INTRODUCTION

1 Scope

1.1 These requirements cover tests for flammability of polymeric materials used for parts in devices and appliances. They are intended to serve as a preliminary indication of their acceptability with respect to flammability for a particular application.

1.2 The methods described in this Standard involve standard size specimens and are intended to be used solely to measure and describe the flammability properties of materials, used in devices and appliances, in response to a small open flame or radiant heat source under controlled laboratory conditions.

1.3 The tests in the Standard for Tests for Flammability of Small Polymeric Component Materials should be used to evaluate small components which contain materials that can not be fabricated into standardized specimens in the minimum use thickness and subjected to applicable preselection tests in UL 94. Test procedures in UL 1694 are applicable to small components with an overall volume of less than 2500 mm^3 (0.15 in^3). UL 1694 is generally not applicable to small components with an overall volume greater than 2500 mm^3 (0.15 in^3).

1.4 The final acceptance of the material is dependent upon its use in complete equipment that conforms with the standards applicable to such equipment. The flammability classification required of a material is dependent upon the equipment or device involved and the particular use of the material. The performance level of a material determined by these methods shall not be assumed to correlate with its performance in end-use application. The actual response to heat and flame of materials depends upon the size and form, and also on the end-use of the product using the material. Assessment of other important characteristics in the end-use application includes, but is not limited to, factors such as ease of ignition, burning rate, flame spread, fuel contribution, intensity of burning, and products of combustion.

1.5 If found to be appropriate, the requirements are applied to other nonmetallic materials.

1.6 These tests, with the exception of the Radiant Panel Test in Section 10, are not applicable to the evaluation of parts where the thickness exceeds 13.0 mm or where the surface area exceeds 1 m^2. These requirements do not cover polymeric materials when used for building construction, finishing, or contents such as wall and floor coverings, furnishings, decorative objects and so forth. In addition, the fire resistance (in terms of an hourly rating), flame spread, smoke characterization, and heat release rate is not evaluated. Other fire tests exist and shall be used to evaluate the flammability of materials in the intended end-use-product configuration.

11.6 Test results

11.6.1 The following are to be observed and recorded:

a) Afterflame time after first flame application, t_1.

b) Afterflame time after second flame application, t_2.

c) Afterglow time after second flame application, t_3.

d) Whether or not the afterflame and/or afterglow progressed up to the 125 mm mark.

e) Whether or not specimens drip flaming particles which ignite the cotton indicator.

12 Horizontal Burning Foamed Material Test; HBF, HF-1, or HF-2...

(ASTM D 4986 or ISO 9772)

12.1 Test criteria

12.1.1 This test is intended to be performed on foamed plastic materials used for parts in devices and appliances in non-structural applications.

12.1.2 This test does not cover foamed plastics for use as materials for building construction or finishing.

12.1.3 Materials shall be classed HBF, HF-1, or HF-2, on the basis of test results obtained on small specimens when tested as described in 12.2.1 – 12.6.2.

12.1.4 MATERIALS CLASSIFIED HBF – Materials classified HBF shall:

a) Not have any specimens with a burning rate exceeding 40 mm per minute over a 100 mm span, or

b) Have each specimen cease to burn before flaming or glowing reaches the 125 mm gauge mark.

12.1.5 If only one specimen from a set of five specimens does not comply with the requirements in 12.1.4, another set of five specimens, subjected to the same conditioning, shall be tested. All specimens from this second set of specimens shall comply with the requirements in 12.1.4 for the material in that thickness and density to be classed HBF.

12.1.6 MATERIALS CLASSIFIED HF-1 and HF-2 – Materials classified HF-1 and HF-2 shall be in compliance with Table 12.1.

Table 12.1
Material classifications

Criteria Conditions	HF-1	HF-2
Afterflame time	4/5 is ≤2s 1/5 is ≤10s	4/5 is ≤2s 1/5 is ≤10s
Afterflame time plus afterglow time for each individual specimen	≤30s	≤30s
Cotton indicator ignited by flaming particles or drops	No	Yes
Damaged length for each individual specimen	< 60mm	< 60mm

Notes: 4/5 – Four out of a set of five specimens.
1/5 – One out of a set of five specimens.

12.1.7 If a set of five specimens does not comply with the requirements in 12.1.6 because of one of the following situations, another set of five specimens subjected to the same conditioning shall be tested:

a) A single specimen flames for more than 10 seconds; or

b) Two specimens flame for more than 2 seconds but less than 10 seconds; or

c) One specimen flames for more than 2 seconds but less than 10 seconds, and a second specimen flames for more than 10 seconds; or

d) One specimen does not comply with the additional criteria in 12.1.6.

12.1.8 All specimens from this second set shall comply with the requirements in 12.1.6 in order for the foamed plastic material in that thickness and density to be classed HF-1 or HF-2.

12.2 Test apparatus

12.2.1 See 5.1– 5.3, 5.5 – 5.8, 5.10, 5.12 – 5.15, 5.18 and 5.19.

12.3 Test specimens

12.3.1 Test specimens are to be cut from a representative sample of the material. Care is to be taken to remove all dust and any particles from the surface.

12.3.2 Standard test specimens are to be 150 ±5 mm long by 50 ±1 mm wide, in the minimum and maximum thicknesses covering the thickness range to be considered. Specimens tested by this method are limited to a maximum thickness of 13 mm. Specimens in intermediate thicknesses are also to be provided and shall be tested if the results obtained on the minimum and/or maximum thickness indicate inconsistent test results. Intermediate thicknesses are not to exceed increments of 6 mm. The edges are to be smooth and the radius on the corners is not to exceed 2 mm.

12.3.3 Material Ranges – If the material is to be considered in a range of densities or colors, specimens representing the extremes of the range are to be provided and considered representative of the range if the test results are essentially the same. When certain color pigments (for example, red, yellow, and the like) are known by experience to affect flammability characteristics, they are also to be provided.

12.3.4 If consideration is to be given to foamed material having a high density exterior on one or both sides, representative specimens are to be provided. If a range of exterior densities are to be considered, the specimens representing the ranges are to be provided.

12.3.5 If consideration is to be given to foamed material having adhesive on a surface, specimens having adhesive on one side are to be provided.

12.4 Conditioning

12.4.1 Two sets of five specimens are to be preconditioned as in 6.1.

12.4.2 Two sets of five specimens are to be preconditioned as in 6.2.

12.5 Procedure

12.5.1 The specimen support gauze is to be held in a support fixture similar to Figure 12.1 such that the major section is horizontal and 13 ±1 mm above the tip of the burner wing tip, and 175 ±25 mm above a horizontal layer of absorbent 100 percent cotton, thinned to approximately 50 x 50 mm and a maximum thickness of 6 mm. The cotton is to be located under the front upturned portion of the wire cloth.

12.5.2 Each specimen is to be marked across its width with three lines, 25 mm, 60 mm, and 125 mm from one end, referred to as gauge marks.

12.5.3 The test specimen is to be placed flat on the wire cloth with the gauge marks facing up. The end closer to the 60 mm mark is to be placed in contact with the upturned end of the wire cloth.

Note 1: Specimens with a high density exterior on one side are to be tested with that side facing down. Specimens with adhesive on one side are to be tested with that side facing up.

Note 2: If a new wire cloth is not used for each test, any material remaining on the cloth from previous tests is to be burned off, and the cloth is to cool before conducting the test.

12.5.4 The burner with wing tip is then to be placed remote from the specimen, ignited, and adjusted to provide a blue flame 38 ±2 mm high, when measured in subdued light. The flame is to be obtained by adjusting the gas supply and the air port of the burner until a 38 ±2 mm yellow-tipped blue flame is produced. The air supply is increased until the yellow tip disappears. The height of the flame is to be measured again and readjusted, if necessary. The flame height measurement should be made from the outside edges of the curved wingtip.

12.5.5 The burner is then to be quickly placed in position beneath the wire gauze under the upturned end of the specimen support so that one edge of the flame is in line with the upturned end of the wire gauze and the other edge of the flame extends into the front end of the specimen. See Figure 12.2.

Note: The center of the width of the wing tip is to be in line with the longitudinal axis of the specimen.

12.5.6 The flame is to be applied for 60 ±1 seconds and then removed from the specimen a distance of 100 mm or greater. Simultaneously start a timing device with the removal of the test flame.

12.5.7 Start another timing device when the flame reaches the 25 mm gauge mark, whether the flame is on the bottom, top or edge of the specimen.

Note: Always start the second timing device when the flame reaches the 25 mm gauge mark, regardless of whether the 60 second flame is still being applied.

12.5.8 Record the time to the nearest second when:

a) The flaming ceases (afterflame).

b) The flaming plus glowing ceases (afterglow).

c) The flaming or glowing front reaches the 125 mm gauge mark, or when the specimen ceases to burn or glow before the 125 mm gauge mark.

12.6 Test results

12.6.1 For specimens considered for Class HBF, the following are to be observed and recorded:

a) The duration of burning (t_b) (sec), between the 25 mm until flaming or glowing stops or passes the 125 mm gauge mark, as recorded by the third timing device.

b) The distance the specimen burned (L_b) (mm), between the 25 mm gauge mark and where flaming or glowing stops, or up to the 125 mm mark, and if the 125 mm mark was reached.

c) The calculated Burning Rate from the formula:

$$BR = 60\left(\frac{L_b}{t_b}\right)$$

in which:

BR = burning rate expressed in mm/min

12.6.2 For specimens considered for Class HF-1 or HF-2, the following are to be observed and recorded:

a) The time recorded in 12.5.8.

b) The distance the specimen burned up to the 60 mm mark, or if the 60 mm mark was passed.

c) Whether or not the dry absorbent surgical cotton placed below the test specimen was ignited by flaming particles.

Figure 12.1
Foam support fixture

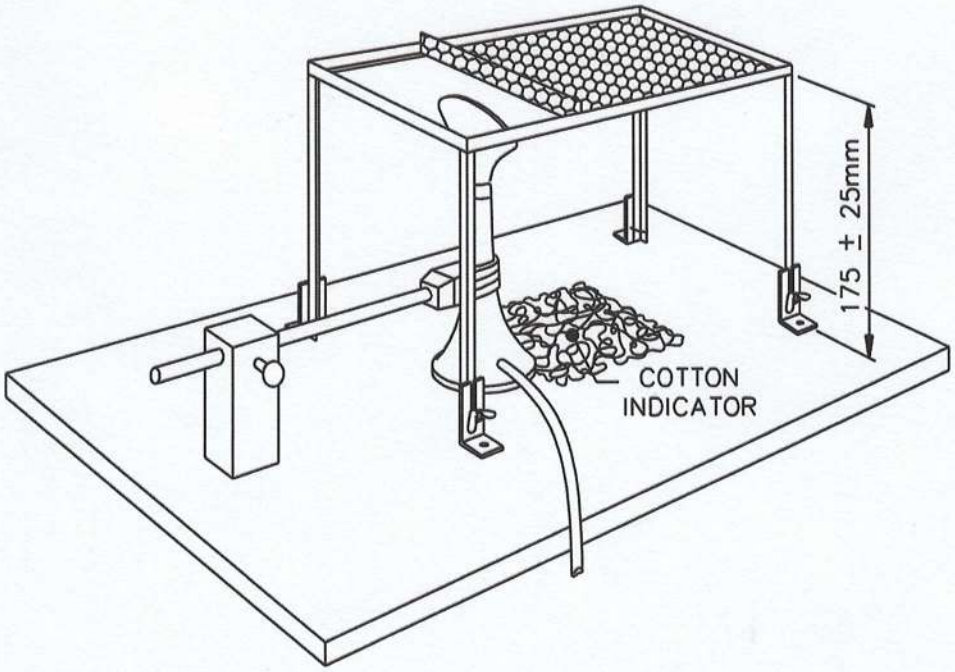

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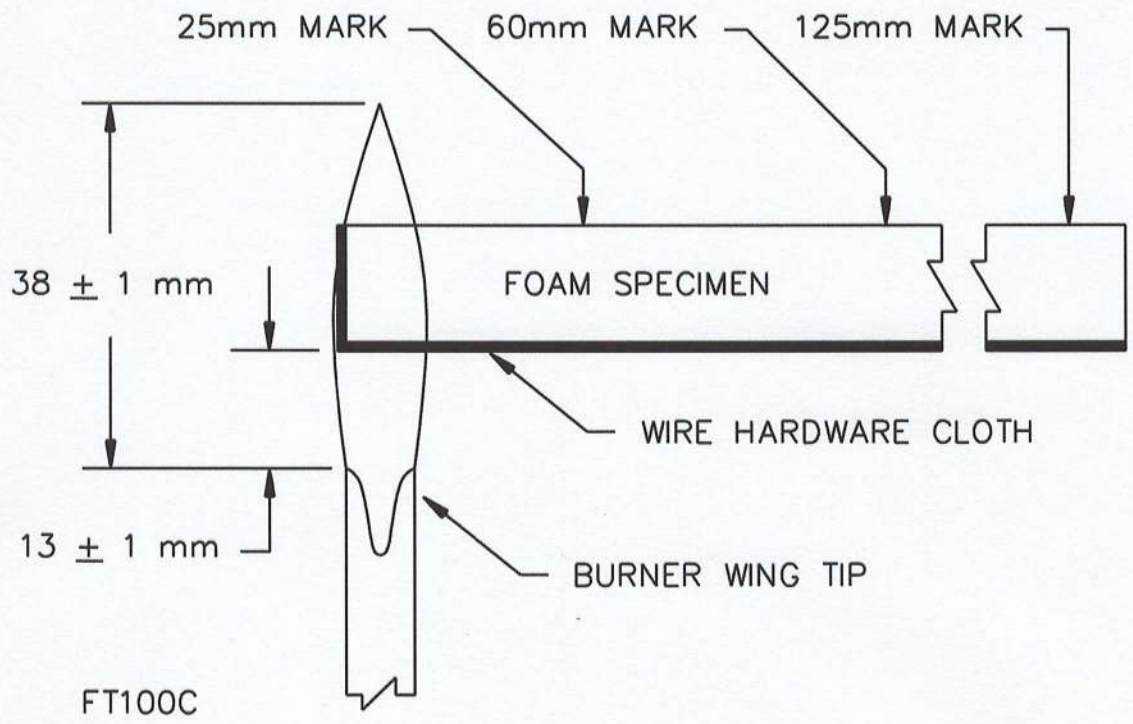
Figure 12.2
Horizontal burning test for HBF, HF-1, OR HF-2 classification



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