

Australian Standard™

**Fire hazard testing**

**Part 6.1: Smoke obscuration—General  
guidance**



This Australian Standard® was prepared by Committee EL-053, Fire hazard testing—  
Electrotechnical equipment. It was approved on behalf of the Council of Standards Australia  
on 23 May 2006.

This Standard was published on 28 June 2006.

---

The following are represented on Committee EL-053:

- Australian Electrical and Electronic Manufacturers Association
  - Australian Information Industry Association
  - Electrical Compliance Testing Association
  - Electrical Regulatory Authorities Council
  - Energy Networks Association
- 

This Standard was issued in draft form for comment as DR 00031.

Standards Australia wishes to acknowledge the participation of the expert individuals that  
contributed to the development of this Standard through their representation on the  
Committee and through public comment period.

---

### **Keeping Standards up to date**

Australian Standards® are living documents that reflect progress in science, technology and  
systems. To maintain their currency, all Standards are periodically reviewed, and new editions  
are published. Between editions, amendments may be issued.

Standards may also be withdrawn. It is important that readers assure themselves they are  
using a current Standard, which should include any amendments that may have been  
published since the Standard was published.

Detailed information about Australian Standards, drafts, amendments and new projects can  
be found by visiting **[www.standards.org.au](http://www.standards.org.au)**

Standards Australia welcomes suggestions for improvements, and encourages readers to  
notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at  
**[mail@standards.org.au](mailto:mail@standards.org.au)**, or write to Standards Australia, GPO Box 476, Sydney, NSW 2001.

---

Australian Standard™

**Fire hazard testing**

**Part 6.1: Smoke obscuration—General  
guidance**

First published as AS 60695.6.1—2006.

**COPYRIGHT**

© Standards Australia

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher.

Published by Standards Australia GPO Box 476, Sydney, NSW 2001, Australia

ISBN 0 7337 7560 8

## PREFACE

This Standard was prepared by the Standards Australia Committee EL-053, Fire hazard testing—Electrotechnical equipment.

The objective of this series of standards is to provide the electrotechnology industry and standards writing committees with a series of standards which give guidance on assessing the fire hazard of electrotechnical products.

This Standard is identical with, and has been reproduced from IEC 60695-6-1, Ed 2.0 (2005), *Fire hazard testing - Part 6.1: Smoke obscuration - General guidance*.

As this Standard is reproduced from an International Standard, the following applies:

- (a) Its number does not appear on each page of text and its identity is shown only on the cover and title page.
- (b) In the source text 'IEC 60695-6-1' should read 'AS 60695.6.1'.
- (c) A full point should be substituted for a comma when referring to a decimal marker.
- (d) Any French text on figures should be ignored.

The terms 'normative' and 'informative' are used to define the application of the annex to which they apply. A normative annex is an integral part of a standard, whereas an informative annex is only for information and guidance.

Any International Standard referenced should be replaced by an equivalent Australian Standard where one is available. The availability of equivalent Australian Standards can be determined either from the Standards Web Shop at [www.standards.com.au](http://www.standards.com.au) or from the annual printed catalogue of Australian Standards.

## CONTENTS

	<i>Page</i>
INTRODUCTION .....	v
1 Scope .....	1
2 Normative references .....	1
3 Terms, definitions and symbols .....	2
3.1 Terms and definitions .....	2
3.2 Symbols .....	5
4 General aspects of smoke test methods .....	6
4.1 Fire scenarios and fire models .....	6
4.2 Factors affecting smoke production .....	7
5 Principles of smoke measurement .....	9
5.1 Bouguer's law .....	9
5.2 Extinction area .....	10
5.3 Log <sub>10</sub> units .....	10
5.4 Light sources .....	10
5.5 Specific extinction area .....	11
5.6 Mass optical density .....	12
5.7 Visibility .....	12
6 Static and dynamic methods .....	12
6.1 Static methods .....	12
6.2 Dynamic methods .....	13
7 Test methods .....	14
7.1 Consideration of test methods .....	14
7.2 Selection of test specimen .....	14
8 Presentation of data .....	15
9 Relevance of data to hazard assessment .....	15
Annex A (informative) Calculation of visibility .....	17
Annex B (informative) Relationships between $D_S$ and some other smoke parameters as measured in IEC 60695-6-30 and IEC 60695-6-31 .....	19
Annex C (informative) Relationships between percent transmission, as measured in a "three metre cube" enclosure, and extinction area .....	22
Bibliography .....	24
Figure 1 – Chart of different phases in the development of a fire within a compartment .....	7
Figure 2 – Attenuation of light by smoke .....	9
Figure 3 – Extinction area .....	10
Figure 4 – Dynamic smoke measurement .....	13
Figure 5 – Evaluation and consideration of smoke test methods .....	16

Figure A.1 – Visibility ( $\omega$ ) versus extinction coefficient ( $k$ ).....	17
Figure B.1 – Smoke parameters related to $D_s$ as measured in IEC 60695-6-30 and IEC 60695-6-31 .....	21
Figure C.1 – Extinction area (amount of smoke) related to percent transmission as measured in the "three metre cube".....	23
Table 1 – General classification of fires (ISO/TR 9122-1) .....	7
Table B.1 – Conversion from $D_s$ to some other smoke parameters as measured in IEC 60695-6-30 and IEC 60695-6-31.....	20
Table C.1 – Conversions from percent transmission, as measured in the "three metre cube" to amount of smoke (extinction area) .....	22

Currently in preview, click buy full version

## INTRODUCTION

The risk of fire needs to be considered in any electrical circuit, and the objective of component, circuit and equipment design, as well as the choice of material, is to reduce the likelihood of fire, even in the event of foreseeable abnormal use, malfunction or failure.

Electrotechnical products, primarily victims of a fire, may nevertheless contribute to the fire. One of the contributing hazards is the release of smoke, which may cause loss of vision and/or disorientation which could impede escape from the building or fire fighting.

Smoke particles reduce the visibility due to light absorption and scattering. Consequently, people may experience difficulties in finding exit signs, doors and windows. Visibility is often determined as the distance at which an object is no longer visible. It depends on many factors, but close relationships have been established between visibility and the measurements of the extinction coefficient of smoke – see Annex A.

The production of smoke and its optical properties can be measured as well as other fire properties, such as heat release, flame spread, and the production of toxic gas and corrosive effluent. This part of IEC 60695-6 serves as a guidance document and focuses on obscuration of light by smoke.

Currently in preview, click buy full version

## STANDARDS AUSTRALIA

---

**Australian Standard****Fire hazard testing**  
**Part 6.1: Smoke obscuration—General guidance**

---

**1 Scope**

This part of IEC 60695 gives guidance on:

- a) optical measurement of smoke obscuration;
- b) general aspects of optical smoke test methods;
- c) consideration of test methods;
- d) expression of smoke test data;
- e) relevance of optical smoke data to hazard assessment.

One of the responsibilities of a technical committee is, wherever applicable, to make use of basic safety publications in the preparation of its publications.

**2 Normative references**

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments), applies.

IEC 60695-1-1, *Fire hazard testing – Part 1-1: Guidance for assessing the fire hazard of electrotechnical products – General guidelines*

IEC 60695-4:2001<sup>1</sup>, *Fire hazard testing – Part 4: Terminology concerning fire tests*

IEC 60695-6-2:2001, *Fire hazard testing – Part 6-2: Smoke obscuration – Summary and relevance of test methods*

IEC 60695-6-30, *Fire hazard testing – Part 6: Guidance and test methods on the assessment of obscuration hazard to vision caused by smoke opacity from electrotechnical products involved in fires – Section 30: Small-scale static method – Determination of smoke opacity – Description of the apparatus*

IEC 60695-6-31, *Fire hazard testing – Part 6-31: Smoke obscuration – Small-scale static test – Materials*

IEC Guide 104:1997, *The preparation of safety publications and the use of basic safety publications and group safety publications*

ISO/TR 9122-1:1989, *Toxicity testing of fire effluents – Part 1: General*

ISO 5659-2:1994, *Plastics – Smoke generation – Part 2: Determination of optical density by a single-chamber test*

---

<sup>1</sup> Consolidated edition 2.2 (2001) that includes IEC 60695-4 (1993), its amendment 1 (1995) and its amendment 2 (2001).