NFPA®

261

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

2018

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NFPA® 261

Standard Method of

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

2018 Edition

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. It was issued by the Standards Council on November 10, 2017, with an effective date of November 30, 2017, and supersedes all previous editions.

This document has been amended by one or more Tentative Interim Amendments (TIAs) and/or Errata. See "Codes & Standards" at www.nfpa.org for more information.

This edition of NFPA 261 was approved as an American National Standard on November 30, 2017.

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. The NBS retained responsibility for designing test methods related to flammable fabrics.

In 1976, the NBS submitted a draft to the CPSC for a proposed cigarette-ignition resistance standard for upholstered furniture. Shortly thereafter, however, a reorganization of the CPSC into separate program areas took place. That reorganization was followed by nearly a year's worth of work on the commission's 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 the NBS, recommended to the CPSC commissioners that they publish the standard.

This standard was developed by the Technical Committee on Fire Tests subsequent to the CPSC actions of 1978–1979 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 and 1998 editions represented reconfirmation of the standard with minor editorial clarifications and stylistic revisions. For the 2003 edition, the chapter layout of NFPA 261 was reorganized to conform to the *Manual of Style for NFPA Technical Committee Documents*. The 2009 edition contained mainly editorial revisions. The 2013 edition has been revised to reference the SRM 1196 cigarettes, and annex material added to explain the revision.

The 2018 edition includes a new section and annex material on repeatability and precision.

Technical Committee on Fire Tests

Barry L. Badders, Jr., *Chair*
Intertek Testing Services, TX [RT]

Farid Alfawakhiri, American Iron and Steel Institute, IL [M]

James A. Burns, New York State Department, NY [E]
Rep. Firemen's Association of the State of New York

Karen C Carpenter, Southwest Research Institute, TX [RT]

Gordon H. Damant, Inter-City Testing & Consulting Corp. of California, CA [SE]

Rick D. Davis, National Institute of Standards & Technology, MD [RT]

Scott E. Dillon, Crane Engineering, MN [SE]

William E. Fitch, Phyrefish.com, FL [SE]

Richard G. Gann, Gaithersburg, MD [SE]

Marcelo M. Hirschler, GBH International, CA [SE]

Paul A. Hough, Armstrong World Industries, Inc., PA [M]

William E. Koffel, Koffel Associates, Inc., MD [SE]

Sergei V. Levchik, Israel Chemicals Ltd. (ICL-IP), NY [M]
Rep. ACC-North American Flame Retardant Alliance

James Andrew Lynch, The Fire Solutions Group, PA [SE]

John Martell, Professional Fire Fighters of Maine/IAFF, ME [L]
Rep. International Association of Fire Fighters

Rodney A. McPhee, Canadian Wood Council, Canada [M]

Kathleen A. Newman, Firetect, CA [M]

Arthur J. Parker, JENSEN HUGHES, MD [SE]

Michael L. Savage, Sr., City of Rio Rancho, NM [E]

Michael Schmeida, Gypsum Association, OH [M]

David T. Sheppard, U.S. Bureau of Alcohol, Tobacco, Firearms & Explosives, MD [RT]

Dwayne E. Sloan, UL LLC, NC [RT]

Stanislav I. Stoliarov, University of Maryland, MD [SE]

Kuma Sumathipala, American Wood Council, VA [M]

Dong Zeng, FM Global, MA [I]
Rep. FM Global

Alternates

Erik H. Anderson, Koffel Associates, Inc., MD [SE]
(Alt. to William E. Koffel)

Jesse J. Beitel, JENSEN HUGHES, MD [SE]
(Alt. to Arthur J. Parker)

Richard J. Davis, FM Global, MA [I]
(Alt. to Dong Zeng)

Timothy Earl, GBH International, MI [SE]
(Alt. to Marcelo M. Hirschler)

Sam W. Francis, American Wood Council, PA [M]
(Alt. to Kuma Sumathipala)

Stephen Paul Fuss, U.S. Bureau of Alcohol, Tobacco, Firearms & Explosives, MD [RT]
(Alt. to David T. Sheppard)

Justin A. Geiman, Fire and Risk Alliance LLC, MD [SE]
(Alt. to James Andrew Lynch)

Karl Dana Houser, Intertek, PA [RT]
(Alt. to Barry L. Badders, Jr.)

Marc L. Janssens, Southwest Research Institute, TX [RT]
(Alt. to Karen C Carpenter)

Ineke Van Zeeland, Canadian Wood Council, Canada [M]
(Alt. to Rodney A. McPhee)

Matthew T. Vinci, International Association of Fire Fighters, DC [L]
(Alt. to John Martell)

Robert J. Wills, American Iron and Steel Institute, AL [M]
(Alt. to Farid Alfawakhiri)

Luke C. Woods, UL LLC, MA [RT]
(Alt. to Dwayne E. Sloan)

Joe Ziolkowski, American Furniture Manufacturers Association, NC [M]
(Voting Alternate)

Nonvoting

Robert H. Barker, American Fiber Manufacturers Association, VA [M]
Rep. American Fiber Manufacturers Association

Rohit Khanna, U.S. Consumer Product Safety Commission, MD [C]
Rep. U.S. Consumer Product Safety Commission

Andrew Lock, U.S. Consumer Product Safety Commission, MD [C]
Rep. U.S. Consumer Product Safety Commission

Tracy L. Vecchiarelli, NFPA Staff Liaison

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

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Standard Method of

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

2018 Edition

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

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex C. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex C.

Chapter 1 Administration

1.1 Scope.

1.1.1* This test shall apply to upholstered furniture mock-ups.

1.1.2 Mock-up testing is used 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 Application.

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

1.3.2 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.

1.3.3 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.

1.4 Summary of Method.

1.4.1 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.

1.4.2 Locations to be tested shall include the following:

(1) Horizontal crevices formed where seat cushions and vertical test panels meet
(2) Seat cushion surfaces, including smooth surface, quilt, tuft, and welt edges
(3) Top surfaces of armrests, back, and loose seat support systems as shown in Figure 1.4.2(a) and Figure 1.4.2(b)

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

N **1.5* Precision.** A repeatability and reproducibility study was conducted on the test methods of NFPA 261.

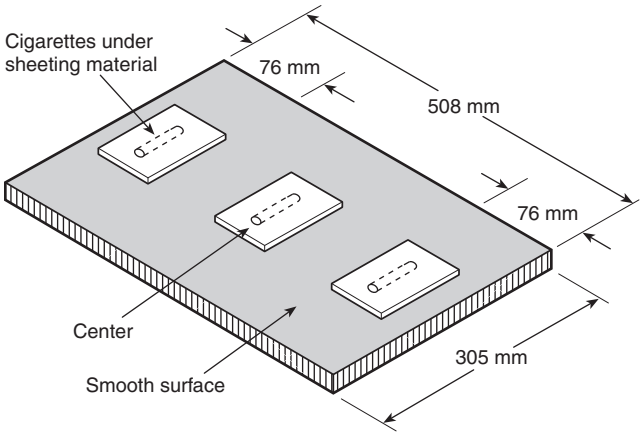

Figure 1.4.2(a) Upholstered Furniture Mock-Up Test: Armrest, Top of Back, and Seat Support System.

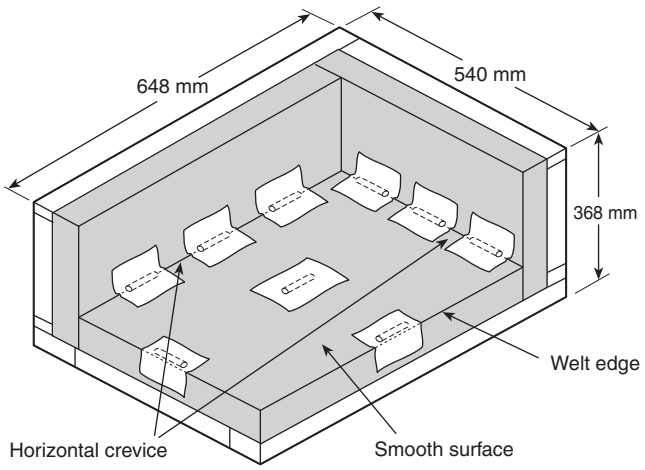

FIGURE 1.4.2(b) Upholstered Furniture Mock-Up Test: Seat Cushion, Side, and Back.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

Δ 2.2 NFPA Publications. (Reserved)

2.3 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th Edition, Merriam-Webster, Inc., Springfield, MA, 2003.

Δ 2.4 References for Extracts in Mandatory Sections. (Reserved)

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1 Shall. Indicates a mandatory requirement.

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

3.2.3 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 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.

3.3.2 Char. Carbonaceous material formed by pyrolysis or incomplete combustion.

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

3.3.4 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.

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

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

3.3.7 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.

3.3.8 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.

3.3.9* 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.

3.3.10 Welt. The cord or piping sewn into the seam or border edge of a cushion, pillow, arm, or back of a furniture item.

Chapter 4 Test Apparatus

4.1* Mock-Ups. Mock-up elements for the mock-up test jigs shall be constructed as illustrated in Figure 4.1(a), Figure 4.1(b), and Figure 4.1(c).

4.2* Ignition Source. The ignition source for the test shall consist of the current supply of SRM 1196 series cigarettes without filter tips, made from natural tobacco, 83 mm ± 2 mm long, with a tobacco packing density of 0.270 g/cm^3 ± 0.020 g/cm^3, and a total weight of 1.1 g ± 0.1 g.

4.3 Sheeting Material.

4.3.1 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.

4.3.2 The material shall be laundered in an automatic home clothes washing machine and dried in a tumble dryer at least once before use.

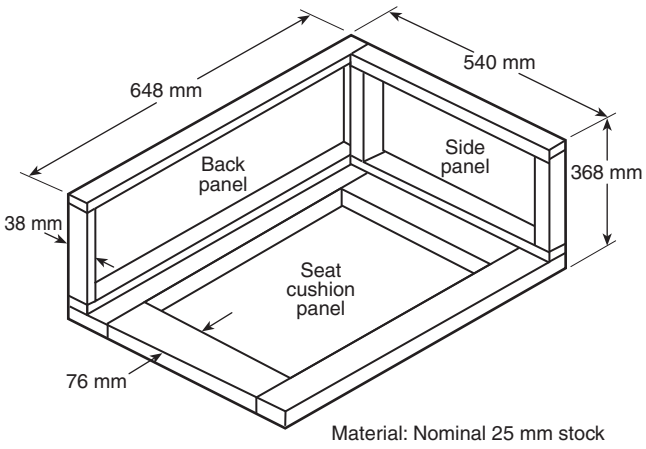

Figure 4.1(a) Frame for Upholstered Furniture Mock-Up Test.

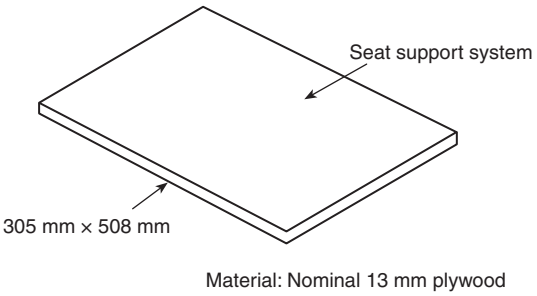

Figure 4.1(b) Armrest and Top of Back Mock-Up Test.

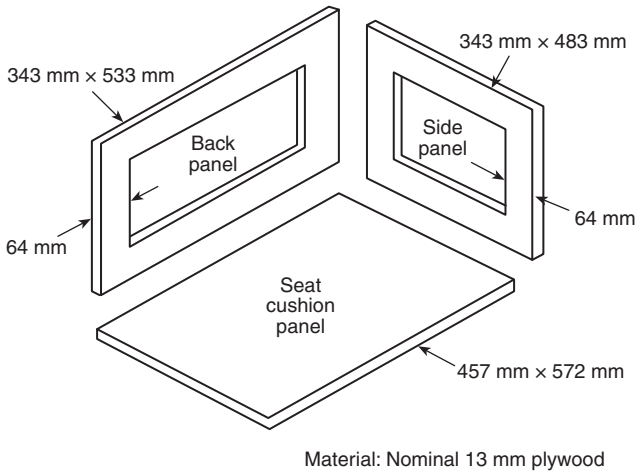

Figure 4.1(c) Panels for Upholstered Furniture Mock-Up Test.

4.3.3 For testing, the sheeting material shall be cut into pieces approximately 125 mm × 125 mm.

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

4.5 Extinguishing Equipment.

4.5.1 A pressurized water fire extinguisher or other fire extinguishing equipment shall be immediately available.

4.5.2 A water bottle fitted with a spray nozzle shall be provided to extinguish any ignited portions of the mock-up.

4.5.3 A bucket of water shall be provided for immersing smoldering or burning materials removed from the mock-up.

4.6 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 5 Conditioning

5.1 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.

5.1.1 If the test room conditions do not meet the specifications stated in Section 5.1, then testing shall be initiated within 10 minutes after the materials are removed from the conditioned room.

5.1.2 The mock-up assembly shall be constructed in the conditioned area.

Chapter 6 Test Specimens

6.1 General.

6.1.1 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.

6.1.2 The various parts of the mock-up shall be constructed as described in Sections 6.2 through 6.7.

6.1.3 In all cases, the arrangement and thickness of upholstery material in the mock-up shall reproduce the construction details of production furniture.

6.2 Loose Seat Cushions.

6.2.1 Seat cushions shall be made in the same size and manner and with the same materials as production furniture.

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

6.2.3 The cushion thickness shall be a maximum of 130 mm.

6.3 Decks.

6.3.1 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 of the test apparatus, as shown in Figure 4.1(b).

6.3.2 The decking or the upholstery cover material shall be stretched over the upholstery materials and securely fastened to the underside of the wood panel.

6.4 Tight Seat.

6.4.1 If a furniture item is constructed with tight seats only, then the seat shall be duplicated for test in mock-up.

6.4.2 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.

6.4.3 The cushion assembly shall be attached to the horizontal panel of the test apparatus, as shown in Figure 4.1(c), by extending the upholstery cover material around the panel edges and fastening the cover material to the underside of the wood panel.

6.5 Side and Back Panels.

6.5.1 A mock-up of furniture sides and back shall be constructed if, in the type of furniture to be represented by the mock-up, the sides and back are located within 25 mm of a seat cushion.

6.5.2 Mock-ups shall be made by upholstering one surface of the vertical test panel as shown in Figure 4.1(c), with the same upholstery material and upholstery cover material used in production furniture.

6.5.3 The upholstery cover material shall be stretched over the upholstery material and fastened to the back side of the framework.

6.5.4 All edges of the panels shall be covered with upholstery cover material.

6.5.5 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.

6.6 Bolsters. In cases where bolsters resting on the seat cushion or suspended above it could confine the heat from the cigarette and create a spatial arrangement that differs from the crevice space found in production furniture, 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.

6.7 Tops of Armrests and Backs.

6.7.1 Tops of armrests and backs shall be tested if they present a surface large enough and so oriented as to support a cigarette and the construction differs in any way from the side panel and back panel constructions.

6.7.2 Mock-ups of tops of armrests and backs shall be made by upholstering a piece of 13 mm thick plywood, approximately 300 mm × 500 mm, with the same materials used in the furniture item.

6.7.3 The mock-up shall reproduce significant details of the construction of full-size furniture.

Chapter 7 Testing Procedures

7.1 Mock-Up Test Sample.

7.1.1 A mock-up test sample shall be assembled by attaching the side panel, back panel, or both, to the mock-up frame and placing a seat cushion, either loose or tight seat construction, against the panels as shown in Figure 1.4.2(b).

7.1.2 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 means for exhausting the products of combustion from testing.

7.1.3 The decks for loose cushion items, tops of armrests, and tops of backs shall be tested separately.

7.2 Cigarette Locations.

7.2.1 At least three cigarettes shall be burned on each surface location as shown in Figure 1.4.2(a) and Figure 1.4.2(b).

7.2.2 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.

7.3 Crevice Location.

7.3.1 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.

7.3.2 The cigarettes shall be placed horizontally.

7.3.3 Two of the three cigarettes shall be placed so that their entire length burns out against the welt cord and the vertical panel surface.

7.3.4 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.

7.4 Test Cigarette.

7.4.1 Each test cigarette shall be well-lighted and burned not more than 4 mm when placed at a specific test location.

7.4.2 After placement, each cigarette shall be covered with a piece of sheeting material.

7.4.3 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.

7.4.4 For all tests, sheeting material-to-cigarette contact shall be ensured by running a finger across the full length of the covered cigarette.

7.5 Seat Cushion.

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

7.5.2 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.

7.5.3 Test cigarettes shall be arranged so that the butt ends burn out on the threads of a quilt or in tuft depressions.

7.5.4 The smooth surface of a quilted or tufted cushion shall not be required to be tested.

7.5.5 For smooth surface cushions, the test cigarettes shall be burned in the center of the cushion.

7.6 Number of Test Cigarettes.

7.6.1 Three test cigarettes shall be burned on each horizontal mock-up test panel duplicating armrests, tops of backs, and seat cushion support systems.

7.6.2 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 as shown in Figure 1.4.2(a) for the location of the cigarettes on the test panels.

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

(1) Three cigarettes in a given location have burned their full lengths without sustained ignition.
(2) Three cigarettes in a given location have self-extinguished before burning their full lengths.
(3) Three cigarettes in a given location sustained ignition.

7.8 Ignition.

7.8.1 If obvious ignition occurs, the test shall be stopped and the burning material extinguished.

7.8.2 The test room shall be ventilated, and an ignition shall be recorded for the cigarette test location.

7.9 Char Length Measurement.

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

7.9.2 Cigarette Ignition Results.

7.9.2.1 The char length measurement for each cigarette shall be recorded, except when the cigarette has extinguished without burning to completion or where obvious combustion occurs.

7.9.2.2 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.

7.9.2.3 All mock-ups shall be disassembled after testing is complete.

7.9.2.3.1 If when disassembling the apparatus, it is determined that smoldering is still in progress, the test shall be invalid and shall be repeated.

7.10 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 8 Safety Precautions

8.1 Test Termination.

8.1.1 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.

8.1.2 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.

8.1.3 The test area shall be ventilated.

8.2* Exposure.

8.2.1 Test personnel shall avoid exposure to smoke and gases produced during testing as much as possible.

8.2.2 A large hood with a low air velocity shall be permitted to be in operation during testing to remove products of combustion.

Chapter 9 Reporting

9.1 Reporting.

9.1.1 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.

9.1.2 When obvious ignition occurs, an ignition shall be recorded for the test location.

Annex A Explanatory Material

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

A.1.1.1 This test method was originally similar to that described in ASTM E1352, *Standard Test Method for Cigarette Ignition Resistance of Mock-Up Upholstered Furniture Assemblies*. When the use of reduced ignition propensity cigarettes became required in the United States, this test method (NFPA 261) changed its ignition source and started using a cigarette developed by NIST (SRM 1196). The cigarette ignition potency of SRM 1196 cigarettes [as assessed by NIST (Gann and Hnetkovsky 2009) using a method close to that in ASTM E2187, *Standard Test Method for Measuring the Ignition Strength of Cigarettes*] is similar to that of the ignition source used when the test method was developed initially and is much higher than that of reduced ignition propensity cigarettes *(see also A.4.2)*. The change in ignition source for ASTM E1352 did not occur until 2016. There is insufficient information as to the effect of the cigarette covered with fabric on ignition potency.

N **A.1.5** An interlaboratory evaluation was performed to provide an estimate of the precision of the test method, wherein five laboratories conducted tests on 12 systems, each with eight different fabrics. The individual fabrics in each class are identified as Sample 1 through Sample 8 in Table A.1.5(a) and Table A.1.5(b). The systems tested, in triplicate, are as follows:

(1) Fabric class fiberglass
(2) Fabric class untreated cotton
(3) Cover fabric FR cotton
(4) Backseat FR cotton
(5) Backseat foam
(6) Backseat PE/FR cotton
(7) Side-seat FR cotton
(8) Side-seat foam
(9) Side-seat 1 in. PE/FR cotton
(10) Cushion foam
(11) Cushion FR cotton
(12) Cushion 1 in. PE/FR cotton

The statistical analyses for repeatability and reproducibility were conducted in two ways: based on actual measurements of char length, as stated in the standard test method, and based on pass/fail, because the test method is, in practical use, a pass/fail test. The results of the statistical analyses for repeatability and reproducibility of the individual systems in the interlaboratory study were determined in accordance with ASTM E691, *Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method*, in spite of the fact that the number of laboratories (i.e., five) is lower than that recommended by ASTM E691, which recommends six laboratories.

The results shown in Table A.1.5(a) correspond to the analysis involving actual numerical results. Note that results of char lengths over 2 in. were not reported by the laboratories; therefore, any result greater than 2 in. was considered to be 2 in., because testing was discontinued at that point. The reason for this is that 2 in. is the maximum char length usually permitted by users. The precision calculated by assuming that the maximum char length measurement is 2 in. does not address the precision of the measurement over the entire possible range, but includes all values up to the point of failure, which are the measurements of concern.

The results of the statistical analyses for repeatability and reproducibility of the individual systems for the interlaboratory study, with the data analyzed as if pass/fail results were produced (with a fail taken to be a char length value of over 2 in., as used in practice) are shown in Table A.1.5(b). Test results greater than 2 in. were assigned a fail value of 0 and test results less than 2 in. were assigned a pass value of 1, for a binary analysis. This analysis was conducted assuming that there can be only two possible outcomes: pass or fail.

Table A.1.5(c) contains the overall repeatability and reproducibility of the test, analyzed both ways. The precision of the pass/fail data is significantly better than that of the numerical data. There is a lack of fit between the repeatability and reproducibility analyses and it indicates that r and R are not correlated.

The true value of cigarette ignition resistance of upholstered furniture composites can only be defined in terms of a test method. Within this limitation, this test method has no known bias and is generally accepted as a referee method.

A.3.3.9 Upholstery Material. This definition includes, but is not limited to, material such as foam, cotton batting, polyester fiberfill, bonded cellulose, or down.

A.4.1 Figure 1.4.2(a) and Figure 1.4.2(b) show the completed mock-up assemblies.

Table A.1.5(a) Interlaboratory Study for NFPA 261 (Results in Inches)

Class of Test	Material	Average	STD Repeat	STD Repro	*r*	*R*
Fabric class fiberglass	Sample 1	0.647	0.089	0.136	0.25	0.38
	Sample 2	1.927	0.128	0.195	0.36	0.54
	Sample 3	0.573	0.070	0.106	0.20	0.30
	Sample 4	0.620	0.056	0.083	0.16	0.23
	Sample 5	1.800	0.256	0.352	0.72	0.98
	Sample 6	1.053	0.277	0.608	0.78	1.70
	Sample 7	0.753	0.191	0.259	0.53	0.72
	Sample 8	0.567	0.037	0.061	0.10	0.17
Fabric class untreated cotton	Sample 1	1.100	0.278	0.700	0.78	1.96
	Sample 2	1.467	0.299	0.563	0.84	1.58
	Sample 3	0.493	0.060	0.137	0.17	0.38
	Sample 4	0.793	0.174	0.551	0.49	1.54
	Sample 5	1.660	0.393	0.565	1.10	1.58
	Sample 6	1.440	0.405	0.614	1.13	1.72
	Sample 7	1.680	0.280	0.558	0.78	1.56
	Sample 8	1.180	0.411	0.687	1.15	1.92
Cover fabric FR cotton	Sample 1	0.853	0.303	0.310	0.85	0.87
	Sample 2	1.087	0.224	0.534	0.63	1.50
	Sample 3	0.573	0.042	0.152	0.12	0.43
	Sample 4	0.693	0.084	0.141	0.24	0.40
	Sample 5	1.273	0.280	0.740	0.79	2.07
	Sample 6	0.900	0.420	0.512	1.18	1.43
	Sample 7	1.133	0.307	0.498	0.86	1.39
	Sample 8	0.733	0.084	0.124	0.24	0.35
Backseat FR cotton	Sample 1	0.467	0.060	0.170	0.17	0.48
	Sample 2	0.567	0.037	0.246	0.10	0.69
	Sample 3	0.493	0.047	0.156	0.13	0.44
	Sample 4	0.520	0.063	0.172	0.18	0.48
	Sample 5	0.607	0.149	0.452	0.42	1.27
	Sample 6	0.533	0.073	0.324	0.20	0.91
	Sample 7	0.533	0.056	0.237	0.16	0.66
	Sample 8	0.407	0.089	0.162	0.25	0.45
Backseat foam	Sample 1	0.547	0.079	0.181	0.22	0.51
	Sample 2	1.920	0.253	0.273	0.71	0.77
	Sample 3	0.487	0.047	0.228	0.13	0.64
	Sample 4	0.573	0.070	0.162	0.20	0.45
	Sample 5	1.713	0.042	0.642	0.12	1.8
	Sample 6	0.70	0.101	0.345	0.28	0.97
	Sample 7	1.133	0.335	0.601	0.94	1.68
	Sample 8	0.620	0.076	0.228	0.21	0.64
Backseat PE/FR cotton	Sample 1	0.413	0.042	0.124	0.12	0.35
	Sample 2	0.607	0.267	0.413	0.75	1.16
	Sample 3	0.600	0.052	0.187	0.14	0.52
	Sample 4	0.533	0.070	0.212	0.20	0.59
	Sample 5	0.573	0.042	0.223	0.12	0.62
	Sample 6	0.580	0.067	0.257	0.19	0.72
	Sample 7	0.527	0.052	0.226	0.14	0.63
	Sample 8	0.500	0.047	0.159	0.13	0.45
Side-seat FR cotton	Sample 1	0.467	0.067	0.224	0.19	0.63
	Sample 2	0.533	0.105	0.251	0.30	0.70

(continues)

Table A.1.5(a) *Continued*

Class of Test	Material	Average	STD Repeat	STD Repro	*r*	*R*
	Sample 3	0.407	0.037	0.129	0.10	0.36
	Sample 4	0.527	0.047	0.240	0.13	0.67
	Sample 5	0.513	0.092	0.264	0.26	0.74
	Sample 6	0.427	0.056	0.149	0.16	0.42
	Sample 7	0.467	0.042	0.183	0.12	0.51
	Sample 8	0.460	0.030	0.225	0.08	0.63
Side-seat foam	Sample 1	0.527	0.067	0.178	0.19	0.50
	Sample 2	1.920	0.132	0.209	0.37	0.58
	Sample 3	0.513	0.047	0.200	0.13	0.56
	Sample 4	0.560	0.063	0.214	0.18	0.60
	Sample 5	1.360	0.389	0.710	1.09	1.99
	Sample 6	0.713	0.084	0.281	0.24	0.79
	Sample 7	0.920	0.094	0.649	0.26	1.82
	Sample 8	0.587	0.067	0.197	0.19	0.55
Side-seat 1 in. PE/FR cotton	Sample 1	0.407	0.056	0.165	0.16	0.46
	Sample 2	0.553	0.037	0.206	0.10	0.58
	Sample 3	0.560	0.056	0.219	0.16	0.61
	Sample 4	0.540	0.042	0.212	0.12	0.59
	Sample 5	0.527	0.056	0.202	0.16	0.56
	Sample 6	0.573	0.052	0.122	0.14	0.34
	Sample 7	0.507	0.030	0.232	0.08	0.65
	Sample 8	0.480	0.037	0.199	0.10	0.56
Cushion foam	Sample 1	0.320	0.037	0.114	0.10	0.32
	Sample 2	0.427	0.052	0.198	0.14	0.55
	Sample 3	0.360	0.047	0.173	0.13	0.49
	Sample 4	0.380	0.030	0.163	0.08	0.46
	Sample 5	0.393	0.030	0.164	0.08	0.46
	Sample 6	0.413	0.030	0.145	0.08	0.41
	Sample 7	0.373	0.047	0.162	0.13	0.45
	Sample 8	0.347	0.021	0.195	0.06	0.54
Cushion FR cotton	Sample 1	0.353	0.042	0.131	0.12	0.37
	Sample 2	0.807	0.276	0.796	0.77	2.23
	Sample 3	0.393	0.021	0.188	0.06	0.53
	Sample 4	0.420	0.037	0.181	0.10	0.51
	Sample 5	1.027	0.021	0.899	0.06	2.52
	Sample 6	0.360	0.047	0.163	0.13	0.46
	Sample 7	0.447	0.030	0.226	0.08	0.63
	Sample 8	0.373	0.047	0.156	0.13	0.44
Cushion 1 in. PE/FR cotton	Sample 1	0.313	0.042	0.179	0.12	0.50
	Sample 2	0.400	0.037	0.210	0.10	0.59
	Sample 3	0.433	0.047	0.264	0.13	0.74
	Sample 4	0.387	0.037	0.266	0.10	0.74
	Sample 5	0.413	0.030	0.257	0.08	0.72
	Sample 6	0.440	0.030	0.284	0.08	0.80
	Sample 7	0.420	0.047	0.243	0.13	0.68
	Sample 8	0.400	0.030	0.176	0.08	0.49

STD Repeat: standard deviation of the repeatability.
STD Repro: standard deviation of the reproducibility.
r: system repeatability.
R: system reproducibility.

Table A.1.5(b) Interlaboratory Study for NFPA 261 (Results as Pass/Fail)

Class of Test	Material	Average	STD Repeat	STD Repro	*r*	*R*
Fabric class fiberglass	Sample 1	1.00	0.00	0.00	0.00	0.00
	Sample 2	0.13	0.20	0.30	0.55	0.83
	Sample 3	1.00	0.00	0.00	0.00	0.00
	Sample 4	1.00	0.00	0.00	0.00	0.00
	Sample 5	0.27	0.26	0.43	0.71	1.22
	Sample 6	0.73	0.26	0.43	0.71	1.22
	Sample 7	1.00	0.00	0.00	0.00	0.00
	Sample 8	1.00	0.00	0.00	0.00	0.00
Fabric class untreated cotton	Sample 1	0.67	0.27	0.47	0.76	1.32
	Sample 2	0.53	0.29	0.51	0.81	1.42
	Sample 3	1.00	0.00	0.00	0.00	0.00
	Sample 4	0.87	0.20	0.30	0.55	0.83
	Sample 5	0.27	0.26	0.37	0.71	1.02
	Sample 6	0.47	0.29	0.45	0.81	1.25
	Sample 7	0.27	0.26	0.43	0.71	1.22
	Sample 8	0.60	0.28	0.43	0.79	1.22
Cover fabric FR cotton	Sample 1	0.93	0.14	0.15	0.40	0.42
	Sample 2	0.93	0.14	0.15	0.40	0.42
	Sample 3	1.00	0.00	0.00	0.00	0.00
	Sample 4	1.00	0.00	0.00	0.00	0.00
	Sample 5	0.53	0.29	0.51	0.81	1.42
	Sample 6	0.87	0.20	0.18	0.55	0.51
	Sample 7	0.87	0.20	0.30	0.55	0.83
	Sample 8	1.00	0.00	0.00	0.00	0.00
Backseat FR cotton	Sample 1	1.00	0.00	0.00	0.00	0.00
	Sample 2	1.00	0.00	0.00	0.00	0.00
	Sample 3	1.00	0.00	0.00	0.00	0.00
	Sample 4	1.00	0.00	0.00	0.00	0.00
	Sample 5	1.00	0.00	0.00	0.00	0.00
	Sample 6	1.00	0.00	0.00	0.00	0.00
	Sample 7	1.00	0.00	0.00	0.00	0.00
	Sample 8	1.00	0.00	0.00	0.00	0.00
Backseat foam	Sample 1	1.00	0.00	0.00	0.00	0.00
	Sample 2	0.07	0.00	0.00	0.00	0.00
	Sample 3	1.00	0.00	0.00	0.00	0.00
	Sample 4	1.00	0.00	0.00	0.00	0.00
	Sample 5	0.20	0.00	0.00	0.00	0.00
	Sample 6	1.00	0.00	0.00	0.00	0.00
	Sample 7	0.73	0.00	0.00	0.00	0.00
	Sample 8	1.00	0.00	0.00	0.00	0.00
Backseat PE/FR cotton	Sample 1	1.00	0.00	0.00	0.00	0.00
	Sample 2	0.93	0.14	0.15	0.40	0.42
	Sample 3	1.00	0.00	0.00	0.00	0.00
	Sample 4	1.00	0.00	0.00	0.00	0.00
	Sample 5	1.00	0.00	0.00	0.00	0.00
	Sample 6	1.00	0.00	0.00	0.00	0.00
	Sample 7	1.00	0.00	0.00	0.00	0.00
	Sample 8	1.00	0.00	0.00	0.00	0.00
Side-seat FR cotton	Sample 1	1.00	0.00	0.00	0.00	0.00
	Sample 2	1.00	0.00	0.00	0.00	0.00

(continues)

Table A.1.5(b) *Continued*

Class of Test	Material	Average	STD Repeat	STD Repro	*r*	*R*
	Sample 3	1.00	0.00	0.00	0.00	0.00
	Sample 4	1.00	0.00	0.00	0.00	0.00
	Sample 5	1.00	0.00	0.00	0.00	0.00
	Sample 6	1.00	0.00	0.00	0.00	0.00
	Sample 7	1.00	0.00	0.00	0.00	0.00
	Sample 8	1.00	0.00	0.00	0.00	0.00
Side-seat foam	Sample 1	1.00	0.00	0.00	0.00	0.00
	Sample 2	0.13	0.20	0.30	0.55	0.83
	Sample 3	1.00	0.00	0.00	0.00	0.00
	Sample 4	1.00	0.00	0.00	0.00	0.00
	Sample 5	0.47	0.29	0.45	0.81	1.25
	Sample 6	1.00	0.00	0.00	0.00	0.00
	Sample 7	0.80	0.23	0.45	0.65	1.25
	Sample 8	1.00	0.00	0.00	0.00	0.00
Side-seat 1 in. PE/FR cotton	Sample 1	1.00	0.00	0.00	0.00	0.00
	Sample 2	1.00	0.00	0.00	0.00	0.00
	Sample 3	1.00	0.00	0.00	0.00	0.00
	Sample 4	1.00	0.00	0.00	0.00	0.00
	Sample 5	1.00	0.00	0.00	0.00	0.00
	Sample 6	1.00	0.00	0.00	0.00	0.00
	Sample 7	1.00	0.00	0.00	0.00	0.00
	Sample 8	1.00	0.00	0.00	0.00	0.00
Cushion foam	Sample 1	1.00	0.00	0.00	0.00	0.00
	Sample 2	0.92	0.00	0.00	0.00	0.00
	Sample 3	1.00	0.00	0.00	0.00	0.00
	Sample 4	1.00	0.00	0.00	0.00	0.00
	Sample 5	0.75	0.00	0.00	0.00	0.00
	Sample 6	1.00	0.00	0.00	0.00	0.00
	Sample 7	1.00	0.00	0.00	0.00	0.00
	Sample 8	1.00	0.00	0.00	0.00	0.00
Cushion FR cotton	Sample 1	1.00	0.00	0.00	0.00	0.00
	Sample 2	1.00	0.16	0.17	0.45	0.47
	Sample 3	1.00	0.00	0.00	0.00	0.00
	Sample 4	1.00	0.00	0.00	0.00	0.00
	Sample 5	1.00	0.25	0.50	0.70	1.40
	Sample 6	1.00	0.00	0.00	0.00	0.00
	Sample 7	1.00	0.00	0.00	0.00	0.00
	Sample 8	1.00	0.00	0.00	0.00	0.00
Cushion 1 in. PE/FR cotton	Sample 1	1.00	0.00	0.00	0.00	0.00
	Sample 2	1.00	0.00	0.00	0.00	0.00
	Sample 3	1.00	0.00	0.00	0.00	0.00
	Sample 4	1.00	0.00	0.00	0.00	0.00
	Sample 5	1.00	0.00	0.00	0.00	0.00
	Sample 6	1.00	0.00	0.00	0.00	0.00
	Sample 7	1.00	0.00	0.00	0.00	0.00
	Sample 8	1.00	0.00	0.00	0.00	0.00

STD Repeat: standard deviation of the repeatability.
STD Repro: standard deviation of the reproducibility.
r: system repeatability.
R: system reproducibility.

N Table A.1.5(c) Repeatability and Reproducibility of Test Method

	Numerical Data	Pass/Fail
Avg	0.69	0.90
r	0.30	0.16
R	0.80	0.24
Coeff STD fit	1.95	1.59
Coeff variance fit	3.01	2.70
RSQ STD fit	0.18	0.97
RSQ variance fit	0.31	0.93

Avg: average.
r: overall repeatability.
R: overall reproducibility.
Coeff STD fit: multiplicative coefficient of the linear regression analysis of reproducibility vs. repeatability.
Coeff variance fit: multiplicative coefficient of the linear regression analysis of reproducibility variance vs. repeatability variance.
RSQ STD fit: linear least squares correlation coefficient of the fit between reproducibility and repeatability.
RSQ variance fit: linear least squares correlation coefficient of the fit between reproducibility variance and repeatability variance.

A.4.2 Standard Reference Material (SRM) 1196 series cigarettes are obtained from the National Institute of Standards and Technology (NIST).

In previous editions of this test method, the ignition source was a commercially available cigarette identified by certain characteristics that corresponded to an unfiltered Pall Mall cigarette. Based on regulations for reduced ignition propensity cigarettes, these particular cigarettes are no longer available in the United States. That cigarette has been replaced by the manufacturer with a banded cigarette that meets the regulations for reduced ignition propensity. Banded cigarettes frequently go out when placed on a test substrate. Since the test requires that a test cigarette burn its full length, the new version of the old test cigarette is not usable.

NIST had samples of the old cigarettes and was able to characterize their ignition propensity. They commissioned cigarettes to be manufactured to those specifications. Then they verified that the new cigarettes met the physical and performance requirements of the previously used cigarettes. These cigarettes were made available by NIST as SRM 1196, one of over 1300 standard reference materials that they produce for various uses. When the original SRM 1196 cigarettes ceased to be available, NIST procured SRM 1196a cigarettes and is planning to continue providing cigarettes to be designated as SRM 1196 series cigarettes in the future.

A.8.2 Products of combustion can be physically irritating and dangerous to test personnel.

Annex B Commentary

This annex 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 (NBS) 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, PFF8.76, *Back-Up Report for the Proposed Standard for the Flammability (Cigarette Ignition Resistance) of Upholstered Furniture.*

Annex C Informational References

C.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

C.1.1 NFPA Publications. (Reserved)

C.1.2 Other Publications.

C.1.2.1 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM E691, *Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method*, 2014.

ASTM E1352, *Standard Test Method for Cigarette Ignition Resistance of Mock-Up Upholstered Furniture Assemblies*, 2016.

ASTM E2187, *Standard Test Method for Measuring the Ignition Strength of Cigarettes*, 2016.

N **C.1.2.2 NIST Publications.** National Institute of Standards and Technology, 100 Bureau Drive, Stop 1070, Gaithersburg, MD 20899-1070.

Gann, R.G., and E.J. Hnetkovsky, "Modification of ASTM E2187 for Measuring the Ignition Propensity of Conventional Cigarettes," NIST Technical Note 1627, June 2009.

C.1.2.3 NTIS Publications. National Technical Information Service, 5301 Shawnee Road, Alexandria, VA 22312.

NBSIR, PFF8.76, *Back-Up Report for the Proposed Standard for the Flammability (Cigarette Ignition Resistance) of Upholstered Furniture*, Joseph J. Loftus, Final Report, June 1978.

C.2 Informational References. (Reserved)

C.3 References for Extracts in Informational Sections. (Reserved)

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