

Methods of testing

Plastics —

Part 1: Thermal properties —

**Method 140C: Determination of the
combustibility of specimens using
a 125 mm flame source**

IMPORTANT NOTE. Before reading this method it is essential to read BS 2782-0, Introduction, issued separately.

UDC (678.5/.8).01:620.1:536.46

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Plastics and Rubber Standards Policy Committee (PRM/-) to Technical Committee PRM/21, upon which the following bodies were represented:

- British Plastics Federation
- British Textile Confederation
- Department of the Environment (Building Research Establishment)
- Department of Trade and Industry (National Physical Laboratory)
- EEA (The Association of Electronics, Telecommunications and Business Equipment Industries)
- Electrical and Electronic Insulation Association (BEAMA Ltd.)
- GAMBICA (BEAMA Ltd.)
- Ministry of Defence
- Packaging and Industrial Films Association
- Plastics and Rubber Institute
- Pira International
- RAPRA Technology Ltd.
- Yarsley Technical Centre Ltd.

This British Standard, having been prepared under the direction of the Plastics and Rubber Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 June 1993

© BSI 08-1999

The following BSI references relate to the work on this standard:
Committee reference PRM/21
Draft for comment 90/40777 DC

ISBN 0 580 21852 X

Amendments issued since publication

Amd. No.	Date	Comments

Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
1 Scope	1
2 Normative references	1
3 Definitions	1
4 Significance of test	1
5 Principle	2
6 Apparatus and materials	2
7 Specimens	3
8 Conditioning	3
9 Test procedure for bars	3
10 Test procedure for plates	6
11 Precision	6
12 Test report	7
Annex A (normative) Procedure for calibration of a 125 mm test flame	8
Annex B (informative) Classification system for determining the combustibility of specimens using a 500 W ignition source	11
National annex NA (informative) Details of laboratory burner (ignition source P/PF2)	12
Figure 1 — Test assembly for bars	4
Figure 2 — Burner supply arrangement	5
Figure 3 — Test assembly for plates	6
Figure A.1 — Thermal sensor	8
Figure A.2 — Arrangement to check the temperature of the flame	9
Figure A.3 — Burner supply arrangement	10
Table 1 — Gas sources	3
Table 2 — Precision data on the afterflame time after the fifth flame application	7
Table 3 — Precision data on the afterflame time or afterglow time after the fifth flame application	7
Table A.1 — Gas sources	8
Table B.1 — Criteria and categories for classifying burning behaviour	11
List of references	Inside back cover

National foreword

This British Standard has been prepared under the direction of the Plastics and Rubber Standards Policy Committee and is identical with ISO 10351:1992 *Plastics — Determination of the combustibility of specimens using a 125 mm flame source*, published by the International Organization for Standardization (ISO).

Cross-references

International standard	Corresponding British Standard
	BS 2782 <i>Methods of testing plastics</i>
ISO 291:1977	Part 0:1992 <i>Introduction</i> (Appendix A is identical)
ISO 293:1986	Method 901A:1988 <i>Compression moulding test specimens of thermoplastic materials</i> (Identical)
ISO 294:1975	Method 910A:1977 <i>Injection moulding test specimens of thermoplastic materials</i> (Identical)
ISO 295:1991	Method 902A:1992 <i>Plastics. Compression moulding test specimens of thermosetting materials</i> (Identical)
ISO 845:1988	BS 4370 <i>Methods of test for rigid cellular materials</i> Part 1:1988 <i>Methods 1 to 5</i> (Method 2 is technically equivalent)
ISO 1210:1992	BS 2782 <i>Methods of testing plastics</i> Method 140A:1992 <i>Determination of the burning behaviour of horizontal and vertical specimens in contact with a small-flame ignition source</i> (Identical)
ISO 5725:1986	BS 5497 <i>Precision of test methods</i> Part 1:1987 <i>Guide for the determination of repeatability and reproducibility for a standard test method by inter-laboratory tests</i> (Identical)

The Technical Committee has reviewed the provisions of the draft of ISO 10093 to which normative reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard. The relevant part of the specification is included as National annex NA.

WARNING NOTE. This British Standard, which is identical with ISO 10351, does not necessarily detail all the precautions necessary to meet the requirements of the Health and Safety at Work etc. Act 1974. Attention should be paid to any appropriate safety precautions and the method should be operated only by trained personnel.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

1.1 This International Standard specifies a small-scale laboratory screening procedure for comparing the relative burning behaviour of small specimens of plastics and also their resistance to burn-through when exposed to an ignition source of medium energy level (500 W flame). This method is applicable to both solid materials and cellular plastics materials with a density of 250 kg/m³ or greater when determined in accordance with ISO 845.

1.2 This method of test is intended to characterize material performance, for example for quality-control purposes, and is not intended to assess the behaviour to fire of building materials or furnishings. The test method described may be used for the preselection acceptance of a material, provided that positive results are obtained at a thickness which equals the smallest thickness used in the application. The results obtained provide some information about the behaviour of plastics materials in service, but can never by themselves assure safe performance in service.

NOTE 1 Test results are influenced by material components, e.g. pigments, fillers, fire-retardant concentrates.

1.3 This test method subjects small specimens of plastics to a flame source approximately 10 times more severe than the flame source used in ISO 1210.

1.4 The classification system described in Annex B is intended to provide guidance for preferred levels of performance when this method is used for quality assurance and the preselection of component materials for products.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 291:1977, *Plastics — Standard atmospheres for conditioning and testing*.

ISO 293:1986, *Plastics — Compression moulding test specimens of thermoplastic materials*.

ISO 294:1975, *Plastics — Injection moulding test specimens of thermoplastic materials*.

ISO 295:1991, *Plastics — Compression moulding of test specimens of thermosetting materials*.

ISO 845:1988, *Cellular plastics and rubbers — Determination of apparent (bulk) density*.

ISO 1210:1992, *Plastics — Determination of the burning behaviour of horizontal and vertical specimens in contact with a small-flame ignition source*.

ISO 5725:1986, *Precision of test methods — Determination of repeatability and reproducibility for a standard test method by inter-laboratory tests*.

ISO 10093:—, *Plastics — Fire tests — Standard ignition sources*¹⁾.

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 afterflame

persistence of flaming of a material after the ignition source has been removed

3.2 afterflame time

the length of time for which a material continues to flame, under specified test conditions, after the ignition source has been removed

3.3 afterglow

persistence of glowing of a material after cessation of flaming or, if no flaming occurs, after the ignition source has been removed

3.4 afterglow time

the length of time for which a material continues to glow, under specified test conditions, after the ignition source has been removed and/or cessation of flaming

4 Significance of test

4.1 Tests made on a material under the conditions specified in this International Standard can be of considerable value when comparing the relative burning behaviour of different materials, controlling manufacturing processes, or assessing any change in burning characteristics prior to, or during, use. The results obtained from this method are dependent on the shape, orientation and environment surrounding the specimen and on the conditions of ignition. Correlation with performance under actual service conditions is not implied.

¹⁾ To be published.

4.2 Assessment for fire hazard requires consideration of such factors as fuel contribution, intensity of burning (rate of heat release), products of combustion, and environmental factors such as the intensity of the flame source, orientation of the exposed material and ventilation conditions.

4.3 Burning behaviour, as measured by this test method, is affected by such factors as the density, colour and anisotropy of the material and the thickness of the specimen.

4.4 Certain materials may shrink from the applied flame without igniting. In this event, test results are not valid, therefore additional bar specimens are required to obtain five valid test results for each conditioning. If all test specimens shrink from the applied flame without igniting, these materials are not suitable for evaluation by this test method.

4.5 The burning behaviour of some plastics materials may change with time. It is accordingly advisable to make tests before and after oven conditioning by an appropriate procedure that shall be described in the test report. The preferred oven conditioning conditions shall be 7 days at 70 °C. However, other oven conditioning times and temperatures may be used if agreeable to all parties and shall be noted in the test report.

5 Principle

5.1 This method requires the use of two specimen configurations to characterize material performance. Bars (clause 9) are used to assess burning behaviour, while plates (clause 10) are used to assess the resistance of the material to burn-through (penetration of the flame through the surface of the specimen on the side opposite the ignition source).

5.2 The effects on the burning behaviour of additives, deterioration and possible loss of volatile components are measurable using this method. Results obtained using this method may serve to compare the relative performance of materials and can be helpful in material assessment.

6 Apparatus and materials

6.1 *Laboratory fume hood (cupboard)*, having an internal volume of at least 0,5 m³, with a door that can be completely closed. The enclosure shall permit observation and shall be draught-free while permitting normal thermal circulation of air past the specimen during burning. For safety and convenience, it is desirable that this enclosure be fitted with an evacuation device, such as an exhaust fan, to remove products of combustion which may be toxic. However, it is important to be able to turn off the device during the actual test and to start it again immediately after the test to remove the products of combustion.

NOTE 2 The amount of oxygen available to support combustion is obviously important for the conduct of these flame tests. For tests conducted by this method when burning times are protracted, enclosure sizes less than 1 m³ may not provide accurate results.

6.2 *Laboratory burner*, as specified in ISO 10093 as ignition source P/PF2, having a barrel length of 90 mm to 100 mm and an inside diameter (9,5 ± 0,3) mm. The barrel shall not be equipped with an end-attachment, such as a stabilizer.

NOTE 3 The burner is specified in more detail in ASTM D 5025:1989, *Standard specifications for a laboratory burner used for small-scale burning tests on plastics materials*.

NOTE 4 The 500 W premixed test flame burner specified in IEC 695-2-4/2:—²⁾, *Fire hazard testing — Part 2: Test methods — Part 2-4, sheet 2: 500 W nominal pre-mixed test flame and guidance*, will provide similar results when adjusted to produce the confirmatory time indicated in A.5.1 of the calibration procedure given in Annex A.

However, in case of dispute, use the ignition source P/PF2 as described in ISO 10093.

6.3 *Ring stand*, with clamps or the equivalent, adjustable for positioning the specimen.

6.4 *Burner mounting block*, capable of positioning the burner at an angle of 20° from the vertical axis.

6.5 *Timing device*, accurate to 1 s.

6.6 *Measuring scale*, graduated in millimetres.

6.7 *Methane gas*, of technical-grade, with regulator and meter for uniform gas flow.

NOTE 5 Other gas mixtures having a heat content of approximately 37 MJ/m³ have been found to provide similar results.

NOTE 6 Propane having a heat content of approximately 94 MJ/m³ and butane having a heat content of approximately 120 MJ/m³ provide similar results when using the procedure given in clause 9.

In cases of dispute, use technical-grade methane.

6.8 *Dry, absorbent surgical cotton*

6.9 *Desiccator*, containing anhydrous calcium chloride or another drying agent.

²⁾ To be published