

Australian Standard[®]

Fire hazard testing

**Part 11.40: Test flames—Confirmatory
tests—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 06196.

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Standards may also be withdrawn.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**

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, or write to Standards Australia, GPO Box 476, Sydney, NSW 2001.

Australian Standard[®]

Fire hazard testing

Part 11.40: Test flames—Confirmatory tests—Guidance

First published as AS 60695.11.40—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 7562 4

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/TS 60695-11-40, Ed 1.0 (2002), *Fire hazard testing - Part 11-40: Test flames - Confirmatory tests - 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/TS 60695-11-40' should read 'AS 60695.11.40'.
- (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 or from the annual printed catalogue of Australian Standards.

CONTENTS

	<i>Page</i>
INTRODUCTION	iv
1 Scope	1
2 Normative references	1
3 Definitions	1
4 Test flames, burner types and dynamics	2
4.1 General dynamics	2
4.2 Diffusion flames and burners	2
4.3 Pre-mixed flames and burners	2
4.4 Fuel gases	3
5 Confirmatory test hardware	3
5.1 General	3
5.2 Procedure and hardware arrangement	3
5.3 Thermocouple	3
5.4 Copper block material	3
5.5 Copper block mass	3
5.6 Copper block geometry	4
5.7 Copper block positioning	4
6 Confirmatory test procedure	4
6.1 Test temperature ranges	4
6.2 Test time ranges	4
7 Copper block calorimetry dynamics and theory	4
8 Calorimetry and theory – Summary and recommendations	7
9 Conclusion	7
 Bibliography	 12
 Figure 1 – Positioning of the copper block	 7
Figure 2 – Results using data from table 2	8
Figure 3 – Parabolic fit of data to 800 °C	9
Figure 4 – Parabolic fit of data to 900 °C	10
Figure 5 – Parabolic fit of data to 1 000 °C	11

INTRODUCTION

Small-scale, standard flames (see note) are specified for various tests, where sufficient hardware design and use parameters are specified in an effort to ensure consistent flames. Hardware designs and dimensions, material specifications and fuel and air specifications are typical necessary parameters. Experience has shown that the quality of the resulting flames and, therefore, the associated test results, are influenced significantly by subtle variations in the equipment and test technique. Some simple checks on flame qualities, such as flame colour and dimensions, or the melting characteristics of silver wire, are often specified in conjunction with hardware, fuel, air or other normal adjustments.

The need for more precise and quantitative confirmation of flame qualities has been recognized, leading to the introduction of confirmatory tests based on the copper block calorimetry technique. This technical specification is intended to provide guidance for the design of test flame confirmatory tests using copper block calorimetry measurements.

Table 1 – Existing test flames with confirmatory tests

Nominal flame power W	Flame type ^a	Reference IEC 60695-	Approximate overall height mm	Approximate cone height mm	Copper block mass g	Copper block position above burner mm	Time spec. 100 °C to 700 °C s
1 000	PP-P	2-4/1 (11-2)	175	55	10	95	45
500	M-P	11-3	125	40	10	55	54
50	M-P	11-4	20	–	1,76	10	44
Needle	B-D	2-2 (11-5)	12	–	0,58	6	23,5
^a PP propane; M methane; B butane; P pre-mixed; D diffusion							
NOTE Flame power and height generally less than 2 000 W and 200 mm, respectively.							

NOTE Readers are encouraged to send test data to the TC 89 Secretary for further study by the author and as valuable feedback for the next revision. The coordinates of the secretary can be found on the IEC website <http://www.iec.ch>

STANDARDS AUSTRALIA

Australian Standard**Fire hazard testing**
Part 11.40: Test flames—Confirmatory tests—Guidance

1 Scope

This part of IEC 60695 presents a general characterization of small-scale test flames and associated confirmatory tests based on copper block calorimetry, and defines theoretical modelling for the associated dynamics. Guidance is presented for the selection of critical parameters in confirmatory test designs. A theory is presented to define additional performance parameters for confirmatory tests, enabling a precise implicit mathematical characterization of confirmatory test heating curves.

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

ISO/IEC 13943:2000, *Fire safety – Vocabulary*

3 Definitions

For the purpose of this part of IEC 60695, definitions taken from ISO/IEC 13943, together with the following definitions, apply.

3.1**copper block heat content**

theoretical total available thermal energy attributable only to the copper test block temperature, copper heat capacity and mass

3.2**confirmatory test**

calorimetric procedure intended as a diagnostic indicator to reveal anomalous behaviour or conditions in a test flame, burner or associated hardware

3.3**flame stabilizer**

assembly normally fitted to the top of a standard laboratory Bunsen or Tirrill burner intended to mitigate the destabilizing effect of the turbulent mixing of flame gases with the ambient air, by providing an intervening layer of gas having an intermediate velocity between the ambient still air and the faster flame gases