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IS 11239-12 (1988): Methods of Test for Rigid Cellular Thermal Insulation Materials, Part 12: Horizontal Burning Characteristics [CHD 27: Thermal Insulation]



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Indian Standard

**METHODS OF TEST FOR RIGID CELLULAR
THERMAL INSULATION MATERIALS**

PART 12 HORIZONTAL BURNING CHARACTERISTICS

(Second Reprint SEPTEMBER 1998)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BHADUR SHAH ZAFAR MARG
NEW DELHI 110002

*Indian Standard***METHODS OF TEST FOR RIGID CELLULAR
THERMAL INSULATION MATERIALS****PART 12 HORIZONTAL BURNING CHARACTERISTICS****0. FOREWORD**

0.1 This Indian Standard (Part 12) was adopted by the Bureau of Indian Standards on 10 May 1988, after the draft finalized by the Thermal Insulation Materials Sectional Committee had been approved by the Chemical Division Council.

0.2 In the preparation of this standard, considerable assistance has been derived from BS 4735 : 1974 'Assessment of the horizontal burning characteristics of specimens not larger

than 150 mm × 50 mm × 13 mm (nominal) of cellular plastics and cellular rubber materials when subjected to a smaller flame'.

0.3 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

*Rules for rounding off numerical values (revised).

1. SCOPE

1.1 This standard (Part 12) prescribes a small scale laboratory procedure for comparing the relative horizontal burning characteristics of rigid cellular thermal insulation material by exposing the specimen to a low energy source of heat.

1.1.1 It has no relevance to the environmental conditions under which rigid cellular thermal insulation materials may be used either singly or in conjunction with other materials.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 3069-1965* shall apply.

3. GENERAL

3.1 Tests made on specimens of material under the conditions described in this standard can be of value in controlling the manufacturing processes to ensure consistency of production. There is no known evidence of correlation between the results of such tests and burning under actual use conditions. Therefore, conclusions shall not be drawn from such results regarding burning behaviour under actual use conditions. If it is desired to measure and compare the fire hazards for a finished product, another test method which simulates as nearly as possible the actual conditions of use has to be used.

3.2 Horizontal burning characteristics under the action of a small flame as measured by this test procedure are affected by such factors as density and anisotropy of the cellular material and the thickness of the specimen.

3.3 Some test specimens of certain materials may shrink from the applied frame without igniting. In this event, test results are not valid and additional test specimens may be required to obtain the ten sets of data required.

3.4 Test specimens of certain materials may show burning only along the upper surface. In such cases, measurement of percentage mass loss may be made and reported if required.

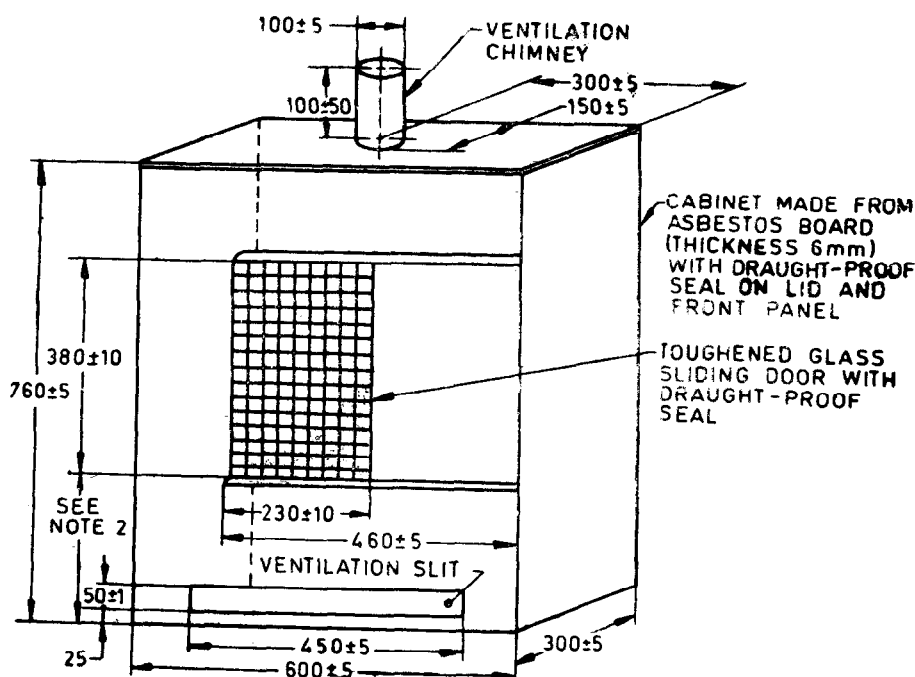
3.5 Inter-laboratory trials have shown that many variables influence the reproducibility of the results of this type of test. For this reason, the procedure laid down shall be adhered to in all respects, specially as regards the use and the construction of the test chamber and the use and location of the support gauzes and gauze holder.

NOTE — Since, with some materials, the horizontal burning characteristic of test specimens may change with time, it is advisable that a series of tests should be carried out both before and after an appropriate ageing procedure, details of which should be given in the test report.

4. APPARATUS

4.1 Test Chamber — A test chamber shall be used, constructed of asbestos insulating board, having inside dimensions of 600 ± 5 mm length, 300 ± 5 mm width and 760 ± 5 mm height, and being otherwise as depicted in Fig. 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 then 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 air in the chamber shall be draught-free, yet permit normal thermal circulation of air past the specimen during the burning.

*Glossary of terms, symbols and units relating to thermal insulation materials.



All dimensions in millimetres.

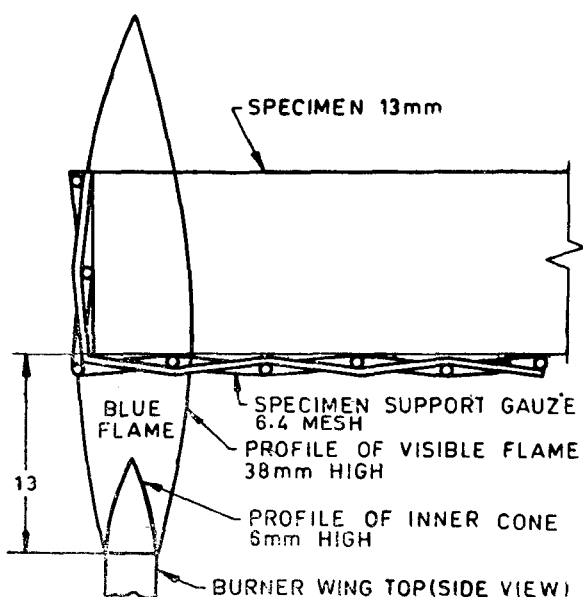
NOTE 1 — The dimensions shown for the test chamber are internal.

NOTE 2 — It is recommended that the bottom of the window be approximately 25 mm below the normal position of the gauge during the test (see Fig. 4).

FIG. 1 TEST CHAMBER

4.2 Fuel Supply — Propane/natural gas of at least 93 percent purity supplied through pressure regulating and on/off valves, shall be used.

4.3 Burner — A burner of internal barrel diameter 9.5 ± 0.5 mm and jet size 0.3 ± 0.1 mm shall be used. The jet shall be such that the propane pressure to obtain the flame as shown in Fig. 2 is less than 7 kN/m^2 .



All dimensions in millimetres.

FIG. 2 DETAILS OF FLAME AND RELATIVE POSITIONS OF BURNER WING TOP, SPECIMEN AND SPECIMEN SUPPORT

4.4 Wing Top — A wing top having an opening of internal length 48 ± 1 mm and internal width 3.0 ± 0.2 mm shall be fitted to the burner.

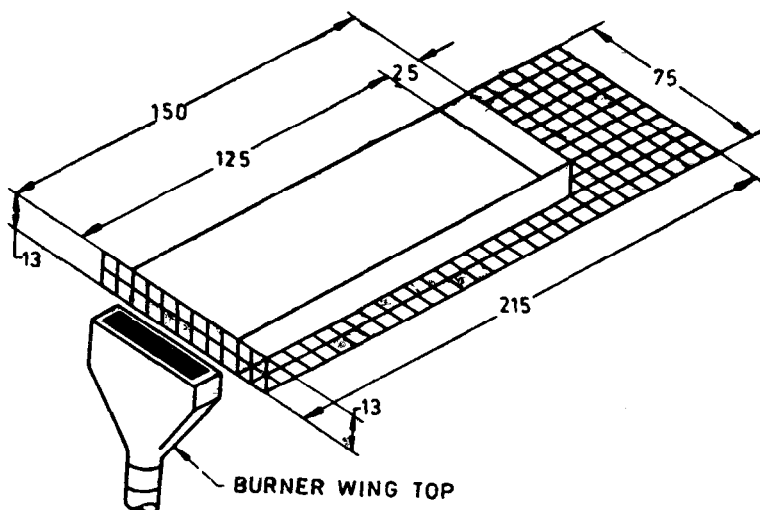
4.5 Specimen Support Gauze — The support shall be 215 mm long, 75 mm wide and shall have 13 mm of its length bent to form a right angle as indicated in Fig. 3. It shall consist of 6.4 mm mesh gauze constructed from 0.8 mm diameter steel wire. A minimum of four supports shall be available.

4.6 Gauze Holder — The gauze holder shall be constructed from mild steel and shall be as depicted in Fig. 4, so that:

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

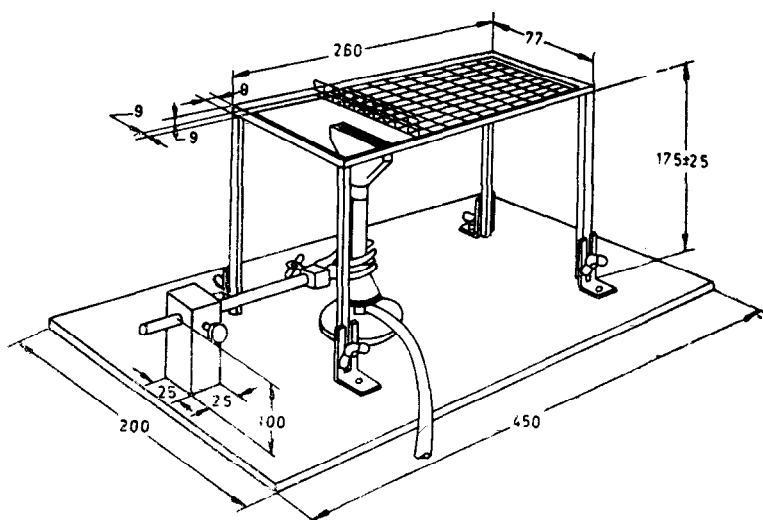
4.7 Timing Device — A timing device accurate to within ± 1 second shall be used.

4.8 Measuring Scale — A measuring scale graduated in millimetres shall be used.



All dimensions in millimetres.

FIG. 3 DIMENSIONS OF SPECIMEN AND SPECIMEN SUPPORT



All dimensions in millimetres.

FIG. 4 GAUZE HOLDER

5. SIZE, NUMBER AND MARKING OF TEST SPECIMENS

5.1 Ten specimens shall be cut from a representative sample of the material. Care shall be taken to remove all dust and any particles from the surfaces.

5.2 The standard specimen shall be 150 ± 1 mm long and 50 ± 1 mm wide. Material supplied in thicknesses over 14 mm shall be cut to 13 ± 1 mm thickness, any skin having been removed. Materials supplied in thicknesses of 14 mm or less shall be tested at the thickness supplied provided that this is not less than 5 mm, and in this case skins need not be removed.

5.3 Each test specimen shall be weighed, if required (see 3.4) and shall be marked across its width by a line 25 mm from one end, referred to hereafter as the gauge mark. For samples

which have a skin on one side only which is normally the exterior surface of the material, the gauge mark shall be placed on the surface with the skin.

6. CONDITIONING OF SPECIMENS

6.1 The material shall be tested not less than 72 h after manufacture.

6.2 The test specimens shall be conditioned for not less than 16 h at $27 \pm 2^\circ\text{C}$ and 65 ± 5 percent relative humidity.

7. PROCEDURE

7.1 Adjustment of Flame

7.1.1 Ensure that the chamber lid is closed and that the fume cupboard fan is off.

7.1.2 Adjust the burner and gas pressure to provide a blue flame whose visible portion is

38 ± 1 mm high, with a clearly defined inner zone 6 ± 1 mm high, using, for example, preset calipers.

7.1.3 Turn the gas off.

7.2 Adjustment of Specimen Support — Place a clean specimen support gauze in the holder so that the lower surface of the specimen is 13 ± 1 mm above the tip of the burner wing top as shown in Fig. 2. The relative position of the burner and the holder shall be such that when the specimen is in position, one edge of the flame is in line with the end of the specimen and the other edge of the flame extends into the specimen as shown in Fig. 2. The centre of the wing top shall be directly under the centre line of the specimen when positioned. Ensure that the front panel of the test chamber is sealed.

7.3 Positioning of Specimen — Open the glass sliding door and place a test specimen 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 from the gauge mark is touching the 13 mm bent up portion of the support gauze; and
- c) its longitudinal axis is parallel to that of the support gauze.

7.4 Conduct of Test

7.4.1 Turn on and ignite the gas and simultaneously start the timing device.

7.4.2 Immediately close the glass sliding door of the test chamber and close the door of the fume cupboard.

7.4.3 Note and record the severity of the burning characteristics of the specimen, that is, warping, charring, melting, dripping and whether any drips continue to burn on reaching the floor of the chamber.

7.4.4 Turn off the gas after 60 s.

7.4.5 Record the time in seconds when the specimen flame reaches the gauge mark.

7.4.6 If the whole of the upper surface has not been consumed, record the time when the specimen flame extinguishes, that is, the time when the yellow or other characteristic flame in contact with the main body of the specimen disappears. In some cases, the specimen flame may extinguish within the propane flame. In these cases, the extinction time shall be taken as the time when the discoloration imparted to the propane flame disappears.

NOTE — Drips falling into the burner should be ignored unless a visible change occurs in the flame. In this case, the test on that specimen should be abandoned and after cleaning the burner and wing top, a new specimen should be substituted.

7.5 Measurement of Extent Burnt

7.5.1 Switch on the fume cupboard fan, open the test chamber lid and the glass sliding door and remove the specimen and the specimen support.

7.5.2 Measure and record the extent burnt 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 specimen. If the whole of the upper surface is affected, record the extent burnt as 150 mm.

7.5.3 If the measurement of percentage mass loss is required, reweigh the test specimen not including anything which has fallen from the test specimen.

7.6 Preparation for the Next Test

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

7.6.2 Examine the burner, wing top and glass sliding door for cleanliness, and clean if necessary.

7.6.3 Check the flame size at least after every five tests.

7.6.4 Close the test chamber lid, switch off the fume cupboard fan, and repeat the test from 7.2 for the other specimens.

8. CALCULATIONS

8.1 If the flame front passes the gauge mark, then the burning rate of the specimens:

$$(\text{mm/s}) = \frac{125}{t_b}$$

where t_b is the time in seconds in which the flame reaches the gauge mark.

8.2 If the flame front does not reach the gauge mark, then the burning rate of the specimen:

$$(\text{mm/s}) = \frac{\text{burnt}}{t_e}$$

where t_e is the time in seconds when the flame is extinguished.

8.3 Calculate the mean extent burnt, the mean extinction time and the mean burning rate and, if required, the mean percentage mass loss for the test specimens.

9. TEST REPORT

9.1 The test report shall include the following:

- a) The statement 'The following test results relate only to the behaviour of the test specimens under the particular conditions of test; they shall not be used as a means for assessing the potential fire hazard of the material in use';
- b) 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 specimen;
 - 3) The presence or the absence of the skins;
 - 4) Any prior treatment before testing other than cutting, trimming and conditioning; and

- 5) The direction of any anisotropy,
- c) A description of the burning characteristics of the test specimens, that is, warping, charring, melting, dripping and whether any drips continue to burn on reaching the floor of the chamber;
- d) The mean extent burnt for the test specimens (*see Note*);
- e) The mean extinction time t_e for the test specimens (*see Note*);
- f) The mean burning rate for the test specimens (*see Note*); and
- g) The mean mass loss, expressed as a percentage, if required.

NOTE — Experience has shown that for both discrimination and reproducibility, the mean extent is the preferred test criterion.

Inter-laboratory tests on specimens from four materials gave 95 percent confidence limits on measurements of extent burnt as follows:

<i>Mean Extent Burnt of Test Specimens, mm</i>	<i>95 Percent Confidence Limits Including Inter- Laboratory and Testing Errors, mm</i>
17	± 8
18	± 10
29	± 12
41	± 18

In view of the reproducibility of the test method as indicated by the confidence limits stated above, it is recommended that results for mean extent burnt should be reported to the nearest 25 mm. Results for the mean extinction time and the mean burning rate should preferably be reported to the nearest 0.5 and 0.1 mm, respectively.

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Amendments Issued Since Publication

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 323 01 31, 323 33 75, 323 94 02

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices:

Telephone

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110002

323 76 17, 323 38 41

Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Maniktola
CALCUTTA 700054

{ 337 84 99, 337 85 61
{ 337 86 26, 337 91 20

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022

{ 60 38 43
{ 60 20 25

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113

{ 235 02 16, 235 04 42
{ 235 15 19, 235 23 15

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)
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