ANSI/NFPA 261 An American National Standard February 6, 1989

NFPA 261 Resistance of Mock-Up Upholstered Furniture Material Assemblies to Ignition by Smoldering Cigarettes 1989 Edition

National Fire Protection Association Batterymarch Park, Quincy, MA 02269

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Policy Adopted by NFPA Board of Directors on December 3, 1982

The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

Statement on NFPA Procedures

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NATIONAL FIRE PROTECTION ASSOCIATION

NFPA 261

Standard Method of Test for Determining

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

1989 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, and acted on by the National Fire Protection Association, Inc. at its Fall Meeting held November 14-17, 1988 in Nashville, Tennessee. It was issued by the Standards Council on January 13, 1989 with an effective date of February 6, 1989, and supersedes all previous editions.

The 1989 edition of this document has been approved by the American National Standards Institute.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

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 besides wearing apparel and home textiles that might constitute an unreasonable flammability risk. The National Bureau of Standards (NBS) began funding laboratory research into 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 relating to flammable fabrics.

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

This standard was developed subsequent to the CPSC actions of 1978-79 by the Fire Test Committee and draws heavily on the NBS research and proposed test methodology. The first edition, published in 1983, was numbered NFPA 260B. This 1989 edition is a reconfirmation of the first edition with the number changed to NFPA 261.

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Contents

NFPA 261

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

1989 Edition

Chapter 1 General

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

1-2 Scope. This method is recommended for upholstered furniture.

1-2.1 This test applies to upholstered furniture mock-ups.

1-2.2 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, welt tape, etc., in realistic combinations in an idealized geometric arrangement of the seat cushions, back, and arms of furniture items.

1-3 Summary of Method.

1-3.1 The test uses lighted cigarettes (covered with a piece of sheeting material) to determine the ignition resistance of upholstered furniture items reproduced in mock-up. [*See Figure 1-3(a) and (b).*]

1-3.2 Test locations include horizontal crevices occurring where seat cushions and vertical test panels meet; seat cushion surfaces including smooth surface, quilt, tuft, and welt edges; and top surfaces of armrests, backs, and loose seat support systems. [*See Figure 1-3(a) and (b).*]

1-3.3 Obvious ignitions or char length measurements are used to determine if a particular combination of upholstering material 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 is accomplished by testing furniture mock-ups.

1-4.2 This method is not intended 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 which differs substantially from the test standard.

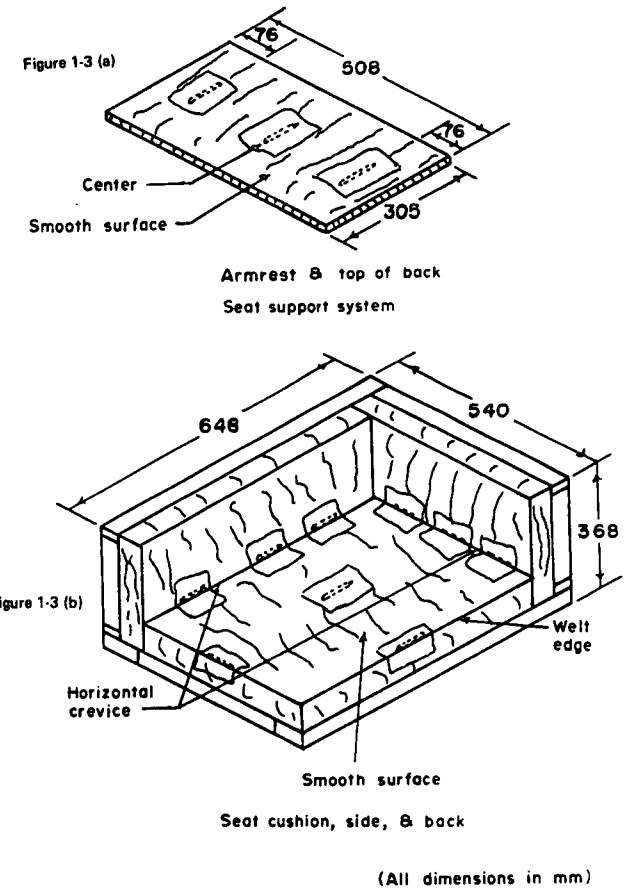

Figure 1-3(a) and (b) Upholstered Furniture Mock-Up Test.

1-4.3 The results obtained with a material assembly tested in mock-up, according to this method, do 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 may or may 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 one or more layers of upholstery material.

Shall. Indicates a mandatory requirement.

Should. Indicates recommendations or that which is advised but not required.

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

Upholstered Furniture. For the purpose of this test method, a unit of interior furnishing that (1) contains any surface which is covered, in whole or in part, with a fabric or related upholstery cover material, (2) contains upholstery material, and (3) is intended or promoted for sitting or reclining upon.

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

Upholstery Material. The padding, stuffing, or filling material used in a furniture item, which may 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 foams, cotton batting, polyester fiberfill, bonded cellulose, or down.)

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

Chapter 2 Test Apparatus

2-1 Mock-Ups. Mock-up elements for the mock-up test jig are illustrated in Figures 2-1 and 2-2(a) and (b). Figures 1-3(a) and (b) show the completed mock-up assemblies.

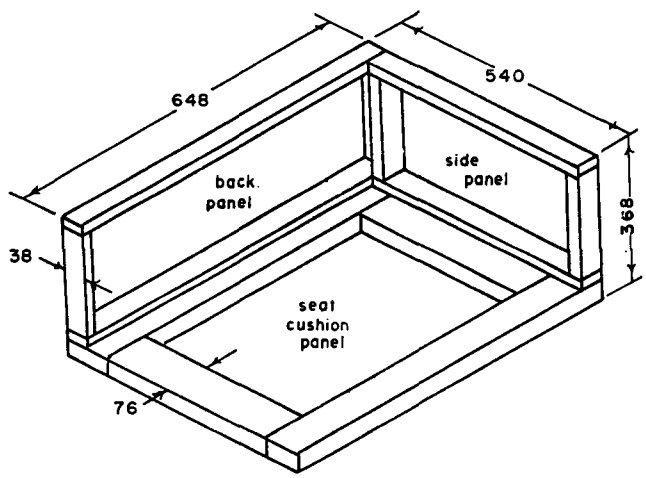

Figure 2-1 Frame for Upholstered Furniture Mock-Up Test.

2-2 Ignition Sources. The ignition source for the test shall be cigarettes without filter tips, made from natural tobacco, 85 ± 2 mm (3.4 ± 0.1 in.) long with a packing density of 0.270 ± 0.020 g/cm^3 (0.156 ± 0.012 oz/in.^{3}) and a total weight of 1.1 ± 0.1 g (0.039 ± 0.004 oz). The smoldering rate of this cigarette shall be 0.10 ± 0.01 mm/sec (0.236 ± 0.024 in./min) when the cigarette is allowed to burn downward in a draft-protected area.

NOTE: With the cigarette supported at the bottom in a vertical position, the burning rate is determined in the region from 10 mm to 50 mm (0.39 in. to 1.97 in.), measured from the top.

2-3 Sheeting Material. The sheeting material to cover the test cigarettes shall be 50 percent cotton/50 percent polyester or 100 percent cotton bed sheeting material, weight 125 ± 28 g/m^2 (3.7 ± 0.8 oz/yd^2). The material shall be laundered in an automatic home clothes washing machine and dried in a tumble drier at least once before use. For testing, the sheeting material shall be cut into pieces approximately 12.5 × 12.5 cm (5 × 5 in.).

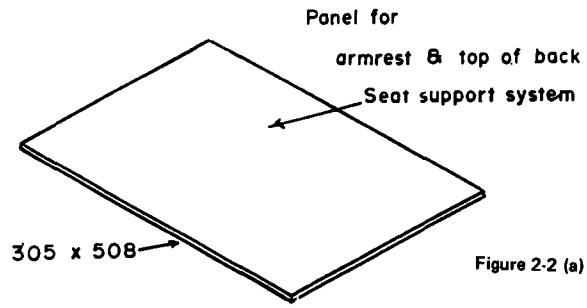

Figure 2-2 (a)

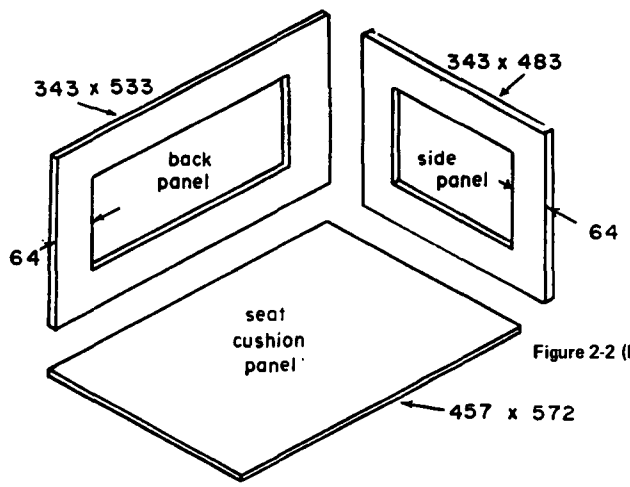

Figure 2-2 (b)

Figure 2-2(a) and (b) Panels for Upholstered Furniture Mock-Up Test.

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 are: straight pins, a knife or scissors, tongs, and a linear scale at least 15 cm (6 in.) long and graduated in millimeters or inches in 1/10 or 1/16 in. divisions.

Chapter 3 Conditioning

3-1 General. Test samples, cigarettes, and sheeting material shall be conditioned at a temperature of 23 ° ± 5 °C (73.4 ° ± 9 °F) and a relative humidity of 50 ± 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 produced by arranging upholstery cover material and upholstery materials in the same sequence as they were used in the production furniture.

The various parts of the mock-up shall be constructed as described in Sections 4-2 to 4-6 below. 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 68 × 55 cm (25 × 22 in.) may be used if actual cushion dimensions exceed these values.

4-2.2 The cushion thickness shall be a maximum of 13 cm (5 in.).

4-3 Decks. Decks shall be prepared (if they are part of the furniture item) by attaching to the horizontal panel [*see Figure 2-2(a)*] of the test apparatus the same materials in the same thickness as used in the actual furniture construction. The decking or 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 the type of furniture item is constructed with only tight seats, then the seat shall be duplicated for test in mock-up. Tight seat cushions shall be made 45 ± 5 × 55 ± 5 cm (18 ± 2 × 22 ± 2 in.) 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 2-2(b)*] 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. Furniture sides and backs shall be mocked-up if, in the type of furniture to be represented by the mock-up, they are within 2.5 cm (1 in.) of a seat cushion. They shall be made by upholstering one surface of the vertical test panel [*see Figure 2-2(b)*] 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 cover material. If the side and back construction of the furniture item are the same, only one vertical panel need 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 present a spatial arrangement different from the crevice. In such cases, a mock-up bolster shall be prepared, with dimensions to fit into the mock-up arrangement and presenting to the cigarette the same spatial arrangement 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 (0.5 in.) thick plywood, approximately 30 cm × 50 cm (12 in. × 20 in.) 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 A mock-up test sample shall be assembled by attaching the side and/or back panels to the mock-up frame and placing a seat cushion (either loose or tight seat construction) against the panels, as shown in Figure 1-3(b). The assembly may 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 backs shall be tested separately. The test to evaluate upholstered furniture material assemblies for cigarette ignition resistance may require two vertical panels, one seat cushion (loose or tight), one bolster, one deck, one top of armrest, and one top of back.

5-2 At least three cigarettes shall be burned on each surface location [*see Figure 1-3(a) and (b)*]. These locations include crevice(s) where seat cushion and vertical panels meet, seat cushion surfaces (including welt and smooth, quilted, or tufted areas), top of upholstered armrest, tops of upholstered back and deck.

5-3 For crevice locations, the two cigarettes next to the center cigarette shall be placed in the crevice so that their butt ends burn out at least 7.5 cm (3 in.) 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 Each test cigarette shall be well-lighted and burned not more than 4 mm (0.16 in.) when placed on 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 5 cm (2 in.) above the cigarette] and the remaining material dropped to completely cover the test cigarette. For all tests it shall be ensured that a good sheeting material-to-cigarette contact is made by running one's finger across the full length of the covered cigarette.

5-5 Seat Cushion.

5-5.1 For the test of a seat cushion (either loose or tight), 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 so 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 is not required to be tested. For smooth surface cushions, the test cigarettes shall be burned in the center of the cushion.

5-6 Three test cigarettes shall be burned on each horizontal mock-up test panel duplicating armrests, tops of backs, and seat cushion support systems. One shall be burned at the center of the panel and the other two shall be burned at least 7.5 cm (3 in.) from the edges of the test panel. [*See Figure 1-3(a) for the location of the cigarettes on the test panels.*]

5-7 A test on any location is 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 extinguished before burning their full lengths;

(c) three cigarettes in a given location sustained ignition.

5-8 If continuing ignition occurs (i.e., fabric and filling materials are ignited and are smoldering and generating smoke at a rapid rate) there is no need 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 recorded for the cigarette test location.

5-9 Char Length Measurement.

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

5-9.2 The char length measurement for each cigarette shall be recorded, except when the cigarette has extinguished without burning to completion or where continuing combustion occurs. If the char from one cigarette runs into that from another, the results of the test are invalid and the test shall be repeated running one cigarette at a time. All mock-ups shall be disassembled.

NOTE: If when disassembling the apparatus, it is shown that smoldering is still in progress, then the test is invalid and must be repeated.

5-10 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 (50 ft) per minute.

Chapter 6 Safety Precautions

6-1 CAUTION: Even under the most carefully observed conditions, smoldering combustion can progress to a point where it cannot be readily extinguished. It is imperative that a test be discontinued as soon as continuing combustion has definitely occurred. Immediately wet the exposed area with a water spray from the water bottle, remove the charred or burned material, and immerse the material in a bucket of water. Ventilate the test area.

6-2 Products of combustion can be irritating and dangerous to test personnel. Test personnel must avoid exposure to smoke and gases produced during testing as much as possible. A large hood with a low air velocity may be in operation during testing to remove products of combustion.

Chapter 7 Report

7-1 The maximum char distance measured to the nearest 0.5 cm (0.2 in.) from the center of the original location of the test cigarette shall be recorded for each cigarette location, except when a continuing combustion occurs. In this case, an "ignition" shall be recorded for the test location.

Appendix A Commentary

This Appendix is not a part of the requirements of this NFPA document, but is included for information purposes only.

A-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.

A-2 Nature of Test.

A-2.1 Upholstered furniture consists of upholstery cover fabric and interior components (filling/padding), 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.

A-2.2 During original development, it was attempted 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 the 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 the furniture.

A-3 Experimental Studies. In a controlled study, the relationship of the mock-up test to the performance of actual furniture was shown to be good.

Thirty-eight chair locations in both mock-up and full-size were tested by 3 laboratories for a total of 114 tests. Fourteen test locations out of 114 gave different results for the mock-up than for the actual item of furniture. There was 87 percent agreement.

A-4 Agreement Between Laboratories. In a controlled study*, the agreement between laboratories was good.

More than 2200 total tests were conducted on mock-ups in 38 laboratories. One hundred twenty-six test results differed from the majority. There was 94 percent agreement.

*NBSIR 78-1438, PFF6-76, June 1978, Loftus, NBS.

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INSTRUCTIONS

Please use the forms which follow for submitting proposed amendments. Use a separate form for each proposal.

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3. In the space identified as "Proposal" include the wording you propose as new or revised text, or indicate if you wish to delete text.

4. In the space titled "Statement of Problem and Substantiation for Proposal" state the problem which will be resolved by your recommendation and give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If a statement is more than 200 words in length, the technical committee is authorized to abstract it for the Technical Committee Report.

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1. a) **Document Title:** Protective Signaling Systems **NFPA No. & Year** NFPA 72D

   b) **Section/Paragraph:** 2-7.1 (Exception)

2. **Proposal recommends: (Check one)** ☐ new text
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   Delete exception.

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   A properly installed and maintained system should be free of ground faults. The occurrence of one or more ground faults should be required to cause a "trouble" signal because it indicates a condition that could contribute to future malfunction of the system. Ground fault protection has been widely available on these systems for years and its cost is negligible. Requiring it on all systems will promote better installations, maintenance and reliability.

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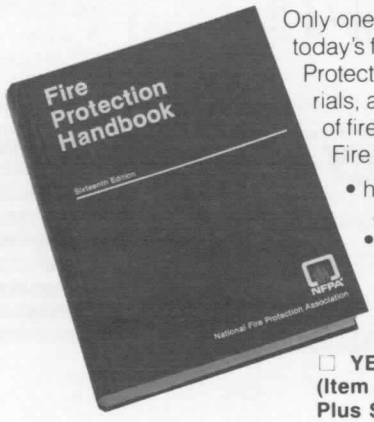

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