 1.2 kg/m³ (1.2 g/L)

Note 1 to entry: For buildings located at an altitude substantially differing from sea level, specified airflow rates should be adjusted.

1.4.2

borrowed air

air that is borrowed from a naturally ventilated enclosure and used to ventilate an adjoining enclosure

1.4.3

Building Class

Class, as defined in the NCC

1.4.4

effective aerodynamic area

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

Note 1 to entry: For determining effective aerodynamic area, see AS/NZS 4740.

1.4.5

enclosure

individual room, space or part thereof

1.4.6

may

indicates the existence of an option

1.4.7

shall

indicates that a statement is mandatory

1.4.8

should

indicates a recommendation

1.4.9

specific contaminants

contaminants that are generated by occupants, the building or devices other than those generally found within most buildings

Note 1 to entry: Examples of specific contaminants include fumes from unflued gas devices, incense, scented candles, indoor pyrotechnics, and sparklers, etc.

Section 2 Building attributes and ventilation openings

2.1 Scope of section

Buildings that are naturally ventilated shall have building attributes and ventilation openings designed in conformance with this Section.

NOTE For guidance regarding determining the suitability of natural ventilation for an enclosure, see [Appendix A](#).

2.2 Building attributes

To utilize wind and thermal forces to generate air movement for natural ventilation purposes, a building shall incorporate some or all of the following attributes:

- (a) Permanent or openable ventilation openings in the external envelope of the building (or enclosure) being ventilated.
- (b) Ventilation openings that are suitably located in the external envelope (i.e. high and low level and/or on opposite facades).
- (c) Ventilation openings that are exposed to prevailing winds (i.e. not obstructed by other buildings, structures or land forms).
- (d) Temperature differentials between inside and outside for thermally induced air movement.
- (e) Active and passive ventilation enhancement features (e.g. cowls, chimneys, wind towers, etc.).

C2.2 *Guidance on the application of natural ventilation can be found in several internationally available publications, including—*

- (a) *BS 5925;*
- (b) *CIBSE, Guide A: Environmental design;*
- (c) *CIBSE, Application Manual AM10; and*
- (d) *ASHRAE, Handbook — Fundamentals.*

Outdoor air ventilation is driven by pressure differences across the external envelope of a building. In the case of natural ventilation, wind pressure and thermal buoyancy are the only available sources of pressure required to drive outdoor air movement.

2.3 Openings

2.3.1 General

Openings for natural ventilation shall be of a type, location and size as required to conform with [Sections 3](#) or [4](#) of this document. Where a combination of calculation procedures are used, the area of openings shall be determined separately for each area.

2.3.2 Type of openings

Openings shall either be fixed, such as wall or roof ventilators (with ducting where needed), or adjustable, such as windows or other openable devices including doors. Adjustable ventilation openings shall be operable by or on behalf of the enclosure occupants.

2.3.3 External openings

External openings shall be positioned to —

- (a) provide an even distribution of outdoor air within the occupied enclosure; and
- (b) minimize the entry of objectionable or noxious discharges.

Required openings shall be unobstructed, meaning that any obstacles do not reduce the minimum outdoor airflow through the openings. Obstructed openings shall be increased in area in direct proportion to the area of the obstruction so that the minimum total area of unobstructed openings, including natural ventilators, is at least equal to the required opening size based on floor area or number of cars, as nominated in [Sections 3](#) or [4](#) of this document.

When using natural ventilation devices in accordance with AS/NZS 4740, the unobstructed opening area of ventilators shall be taken as the effective aerodynamic area. Where the airflow is reduced by ducting being installed to a natural ventilator, the minimum area shall be increased in direct proportion to the amount that the airflow has been reduced.

Where devices such as insect or ember mesh, fall protection systems, security screens etc are used on ventilation openings, the overall area of the opening shall be increased so that the free area of the device is equal to the required opening size.

C2.3.3 *Positioning external openings on opposite or adjacent sides of the building should maximize the cross-ventilation benefit of wind effects. Positioning external openings at both high and low levels maximizes the benefits of thermal effects.*

Where concentrations of people are high, specific contaminants are present, hazardous gases are present or where combustion air is needed for plant, then larger openings or mechanical ventilation systems may be needed, see [Appendix A](#).

2.3.4 Internal openings

All internal openings along the air path shall be no less in area than the total area required for external openings, based on the floor area of the enclosures along the air path.

Section 3 Ventilation of occupied enclosures

3.1 Scope of section

The design of natural ventilation systems for the ventilation of occupied enclosures shall conform with this Section.

NOTE 1 This Section specifies the means of achieving acceptable natural ventilation to occupied enclosures for general applications. The specified provisions include ventilation openings for the amenity of occupants. When the ventilation openings are open, general contaminants are considered to be maintained at concentrations below exposures that have the potential to cause adverse health effects to a substantial majority of occupants. Natural ventilation designed in accordance with this document however may not ensure that specific contaminants are maintained at concentrations below exposures that have the potential to cause adverse health effects under all atmospheric conditions.

NOTE 2 Requirements for the natural ventilation of enclosures used by vehicles with combustion engines are given in [Section 4](#).

3.2 Ventilation arrangements

3.2.1 Direct ventilation

Where the following and similar enclosures are naturally ventilated, they shall be designed as direct ventilation systems:

- (a) Bathrooms, showers and the like.
- (b) Enclosures containing sanitary fixtures.
- (c) Laundries.
- (d) Enclosures containing unflued gas appliances.

NOTE 1 A direct ventilation system is a system that ventilates individual enclosures with one or more openings in the external envelope of the enclosure [see [Figure 3.1\(a\)](#)].

NOTE 2 Requirements for unflued gas appliances may be the subject of State and Territory governments legislation.

3.2.2 Borrowed ventilation

Borrowed ventilation [see [Figure 3.1\(b\)](#)] may be applied to a particular enclosure by considering it as part of a second adjoining enclosure (that is, borrows air from and returns it to that adjoining enclosure) provided —

- (a) the area of the openings between the enclosures is twice that of the requirements for external openings, based on the area of the particular enclosure; and
- (b) the adjoining enclosure has an external opening area based on the total area of both enclosures.

The enclosures listed in [Clause 3.2.1](#) shall not be used as the source for borrowed ventilation.

3.2.3 Flowthrough ventilation

Flowthrough ventilation [see [Figure 3.1\(c\)](#)] may be applied to a series of enclosures and is designed to enter by one enclosure and leave by a different enclosure.