

Australian Standard™

---

**Smoke management systems—  
Hot smoke test**

---

This Australian Standard was prepared by Committee ME/62, Ventilation and Air-conditioning. It was approved on behalf of the Council of Standards Australia on 13 November 1998 and published on 5 January 1999.

---

The following interests are represented on Committee ME/62:

Air Conditioning and Mechanical Contractors Association of Australia

Air-Conditioning and Refrigeration Equipment Manufacturers Association of Australia

Australasian Fire Authorities Council

Australian Building Codes Board

Australian Institute of Building Surveyors

Australian Institute of Environmental Health

Australian Institute of Refrigeration Air Conditioning and Heating

Chartered Institution of Building Services Engineers

Department of Contract and Management Services W.A.

Fire Protection Association Australia

Institution of Refrigeration Heating and Airconditioning Engineers New Zealand

Metal Trades Industry Association of Australia

Plastics and Chemicals Industries Association

Property Council of Australia

Thermal Insulation Contractors Association of Australia

---

*Review of Australian Standards.* To keep abreast of progress in industry, Australian Standards are subject to periodic review and are kept up to date by the issue of amendments or new editions as necessary. It is important therefore that Standards users ensure that they are in possession of the latest edition, and any amendments thereto.

Full details of all Australian Standards and related publications will be found in the Standards Australia Catalogue of Publications; this information is supplemented each month by the magazine 'The Australian Standard', which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn Standards.

Suggestions for improvements to Australian Standards, addressed to the head office of Standards Australia, are welcomed. Notification of any inaccuracy or ambiguity found in an Australian Standard should be made without delay in order that the matter may be investigated and appropriate action taken.

---

*This Standard was issued in draft form for comment as DR 98305.*

Australian Standard™

---

**Smoke management systems—  
Hot smoke test**

---

Originated as AS/NZS 4391(Int):1996.  
Revised and designated AS 4391—1999.

## PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME/62, Ventilation and Airconditioning, to supersede AS/NZS 4391(Int)—1996.

This Standard is the result of a consensus among Australian and New Zealand representatives on the Joint committee to produce it as an Australian Standard.

The objective of this Standard is to provide a standardized methodology for the subjection of smoke management systems to a safe hot smoke test to be used by system designers, installers and regulators.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix 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 Standard incorporates a Commentary on some of the clauses. The Commentary, directly following 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.*

## © Copyright – STANDARDS AUSTRALIA

Users of Standards are reminded that copyright subsists in all Standards Australia publications and software. Except where the Copyright Act allows and except where provided for below no publications or software produced by Standards Australia may be reproduced, stored in a retrieval system in any form or transmitted by any means without prior permission in writing from Standards Australia. Permission may be conditional on an appropriate royalty payment. Requests for permission and information on commercial software royalties should be directed to the head office of Standards Australia.

Standards Australia will permit up to 10 percent of the technical content pages of a Standard to be copied for use exclusively in-house by purchasers of the Standard without payment of a royalty or advice to Standards Australia.

Standards Australia will also permit the inclusion of its copyright material in computer software programs for no royalty payment provided such programs are used exclusively in-house by the creators of the programs.

Care should be taken to ensure that material used is from the current edition of the Standard and that it is updated whenever the Standard is amended or revised. The number and date of the Standard should therefore be clearly identified.

The use of material in print form or in computer software programs to be used commercially, with or without payment, or in commercial contracts is subject to the payment of a royalty. This policy may be varied by Standards Australia at any time.

## CONTENTS

	Page
FOREWORD .....	5
<b>SECTION 1 SCOPE AND GENERAL</b>	
1.1 SCOPE .....	6
1.2 APPLICATION .....	6
1.3 PRINCIPLE.....	6
1.4 NEW DESIGNS AND INNOVATIONS .....	6
1.5 REFERENCED DOCUMENTS .....	7
1.6 DEFINITIONS .....	7
<b>SECTION 2 TEST APPARATUS</b>	
2.1 GENERAL .....	8
2.2 NON-COMBUSTIBLE BASE .....	8
2.3 FIRE TRAYS .....	8
2.4 WATER BATH .....	8
2.5 HEAT SENSOR .....	9
2.6 TRACER SMOKE.....	9
2.7 FUEL.....	9
2.8 WATER.....	9
<b>SECTION 3 TEST PROCEDURES</b>	
3.1 APPLICATION.....	12
3.2 TEST OBJECTIVES .....	12
3.3 TEST PROCEDURES .....	12
3.4 SUPPLEMENTARY TESTING.....	14
3.5 AIR PURGE.....	14
<b>SECTION 4 LIFE AND ASSET SAFETY REQUIREMENTS</b>	
4.1 FIRE SAFETY .....	16
4.2 BREATHING APPARATUS .....	16
4.3 FUEL AND SMOKE GENERATOR STORAGE.....	16
4.4 PROTECTION OF FITTINGS AND FURNISHINGS .....	16
4.5 MONITORING CEILING TEMPERATURES.....	17
4.6 WATER BATH TEMPERATURE.....	17
4.7 HOW TO SUBDUE A TEST FIRE.....	17
4.8 IGNITING THE METHYLATED SPIRITS .....	17
4.9 MINIMUM RECOMMENDED COMPARTMENT SIZE.....	17
<b>SECTION 5 RECORDING EQUIPMENT</b>	
5.1 REVIEW REQUIREMENTS .....	19
5.2 STATIC PHOTOGRAPHS.....	19
5.3 VIDEO RECORDINGS.....	19
5.4 CEILING TEMPERATURE MEASUREMENTS .....	19
<b>SECTION 6 TEST PREPARATION AND REPORTING</b>	
6.1 GENERAL .....	20
6.2 PREREQUISITE OF TEST .....	20
6.3 MANDATORY REPORTS .....	22
6.4 SUPPLEMENTARY REPORTS .....	23

## APPENDICES

A	TEMPERATURE AND VOLUME FLOW OF GASES INTO THE SMOKE LAYER AT THE INTERFACE OF THE RISING PLUME AND UNDERSIDE OF THE SMOKE LAYER.....	24
B	SELECTION OF A SAFE TEST FIRE SIZE .....	28
C	SCIENTIFIC MEASUREMENTS FOR RESEARCH .....	29
D	HEAT OUTPUT FROM METHYLATED SPIRITS POOL FIRE STABILIZED BY A WATER BATH.....	30

Currently in preview, click buy full vers.

## FOREWORD

This Standard has been written to ensure that safe tests can be undertaken without threat to the building occupants or damage to property.

The hot smoke test described in this Standard is based on research and development work carried out by the Adelaide Fire Safety Research Unit (Adelaide University) in association with the South Australian Metropolitan Fire Service and CSIRO, over the period from 1986 to 1995. During this time over 150 tests were carried out in a wide range of building types and compartment geometry.

This Standard details the safety procedures and equipment necessary to carry out a hot smoke test. It indicates the size of apparatus and quantity of fuel required for a given compartment geometry which is consistent with the safe practical application of the test. The dimensions of the equipment described should be strictly adhered to.

The assumption is made that the smoke control system under test has been designed within the scope of current Australian legislation and will operate under anticipated interior fire conditions determined by compartment geometry, acceptable design fire size, fire load, active fire suppression system and fire growth rate.

Because of their special geometry and sufficiently complex smoke control systems, buildings to which the hot smoke test is ideally applicable include: atriums, factories, warehouses, department stores, shopping and other complexes, multistorey office buildings or sporting and entertainment centres. The hot smoke test provides a means by which a specified quantity of smoke is generated by a test fire to assist in the assessment of the performance characteristics of a building's smoke management system. The test fire provides a dynamic buoyant flow of smoke representative of real fire plumes.

The hot smoke test, suitably instrumented, can be used to validate computer-based software and its application to simulate or model movement of smoke in one or more building compartments.

Standards Australia would be pleased to receive any feedback on the usage of this test and request that full details of test methodology and results achieved be forwarded for analysis by the Committee.

## STANDARDS AUSTRALIA

**Australian Standard**  
**Smoke management systems—Hot smoke test**

## SECTION 1 SCOPE AND GENERAL

**1.1 SCOPE**

This Standard sets out the means by which a specified quantity of smoke may be generated, at a safe temperature, within a building. It details test apparatus, procedures and safety requirements for the hot smoke testing of smoke management systems. The size of test fire is selected to generate the required quantity of smoke at a safe temperature.

*CI.1 The size of test fires specified in this Standard varies from areas of 0.03 m<sup>2</sup> to 2 m<sup>2</sup>. It is, therefore, possible to apply a hot plume in a compartment of any size without causing damage. It is recommended that a hot smoke test be utilized whenever a smoke test is considered necessary.*

**1.2 APPLICATION**

This test method is intended for use as a tool in the commissioning process of a building's smoke management system to verify that the operation of the system, under simulated test fire conditions, is as approved by the regulatory authority. It is not intended that carrying out a hot smoke test be a mandatory requirement for every installed smoke management system.

*CI.2 This test is intended to verify the correct performance of a smoke management system including operation, sequence of control and, where practical, specified smoke layer depths. It is not intended as a means of establishing smoke obscuration levels or system integrity under real fire conditions. It is not intended that this test be mandatory for all systems, rather, it provides a tool to resolve uncertainties in some smoke management systems.*

**1.3 PRINCIPLE**

A pool of methylated spirit is ignited to create a plume of hot air which is then charged with a tracer smoke. This plume activates the smoke control system, the performance of which is monitored to compare with the system as approved by the regulatory authority.

*CI.3 It is intended that the fire size used in the hot smoke test is of such a magnitude that damage to the building finishes and structure or activation of the fire protection system will not occur. The test fire size may not be equal to the design fire size.*

**1.4 NEW DESIGNS AND INNOVATIONS**

Any alternative materials, designs, methods of assembly and procedures that do not comply with specific requirements of this Standard, or are not mentioned in it, but give equivalent results to those specified, are not necessarily prohibited.