NFPA 261

Standard Method of Tests for Determining Resistance of Mock-Up Upholstered Furniture Material Assemblies to Ignition by Smoldering Cigarettes

1998 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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This edition of NFPA 261, *Standard Method of Test for Determining Resistance of Mock-Up Upholstered Furniture Material Assemblies to Ignition by Smoldering Cigarettes,* was prepared by the Technical Committee on Fire Tests and acted on by the National Fire Protection Association, Inc., at its Annual Meeting held May 18–21, 1998, in Cincinnati, OH. It was issued by the Standards Council on July 16, 1998, with an effective date of August 5, 1998, and supersedes all previous editions.

This edition of NFPA 261 was approved as an American National Standard on August 6, 1998.

Origin and Development of NFPA 261

Regulation of the manufacture of furniture has been a subject of research and debate since 1967, when the Flammable Fabrics Act was amended by Congress to include products in addition to wearing apparel and home textiles that might constitute an unreasonable flammability risk. The National Bureau of Standards (NBS) began funding laboratory research on the subject in 1968. With its formation in 1973, the U.S. Consumer Product Safety Commission (CPSC) became the government agency responsible for administration of the Flammable Fabrics Act, including the adoption of any program or standard regulating upholstered furniture. NBS retained responsibility for designing test methods related to flammable fabrics.

In 1976, NBS submitted a draft to the CPSC for a proposed cigarette-ignition resistance standard for upholstered furniture. Shortly thereafter, however, CPSC was reorganized into separate program areas, which was followed by nearly a year's worth of work on its children's sleepwear standards due to findings that a chemical added to sleepwear to make it flame retardant might be carcinogenic. In November 1978, the CPSC staff, after modifying the original standard on upholstered furniture proposed by NBS, recommended to the CPSC commissioners that they publish the standard.

This standard was developed subsequent to the CPSC actions of 1978–79 by the Technical Committee on Fire Tests and drew heavily on the NBS research and proposed test methodology. The first edition, published in 1983, was identified as NFPA 260B. The 1989 edition was a reconfirmation of the first edition and was renumbered as NFPA 261.

The 1994 edition represented a reconfirmation of the 1989 edition with minor editorial clarifications.

The 1998 edition is a reconfirmation of the 1994 edition. Minor editorial revisions were made to conform with the NFPA *Manual of Style*.

Technical Committee on Fire Tests

Jesse J. Beitel, *Chair*
Hughes Assoc. Inc., MD [SE]

April L. Berkol, ITT Sheraton Corp., NY [U]
Rep. American Hotel & Motel Assn.
John A. Blair, The DuPont Co., DE [M]
Rep. Society of the Plastics Industry Inc.
William P. Chien, State of New York Dept. of Fire Prevention & Control, NY [E]
William E. Fitch, Omega Point Laboratories Inc., TX [RT]
Sam W. Francis, American Forest & Paper Assn., PA [M]
Thomas W. Fritz, Armstrong World Industries Inc., PA [M]
James R. Griffith, Southwest Research Inst., TX [RT]
Marcelo M. Hirschler, GBH Int'l, CA [SE]
Alfred J. Hogan, Reedy Creek Improvement District, FL [E]
Rep. Fire Marshals Assn. of North America
Karl D. Houser, Gypsum Assn., DC [M]
William E. Koffel, Jr., Koffel Assoc. Inc., MD [SE]
James R. Lawson, U.S. Nat'l Inst. of Standards & Technology, MD [RT]
Gerald E. Lingenfelter, American Ins Services Group Inc., NY [I]
William S. Metes, Underwriters Laboratories Inc., IL [RT]
George E. Meyer, Warnock Hersey, Inc., CA [RT]
John W. Michener, Milliken Research Corp., SC [M]
Rep. American Textile Mfrs. Inst. Inc.
James A. Milke, University of Maryland, MD [SE]
James C. Norris, Union Carbide Corp., TN [M]
John Roberts, Underwriters Laboratories of Canada, ON, Canada [RT]
T. Hugh Talley, Hugh Talley Co., TN [M]
Rep. Upholstered Furniture Action Council
David K. Tanaka, Factory Mutual Research Corp., MA [I]
Richard P. Thornberry, The Code Consortium, Inc., CA [SE]
Robert J. Wills, American Iron & Steel Inst., AL [M]
Peter J. Gore Willse, Industrial Risk Insurers, CT [I]
Rep. Industrial Risk Insurers

Alternates

Delbert F. Boring, Jr., American Iron & Steel Inst., OH [M]
(Alt. to R. J. Wills)
Tony Crimi, Underwriters Laboratories of Canada, ON, Canada [RT]
(Alt to J. Roberts)
Philip J. DiNenno, Hughes Assoc. Inc., MD [RT]
(Alt. to J. J. Beitel)
Richard G. Gann, U.S. Nat'l Inst. of Standards and Technology, MD [RT]
(Alt. to J. R. Lawson)
Richard D. Gottwald, Society of the Plastics Industry Inc., DC [M]
(Alt. to J. A. Blair)
Marc L. Janssens, Southwest Research Inst., TX [RT]
(Alt. to J. R. Griffith)
Gene V. Paolucci, Yasuda Fire & Marine Insurance Co. of America, NY [I]
(Alt. to G. E. Lingenfelter)
R. Joseph Pearson, Inchcape Testing Services NA Inc., NY [RT]
(Alt. to G. E. Meyer)
William A. Thornberg, Industrial Risk Insurers, CT [I]
(Alt. to P. J. G. Willse)
James J. Urban, Underwriters Laboratories Inc., IL [RT]
(Alt. to W. S. Metes)
Kay M. Villa, American Textile Mfrs. Inst. Inc., DC [M]
(Alt. to J. W. Michener)
Joe Ziolkowski, American Furniture Mfrs. Assn., NC [M]
(Alt. to T. H. Talley)

Nonvoting

Robert H. Barker, American Fiber Mfrs. Assn., DC [M]
(Alt. to T. L. Jilg)
James F. Hoebel, U.S. Consumer Product Safety Commission, MD
Tod L. Jilg, Hoechst Celanese Corp., NC [M]
Rep. to American Fiber Mfrs. Assn.
Herman H. Spaeth, Novato, CA
(Member Emeritus)

Walter P. Sterling, NFPA Staff Liaison

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1998 Edition

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Appendix A.

Information on the referenced publication can be found in Appendix C.

Chapter 1 General

1-1 Scope. This method is recommended for upholstered furniture.

1-1.1 This test shall apply to upholstered furniture mock-ups.

1-1.2 Mock-up testing is useful in assessing the relative resistance to continuing combustion of individual materials used in furniture such as cover fabrics, filling materials, and welt tape in realistic combinations and in an ideal geometric arrangement of the seat cushions, back, and arms of furniture items.

1-2 Purpose. This test method is designed to evaluate the ignition resistance of upholstered furniture when exposed to smoldering cigarettes under specified conditions.

1-3 Summary of Method.

1-3.1 The test shall use lighted cigarettes covered with a piece of sheeting material to determine the ignition resistance of upholstered furniture items reproduced in mock-up.

1-3.2 Locations to be tested shall include the following:

(a) Horizontal crevices formed where seat cushions and vertical test panels meet
(b) Seat cushion surfaces including smooth surface, quilt, tuft, and welt edges
(c) Top surfaces of armrests, back, and loose seat support systems *[see Figures 1-3.2(a) and (b)]*

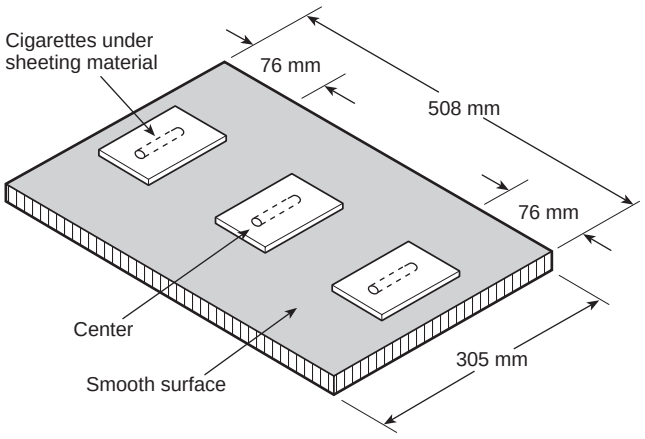

Figure 1-3.2(a) Upholstered furniture mock-up test: armrest, top of back, and seat support system.

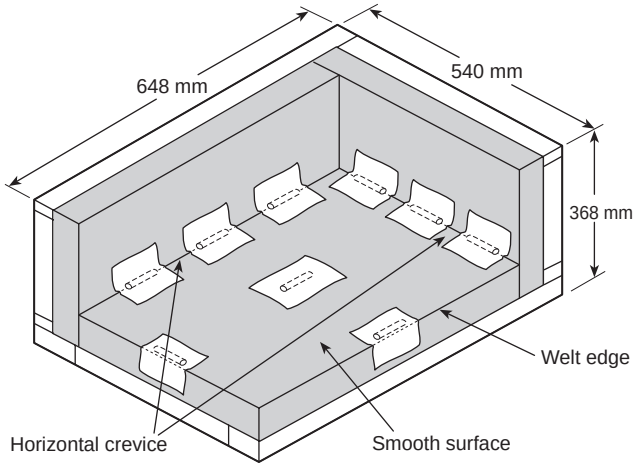

Figure 1-3.2(b) Upholstered furniture mock-up test: seat cushion, side, and back.

1-3.3 Obvious ignitions or char length measurements shall be used to determine if a particular combination of upholstering materials meets test criteria.

1-4 Significance.

1-4.1 This method is intended to measure the performance of upholstered furniture under conditions of exposure to a smoldering cigarette. This shall be accomplished by testing furniture mock-ups.

1-4.2 This method shall not be used to measure the performance of upholstered furniture under conditions of open flame exposure and does not indicate whether the furniture will resist the propagation of flame under severe fire exposure or when tested in a manner that differs substantially from this test standard.

1-4.3 The results obtained with a material assembly that is tested in mock-up using this method shall not necessarily indicate the performance of the same material assembly in other geometric configurations.

1-5 Definitions.

Bolsters. Pillows or similarly shaped units containing upholstery material covered by upholstery cover material, which might or might not be attached to the upholstered furniture item but are sold and delivered with it.

Char. Carbonaceous material formed by pyrolysis or incomplete combustion.

Deck. The upholstered support under the seat cushion in a loose seat construction.

Furniture Mock-Up. A representation of production furniture that uses the same upholstery cover material and upholstery material, assembled in the same manner as in production furniture but with straight, vertical sides.

Quilted. Fused or stitched with thread through the upholstery cover material and through one or more layers of upholstery material.

Shall. Indicates a mandatory requirement.

Should. Indicates a recommendation or that which is advised but not required.

Tufted. Buttoned or laced through the upholstery cover material and through the upholstery material.

Upholstered Furniture. For the purpose of this test method, a unit of interior furnishing that has any surface covered, in whole or in part, with a fabric or related upholstery cover material, contains upholstery material, and is intended or promoted for sitting or reclining.

Upholstery Cover Material. The outermost layer of fabric or related material used to enclose the main support system, upholstery materials, or both, used in a furniture item.

Upholstery Material. The padding, stuffing, or filling material used in a furniture item, which can be either loose or attached, enclosed by an upholstery cover material, or located between the upholstery cover material and support system, if present. This definition includes, but is not limited to, material such as foam, cotton batting, polyester fiberfill, bonded cellulose, or down.

Welt. The seam or border edge of a cushion, pillow, arm, or the back of an item.

Chapter 2 Test Apparatus

2-1 Mock-Ups. Mock-up elements for the mock-up test jigs shall be constructed as illustrated in Figures 2-1(a), (b), and (c). Figures 1-3.2(a) and (b) show the completed mock-up assemblies.

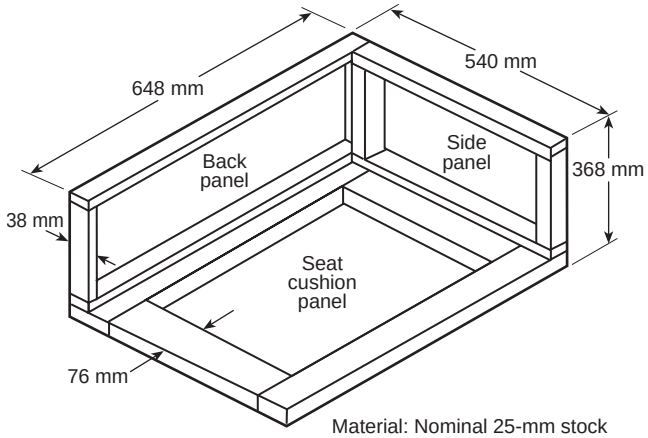

Figure 2-1(a) Frame for upholstered furniture mock-up test.

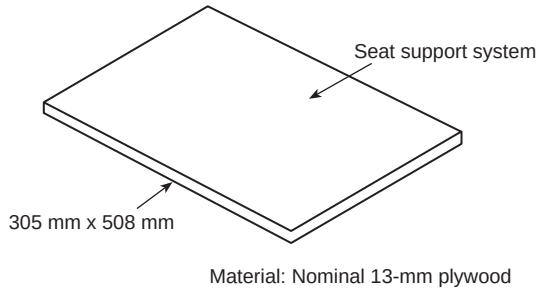

Figure 2-1(b) Armrest and top of back mock-up test.

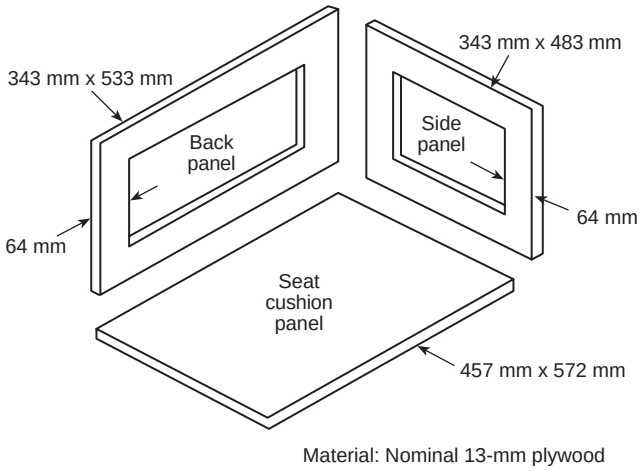

Figure 2-1(c) Panels for upholstered furniture mock-up test.

2-2* Ignition Sources. The ignition sources for the test shall be cigarettes without filter tips, made from natural tobacco, 85 mm ± 2 mm long with a packing density of 0.270 g/cm^3 ± 0.020 g/cm^3, and a total weight of 1.1 g ± 0.1 g. The smoldering rate of this cigarette shall be 0.10 mm/sec ± 0.01 mm/sec when the cigarette is allowed to burn downward in a draft-protected area.

2-3 Sheeting Material. The sheeting material used to cover the test cigarettes shall be 50 percent cotton/50 percent polyester or 100 percent cotton bed sheeting material, and shall weigh 125 g/m^2 ± 28 g/m^2. The material shall be laundered in an automatic home clothes washing machine and dried in a tumble dryer at least once before use. For testing, the sheeting material shall be cut into pieces approximately 125 mm × 125 mm.

2-4 Test Area. The test room shall be draft-protected and equipped with a suitable system for exhausting smoke and noxious gases produced during testing.

2-5 Extinguishing Equipment. A pressurized water fire extinguisher or other suitable fire extinguishing equipment shall be immediately available. A water bottle fitted with a spray nozzle shall be provided to extinguish any ignited portions of the mock-up. A bucket of water shall be provided for immersing smoldering or burning materials removed from the mock-up.

2-6 Miscellaneous. Other apparatus required to carry out the testing shall include the following: straight pins, a knife or scissors, tongs, and a linear scale at least 150 mm long and graduated in millimeter divisions.

Chapter 3 Conditioning

3-1 General. Test samples, cigarettes, and sheeting material shall be conditioned at a temperature of 23°C ± 5°C and at a relative humidity of 50 percent ± 5 percent for at least 48 hours immediately prior to testing. If the test room conditions do not meet the above specifications, then testing shall be initiated within 10 minutes after the materials are removed from the conditioned room. The mock-up assembly shall be constructed in the conditioned area.

Chapter 4 Test Specimens

4-1 General. Furniture mock-ups shall be created by arranging upholstery cover material and upholstery materials in the same sequence in which they are used in production furniture.

The various parts of the mock-up shall be constructed as described in Sections 4-2 through 4-7. In all cases, the arrangement and thickness of upholstery material in the mock-up shall reproduce the construction details of production furniture.

4-2 Loose Seat Cushions.

4-2.1 Seat cushions shall be made in the same size and manner and with the same material as production furniture.

Exception: Cushions 680 mm × 550 mm shall be permitted to be used if production furniture cushion dimensions exceed these values.

4-2.2 The cushion thickness shall be a maximum of 130 mm.

4-3 Decks. Decks shall be prepared, if they are part of the furniture item, by attaching the same materials with the same thickness as used in actual furniture construction to the horizontal panel *[see Figure 2-1(b)]* of the test apparatus. The decking or the upholstery cover material shall be stretched over the upholstery materials and securely fastened to the underside of the wood panel.

4-4 Tight Seat. If a furniture item is constructed with tight seats only, then the seat shall be duplicated for test in mock-up. Tight seat cushions shall be made 450 mm ± 50 mm × 550 mm ± 50 mm and with the same fabric and the same thickness used in production furniture. The cushion assembly shall be attached to the horizontal panel of the test apparatus *[see Figure 2-1(c)]* by extending the upholstery cover material around the panel edges and fastening the cover material to the underside of the wood panel.

4-5 Side and Back Panels. A mock-up of furniture sides and backs shall be constructed if, in the type of furniture to be represented by the mock-up, the sides and backs are located within 25 mm of a seat cushion. Mock-ups shall be made by upholstering one surface of the vertical test panel *[see Figure 2-1(c)]* with the same upholstery material and upholstery cover material used in production furniture. The upholstery cover material shall be stretched over the upholstery material and fastened to the back side of the framework. All edges of the panels shall be covered with upholstery cover material. If the side panel and back panel constructions of the furniture item are the same, only one vertical panel shall be required to be assembled and tested.

4-6 Bolsters. Bolsters resting on the seat cushion or suspended above it tend to confine the heat from the cigarette and often create a spatial arrangement that differs from the crevice space found in production furniture. In such cases, a mock-up bolster shall be prepared with dimensions that fit into the mock-up to create the same spatial arrangement for the cigarette as in production furniture.

4-7 Armrests and Tops of Backs. Tops of armrests and backs shall be tested if (1) they present a surface large enough and so oriented as to support a cigarette and (2) if the construction differs in any way from the side panel and back panel constructions. Tops of armrests and backs shall be made by upholstering a piece of 1.3-cm-thick plywood, approximately 30 cm × 50 cm, with the same materials used in the furniture item. The mock-up shall reproduce significant details of the construction of full-size furniture.

Chapter 5 Testing Procedures

5-1 Mock-up Test Sample. A mock-up test sample shall be assembled by attaching the side panel, back panel, or both, to the mock-up frame and by placing a seat cushion, either loose or tight seat construction, against the panels as shown in Figure 1-3.2(b). The assembly shall be permitted to be placed on a table or platform in the test area and shall be under an exhaust hood or other suitable means for exhausting the products of combustion from testing. The decks for loose cushion items, tops of armrests, and tops of backs shall be tested separately.

5-2 Cigarette Locations. At least three cigarettes shall be burned on each surface location *[see Figures 1-3.2(a) and (b)]*. These locations shall include the crevice(s) where seat cushions and vertical panels meet; seat cushion surfaces, including welt and smooth, quilted, or tufted areas; top of upholstered armrest; and tops of upholstered back and deck.

5-3 Crevice Location. For crevice locations, the two cigarettes on either side of the center cigarette shall be placed in the crevice so that their butt ends burn out at least 75 mm from the outermost edge of the side of the back panel. The cigarettes shall be placed horizontally. Two of the three cigarettes shall be placed so that their entire length burns out against the welt cord and the vertical panel surface. The third cigarette shall be placed so that its entire length burns out against the welt cord and a horizontal surface of the seat cushion.

5-4 Test Cigarette. Each test cigarette shall be well-lighted and burned not more than 4 mm when placed at a specific test location. After placement, each cigarette shall be covered with a piece of sheeting material. For crevice tests, one end of the sheeting material shall be pinned to the vertical panels approximately 50 mm above the cigarette and the remaining material dropped to completely cover the test cigarette. For all tests, proper sheeting material-to-cigarette contact shall be ensured by running a finger across the full length of the covered cigarette.

5-5 Seat Cushion.

5-5.1 For the test of either loose or tight seat cushions, three covered cigarettes shall be burned on each different surface location encountered.

5-5.2 For the purposes of this test, smooth surfaces, welt edges, fused or threaded portions of quilts, and tuft depressions shall be considered different surface locations on a seat cushion. Test cigarettes shall be arranged so that the butt ends burn out on the threads of a quilt or in tuft depressions. The smooth surface of a quilted or tufted cushion shall not be required to be tested. For smooth surface cushions, the test cigarettes shall be burned in the center of the cushion.

5-6 Number of Test Cigarettes. Three test cigarettes shall be burned on each horizontal mock-up test panel duplicating armrests, tops of backs, and seat cushion support systems. One cigarette shall be burned at the center of the panel, and the other two shall be burned at least 75 mm from the edges of the test panel. Refer to Figure 1-3.2(a) for the location of the cigarettes on the test panels.

5-7 Test Acceptance. A test at any location shall be considered complete if any of the following occurs:

(a) Three cigarettes in a given location have burned their full lengths without sustained ignition.

(b) Three cigarettes in a given location have self-extinguished before burning their full lengths.
(c) Three cigarettes in a given location sustained ignition.

5-8 Ignition. If continuing ignition occurs (i.e., fabric and filling materials are ignited and are smoldering and generating smoke at a rapid rate), it shall not be a requirement to wait until a cigarette has burned its full length; the test shall be stopped and the burning material extinguished. The test room shall be ventilated and an ignition shall be recorded for the cigarette test location.

5-9 Char Length Measurement.

5-9.1 If the cigarette burns to completion at a test location, the maximum char length in any direction of any material, from the point nearest to the original location of the cigarette, shall be measured.

5-9.2 Cigarette Ignition Results.

5-9.2.1 The char length measurement for each cigarette shall be recorded.

Exception: When the cigarette has extinguished without burning to completion or where continuous combustion occurs.

5-9.2.2 If the char from one cigarette runs into the char from another, the results of the test shall be invalid and the test shall be repeated, burning one cigarette at a time.

5-9.2.3 All mock-ups shall be disassembled. When disassembling the apparatus, if it is shown that smoldering is still in progress, the test shall be invalid and shall be repeated.

5-10 Testing Environment. The test shall be carried out in a draft-protected area. The maximum airflow across the sample face shall be less than 15.2 m/min.

Chapter 6 Safety Precautions

6-1 Test Termination. A test shall be stopped as soon as continuing combustion has definitely occurred.

CAUTION

Even under the most carefully observed conditions, smoldering combustion can progress to a point where it cannot be readily extinguished.

The exposed area shall be immediately wetted with a water spray from the water bottle, the charred or burned material shall be removed, and the material shall be immersed in a bucket of water. The test area shall be ventilated.

6-2* Exposure. Test personnel shall avoid exposure to smoke and gases produced during testing as much as possible. A large hood with a low air velocity shall be permitted to be in operation during testing to remove products of combustion.

Chapter 7 Report

7-1 Reporting. The maximum char distance measured to the nearest 5 mm from the center of the original location of the test cigarette shall be recorded for each cigarette location.

Exception: When a continuing combustion occurs, an ignition shall be recorded for the test location.

Appendix A Explanatory Material

Appendix A is not a part of the requirements of this NFPA document but is included for informational purposes only. This appendix contains explanatory material, numbered to correspond with the applicable text paragraphs.

A-2-2 With the cigarette supported at the bottom in a vertical position, the burning rate is determined in the region of 10 mm to 50 mm measured from the top.

A-6-2 Products of combustion can be physically irritating and dangerous to test personnel.

Appendix B Commentary

This appendix is not a part of the requirements of this NFPA document but is included for informational purposes only.

B-1 Introduction. The test for determining the smoldering cigarette ignition resistance of mock-up furniture material assemblies was developed by the National Bureau of Standards with the cooperation of various industry groups and individuals. The work was done in response to data indicating that cigarette ignition of upholstered furniture is a major cause of life loss due to fire in the United States.

B-2 Nature of Test.

B-2.1 Upholstered furniture consists of upholstery cover fabric and interior filling/padding components such as foam, polyester, or cotton batting. Often a welt cord is attached to the pillow and other edges of the upholstery. These materials are arranged in complex geometrical forms, including flat, tufted, convex, concave, and horizontal and vertical surfaces. Both the combination of fabric and filling/padding materials and their geometrical arrangement affect their propensity to ignite when exposed to burning cigarettes.

B-2.2 Originally, an attempt was made to develop separate tests for each of the component materials: fabric, filling/padding, and welt cord. It soon became obvious that there was considerable interaction among these components, and it was decided that they would have to be tested in the combination in which they would be used in actual furniture. However, to avoid the cost and effort required to build prototype furniture for each combination of materials, the test is limited to a simple mock-up of the seating surface and vertical members, with the fabric, filling/padding, and welt cord arranged as in the proposed construction of actual furniture.

B-3 Experimental Studies. In a controlled study, the relationship between the results of the mock-up test and the performance of actual furniture was shown to be very close.

Thirty-eight locations in both mock-up and full-size chairs were tested in each of three laboratories for a total of 114 tests. Fourteen out of 114 test locations provided different results for the mock-up than for the actual item of furniture. There was 87 percent agreement.

B-4 Agreement Between Laboratories. In a controlled study, the percentage of agreement between laboratories was high.

More than 2200 tests were conducted on mock-ups in 38 laboratories. One hundred twenty-six test results differed from the majority. There was 94 percent agreement. For additional information, see NBSIR, PFF6-76, "Back-Up Report for the Proposed Standard for the Flammability (Cigarette Ignition Resistance) of Upholstered Furniture."