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AN2-1

FORD MOTOR COMPANY  
QUALITY LABORATORY & CHEMICAL ENGINEERING  
CHEMICAL METHODS

RESISTANCE OF PLASTIC MATERIALS TO  
HYDROGEN SULFIDE STAINING

Application

This procedure is used for determining the resistance to hydrogen sulfide of vinyls, plastics, welts, etc.

Apparatus Required

Hydrogen sulfide cylinder with valve \*

Two two-hole #8 rubber stoppers

Two 38 x 200 mm Corning glassware test tubes, or equivalent

Glass tubing, cotton packing, plastic tubing and pinch clamp, per attached sketch

Stopwatch

AATCC Chart for measuring transference of color \*\*

Rack or fixture to hold above apparatus

\* Lecture bottle of hydrogen sulfide and valve may be purchased from the Matheson Co., East Rutherford, N. J.

\*\* Available from the American Association of Textile Chemists & Colorists, Research Triangle Park, P. O. Box 886, Durham, North Carolina.

Procedure

1. Apparatus is to be assembled per attached sketch and used under a fume hood.
2. Place a 2 in. by 2 in. sample in Tube "B" which has been previously dried and is free of residual moisture.
3. Add 50 cc tap water to Test Tube "A". Stopper test tubes per the attached sketch.
4. Open hydrogen sulfide cylinder valve and remove pinch clamp from exhaust hose on Tube "B". Adjust valve so hydrogen sulfide gas

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July 6, 1965 (Revised)

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CHARDO 01103

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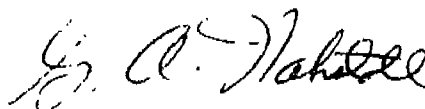
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QUALITY LABORATORY & CHEMICAL ENGINEERING  
CHEMICAL METHODS

RESISTANCE OF PLASTIC MATERIALS TO  
HYDROGEN SULFIDE STAINING

Procedure (Cont'd)

entering Tube "A" bubbles through at a controlled uniform rate so that moisture is not carried into Tube "B". Allow gas to flow through system for 1-1/2 min.

5. Close hydrogen sulfide cylinder valve and replace pinch clamp on Tube "B" exhaust hose.
6. Allow to stand for 2 min.
7. Remove stopper Tube "B" and take out sample.
8. Compare the relative color change with the use of the AATCC Color Chart and report per the Engineering specification.



Merle F. Valade, Manager

Chemical & Metallurgical Dept.  
Quality Control Office

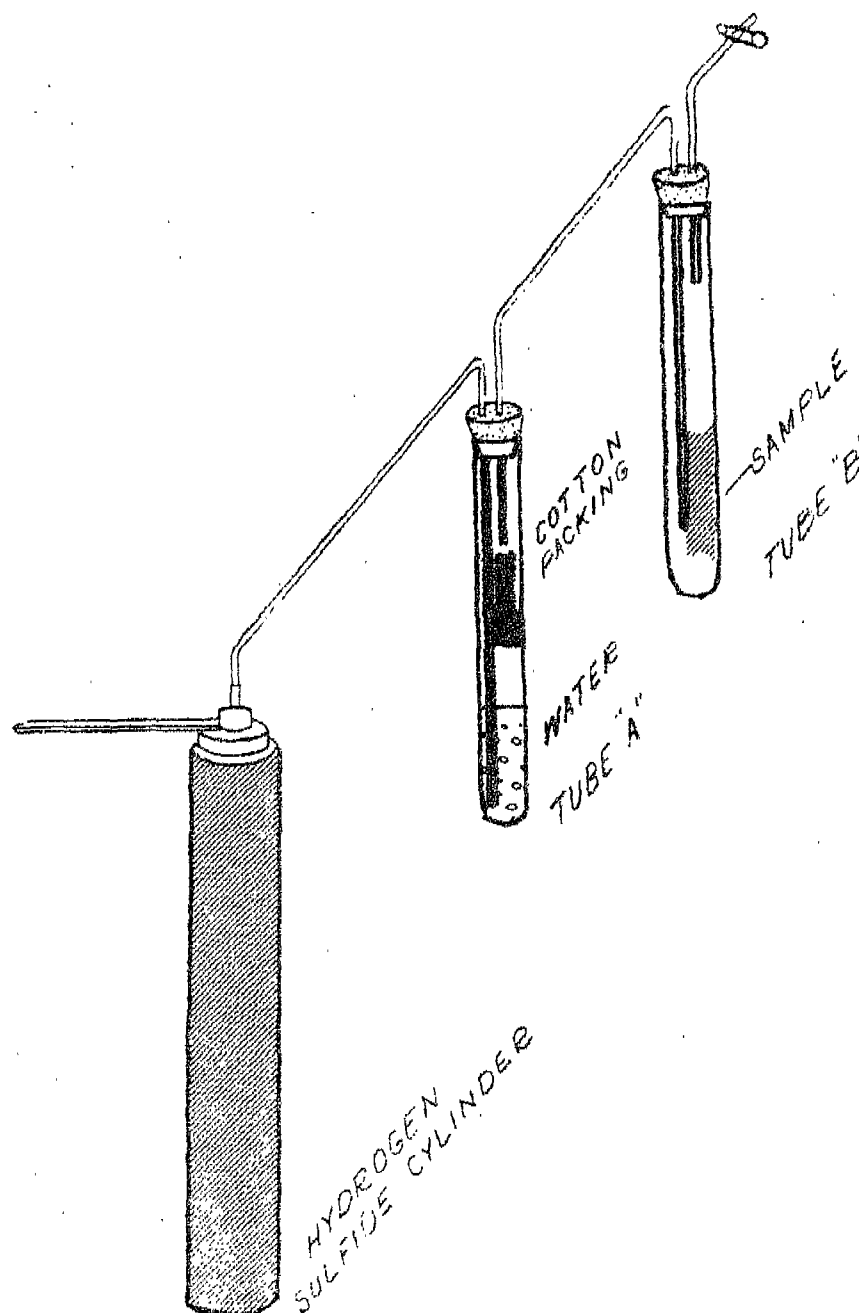
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CHEMICAL METHODS

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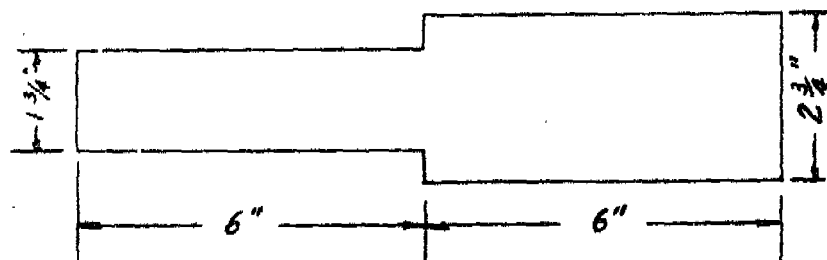
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Supplement No. 2

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PHYSICAL TEST METHODS

RESISTANCE TO WET FADE

Procedure (Cont'd)

to the warp.



3. Mount the specimen in the sample holder with the face side exposed to the arc.
4. Fill the water tank to within 1/2 in. of the top with deionized water and allow the narrow end of the specimen to hang freely in the water during exposure. The water level shall be maintained at the prescribed depth for the duration of the test and the tank cleaned when sediment begins to accumulate.
5. Expose the test specimen for the number of standard hours specified by the material standard.

*Merle F. Valade*  
Merle F. Valade, Manager

Chemical & Metallurgical Dept.  
Quality Control Office

February 8, 1960

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QUALITY LABORATORY & CHEMICAL ENGINEERING  
PHYSICAL TEST METHODS

RESISTANCE TO WET FADE

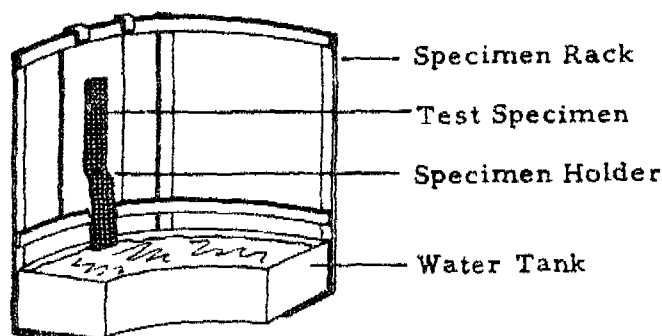
Application

This procedure is used to determine the resistance to wet fade of fabrics such as bodycloth and headlining materials by simulating outdoor exposure conditions of high humidity, high temperature and sunlight.

Apparatus Required

Water Supply Tank

A stainless steel tank 2-1/2 in. wide, 4 in. deep and having a convenient length is required for immersion of the sample during exposure. The tank should have the same radius as the inside of the rotating specimen rack and is attached to the rack by means of hooks welded to the tank. (See sketch.)



Specimen Holder

The specimen holder, Type SL-LSR, may be obtained from the Atlas Electric Devices Co. The exposure area of the holder is 1-3/4 in. by 5 in.

Procedure

1. Assemble the water tank to the rotating specimen rack.
2. Cut the test specimen as shown with the long dimension parallel

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**MF-MH**  
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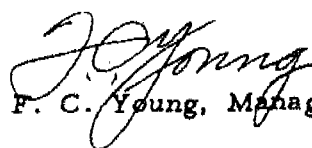
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QUALITY LABORATORY & CHEMICAL ENGINEERING  
PHYSICAL TEST METHODS

COLD FLEXIBILITY TEST FOR GENUINE  
AND ARTIFICIAL LEATHER

Procedure (Cont'd)

2. After oven conditioning, remove the test specimen and allow to remain at room temperature for 2 hr to attain moisture equilibrium. \*
3. Next, place the test specimen, mandrel and cloth gloves in the cold box at -30 F for 24 hr (unless material specification indicates otherwise). \*
4. At the end of the 24 hr in the cold box, open the door, put on the gloves, grasp the test specimen in both hands and bend finish side out, as quickly as possible, 180 deg. around the mandrel.
5. Examine for and report any cracks which may occur in the leather, coating or welt.

\* Note: In Steps 1, 2 and 3 above, suspend the test specimen in the oven, air and cold box so that there will be free circulation of air around the test specimen, and check the air surrounding the sample for proper temperature. This will result in better duplication of test results, as some ovens and cold boxes vary in temperature, especially near heating and cooling coils.

  
F. C. Young, Manager

Chemical & Metallurgical Dept.  
Quality Control Office

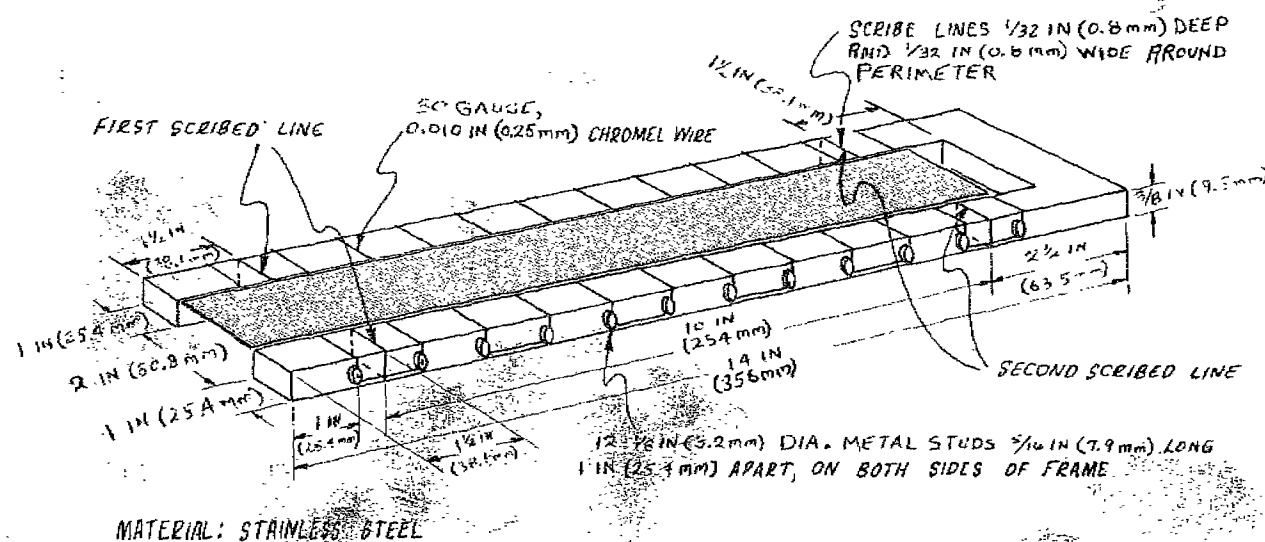
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**Figure 5: BOTTOM U-SHAPED WIRED FRAME (USED FOR SPECIMENS THAT ARE TWO INCHES OR LESS IN WIDTH OR THAT BURN NON-UNIFORMLY)**

Used in conjunction with either frame shown in figure #3.



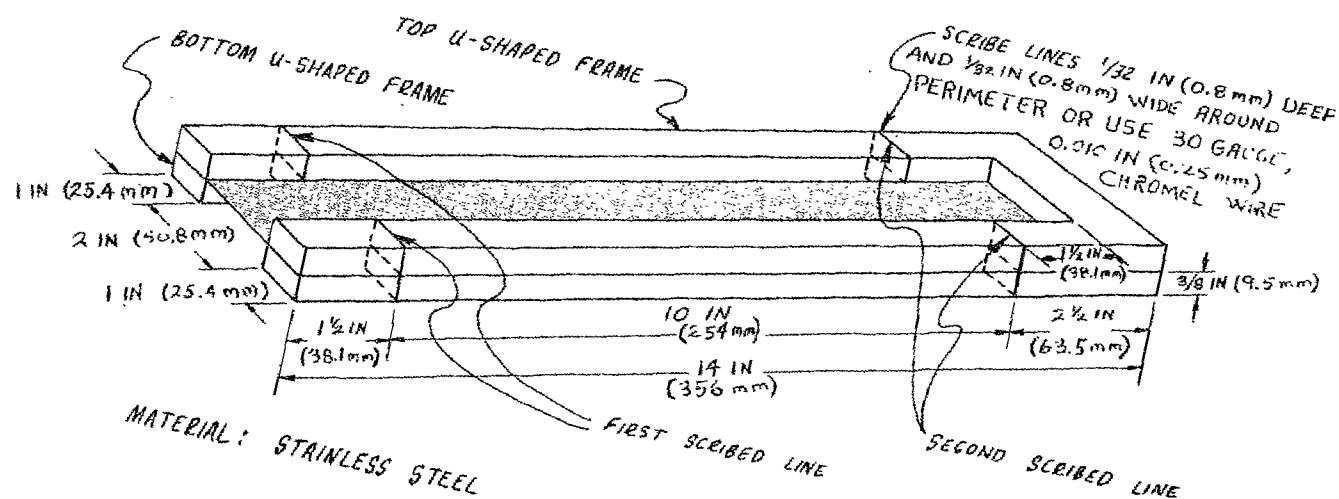


Ford Laboratory Test Methods

FLAMMABILITY TEST FOR AUTOMOTIVE INTERIOR MATERIALS

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Figure 4: SPECIMEN HOLDER—CONSISTING OF TWO IDENTICAL U-SHAPED FRAMES

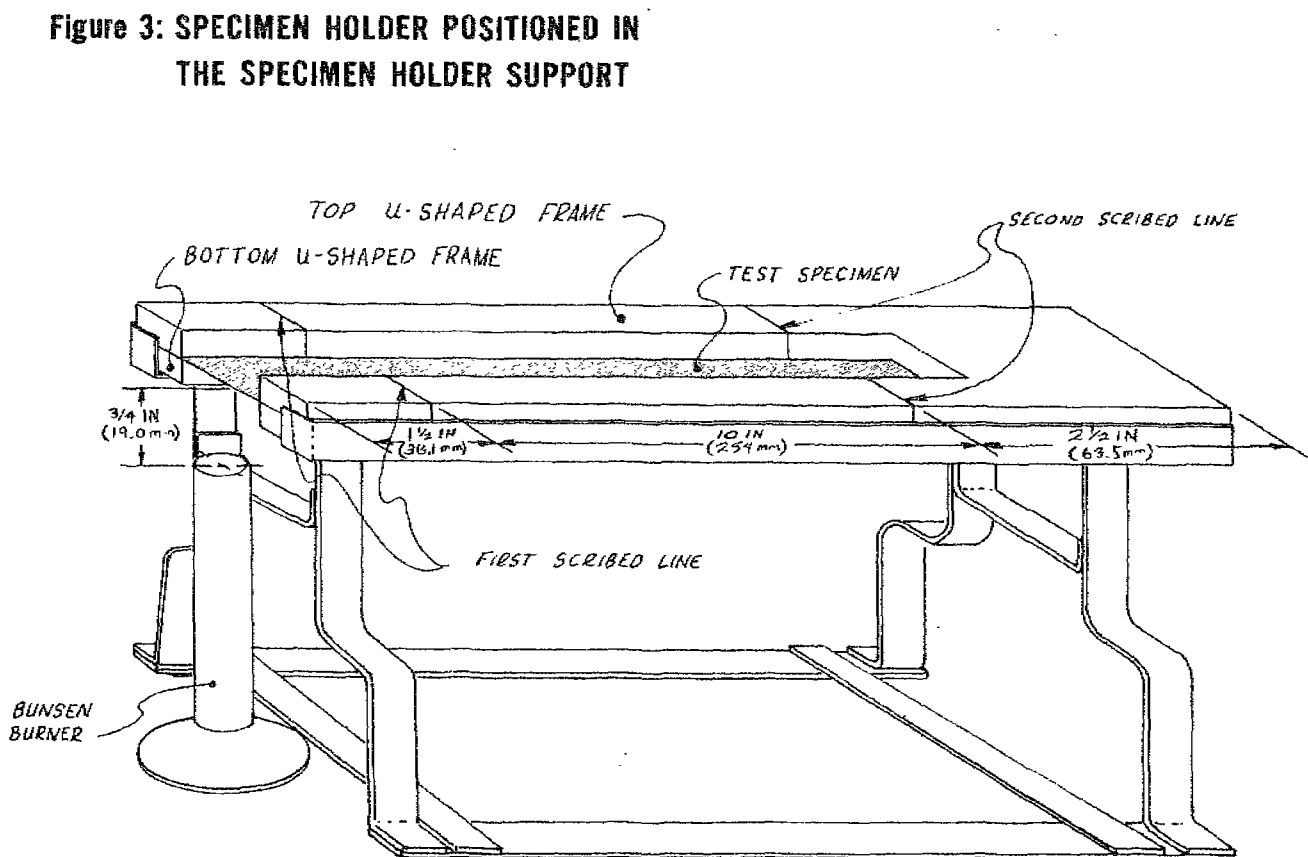


Manufacturing Staff  
March 9, 1979

Printed in U.S.A.

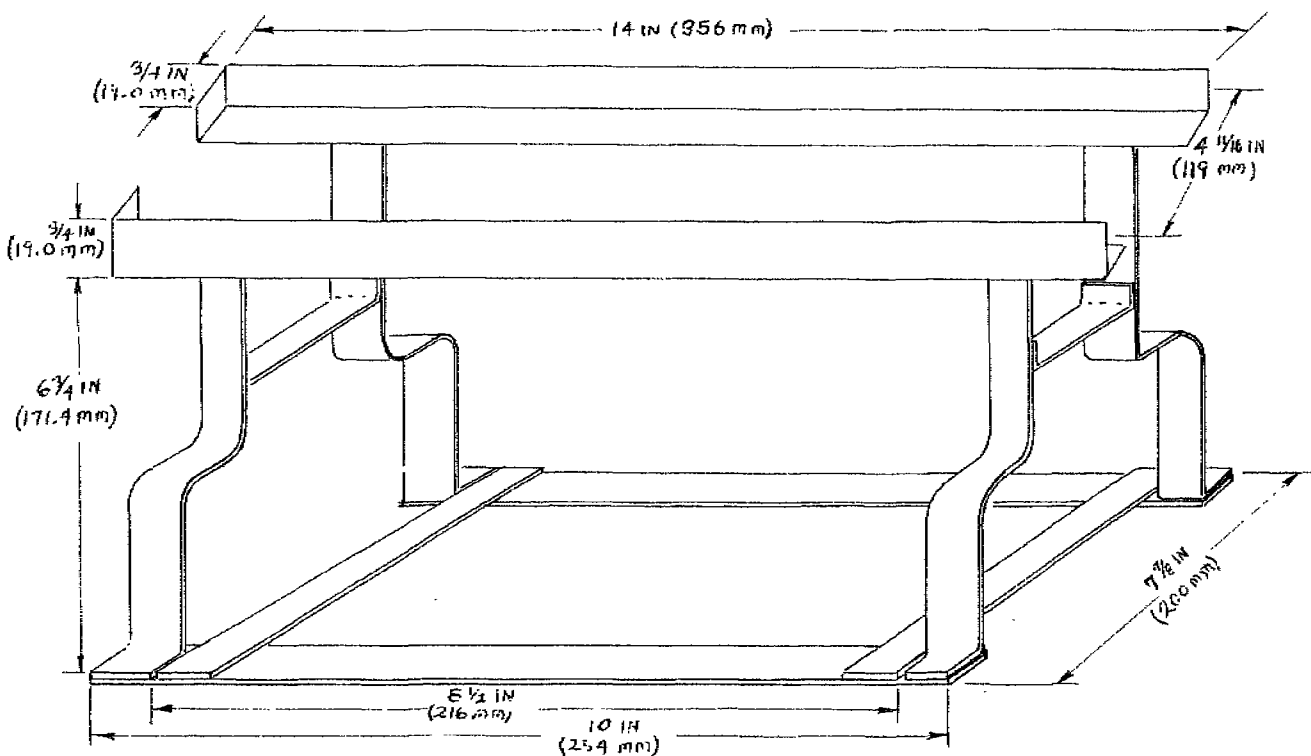
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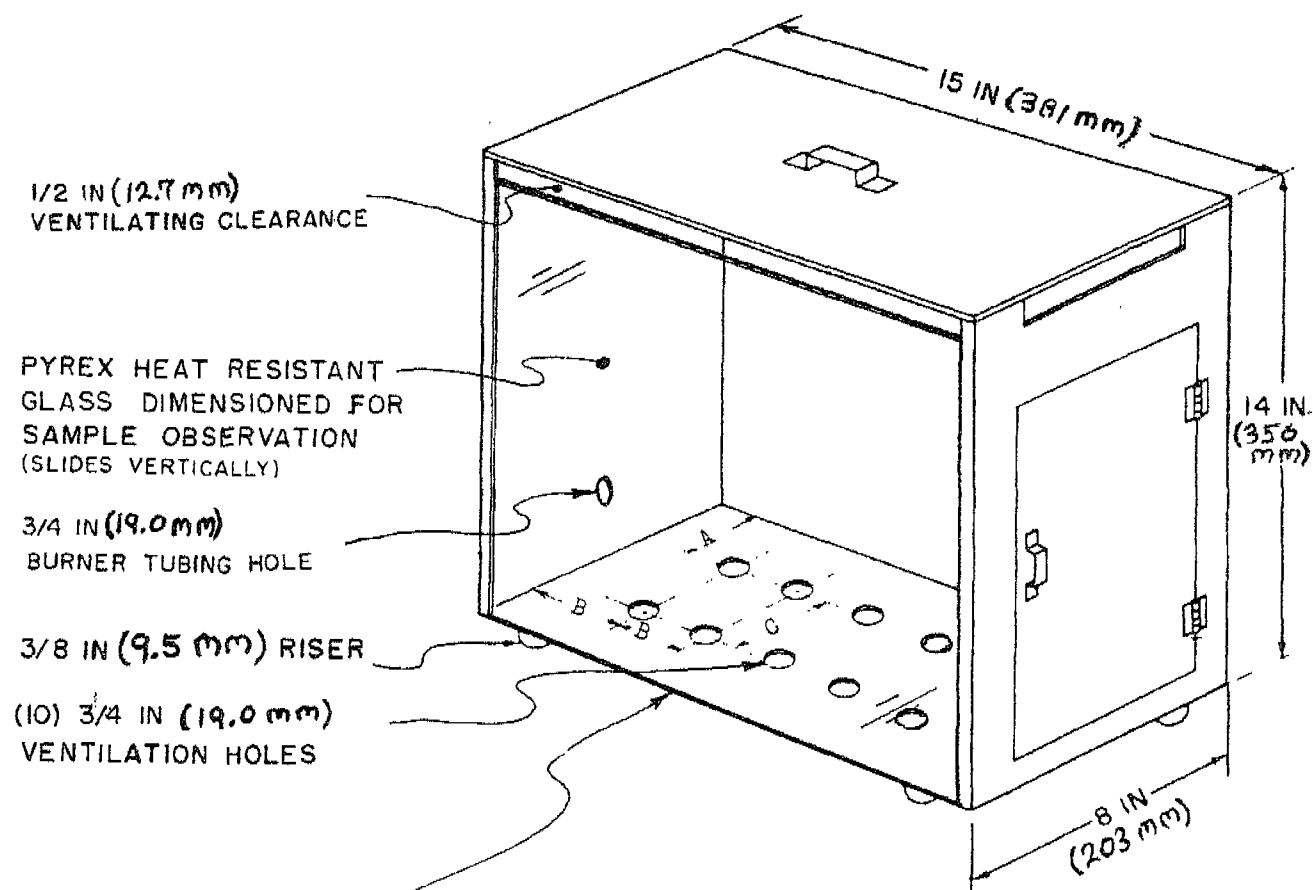


FLAMMABILITY TEST FOR AUTOMOTIVE INTERIOR MATERIALS



ALL MEMBERS TO BE  $\frac{3}{4}$  IN (19.0 mm) WIDE BY  $\frac{1}{8}$  IN (1.6 mm) THICK  
TYPICAL MATERIAL: STAINLESS STEEL

**Figure 1: HORIZONTAL FLAMMIBILITY CABINET**



TYPICAL MATERIAL:

CR. STEEL .050 IN (1.3 mm) THICK

**NOTE:** INTERIOR DIMENSIONS  
(See par. S5.1.1 of FMVSS 302)

|   |                    |
|---|--------------------|
| A | 1 1/8 in (33.1 mm) |
| B | 2 1/2 in (63.5 mm) |
| C | 5 in (127.0 mm)    |

FLAMMABILITY TEST FOR AUTOMOTIVE INTERIOR MATERIALSBURN RATE ACCEPTANCE CHARTMAXIMUM BURN RATE (INCHES / MIN)

|                                  |     |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                                  | 3.6 | 3.4 | 3.2 | 3.0 | 2.8 | 2.6 | 2.4 | 2.2 | 2.0 | 1.8 | 1.6 |     |
| MINIMUM BURN RATE (INCHES / MIN) |     |     |     |     |     |     |     |     |     |     |     |     |
| Sample Size                      | 4   | 3.4 | 3.0 | 2.7 | 2.4 | 2.1 | 1.7 | 1.4 | 1.1 | 0.8 | 0.4 | 0.2 |
|                                  | 6   | 3.0 | 2.4 | 1.9 | 1.4 | 0.9 | 0.3 | 0   | 0   | 0   | 0   | 0   |
|                                  | 8   | 2.5 | 1.7 | 0.9 | 0.2 | 0   | 0   |     |     |     |     |     |
|                                  | 10  | 1.9 | 0.9 | 0   | 0   |     |     |     |     |     |     |     |
|                                  | 12  | 1.4 | 0   |     |     |     |     |     |     |     |     |     |

MAXIMUM BURN RATE (MILLIMETERS / MIN)

|                                       |    |    |    |    |    |    |    |    |    |    |    |
|---------------------------------------|----|----|----|----|----|----|----|----|----|----|----|
|                                       | 91 | 86 | 81 | 76 | 71 | 66 | 61 | 56 | 50 | 46 | 41 |
| MINIMUM BURN RATE (MILLIMETERS / MIN) |    |    |    |    |    |    |    |    |    |    |    |
| 4                                     | 86 | 76 | 69 | 61 | 53 | 43 | 36 | 28 | 20 | 10 | 5  |
| 6                                     | 76 | 61 | 48 | 36 | 23 | 8  | 0  | 0  | 0  | 0  | 0  |
| 8                                     | 64 | 43 | 23 | 5  | 0  | 0  |    |    |    |    |    |
| 10                                    | 48 | 23 | 0  | 0  |    |    |    |    |    |    |    |
| 12                                    | 36 | 0  |    |    |    |    |    |    |    |    |    |

NOTE: This is not a sequential sampling plan and once a sampling size has been selected and tested, the results are final. If maximum-minimum burn rates do not comply with the charted requirements, additional sampling is not valid unless physical material revisions are made.



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FLAMMABILITY TEST FOR AUTOMOTIVE INTERIOR MATERIALSTest Procedure (contd.)

The following information shall be written on or attached to form  
BAE 7183:

- (a) The size of the sample and the method of measuring the burn rate when the sample is less than standard length.
- (b) A description (sketch) of where the test sample was removed from the part if the location can affect the burn rate.
- (c) List the referenced "like parts" and blueprint date, (i.e., when test data is utilized to certify more than one part).
- (d) A description of all deviations from this procedure including required referenced material.

C. C. Hascall, Manager  
Chemical & Metallurgical Dept.  
Product Quality Office



FLAMMABILITY TEST FOR AUTOMOTIVE INTERIOR MATERIALS

Test Procedure (contd.)

10. Calculate and record the burn rate for the conditions SE/B (paragraph d) and B (paragraph e) from the formula

$$\text{Burn Rate (B)} = 60 \times \frac{D}{T}$$

Where B = Burn rate in inches (millimeters) per minute  
(rounded to one decimal)

D = Length the flame travels in inches (millimeters)  
(rounded to one decimal)

T = Time in seconds for the flame to travel  
"D" inches (millimeters)

11. Flammability Burn Rate Acceptance Chart (formerly titled "Lot Sampling Plan")

- (a) The Flammability Burn Rate Acceptance Chart is to be employed for certification to FMVSS No. 302 of Original, unaged materials only. Materials aged in accordance with ESB-M25P3 are not evaluated by the Burn Rate Acceptance Chart.
- (b) The supplier will take a random sample of specimens of material and determine the burn rate. The randomness of the sample must be assured by strict adherence to the standard rules of sampling.
- (c) The maximum burn rate and the minimum burn rate are selected from the data and compared with the Flammability Burn Rate Acceptance Chart to ascertain either acceptance or rejection of the material.
- (d) For any given sample size and maximum burn rate, the chart on page 9 reflects the minimum burn rate allowable.

e.g. - If one of the pieces in a sample size of 6 has a burn rate of 3.0 in (76 mm), the remaining five test samples must reflect burn rates from 1.4 in (36 mm) to 3.0 in (76 mm).

12. Presentation of Data

For Engineering Certification to F/CMVSS 302, report the maximum burn rate on the original (sheet #1) signed and dated copy of form BAE 7183. In addition, the remaining burn rates that represent the supplier's lot sampling selection are to be reported on the same sheet. The maximum burn rate must always be reported on the face of the original signed copy, whereas the remaining burn rates shall be reported on the reverse side of the original BAE 7183 form. All recorded burn rates are thus retained on the original signed copy. Testing performed on surrogate plaques must be so identified on form BAE 7183 under paragraph 2.0 Part II - Flammability Test Results - Requirements S4.

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### FLAMMABILITY TEST FOR AUTOMOTIVE INTERIOR MATERIALS

#### Test Procedure (contd.)

#### REPORT RESULTS AS FOLLOWS:

- (a) Does Not Ignite (DNI). The material does not support combustion during or following the 15 second ignition period and does not transmit a flame from across either surface to the first scribed line. (No Calculation Required) DNI  
0 in/minute
- (b) Self-Extinguishing (SE). The material ignites on either surface, but the flame extinguishes itself before reaching the first scribed line. (No Calculation Required) SE  
0 in/minute
- (c) Self-Extinguishing/No-Burn Rate (SE/NBR). The material stops burning before it has burned for 60 seconds from the start of timing, and has not burned more than two (2) inches (50 mm) from the point where timing was started. (No Calculation Required) SE/NBR  
(note)

NOTE: Burn rates for these sample specimens should not be calculated. Instead, the burn rate assigned will be the minimum burn rate from the remaining sample specimens calculated in categories 9 (d) or (e) below or 2 inches (50 mm) per minute whichever is the lesser. If all sample specimens selected are this classification, the lot shall be reported as accepted.

- (d) Self-Extinguishing with a Burn Rate in Inches (Millimeters)/Minute (SE/B). When the leading flame front on either surface progresses beyond the first scribed line, but extinguishes itself before reaching the second scribed line; time and measure its progress to the furthest point where burning stops and calculate and report the burn rate only if the burn distance exceeds 2 inches (50 mm) or the burn time is 60 seconds or greater. SE/B  
Calculate  
Burn Rate
- (e) Burn Rate in Inches (Millimeters)/Minute (B). The material burns the full 10 inches (250 mm). B  
Calculate  
Burn Rate
- (f) Rapid Burning (RB). The material transmits a flame across either surface more than 2 inches (50 mm) beyond the first scribed line at a rate greater than 4 inches (100 mm)/minute and too fast to measure accurately; therefore, no calculation is required. Examples of materials in this category are extremely thin films which burn rapidly, or napped surfaces which "flash". RB  
Over 4 in  
(100 mm)/min

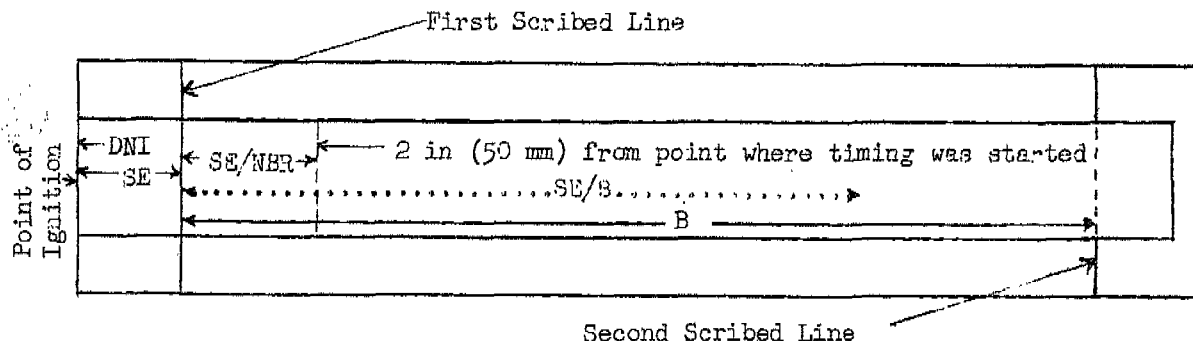
NOTE: Rapid burning of a surface created by cutting the specimen to the 1/2 in (12.7 mm) maximum dimension does not constitute a failure. The requirement concerning transmission of a flame front shall not apply to a surface created by the cutting of a test specimen.

FLAMMABILITY TEST FOR AUTOMOTIVE INTERIOR MATERIALSTest Procedure (contd.)

3. 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 1-1/2 in (37.7 mm) in height. The burner position should be pre-determined to insure that the center of the burner tip is 3/4 in (19.0 mm) below the center of the bottom edge of the open end of the specimen (See Figure 3).
4. Place the mounted specimen and the stand in the horizontal position into the cabinet and into contact with the flame.
5. Expose the specimen to the flame for 15 seconds, then extinguish the burner flame or remove the burner from the specimen.
6. From the time of initial burner flame contact with the specimen, observe for any rapid burning or flame front progression from across the material's top or bottom surface. Begin timing (without reference to the 15 second burner flame application) when the leading flame front reaches the first scribed line 1-1/2 inches (37.7 mm) from the open end of the top or bottom U-shaped frame (see Figure 4). If the leading flame front progresses more than two (2) inches (50 mm) beyond the first scribed line at such a rapid rate that it cannot be measured with any degree of accuracy, the material shall be reported as Rapid Burning.

NOTE: Caution should be taken to avoid inhalation of combustion products.

7. Measure the time that it takes the leading flame front to progress to the second scribed line 1-1/2 inches (37.7 mm) from the clamped end of the top or bottom U-shaped frame (see Figure 4).
8. If the leading flame front extinguishes itself before reaching the second scribed line, time its progress to the point where flaming stops and measure the furthest distance burned.
9. Use the following definitions to report complete flammability results as illustrated in the following sketch.





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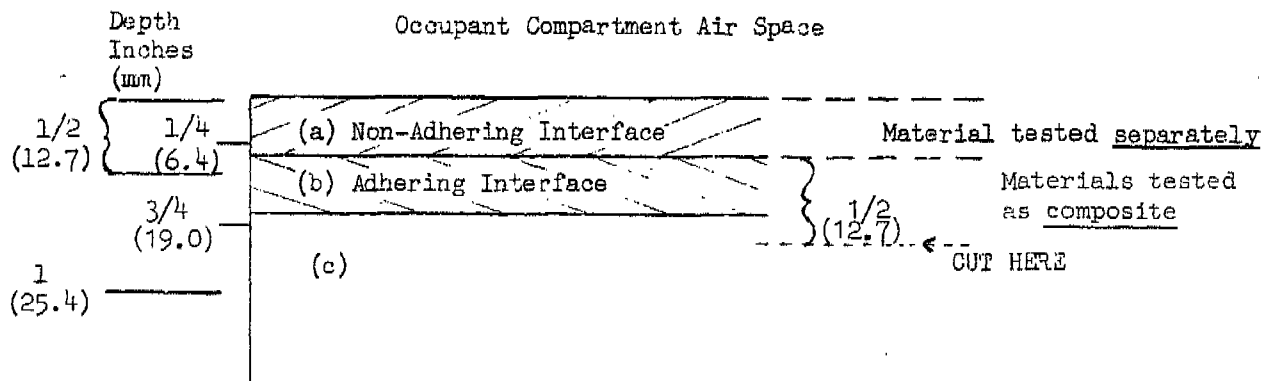
### FLAMMABILITY TEST FOR AUTOMOTIVE INTERIOR MATERIALS

#### II. Small Parts (contd.)

A 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 4 inches (100 mm) wide, 14 inches (356 mm) long and the minimum thickness of the component up to 1/2 inch (12.7 mm) maximum, employing the same or equivalent process as used to produce the component part. The thickness of the plaque is that of the material as utilized in the vehicle except where it exceeds 1/2 inch (12.7 mm). In those applications, the plaque is to be reduced to a uniform thickness of 1/2 inch (12.7 mm) to include the surface material exposed to the occupant compartment air space.

#### Test Procedure

1. Prior to testing, each specimen is conditioned for 24 hours at a temperature of  $73.4 \pm 3.6^{\circ}\text{F}$  ( $23.0 \pm 2.0^{\circ}\text{C}$ ) and  $50 \pm 5\%$  relative humidity and the test is conducted under those conditions.
2. Material is placed in the specimen holder as indicated below and tested in the direction (transverse or longitudinal) that produces the most adverse results. The specimen is oriented so that the surface closest to the occupant compartment air space faces downward on the test frame.
  - (a) The standard test specimen (4 x 14 in (100 x 356 mm) x thickness) is inserted between two matching U-shaped frames (specimen holder) so that both sides of the specimen are held by the frames. The temperature of the frame in Figure 4 at the start of each test shall not exceed the conditioned temperature as stated above in Paragraph 1 of Test Procedure.
  - (b) Where the maximum available width of the specimen is 2 in (50 mm) or less so that the sides of the specimen cannot be held in the two matching U-shaped frames, it is to be supported by the use of 10 mil (0.25 mm) wires spanning the top surface of the bottom U-shaped frame at 1 in (25 mm) intervals, keeping such specimens from bending away from the horizontal at the flaming end, thereby allowing a more uniform and constant burn rate (see Figure 5). The bottom U-shaped frame shall always be positioned so that the wires are "sandwiched" between the top and bottom frames.
  - (c) Samples tested with support wires: Flexible specimens, such as genuine leather, supported and unsupported vinyls, textile and backing fabrics, foams, textile padding, rubber compounds, etc., that frequently soften and bend at the flaming end so as to cause a non-uniform, uneven burn rate.  
 Samples tested without wires: Less flexible materials such as paper-board, carpets, rigid plastics, etc., seldom soften and bend at the flaming end; therefore, do not justify or necessitate support wires.
  - (d) Adjust ventilation hood door opening to approximately 23 in (580 mm) and regulate ventilation up to 110 CFM ( $0.052 \text{ m}^3/\text{s}$ ) maximum air flow to prevent smoke and fumes from entering room.

FLAMMABILITY TEST FOR AUTOMOTIVE INTERIOR MATERIALSSample Selection and Preparation (contd.)Illustrative Example

Material (a) has a non-adhering interface with material (b) and is tested separately. Part of material (b) is within 1/2 inch (12.7 mm) of the occupant compartment air space, and materials (b) and (c) adhere at every point of contact: therefore, (b) and (c) are tested as a composite. The cut is in material (c) as shown, to make a specimen 1/2 inch (12.7 mm) thick.

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 so that the surface closest to the occupant compartment air space faces downward 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 nap with the comb.

II. Small Parts

Components, portions of components and composites less than 6 inches (150 mm) in their longest dimension.

FLAMMABILITY TEST FOR AUTOMOTIVE INTERIOR MATERIALSApplication

This procedure establishes a uniform method of determining the burn rate of automotive materials, component parts, portions of parts, composites and surrogate plaques used in passenger cars, multipurpose passenger vehicles, trucks and buses as defined in the Federal Motor Vehicle Safety Standard No. 302 (\*), Canadian Motor Vehicle Safety Standard No. 302 (\*), Engineering Design and Test Standard DD O.OO-127 (\*), and/or the more stringent requirement such as DMI (Does Not Ignite), etc., sometimes imposed by Ford Motor Company upon the material for specific applications.

\* Current date in effect.

Apparatus RequiredBurner

Tirrill, Bunsen or equivalent, with a regulator valve, 3/8 inch inside diameter tube. VWR Scientific Catalog #17920-003.

Burner Fuel

Natural gas mixture (typically 900-1100 BTU/ft<sup>3</sup> (33.5-40.9 MJ/m<sup>3</sup>)) or equivalent.

Horizontal Flammability Equipment

See Figures 1 through 5, or Model 7636A, U.S. Testing Company, 1415 Park Avenue, Hoboken, New Jersey 07030.

Ventilated Hood

Cabinet shall be placed in a ventilated hood approximately 41 in (1040 mm) high, 44 in (1120 mm) wide and 22 in (560 mm) deep. The hood shall have an exhaust fan capable of producing approximately 110 CFM (0.052 m<sup>3</sup>/s) air flow.

Specimen Holder Support

The specimen holder shall be supported horizontally so that the top of the burner tube is 3/4 in (19 mm) below the top surface of the bottom U-shaped frame when positioned in the specimen holder support (see Figures 2 and 3).

Specimen Holder

Specimen holder consists of two identical U-shaped metal frames made from chromium or nickel plated steel or other non-corroding metal (see Figure 4). Where an Umpire Test is required, steel holders must be used. For undersized specimens, a bottom U-shaped wired frame shall be used (see Figure 5).

Environmental Controls

The laboratory shall have the capability of conditioning test specimens at a temperature of  $73.4 \pm 3.6^\circ \text{F}$  ( $23.0 \pm 2.0^\circ \text{C}$ ) and a relative humidity at  $50 \pm 5\%$ .



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### FLAMMABILITY TEST FOR AUTOMOTIVE INTERIOR MATERIALS

#### Apparatus Required (contd.)

#### Instrumentation

- . Combing device consisting of a comb 4 in (100 mm) wide with 7 to 8 smooth rounded teeth per inch (25 mm)
- . Stop watch or timing device capable of recording time to 0.1 seconds.
- . Hygrometer
- . Thermometer
- . 12 inch scale with 0.1 inch graduations (300 mm scale with 1.0 mm graduations).

#### Sample Selection and Preparation

#### I. 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 4 x 14 in (100 x 356 mm) x thickness. The thickness of the specimen is that of the material as utilized in the vehicle except where it exceeds 1/2 in (12.7 mm) and in those applications, the specimen is to be reduced to a uniform thickness of 1/2 in (12.7 mm) to include face side. Where it is not possible to obtain a flat specimen because of component configuration, the specimen is cut to not more than 1/2 in (12.7 mm) in thickness at any point, from the area with the least curvature and 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 14 in (356 mm) or 4 in (100 mm) respectively.

#### 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 one-half inch.
- (c) All padding and cushioning materials taken separately, regardless of their attachment to each other, to other underlying materials, or to surface materials.