Australian Standard™

# The use of ventilation and airconditioning in buildings

## Part 3: Smoke control systems for large single compartments or smoke reservoirs

Standards Australia

This Australian Standard was prepared by Committee ME-062, Ventilation and Airconditioning. It was approved on behalf of the Council of Standards Australia on 22 December 2000 and published on 17 December 2001.

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The following interests are represented on Committee ME-062:

Airconditioning and Mechanical Contractors Association of Australia

Air-conditioning and Refrigeration Equipment Manufacturers Association of Australia

Australian Fire Authorities Council

Australian Buildings Code Board

Australian Industry Group

Australian Institute of Building

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# The use of ventilation and airconditioning in buildings

# Part 3: Smoke control systems for large single compartments or smoke reservoirs

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# PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME-062, Ventilation and Airconditioning.

The Standard does not identify those buildings in which smoke control systems are required. This is covered in the Building Code of Australia (BCA).

The objective of this document is to provide a standardized methodology for the design of smoke control systems, utilizing exhaust from above the hot layer, for use by system owners, regulators, designers and installers.

In the preparation of this Standard, consideration has been given to the following—

(a) British Standard Institute, Draft for development DD 240: Part 1:1997, Fire safety engineering in buildings, Part 1: Guide to the application of fire safety engineering principles.

(b) BS 7346 Parts 1–3 inclusive, Performance of fans, vents and smoke curtains commensurate with likely fire impact (consolidated into this Standard).

(c) CIBSE, Technical Memoranda TM19, Relationships for Smoke Control Calculations (1995).

(d) Building Research Establishment Report, Design principles for smoke ventilation in enclosed shopping centres (1990).

(e) Building Research Establishment Report: Sprinkler Operation and the Effect of Venting: Studies Using a Zone Model.

(f) Building Research Establishment Report: Design Principles for Smoke Ventilation in Enclosed Shopping Centres.

(g) Building Control Commission, Smoke Management in Large Spaces in Buildings.

(h) Fire Brigade Intervention Model, pre-publication version 2.1, November 1997, Australasian Fire Authorities Council.

(i) Micro-economic Reform, Fire Regulation—Building Regulation Review Task Force May 1991. The concept of a ‘Time Line’ and the impact of resources to combat a fire has been considered.

(j) Fire Code Reform Centre, Fire Engineering Guidelines.

(k) The N.F.P.A. 92B, 'T' squared fire concept has also been utilized in the development of this Standard.

(j) Adelaide University, C.S.I.R.O. and South Australian Metropolitan Fire Service Data: recorded whilst fire and smoke testing within Australian buildings.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which they apply. An ‘informative’ appendix is only for information and guidance.

*This Standard incorporates a Commentary on some clauses. The Commentary directly follows the relevant Clause, is designated by ‘C’ preceding the clause number and is printed in italics in a panel. The Commentary is for information only and does not need to be followed for compliance with the Standard.*

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# FOREWORD

The intent of this Standard is to provide a structured prescriptive method for the design of smoke control systems in large single compartments or smoke reservoirs. Systems designed in accordance with this Standard are required to have a performance graded to the characteristics of a particular risk.

The outcome of the methodology employed by this Standard will be a relative grading of the interactions of fire load, building characteristics and fire intervention systems. As with other fire Standards (e.g. AS 1530 series of Standards) this Standard does not predict system performance under actual building fire conditions.

Systems are designed to operate under prescribed interior fire conditions influenced by such factors as enclosure volume, fire growth rate and active suppression systems. The period of time the system is required to operate is affected by the safety risk and resources available to fight the fire.

STANDARDS AUSTRALIA

# Australian Standard

# The use of ventilation and airconditioning in buildings

## Part 3: Smoke control systems for large single compartments or smoke reservoirs

## SECTION 1 GENERAL

### 1.1 SCOPE

This Standard sets minimum requirements for the design of smoke control systems in large single compartments in which smoke accumulates in a smoke reservoir. It sets minimum requirements considered necessary to meet the system design objectives in terms of continuous operation over a specified time period under a specified fire condition.

The design information given in this Standard is based on axisymmetric plumes. Compartments and smoke reservoirs are designed separately and spill plumes between compartments/reservoirs are not considered.

This Standard is not appropriate in situations where a stable buoyant hot layer does not exist.

NOTES:

1 Smoke control in multi-compartment buildings is covered in AS/NZS 1668.1.

2 This Standard should only be applied to areas with greater than 3 m floor to ceiling or upper bounding layer height.

3 AS 1851.5 and AS/NZS 1851.6 outline management procedures for maintaining smoke and heat vents and the fire and smoke control features of air-handling systems.

### 1.2 DESIGN PARAMETERS

This Standard specifies minimum requirements for the design of mechanical and buoyancy-driven smoke control systems relying on the removal of smoke from a buoyant hot layer within a smoke reservoir. The method of system design is based on key input design parameters. These key input design parameters include —

(i) total fire heat output $(\dot{Q}_c)$;

(ii) volumetric exhaust flow rate $(\dot{V})$;

(iii) hot layer temperature ($T_L$);

(iv) hot layer depth ($d$); and

(v) system duration time ($t_d$).

Such design parameters are required before system design is undertaken. They may be developed for a particular building from consideration of a Fire Engineering Design Brief (FEDB) or from the application of the information and calculations contained in this Standard. Design parameters will vary depending on the objectives of the smoke control system.

NOTE: Guidance on the selection/development of these design parameters is provided in the Fire Engineering Guidelines or in Appendix A.

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