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**Flexible cellular polymeric materials —  
Laboratory assessment of horizontal  
burning characteristics of small specimens  
subjected to a small flame**

*Matières alvéolaires polymères souples — Méthode de laboratoire pour la  
détermination des caractéristiques de combustion de petites éprouvettes  
soumises, en position horizontale, à une petite flamme*



Reference number  
ISO 3582:2000(E)

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 3582 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 4, *Products (other than hoses)*.

This second edition cancels and replaces the first edition (ISO 3582:1978), which has been technically revised.

# Flexible cellular polymeric materials — Laboratory assessment of horizontal burning characteristics of small specimens subjected to a small flame

**WARNING** — Persons using this International Standard should be familiar with normal laboratory practice. This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

## 1 Scope

This International Standard specifies a small-scale laboratory screening procedure for comparing the relative horizontal burning characteristics of small test pieces of flexible cellular polymeric material exposed to a low-energy source of heat. It is intended only for the purpose of assessing quickly and simply the horizontal burning characteristics of small test pieces of the material as such, i.e. considered without reference to the environmental conditions under which the material, or products made from it, may be used. As a consequence, it is not possible to establish a correlation between the results of this test and the performance of such materials or products under actual service conditions. The test is restricted to test pieces of thickness greater than 5 mm. Results of tests on test pieces of different thicknesses are not comparable.

This test method is not intended to be used to assess the potential fire hazard in use.

**NOTE** For cellular plastics having a density less than 250 kg/m<sup>3</sup>, another test method exists: ISO 9772:—<sup>1)</sup>, *Cellular plastics — Determination of horizontal burning characteristics of small specimens subjected to a small flame*. The test equipment and procedures differ from those contained in this International Standard, and it should not therefore be assumed that they will produce identical test results.

## 2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 1923:1981, *Cellular plastics and rubbers — Determination of linear dimensions*.

## 3 Significance of test

Tests made on a material under the conditions specified here can be of considerable value in comparing the horizontal burning characteristics of different materials, in controlling manufacturing processes or in assessing any change in horizontal burning characteristics prior to, or during, use. Correlation with performance under actual

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1) To be published. (Revision of ISO 9772:1994)

service conditions is not implied, and the finished product should be tested in the form in which it will finally be used by a test method appropriate to products fulfilling a similar purpose.

It is essential to appreciate that this method of test is not intended, and cannot be used, to assess the potential fire hazard of a material or product in use. Assessment of fire hazard would require consideration of factors such as fuel contribution, intensity of burning and products of combustion, as well as environmental factors such as intensity of source, orientation of exposed material and ventilation conditions.

## 4 General

**4.1** Horizontal burning characteristics, as measured by this test procedure, are affected by factors such as density, any anisotropy of the cellular material and the thickness of the test piece.

Certain materials may shrink from the applied flame without igniting. In this event, the test results are not valid and additional test pieces may be required to obtain the ten sets of data necessary. If the test pieces continue to shrink from the applied flame without igniting, the material is not suitable for evaluation by this method of test.

**4.2** Inter-laboratory trials have shown that many variables influence the reproducibility of the results of this type of test. For this reason, the procedure laid down shall be adhered to in all respects, especially as regards the use and construction of the test chamber.

**4.3** For certain materials which exhibit burning only along the upper surface of the test piece, the mass loss shall be measured and reported, if required.

**4.4** The horizontal burning characteristics of some flexible cellular polymeric materials may change with time. It is accordingly advisable to make tests before and after ageing by an appropriate procedure, details of which shall be given in the test report.

## 5 Apparatus

**5.1 Test chamber**, constructed of non-combustible materials, for example insulating board on a steel frame, having inside dimensions of 600 mm  $\pm$  5 mm in length, 300 mm  $\pm$  5 mm in width and 760 mm  $\pm$  5 mm in height, and being otherwise as shown in Figure 1. To allow easy access between tests, the chamber may be designed so that the front panel containing the window is removable, but, if so constructed, provision shall be made for ensuring that a draught-proof seal is obtained when the panel is in position. The chamber shall be used in a fume cupboard.

The chamber shall be draught-free, yet permit normal thermal circulation of air past the test piece during burning.

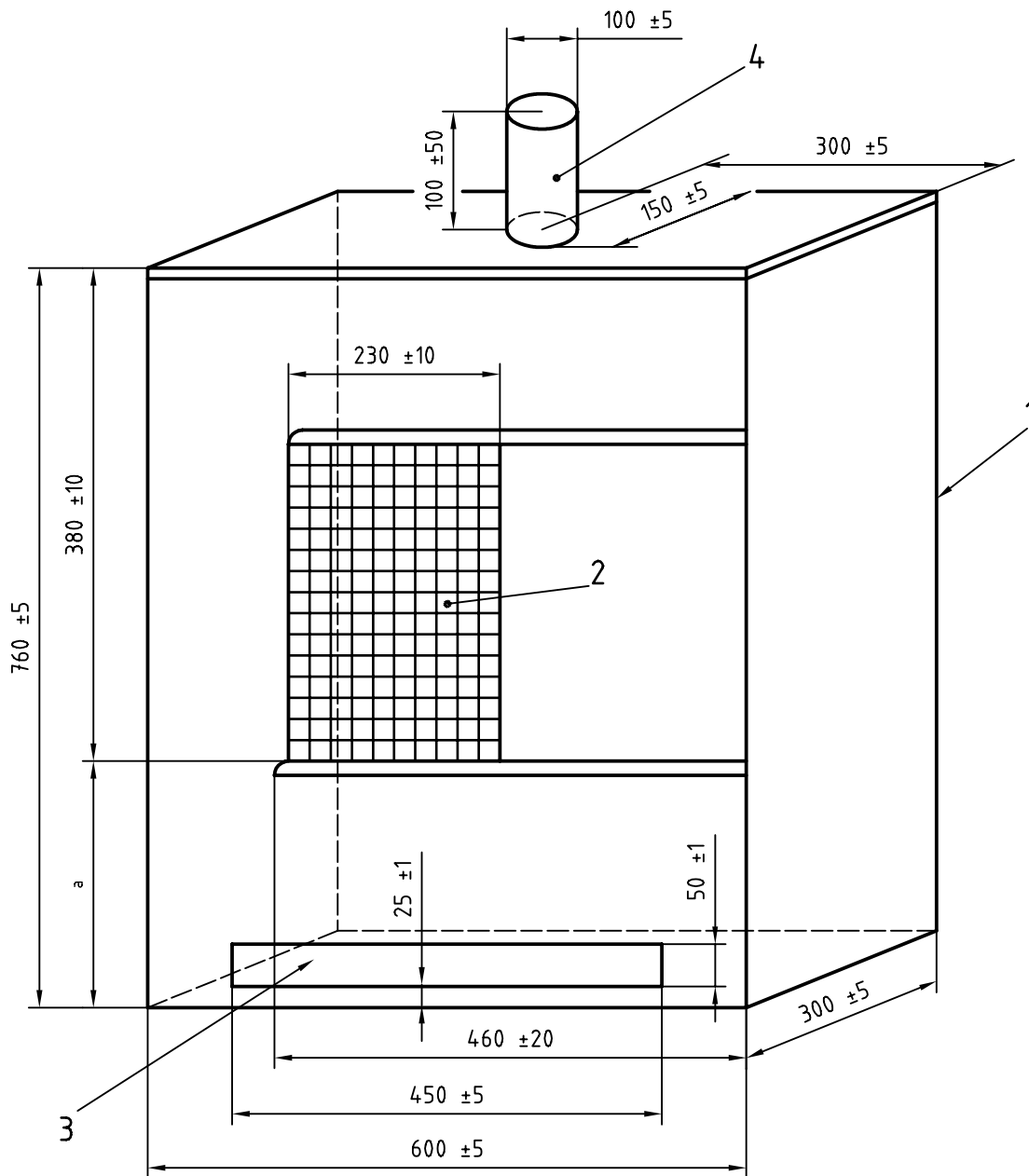
**5.2 Burner**, of internal diameter 9,5 mm  $\pm$  0,5 mm. A gaseous hydrocarbon fuel shall be used to provide the standard flame shown in Figure 2. This flame shall maintain a temperature of 1 000 °C  $\pm$  100 °C at a height of 13 mm  $\pm$  1 mm above the burner top.

**NOTE** Propane, of at least 93 % purity, supplied through a jet of diameter 0,3 mm  $\pm$  0,1 mm, is suitable for provision of the specified flame and temperature. This jet size is such that the propane pressure required to obtain the standard flame is less than 7 kPa.

**5.3 Wing top**, having an opening of internal length 48 mm  $\pm$  1 mm and internal width 3,0 mm  $\pm$  0,2 mm, fitted to the burner.

**5.4 Support gauze**, 215 mm long, 75 mm wide and having 13 mm of its length bent to form a right angle as shown in Figure 3. It shall consist of 6,4 mm mesh gauze constructed from 0,8 mm diameter stainless-steel wire. A minimum of four supports shall be available.

Dimensions in millimetres  
(the dimensions shown are internal)

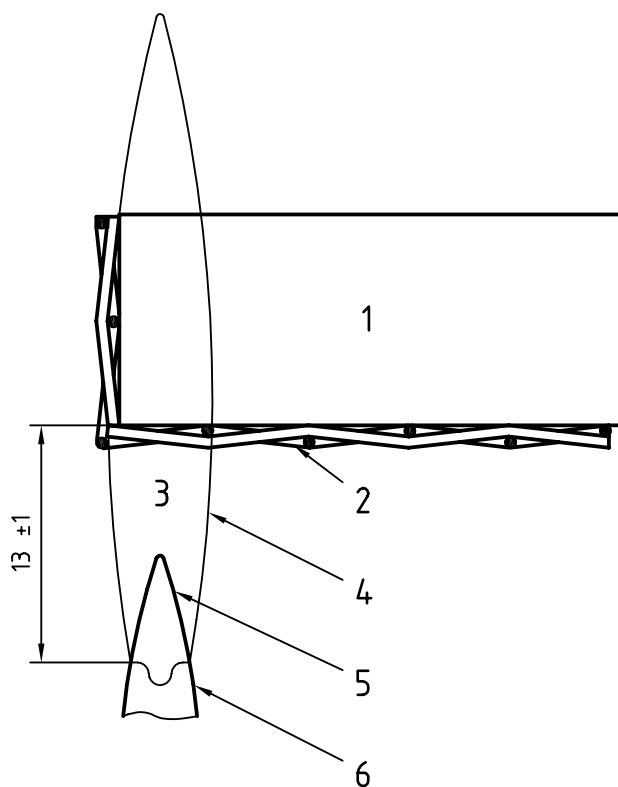


**Key**

- 1 Cabinet made from non-combustible material with draught-proof seal on lid and front panel
- 2 Toughened-glass sliding door with draught-proof seal
- 3 Ventilation slit
- 4 Ventilation chimney

<sup>a</sup> It is recommended that the bottom of the window is approximately 25 mm below the normal position of the gauze during the test (see Figure 4)

**Figure 1 — Test chamber**

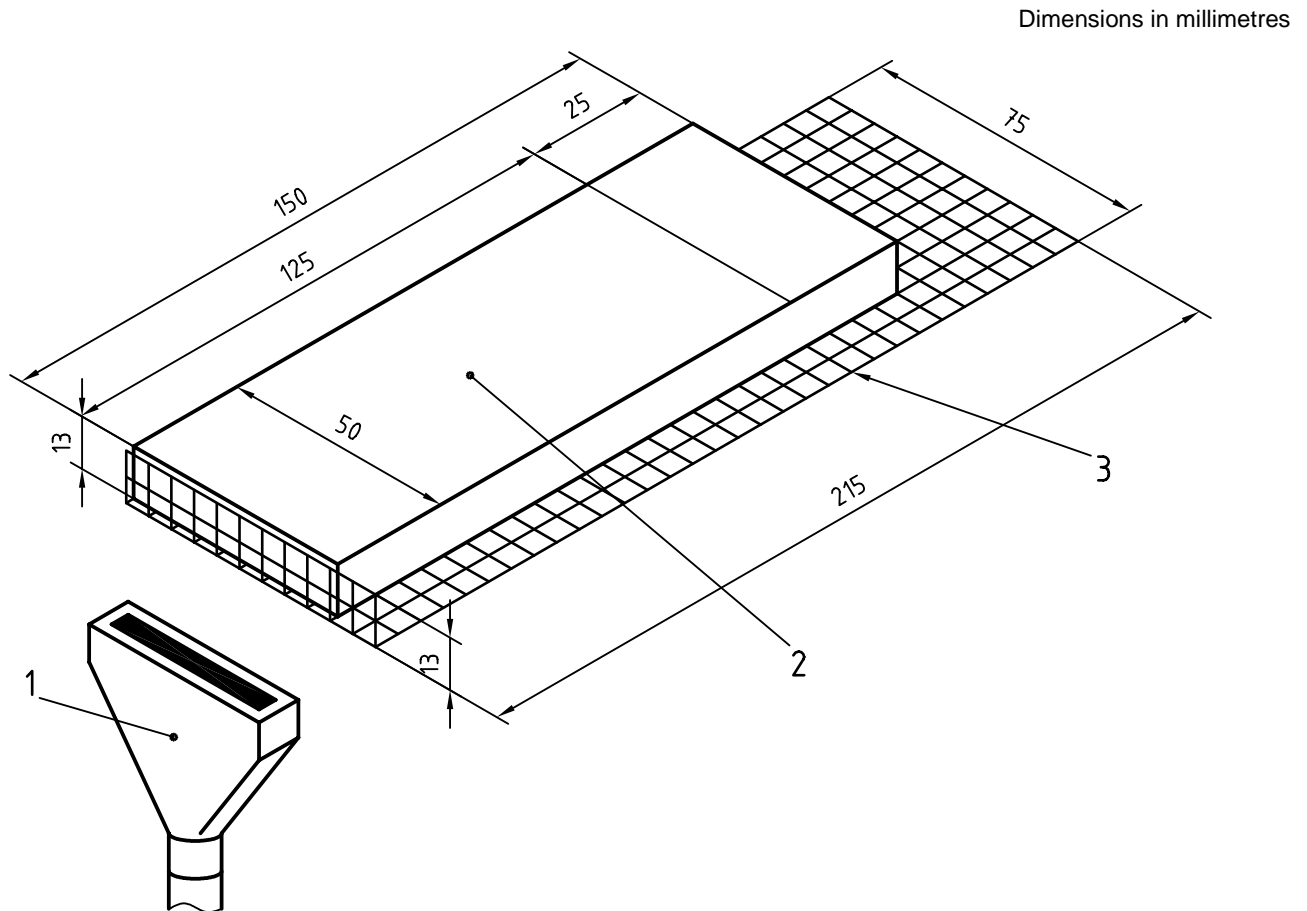


**Key**

- 1 Test piece, 13 mm thick
- 2 Test piece support gauze, 6,4 mm mesh
- 3 Blue flame
- 4 Profile of visible flame, 38 mm high
- 5 Profile of inner cone, 6 mm high
- 6 Burner wing top

**Figure 2 — Details of flame and relative positions of burner wing top, test piece and test piece support gauze**



**Key**

- 1 Burner wing top
- 2 Test piece
- 3 Test piece support gauze

**Figure 3 — Test piece and test piece support gauze**

**5.5 Support-gauze holder**, constructed from mild steel as shown in Figure 4 so that:

- a) the gauze is maintained with its long axis within  $1^\circ$  of the horizontal, and parallel to the 600 mm dimension of the test chamber;
- b) the nearest end of the test piece is  $13 \text{ mm} \pm 1 \text{ mm}$  above the burner wing top (see Figure 2);
- c) the space both above and below the test piece is unobstructed;
- d) means is provided for positioning the burner in the correct position relative to the test piece;
- e) the gauze is equidistant from the front, back and sides of the test chamber, and is  $175 \text{ mm} \pm 25 \text{ mm}$  above the base of the test chamber.

**5.6 Timing device**, accurate to  $\pm 1 \text{ s}$ .

**5.7 Measuring scale**, graduated in millimetres.

**5.8 Balance** (if necessary), accurate to  $\pm 1 \text{ mg}$ .

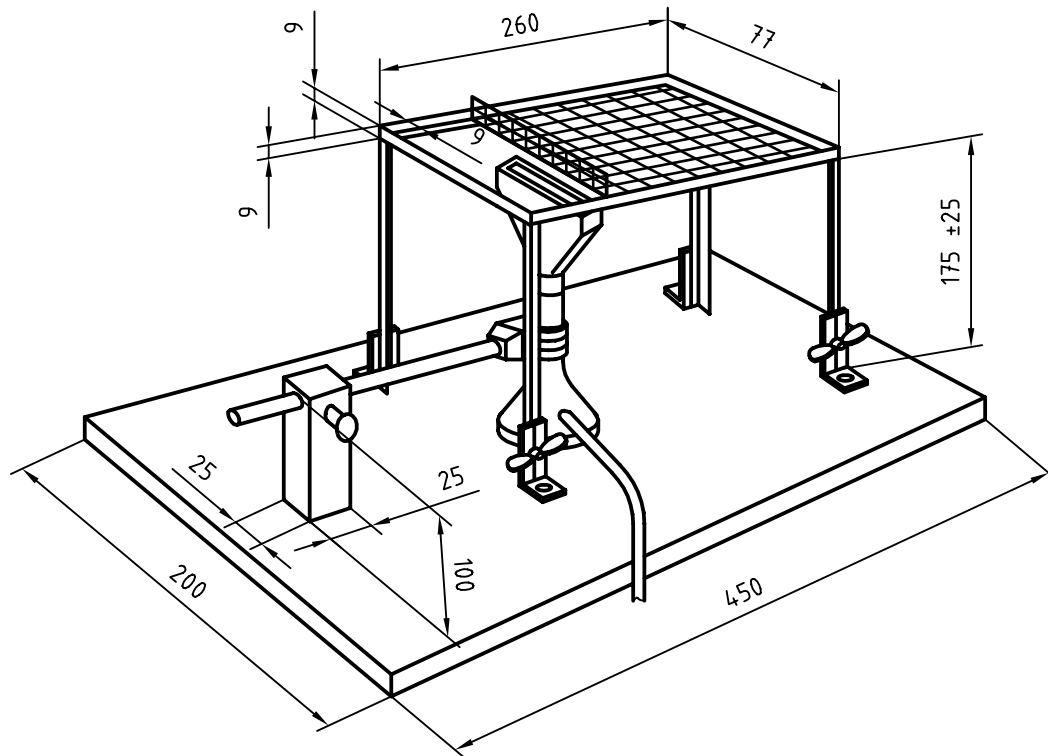


Figure 4 — Support-gauze holder

## 6 Number, size, marking and weighing of test pieces

**6.1** Cut ten test pieces from a representative sample of the material. Take care to remove all dust and any particles from the surfaces.

**6.2** The standard test piece shall be  $150 \text{ mm} \pm 1 \text{ mm}$  long by  $50 \text{ mm} \pm 1 \text{ mm}$  wide. Materials supplied in thicknesses over  $13 \text{ mm}$  shall be cut to  $13 \text{ mm} \pm 1 \text{ mm}$  thickness, any skin having been removed. Materials supplied in thicknesses of  $13 \text{ mm}$  or less shall be tested at the thickness supplied, provided that this is not less than  $5 \text{ mm}$ , and in this case skins need not be removed. Measure all dimensions in accordance with ISO 1923.

**NOTE** Tests made on test pieces of different thicknesses are not comparable, and tests made in different directions of anisotropy may also not be comparable.

**6.3** Weigh each test piece, if required (see 4.3), and mark it across its width with a line  $25 \text{ mm}$  from one end, referred to hereafter as the gauge mark. For thin samples having a skin on one side only, normally the exterior surface of the material, place the gauge mark on the surface with the skin.

## 7 Conditioning of test pieces

Materials shall not be tested for at least 72 h after manufacture. Prior to the test, the test pieces shall be conditioned for at least 16 h in one of the following atmospheres:

$23 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$  and  $50 \% \pm 5 \%$  relative humidity;

$27 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$  and  $65 \% \pm 5 \%$  relative humidity.

**NOTE** This storage period can form the final part of the period following manufacture.

## 8 Test procedure

### 8.1 Adjustment of flame

8.1.1 Ensure that the lid of the chamber (5.1) is closed and the fume cupboard fan is off.

8.1.2 Adjust the burner and gas pressure (see 5.2) to provide a blue flame with a temperature of  $1\ 000\text{ °C} \pm 100\text{ °C}$  13 mm  $\pm$  1 mm above the wing top (5.3). The visible portion of the flame shall be 38 mm  $\pm$  1 mm high with a clearly defined inner cone 6 mm  $\pm$  1 mm high. These heights shall be measured, for example with pre-set callipers.

8.1.3 Turn off the gas.

### 8.2 Adjustment of test piece support

Place a clean test piece support gauze (5.4) in the holder (5.5) so that the lower surface of the test piece will be 13 mm  $\pm$  1 mm above the tip of the burner wing top as shown in Figure 2. The relative positions of burner and holder shall be such that, when the test piece is in position, one edge of the flame is in line with the end of the test piece and the other edge of the flame extends into the test piece as shown in Figure 2.

The centre of the wing top shall be directly under the centreline of the test piece when positioned. Ensure that the front panel of the test chamber is sealed.

### 8.3 Positioning of test piece

Open the glass sliding door of the test chamber and place a test piece on the support in such a manner that:

- a) the surface on which the gauge mark has been made is uppermost;
- b) the end farthest away from the gauge mark is touching the 13 mm bent-up portion of the support gauze;
- c) its longitudinal axis is parallel to that of the support gauze.

### 8.4 Conduct of test

8.4.1 Turn on and ignite the gas, and simultaneously start the timing device (5.6).

8.4.2 Immediately close the door of the test chamber, and close the window of the fume cupboard.

8.4.3 Note and record the severity of the burning characteristics of the test piece, i.e. warping, charring, melting, dripping and whether any drips continue to burn on reaching the floor of the chamber.

8.4.4 After 60 s, turn off the gas or remove the burner.

8.4.5 Stop the timing device when the test piece flame reaches the gauge mark, and record the time  $t_b$ , in seconds.

8.4.6 If the whole of the upper surface is not consumed, stop the timing device when the test piece flame goes out, i.e. at the time at which the yellow or other characteristic flame in contact with the main body of the test piece disappears, and record the time  $t_e$ .

In some cases, the test piece flame may go out when it is still in the gas flame. In these cases, take the extinction time as the time when the discolouration imparted to the flame disappears.

For certain materials which exhibit burning only along the upper surface of the test piece, measure and report the mass loss, if required.

Ignore drips falling into the burner unless a visible change occurs in the flame. In this case, abandon the test on that particular test piece and, after cleaning the burner and wing top, substitute a new test piece.

## 8.5 Measurement of extent burnt

**8.5.1** Open the test chamber lid and switch on the fume cupboard fan, open the glass sliding door, and remove the test piece and the test piece support.

**8.5.2** Measure and record the extent burnt  $L_e$ , which is equal to 150 mm minus the distance from the unburnt end to the nearest evidence (such as charring) of the flame front along the upper surface of the test piece.

## 8.6 Measurement of mass loss

Reweigh the test piece, if required. The reweighing shall not include any mass which has fallen from the test piece.

## 8.7 Preparation for the next test

**8.7.1** Burn and clean off any residues remaining on the test piece support. Use at least four test piece supports in strict rotation to allow each to cool to room temperature before re-use.

**8.7.2** Examine the burner, wing top and glass sliding door for cleanness, and clean if necessary.

**8.7.3** Check the flame size at least after every five tests.

**8.7.4** Close the test chamber lid, switch off the fume cupboard fan, and repeat the procedure in 8.2 for the other test pieces.

## 9 Calculations

**9.1** If the flame front passes the gauge mark:

**9.1.1** Calculate, for each test piece, the burning rate  $v$ , in millimetres per second, from the equation

$$v = \frac{125}{t_b}$$

where  $t_b$  is the time, in seconds, taken for the flame to reach the gauge mark.

**9.1.2** Calculate the mean burning rate.

**9.2** If the flame front does not reach the gauge mark:

**9.2.1** Calculate the burning rate  $v_c$ , in millimetres per second, from the equation

$$v_c = \frac{L_e}{t_e}$$

where

$t_e$  is the time, in seconds, taken for the flame to go out;

$L_e$  is the extent burnt, in millimetres.

**9.2.2** Calculate the mean values of:

- a) the burning rate;
- b) the extinction time;
- c) the extent burnt;
- d) the mass loss (if required).

## 10 Test report

The test report shall include the following:

- a) a reference to this International Standard;
- b) the following statement:

"The test described in this report has provided information which may only be used for quality assurance purposes provided the user/manufacture is aware of the importance of this quality in the context of fire hazard assessment. Safety authorities shall exercise a degree of caution in using test data alone in an absolute sense."

- c) a description of the material tested, including:
  - 1) the nominal apparent density of the material,
  - 2) the thickness, to the nearest millimetre, of the test pieces,
  - 3) the presence or absence of skins,
  - 4) the direction of any anisotropy relative to the test piece dimensions,
  - 5) the conditioning treatment used,
  - 6) any prior treatment before testing, other than cutting, trimming and conditioning;
- d) a description of the burning characteristics of the material, e.g. warping, charring, melting, dripping, and whether any drips continued to burn on reaching the floor of the chamber;
- e) the mean extent burnt;
- f) the mean extinction time;
- g) the mean burning rate;
- h) the mean mass loss (if required);
- i) the date of the test.

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