Implementation of revised AS 1668  Parts 2 & 4 — 2012

The use of airconditioning and ventilation in buildings

Part 2: Mechanical ventilation
Part 4: Natural ventilation
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<td>Principal changes &amp; Details</td>
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Q: Why ventilate buildings?
A: Amenity, Health and the Law

- Buildings protect us from wind, rain, hail & heat, but also shield us from fresh air and capture contaminants.
- Cooking smells & metabolic odours detract from amenity.
- Laboratories, factories, etc. contaminate with smells & toxins.
- Respect your neighbour. Exhaust mustn’t be a nuisance.
- Construction must comply with BCA, esp. Part F4.
- AS 1668.2 & AS 1668.4 are both required by Part F4.
History of ventilation Standards

- Research on ventilation & perception of indoor air quality by Yaglou, Fanger et al, 1930s to present:
  - Acceptable to 80% of visitors requires 7.5 L/s/person
  - Acceptable to 95% of visitors requires 9.7 L/s/person
  - More air required if activity is strenuous
  - More air required for dilution if dust content is high

- Higher productivity has recently been linked to 20 L/s per person

- Australian and international Standards were based on Yaglou research — except in 1970s oil price shock!
### Overview

#### History of ventilation Standards

<table>
<thead>
<tr>
<th>Source</th>
<th>Publication date or Period</th>
<th>Typical rate per person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Australian practice</td>
<td>1970s</td>
<td>11.8 l/s</td>
</tr>
<tr>
<td>ASHRAE</td>
<td>1972</td>
<td>11.8 l/s</td>
</tr>
<tr>
<td>AS 1668.2</td>
<td>1976</td>
<td>3.5 l/s</td>
</tr>
<tr>
<td>Ordinance 70 (NSW)</td>
<td>1978</td>
<td>5 l/s</td>
</tr>
<tr>
<td>AS 1668.2</td>
<td>1980</td>
<td>3.5 l/s [2.5 l/s in some cases]</td>
</tr>
<tr>
<td>Sydney Ventilation Code</td>
<td>1983</td>
<td>3.5 l/s</td>
</tr>
<tr>
<td>AS 1668.2</td>
<td>1991</td>
<td>10 l/s [7.5 l/s to 2.5 l/s]</td>
</tr>
<tr>
<td>AS 1668.2</td>
<td>2002</td>
<td>10 l/s [7.5 l/s to 2.5 l/s]</td>
</tr>
<tr>
<td>AS 1668.2</td>
<td>2012</td>
<td>10 l/s [7.5 l/s to 2.5 l/s]</td>
</tr>
<tr>
<td>Seppänen &amp; Fisk + Bahnfleth</td>
<td>2006 &amp; 2014</td>
<td>20 l/s (Productivity basis)</td>
</tr>
</tbody>
</table>

* Reductions permitted if particulate filters only or odour + particulate filters are used*
AS 1668  Part 2 - 2012
Principal Changes

Changes from the 1991 and 2002 editions

- All references to smoking removed
- Mech. ventilation in Pt. 2 & Natural ventilation in Pt. 4
- Dilution Index of 2002 edition removed
- O/A rates generally 10 L/s, with option to 7.5 L/s or 2.5 L/s
- Simpler outdoor air calculations for complex spaces
- More kitchen hood types & cooking processes included
- Automatic demand control ventilation allowed
AS 1668 Part 2
Principal Changes

- Guidance added on make-up air sources
- Distance from inlets to small exhausts relaxed
- 2002 edition car park exhaust rates used
- Car park natural vent. now in AS1668.4
- Small car park ventilation simpler & matches BCA
- Jet fans permitted to “bend” car park airflow
- Mechanical ventilation of health care now included
- Big increase in exhaust from pools and spas
AS 1668 Part 2
Principal Changes

BCA 2013 & 2014 reference AS 1668.2 – 2012
- Ventilation of rooms F4.5
- Ventilation of Car parks F4.11
- Local exhaust ventilation of Kitchens F4.12
- Air conditioning & ventilation J5.2
  esp. automatic contaminant control in Car parks

BCA 2014 references AS 1668.4 – 2012
- Natural ventilation of Car parks F4.11
Supply Air

- Floor wastes in ducts or plenums **MUST** always be charged
- Reliance on condensate only is not appropriate

### 2.4 TUNDISHES AND FLOOR WASTES

A duct or plenum shall not contain a tundish or floor waste that is not permanently charged.

**NOTES:**
1. Designing systems for charging by condensate only is not appropriate.
2. The installation of tundishes and floor wastes will need to comply with AS/NZS 3500.2.

Enclosures prohibiting recycle air, increased to 9:

- Rooms where odours/noxious gases are produced or outgassed
- Pet shops, vet centres, kennels, etc.
- Swimming pools, decks, etc
- Enclosures containing “Specific contaminants”
Supply Air Filters

- Minimum filter ratings, now based on systems and airflow

**TABLE 2.1 MINIMUM FILTER RATING**

<table>
<thead>
<tr>
<th>System characteristics</th>
<th>Minimum filter rating (see AS 1324.1)</th>
</tr>
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<tbody>
<tr>
<td>≥1000 L/s ducted</td>
<td>G4</td>
</tr>
<tr>
<td>≥1000 L/s non-ducted</td>
<td>G4</td>
</tr>
<tr>
<td>&lt;1000 L/s ducted</td>
<td>G2</td>
</tr>
<tr>
<td>&lt;1000 L/s non-ducted</td>
<td>NR</td>
</tr>
<tr>
<td>Evaporative coolers</td>
<td>NR</td>
</tr>
</tbody>
</table>

**LEGEND:**
NR = no requirement
Minimum Outdoor Air supply

- Outdoor air calculation based on 1991 Standard
- Concept of “Effective Outdoor Air” allows credits for:
  - Air-cleaning systems,
  - Transfer from adjacent spaces,
  - Unused O/A in recycle airstream,
  - Odour & particulate filters
- Calculation methods in Appendix D
- These are the minimum values noted in BCA J5.2 (b)
AS 1668 Part 2 - 2012

First trial iteration for Outdoor Air flow

Air-handling Unit serving Multiple Enclosures
AS 1668 Part 2 - 2012

3rd iteration for Outdoor Air + Transfer Air

18% OA

Outdoor Air

Plant Room

Supply Air

Recycle Air

Conference Room

Air Cleaner

33% OA

Return Air

Secondary Office

15% OA

Transfer Air

Meeting Room A

25% OA

Main Office

15% OA

Air-handling Unit serving Multiple Enclosures
Demand Controlled supply ventilation

- Automatic operation of Outdoor Air Demand Control Ventilation using population indicators. Options are:
  - Time-of-day schedules
  - CO₂ sensors
  - Mixed gas sensors
  - People counters
Exhaust Air

- Supply air instead of exhaust is permitted where:
  - Discharge is not objectionable, and
  - Adjacent spaces are at higher pressure
- Full Kitchen Exhaust exempted when only reheating food
- **BUT** AS 1668.2 doesn’t cover all exhaust ventilation, refer Appendix O (eg: Explosion vents, Spray painting, Fume cupboards and Welding booths)
Kitchen Hood Exhaust types

- Now 7 different hood types. Additions are:
  - Eyebrow hoods
  - Ventilated ceilings
  - Proprietary equipment

- And 7 different cooking process types. Additions are:
  - Oriental cooking tables and woks
  - Bread ovens & steam-producing Combi oven
“Closed” ventilated ceilings envisaged in the Standard, incorporate direct duct connections to supply and exhaust
Kitchen Hood Exhaust airflows

- Energy saving feature. Exhaust velocity can be reduced to 0.3 m/sec for hoods over non-grease-producing items.
- Further reduction to 0.1 m/s if hood volume is increased.

Kitchen Hood Exhaust discharges

- Concessions allowed on separation from Kitchen Exhaust discharge to Air Intakes if odour filter or photochemical treatment is installed. Calculation methods provided.
AS 1668 Part 2
Details & Implications

Filters & Ozone odour treatment

1. Honeycomb filter
2. Electrostatic filter
3. LED lighting
4. Grease tray
5. Air supply plenum
6. Air supply spigot
7. Exhaust spigot
8. Gutter & drain cap
9. MUA perforated plate
10. ESP control box
11. ESP cell access door
12. Ozone generator door
AS 1668  Part 2
Details & Implications

Make up of Exhaust Airflow

- Reflecting Section J  Guidance is given on maximum flow of air-conditioned air for Kitchen Exhaust make-up air

- Warning given on openable windows for make-up of residential exhausts.  These may not be suitable sources
Separation of Exhausts & Air Intakes

- Exhaust discharges less than 1,000 L/s not required to be 6 metres from air intakes
- Discharges less than 200 L/s can be 1 metre from intake
- But, multiple discharges less than 1,000 L/s within a 6 m radius are aggregated as one
- Perhaps riser shafts no longer required in apartments?
Proximity of exhaust discharges & openable windows

Multiple discharge treated as one outlet
Airflow equals sum of all 3

1 m to opening panel
Carpark Ventilation

- Major reduction in exhaust airflows, based on 2002 edition

  - Small car parks:
    - 40 cars, same as BCA
    - Min airflow: 3,000 down to 2,000 L/s
    - Per vehicle rate: 500 down to 400 L/s
    - Area rate: 3.5 down to 2.5 L/s per m²

  - Large car parks:
    - 20% less flow by calculation
    - Entering cars not calculated
    - Extra factors for Vehicle type, Usage & Staff exposure
Carpark Ventilation

- Methods for reducing ventilation rates in small carparks simplified, options for automatic control with door switches & motion detectors
- High/Low level exhaust outlets no longer required
- “Air moving devices” are permitted to avoid extra ductwork where air paths are obstructed within the car park. (Impulse fans or Jet fans)
NOTE: This option allows ventilation of “dead ends” in car parks. Not to ventilate the whole car park.
AS 1668 Part 2
Details & Implications

Examples of Air Moving Devices
Health Care Buildings

- Change from the 1991 edition, but generally same as 2002 edition
- Applies to: Operating theatres, Sterile Stores, Infectious & Protective isolation rooms, Recovery rooms, Autopsy rooms and Dirty utility rooms
- Specifies: Supply & Recirculation air change rates, Outdoor airflow, Filtration, Exhaust grille location and Room pressure versus adjacent areas
Section 5: Health Care Buildings

Relative Pressure Diagram - Health Care Enclosures
Appendix A – Minimum effective outdoor air

- Dilution Index method of 2002 edition has gone. Same as 1991 edition without smoking
- Generally, all requirements for 15 & 20 L/s per head now reduced to 10 L/s per head

Appendix B – Minimum exhaust rates

- Swimming Pools increased, 2.5 to 10 L/s per m² and Spa Exhaust from 5 to 15 L/s per m² + 15% splash area
- Domestic laundry exhaust doubled, to suit clothes dryers
AS 1668  Part 4 - 2012
The Principal Changes
Changes from the 1991 and 2002 editions

- Generally includes text from Sections 2 & 3 of the 2002 edition (not in the same order)
- Commentary provides pros and cons of natural ventilation
- Two types of natural ventilation are nominated:
  - Simple prescriptive procedure that follows Clauses F4.6 & F4.7 of BCA
  - Detailed procedure which refers to Appendix A & B
Car Park Ventilation

- Natural ventilation of car parks included with minimal change from the requirements of the 2002 edition.


- Changed depth of naturally ventilated carpark from 7m to 9m, with 12.5% open area on outside wall.
Appendix A & B  Advisory appendices

- **A** Provides performance-based design requirements for Alternative Solutions to natural ventilation

- **A** Includes mandatory references to AS 1668.2, NCC, AS/NZS 1668.1 and CIBSE Guide Vol. A Infiltration & Natural Ventilation

- **B** Provides metabolic rates of building occupants for calculations required by the detailed procedures of Clause 3.5
Any Questions?