



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



Topics



Overview

Why, Where & How of ventilation

Part 2 Mech. Vent

Principal changes

Details & Implications of changes

Part 4 Natural Vent

Principal changes & Details



Overview



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

Source	Publication date or Period	Typical rate per person
Sydney Ventilation Code	1963 & 1971	14.2 l/s
Common Australian practice	1970s	11.8 l/s
ASHRAE	1972	11.8 l/s
AS 1668.2	1976	3.5 l/s
Ordinance 70 (NSW)	1978	5 l/s
AS 1668.2	1980	3.5 l/s [2.5 l/s in some cases]
Sydney Ventilation Code	1983	3.5 l/s
AS 1668.2	1991	10 l/s [*7.5 l/s to 2.5 l/s]
AS 1668.2	2002	10 l/s [*7.5 l/s to 2.5 l/s]
AS 1668.2	2012	10 l/s [*7.5 l/s to 2.5 l/s]
Seppänen & Fisk + Bahnfleth	2006 & 2014	20 l/s (Productivity basis)

* Reductions permitted if particulate filters only or odour + particulate filters are used



AS 1668 Part 2 - 2012

STANDARDS
Australia



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



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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



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Principal Changes



BCA 2013 & 2014 reference AS 1668.2 – 2012

- Ventilation of rooms F4.5
- Ventilation of Carparks F4.11
- Local exhaust ventilation of Kitchens F4.12
- Air conditioning & ventilation J5.2
esp. automatic contaminant control in Carparks

BCA 2014 references AS 1668.4 – 2012

- Natural ventilation of Carparks F4.11



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Details & Implications



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”

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Details & Implications

Supply Air Filters

- Minimum filter ratings, now based on systems and airflow

TABLE 2.1
MINIMUM FILTER RATING

System characteristics	Minimum filter rating (see AS 1324.1)
≥1000 L/s ducted	G4
≥1000 L/s non-ducted	G4
<1000 L/s ducted	G2
<1000 L/s non-ducted	NR
Evaporative coolers	NR

LEGEND:
NR = no requirement



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Details & Implications

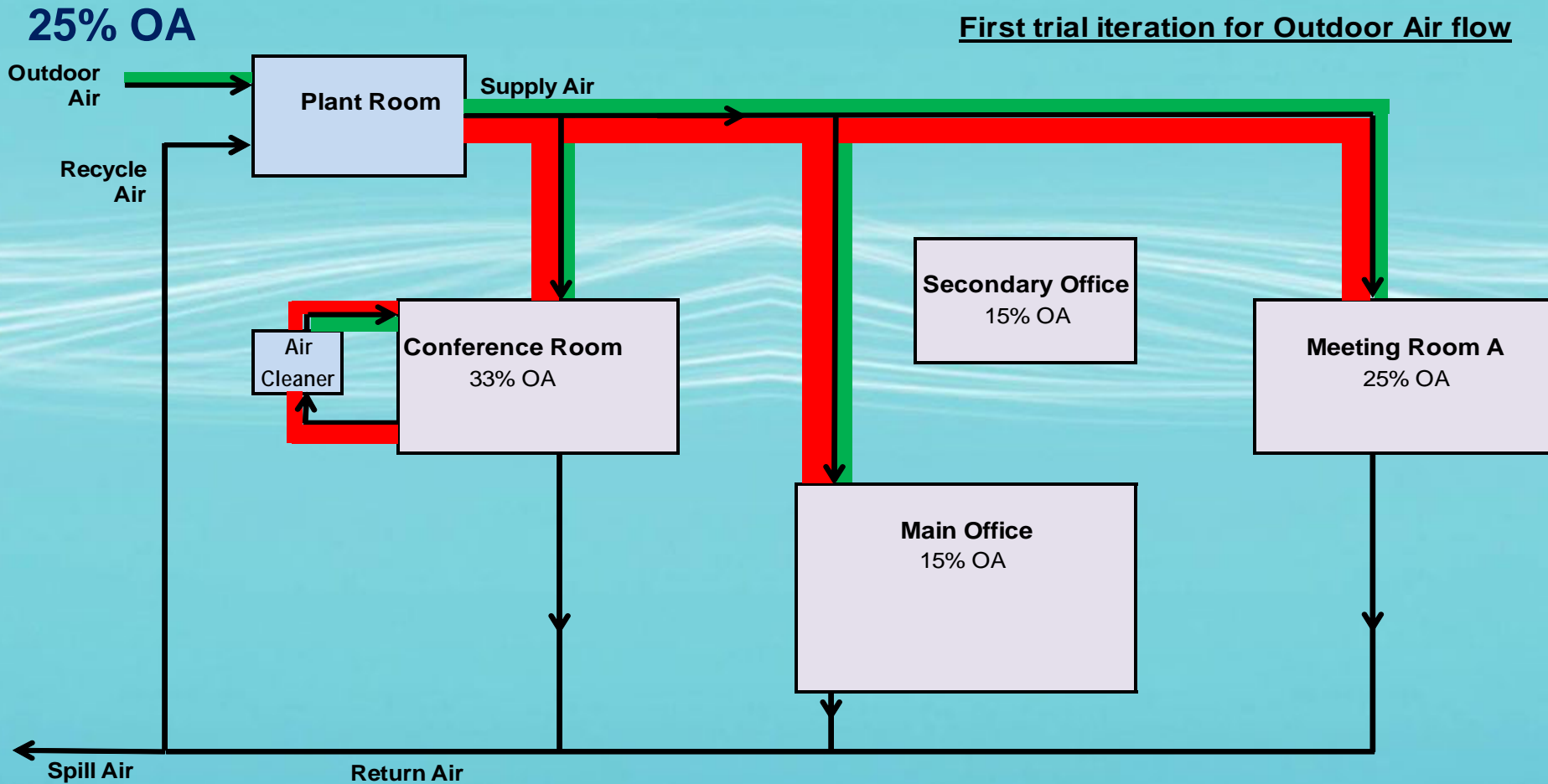


Minimum Outdoor Air supply

- 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)

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First trial iteration for Outdoor Air flow

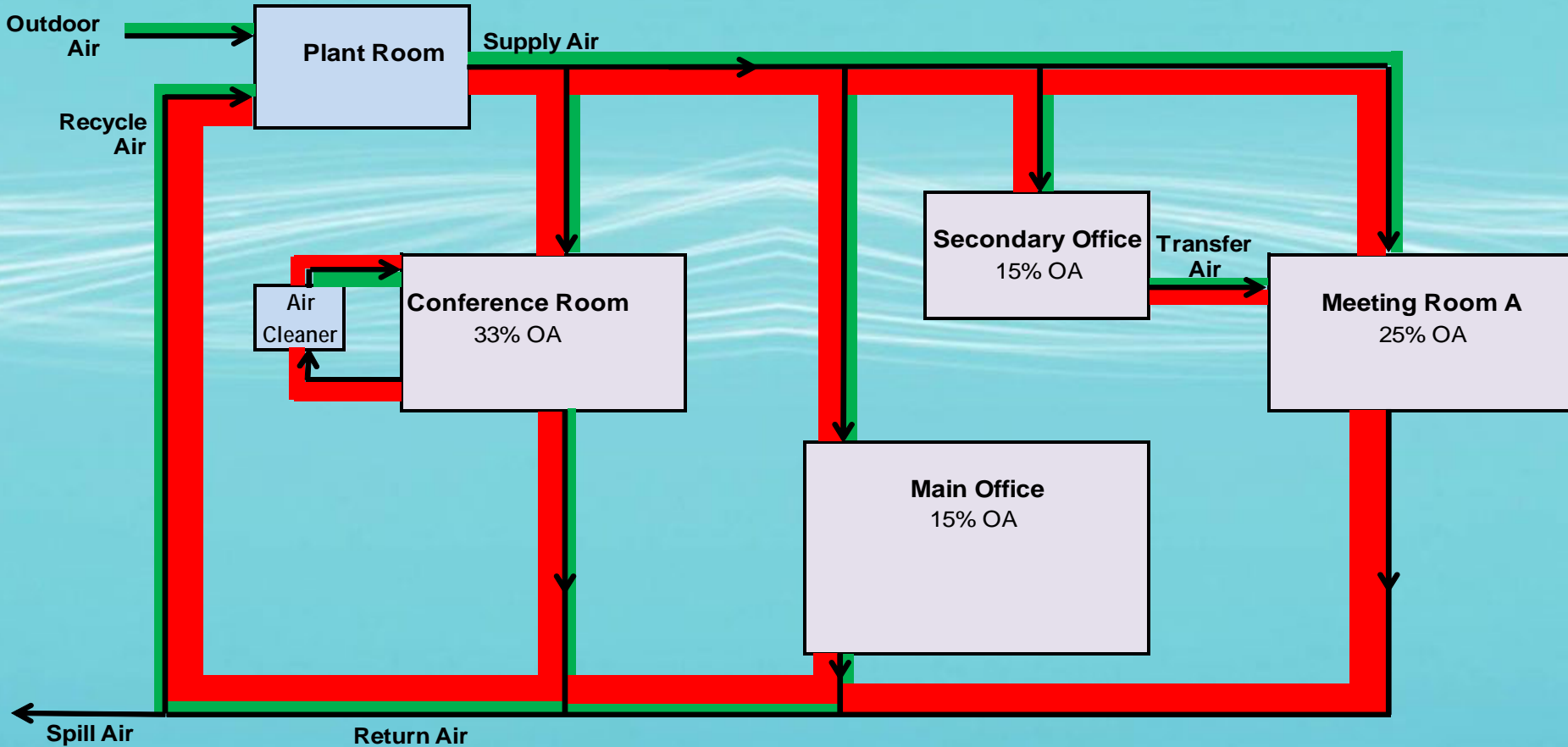


Air-handling Unit serving Multiple Enclosures

AS 1668 Part 2 - 2012

3rd iteration for Outdoor Air + Transfer Air

18% OA



Air-handling Unit serving Multiple Enclosures



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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



AS 1668 Part 2

Details & Implications



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



AS 1668 Part 2

Details & Implications



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

AS 1668 Part 2

Details & Implications



“**Closed**” ventilated ceilings envisaged in the Standard, incorporate direct duct connections to supply and exhaust



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Details & Implications



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

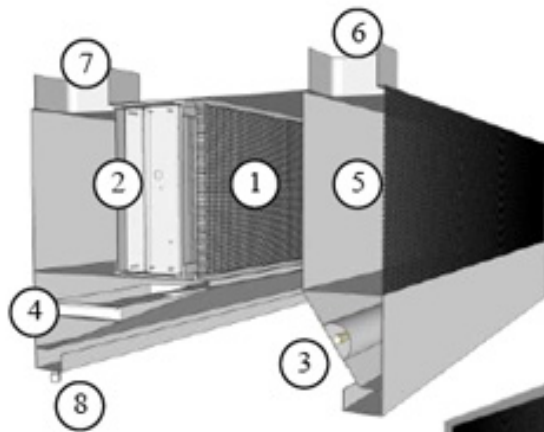
- Concessions allowed on separation from Kitchen Exhaust discharge to Air Intakes if odour filter or photochemical treatment is installed. Calculation methods provided

AS 1668 Part 2

Details & Implications



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



**Filters &
Ozone
odour
treatment**



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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**



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Details & Implications



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?

AS 1668 Part 2 Details & Implications

Proximity of exhaust discharges & openable windows





AS 1668 Part 2

Details & Implications



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



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Details & Implications



Carpark Ventilation

- Methods for reducing ventilation rates in small car parks 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)

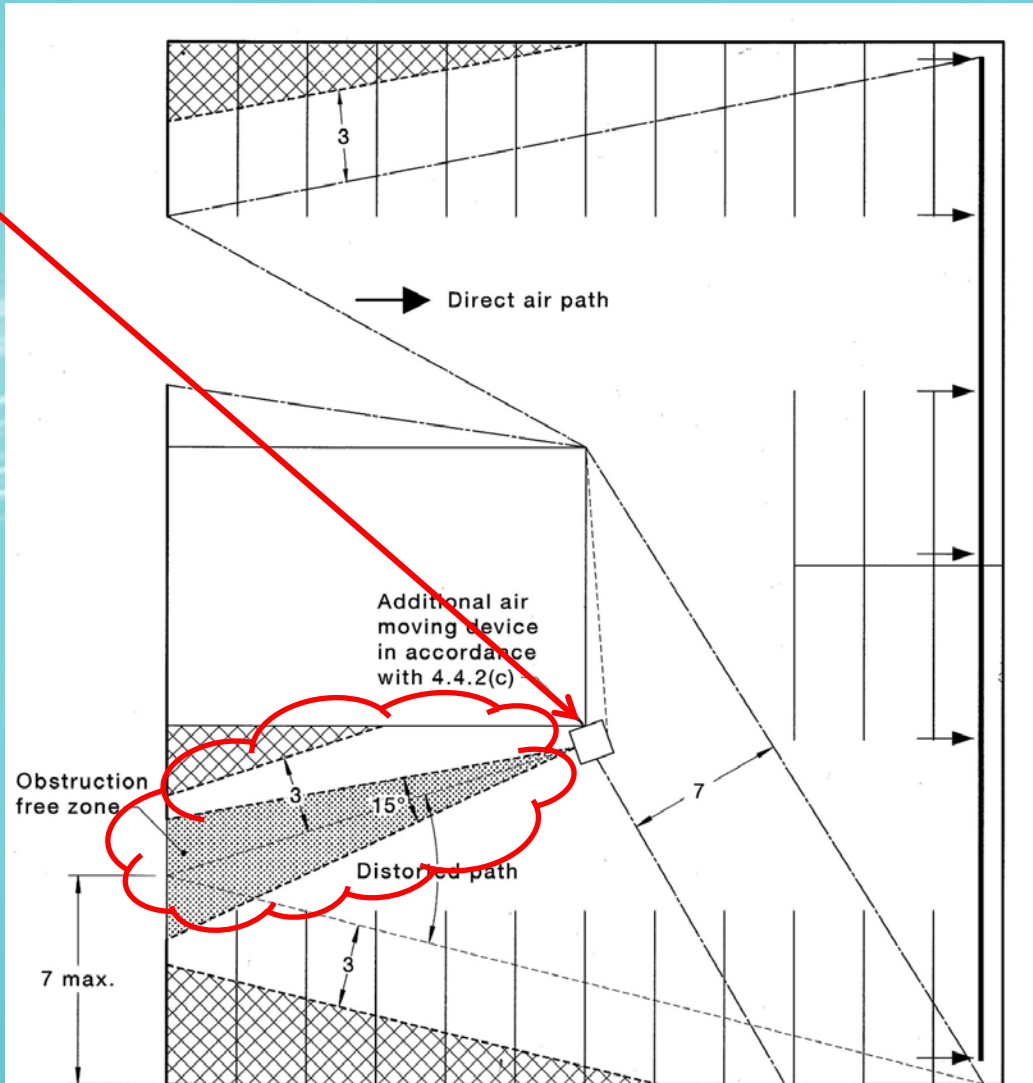
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Air moving device

NOTE: This option allows ventilation of “dead ends” in car parks. Not to ventilate the whole car park

15 degree cone



AS 1668 Part 2 Details & Implications



**Examples of Air
Moving Devices**



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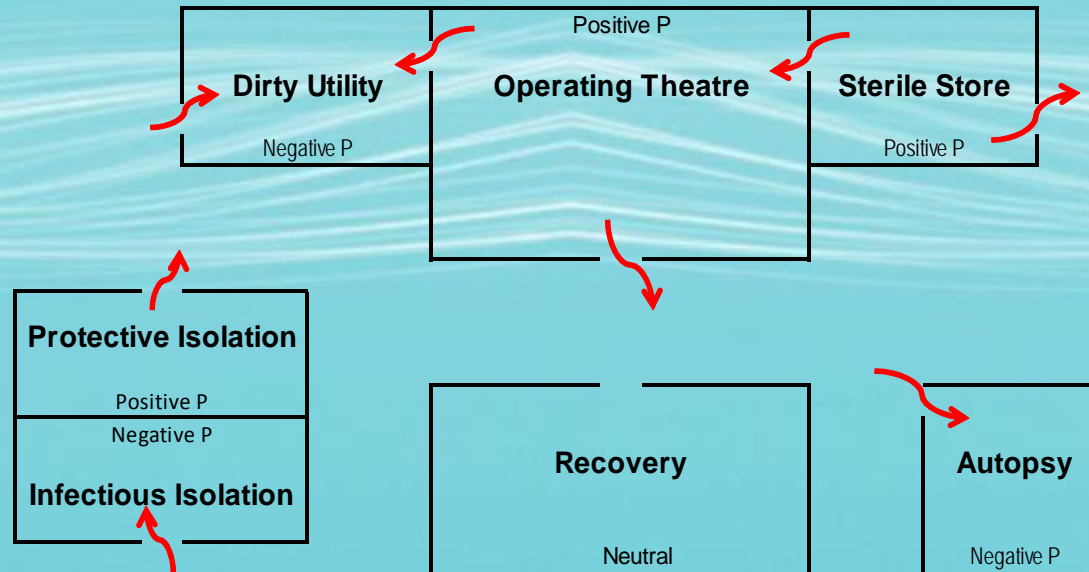
Details & Implications



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



AS 1668 Part 2

Details & Implications



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



AS 1668 Part 4

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



AS 1668 Part 4

Details & Implications



Car Park Ventilation

- Natural ventilation of car parks included with minimal change from the requirements of the 2002 edition.
- Main variation from 1991 edition is addition of methods for calculating “Ventilation Coefficients” of different shapes & configurations of natural ventilation openings
- Changed depth of naturally ventilated carpark from 7m to 9m, with 12.5% open area on outside wall.



AS 1668 Part 4

Details & Implications



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?