

FLAMMABILITY TEST FOR AUTOMOTIVE INTERIOR MATERIALS**Application**

This test procedure is used to determine the burn rate of automotive interior materials, component parts and portions of components and composites and substitute (surrogate) plaques as defined in the U.S. Federal Motor Vehicle Safety Standard No. 302 and/or the more stringent requirement such as DNI (Does Not Ignite), etc. sometimes imposed by Ford Motor Company upon the material for specific application.

Apparatus Required**Horizontal Flammability Cabinet** (See Sketch 1)*

Constructed as described below to meet US-FMVSS No. 302. The cabinet is made of stainless steel. For observation purposes it is fitted with a flame resistant glass door extending over the whole of the front side and sealed with an asbestos strip. For ventilation the cabinet has a 13 mm clearance space around the top of the cabinet, ten 19 mm diameter holes in the base of the cabinet and legs to raise the bottom of the cabinet by 9.5 mm. Inside the test cabinet - parallel to the longer sides and centrally located - is a specimen holder support for guiding the specimen holder into the correct position. On its narrower side the cabinet has an opening for introducing the specimen holder with the fitted test specimen and on the other side a suitable opening for the gas burner connection.

Note: A tray is placed on the base plate in the space between the rows of ventilation holes to catch the material dripping off. The tray has a maximum width of 80 mm, a length of 350 mm and a rim of 10 mm in height on the longer sides.

Specimen Holder (See Sketches 2a, b and c)*

The specimen holder consists of two matching U-shaped stainless steel frames. The lower frame is provided with a cover plate and handle which, when the specimen holder is fully pushed in, covers the opening in the cabinet side. In order to ensure an even fit, the lower frame is provided with pins. These pins are so placed, as to serve also as measuring marks in the timing procedure of the test.

For undersized test specimens or those which soften and bend away from the horizontal at the flaming end during the test, use a top and bottom frame as shown in Sketches 2a and 2c respectively.

Burner (positioning of burner in the cabinet, see Sketch 1)

A bunsen burner or equivalent with a regulator valve and an inner diameter of 9.5 mm for initiating burning.

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Stop Watch

Accuracy - 0.5 seconds.

Gas

Natural gas mixture (typically 34×10^6 to 41×10^6 J/m³) or equivalent.

Metal Comb

A metal comb 100 mm wide with 7 to 8 smooth rounded teeth/25 mm.

Fume Cabinet

Test cabinet shall be placed in a fume cabinet with minimum dimensions: 100 cm high, 100 cm wide and 50 cm deep. The hood shall have an adjustable exhaust system. During test, the door of the fume cabinet shall normally be kept open approximately 55 cm. Air flow should not be adjusted any higher than is necessary to prevent smoke and fumes from entering room.

*Deviating constructions of the test cabinet and the specimen holders must meet the US-FMVSS No. 302 requirements and need written approval of the Materials Development Laboratory, Product Engineering.

Sample Selection and Preparation

1. Large Parts

Specimen Size

In all cases the largest possible sample size is to be cut from the component up to the standard specimen of 100 x 355 mm x thickness. The thickness of the specimen is that of the material as utilized in the vehicles except where it exceeds 13 mm and in those applications the specimen is to be cut down to a uniform thickness of 13 mm to include face side. Where it is not possible to obtain a flat specimen because of component configuration, the specimen is cut to no more than 13 mm in thickness at any point, from the area with the least curvature, by mechanically removing layers from the underside in such a manner as to include the face side. The maximum available length or width of a specimen is used where either dimension is less than 355 x 100 mm respectively. However, specimens with a length of less than 150 mm shall not be tested. In this case, surrogate testing shall be performed according to para 2.

Selection of Specimen

The materials evaluated to this test method shall be as follows:

- (a) **Surface Materials** taken separately shall meet the requirements; except when surface materials are completely bonded to one or more substrate materials, the assembly shall meet the requirements.

- (b) **Composites** consisting of the surface material and underlying materials, including padding and cushioning materials, as they appear in the vehicle, to a depth of 13 mm.
- (c) All padding and cushioning materials taken separately, if they are not completely bonded to the other materials.

The sample location in any composite or material shall be that which produces the most adverse burn rate. This is normally the location that has the thinnest cross-section, the lowest density, and/or the deepest pattern.

The sample direction for burning shall be that which produces the most adverse burn rate. The most adverse burn direction shall be determined by testing the material in the transverse and longitudinal directions. The surface of the specimen closest to the occupant compartment air space should be face downwards on the test frame.

Special Surface Preparation

Material with a napped or tufted surface is placed on a flat, hard surface and combed twice against the pile with the comb.

2. Small Parts

Components, portions of components and composites less than 150 mm in their longest direction.

A substitute (surrogate) test plaque specimen made with a composition identical to that of the component material(s) shall be produced in the shape of a rectangle 100 mm wide, 355 mm long and the minimum thickness of the component up to 13 mm maximum or as specified in the individual Engineering Material Specification, employing the same or equivalent process as used to produce the component part.

Conditioning and Test Conditions

All test values indicated herein are based on material conditioned in a controlled atmosphere of 23 +/- 2 °C and 50 +/- 5 % relative humidity for not less than 24 h prior to testing and tested under the same conditions unless otherwise specified.

Where the test cannot be conducted at 23 +/- 2 °C and 50 +/- 5 % relative humidity, it must be ensured that the conditioned specimen will be flammability tested immediately after removal from the conditioning room chamber.

Test Procedure

1. The test specimens are mounted in the specimen holder as indicated below tested in the direction that produces the most adverse results with surface of the test specimen closest to the occupant compartment air space facing downwards on the test frame.
 - (a) The standard test specimen (100 x 355 mm x thickness) with 4 matching holes for the lower frame pins is inserted between the two matching U-shaped frames so that both sides of the specimen are held by the frames and the one end of the specimen is even with the open end of the frame. The temperature of the specimen holder at the start of each test shall be 23 +/- 2 °C.
 - (b) Where the maximum available width of the specimen is less than 50 mm so that the sides of the specimen cannot be held in the two matching U-shaped frames, it is to be supported by the bottom wired frame (see Sketch 2c) and positioned in its centre.

Tests are to be performed with the U-shaped frame assembled to the bottom wired frame.
 - (c) Test specimens that soften and bend at the flaming end so as to cause a non-uniform, uneven burn rate, shall be kept horizontal by the use of the bottom wired frame, as described above in b.
2. With the burner positioned at one end of the cabinet and with the burner air inlets closed, adjust the gas regulating valve to provide a flame 38 mm in height. The burner position should be checked to insure that the centre of the burner tip is 19 mm below the centre of the bottom edge of the open end of the specimen.
3. Insert the mounted specimen by pushing it gently along the holder support into the cabinet and into contact with the flame.
4. Expose the specimen to the flame for 15 seconds, then extinguish the burner flame.
5. From the time of initial burner flame contact with the specimen, observe for any rapid burning or flame foot progression from across the material's top or bottom surface.

Begin timing (without reference to the period of application of the burner flame) when the foot of flame from the burning specimen reaches the first measuring mark (38 mm from the open end of the specimen).

Note: Caution should be taken to avoid inhalation of combustion products.
6. Measure the time that it takes the foot of flame to progress to the second measuring mark 38 mm from the clamped end of the top or bottom U-shaped frame.
7. If the flame extinguishes itself before reaching the second measuring mark, time its progress to the point where flaming stops and measure the furthest distance burned.
8. Use the following definitions to report complete flammability results as illustrated in the following sketch.