ANSI/NFPA 1982 An American National Standard June 8, 1988

NFPA 1982 Personal Alert Safety Systems (PASS) for Fire Fighters 1988 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

This material has been developed under the published procedures of the National Fire Protection Association, which are designed to assure the appointment of technically competent Committees having balanced representation. While these procedures assure the highest degree of care, neither the National Fire Protection Association, its members, nor those participating in its activities accepts any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

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INSIDE, THE PROFESSIONAL RESEARCH, REVIEW, OPINION, DISCUSSION AND REVISION YOU ORDERED FROM NFPA

NATIONAL FIRE PROTECTION ASSOCIATION

NFPA 1982

Standard on

Personal Alert Safety Systems (PASS)

for Fire Fighters

1988 Edition

This edition of NFPA 1982, *Standard on Personal Alert Safety Systems (PASS) for Fire Fighters*, was prepared by the Technical Committee on Fire Service Protective Clothing and Equipment, and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 16-18, 1988, in Los Angeles, California. It was issued by the Standards Council on June 8, 1988 with an effective date of June 28, 1988.

The 1988 edition of this document has been approved by the American National Standards Institute.

Origin and Development of NFPA 1982

The Technical Committee on Protective Equipment for Fire Fighters began work on this standard in 1980 in answer to requests from the fire service to establish requirements for a device that would signal for aid if a fire fighter became incapacitated while operating at an emergency. The International Association of Fire Fighters (IAFF) was instrumental in the developmental work that resulted in this standard. Developmental work was completed in the Spring of 1982, and submitted to the NFPA for official adoption. The first edition was presented at the Annual Meeting in Kansas City, Missouri and released on June 9, 1983. This second edition was prepared by the Subcommittee on PASS during 1986 and 1987.

Technical Committee on

Fire Service Protective Clothing and Equipment

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Anthony L. Mudford, Lifeline Safety Products

This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

NOTE: Membership on a Committee shall not in and of itself constitute an endorsement of the Association or any document developed by the Committee on which the member serves.

Contents

NFPA 1982

Standard on

Personal Alert Safety Systems (PASS) for Fire Fighters

1988 Edition

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

Information on referenced publications can be found in Chapter 5.

Chapter 1 Administration

1-1 Scope.

1-1.1* This standard specifies minimum performance criteria, functioning, and test methods for Personal Alert Safety Systems (PASS) to be used by fire fighters engaged in rescue, fire fighting, and other hazardous duties.

1-1.2 This standard is not intended to serve as a detailed manufacturing or purchase specification, but may be referenced in purchase specifications as minimum acceptable requirements.

1-1.3* Environmental and physical tests are used to determine compliance with the performance requirements of this standard. These tests shall not be deemed as establishing PASS performance levels for all situations to which fire fighting personnel may be exposed.

1-2 Purpose.

1-2.1 The purpose of this standard is to provide Personal Alert Safety Systems, to be worn by fire fighters, that will emit an audible alarm signal to summon aid in the event the fire fighter becomes incapacitated or needs assistance.

1-3 Definitions.

Alarm Signal. An audible warning that is identifiable as an indication that a fire fighter is in need of assistance.

Annunciator. The device on a PASS unit designed to emit the alarm signal.

Automatic. A functional mode in which the motion detector is activated and is sensing motion of the wearer.

Hazardous Environment. A place where a fire fighter could potentially receive harmful exposure to a hazardous or toxic atmosphere or substance, or be exposed to physical or mechanical hazards that are likely to cause injury.

Manual. A functional mode in which the Alarm Signal is activated.

Motion Detector. An integral portion of the PASS that senses movement, or lack of movement, and activates the Alarm Signal under a specified sequence of events.

Off. A functional mode in which the PASS is deactivated with no drain on the power source.

Personal Alert Safety System. A device that emits an audible alarm to notify others and assist in locating a fire fighter in danger.

PASS. An acronym for Personal Alert Safety System.

Shall. Indicates a mandatory requirement.

Should. This term, as used in the appendix, indicates a recommendation or that which is advised but not required.

Chapter 2 General Requirements

2-1 Compliance.

2-1.1 PASS labeled as being compliant with this standard as determined by laboratory testing shall meet or exceed all requirements of this standard.

2-1.2 To comply with the performance requirements of Chapter 3 of this standard, samples of the manufacturer's current production PASS that are to be labeled as being compliant with NFPA 1982 shall be:

(a) Initially tested and shall meet the performance and design requirements as defined in Chapter 3 of this standard.

(b) Annually tested and shall meet the design and performance requirements as defined in Chapter 3 of this standard.

2-1.3 Any modification made to the PASS by the manufacturer after the tests specified in 2-1.2 of this section have been conducted shall require the retesting and compliance with the performance and design requirements of all those individual tests that may be affected by such changes. This retesting shall be conducted before labeling the modified PASS as being in compliance with NFPA 1982.

2-2 Labeling.

2-2.1 Only PASS that meet all the requirements of this standard and are so represented by the manufacturer shall be labeled according to the provisions of 2-2.2 of this section.

2-2.2 Each PASS shall be durably and legibly labeled with the following information:

(a) The following statement: "This PASS meets all requirements of NFPA 1982, *Standard on Personal Alert Safety Systems (PASS) for Fire Fighters*, 1988 Edition."

(b) The following information:

(1) Name or designation of manufacturer.

(2) Model number or design.

(3) Lot or serial number.
(4) Recommended battery type and size.

2-2.3 Manufacturers of PASS shall provide, upon request, a written statement that the PASS manufactured and labeled as being compliant with this standard does meet or exceed all requirements of this standard.

2-3 Manufacturer's Instructions.

2-3.1 The PASS manufacturer shall provide with each PASS instructions and information for maintenance, cleaning, storage, and frequency and details of inspection.

2-3.2 The PASS manufacturer shall provide with each PASS specific instructions regarding the use, operation, and limitations of the PASS, and training materials.

Chapter 3 Design and Performance Requirements

3-1 Mode Selection.

3-1.1 PASS shall operate as specified in this section after being conditioned and tested in accordance with the requirements of Sections 4-1, 4-2, 4-3, and 4-4 of this standard.

3-1.2 PASS shall incorporate a switch(es) that shall allow for operation in three modes: (1) Off, (2) Manual, and (3) Automatic. The switch(es) shall be clearly labeled for each of the three modes of operation.

3-1.3 The switch(es) shall be protected against accidental change of operation or impact damage. The switch(es) shall be operated by a gloved hand to both the Manual or Automatic mode.

3-1.3.1 Glove utilized for this function test shall have a minimum thickness of 200 mils.

3-1.4 The switch(es) shall be rated for a service life of not less than 50,000 cycles.

3-1.5 Two separate and distinct manual actions shall be required to change the switch(es) from Automatic to Off, to reduce the possibility of unintentional deactivation of the PASS.

3-1.6 PASS shall be provided with a visual or audible indication of the mode selection status.

3-2 Motion Detector.

3-2.1 PASS shall operate as specified in this section after being conditioned and tested in accordance with the requirements of Sections 4-1, 4-2, 4-3, and 4-4 of this standard.

3-2.2 PASS shall incorporate a motion detector that shall sense movement of the fire fighter and automatically activate the Alarm Signal specified in 3-3.4.2 if no movement is sensed for 30 seconds, ±5 seconds.

3-2.3 The motion detector shall be operable independent of angle of deployment of the PASS unit.

3-2.4 PASS shall sound the Alarm Signal specified in 3-3.4.2 to warn of failure of the motion detector within 30 seconds, ±5 seconds.

3-3 Signals.

3-3.1 PASS shall operate as specified in this section after being conditioned and tested in accordance with the requirements of Sections 4-1, 4-2, 4-3, and 4-4 of this standard.

3-3.2 Operational Signal.

3-3.2.1 PASS shall emit an audible signal within 1 second when switched to Automatic mode, indicating to the wearer that the unit is functioning properly.

3-3.3 Pre-Alert Signal.

3-3.3.1 PASS shall emit a Pre-Alert Signal which shall sound 10 seconds, +5 seconds −3 seconds, preceding sounding of the Alarm Signal.

3-3.3.2 The Pre-Alert Signal shall be audible in a variable or noncontinuous tone and shall be a distinct and different sound from the Alarm Signal. The Pre-Alert Signal shall be between 70 and 85 dBA measured at a distance of 1 m (3.3 ft). The Pre-Alert Signal frequency shall not be less than 1,000 Hertz (Hz) nor more than 4,000 Hz.

3-3.3.3 PASS shall provide for a motion-induced cancellation of the Alarm Signal after the Pre-Alert Signal and prior to the Alarm Signal sounding.

3-3.3.4 Cancellation of the sounding of the Pre-Alert Signal shall not require the use of the wearer's hand(s).

3-3.3.5 PASS shall return to the Automatic mode upon cancellation of the Pre-Alert Signal.

3-3.4 Alarm Signal.

3-3.4.1 PASS shall emit an Alarm Signal when activated either by the motion sensor, or by activation of the Manual mode.

3-3.4.2 The Alarm Signal shall be audible in a variable or noncontinuous tone. The Alarm Signal shall consist of a minimum of three primary frequencies. Each primary frequency shall not be less than 1,000 Hertz (Hz) nor more than 4,000 Hz. The frequencies may be sounded sequentially or simultaneously. The Alarm Signal sound pressure level (SPL) shall not be less than 95 dBA measured at a distance of 3 m (9.9 ft) for an uninterrupted duration of not less than 1 hour, when tested in accordance with Section 4-6 of this standard.

3-3.5 Low Battery Warning Signal.

3-3.5.1 While in the Automatic mode, PASS shall emit a distinct and different audible Low Battery Warning Signal between 70 and 85 dBA when measured at a distance of 1 m (3.3 ft) when the battery can no longer maintain the 95 dBA sound for a period of 1 hour.

3-4 Retention System.

3-4.1 PASS shall be secured to the wearer by a retention system that meets the requirements of Section 4-5 of this standard.

3-4.2 The retention system shall not affect the performance of the PASS as worn. The retention system shall not cause the fire fighter's protective clothing and protective equipment to become degraded to a protection level less than the requirements to which the protective clothing and protective equipment were designed or certified.

3-5 Weight.

3-5.1 The weight of a complete PASS unit shall not be greater than 454 g (16 oz), including power source.

3-6 Intrinsic Safety.

3-6.1 PASS shall meet the Class I, Division I hazardous locations requirements of NFPA 493, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1 Hazardous Locations.*

3-7 Water Drainage.

3-7.1 PASS shall operate as specified in 3-3-4.2 of this chapter after being conditioned and tested in accordance with the requirements of Section 4-7 of this standard.

3-8 Corrosion.

3-8.1 PASS shall survive leakage from specified batteries without damage to the operating components as defined by ASTM G 15, *Definitions of Terms Relating to Corrosion and Corrosion Testing.*

Chapter 4 Test Requirements

4-1 Environmental and Physical Tests.

4-1.1 PASS shall be conditioned and tested in accordance with each of the following procedures, in the sequence given.

4-1.2 Case Integrity.

4-1.2.1 PASS shall support a 200-kg (442-lb) weight on each surface of the case without affecting case integrity or causing visible damage.

4-1.3 Elevated Operating Temperature.

4-1.3.1 PASS shall be tested in accordance with MIL-STD-810D:501.2 (Procedure II) with highest designed operating temperature of 71° C (160° F).

4-1.4 Low Operating Temperature.

4-1.4.1 PASS shall be tested in accordance with MIL-STD-810D:502.2 (Procedure I) with lowest designed operating temperature of −40° C (−40° F).

4-1.5 Temperature Shock.

4-1.5.1 PASS shall be tested in accordance with MIL-STD-810D:503.2 (Procedure I) except the cold temperature chamber temperature shall be −40° C (−40° F).

4-1.6 Salt Fog.

4-1.6.1 PASS shall be tested in accordance with MIL-STD-810D:509.2 (Procedure I).

4-1.7 Dust.

4-1.7.1 PASS shall be tested in accordance with MIL-STD-810D:510.2 (Procedure I).

4-1.8 Immersion/Leakage.

4-1.8.1 PASS shall be tested in accordance with MIL-STD-810D:512.2 (Procedure I) for conditioning only. This test shall exclude the opening and examining of the interior of the PASS.

4-2 Radiant Heat Test.

4-2.1 PASS shall be stabilized at 71° C (160° F) for 4 hours. The face of the PASS unit shall then be exposed to 1.5 cal/cm² for 10 seconds.

4-3 Flame Resistance Test.

4-3.1 The PASS unit shall be positioned to receive radiant flux of 0.60 W/cm², + 0.06 −0.00 W/cm². After 60 seconds, + 5 −0 seconds exposure to the radiant heat flux, and without removing the radiant heat source, the tip of the inner core of a Bunsen burner flame of 25-38 mm (1-1.5 in.) in length shall be placed against the face of the PASS unit so that the flame makes an angle of 45°, ±10° with the plane tangent to the test area at the point of contact. The Bunsen burner flame shall be fueled by a gas of 1,100 British Thermal Units (BTU), ±200 (BTU) per cu ft. The barrel of the Bunsen burner shall be 12 mm, ±3 mm (0.5 in., ±0.125 in.) in diameter. A flame spreader shall not be used.

4-3.2 After 15 seconds, + 1 −2 seconds, the flame shall be removed and the duration of afterflame and afterglow shall be measured.

4-3.3 There shall not be any visible flame or afterglow 5 seconds after removal of the test flame.

4-4 Impact Tests.

4-4.1 A separate PASS shall be used for each series of drops. Each PASS unit tested shall be complete with power source.

4-4.2 Ambient Temperature.

4-4.2.1 PASS shall be preconditioned by exposure to a temperature of 25° C (77° F) for at least 4 hours.

4-4.2.2 The PASS unit shall be removed from the conditioning chamber, and set in the Automatic mode. The PASS unit shall then be dropped a total of 8 times from a distance of 3 m (9.9 ft) onto a concrete surface, so that impact is on each face and on one corner and one edge of the PASS.

4-4.2.3 Following each drop, the PASS unit shall remain motionless and shall sound the Pre-Alert and Alarm Signals from the Automatic mode after which the Alarm Signal shall be stopped and the PASS reset to Automatic mode for the next drop.

4-4.2.4 The entire series of drops shall be completed within 10 minutes of removal from the preconditioning chamber.

4-4.3 Cold Temperature.

4-4.3.1 PASS shall be preconditioned by exposure to a temperature of −40° C (−40° F) for at least 4 hours.

4-4.3.2 The PASS unit shall be removed from the conditioning chamber, and set in the Automatic mode. The PASS unit shall then be dropped a total of 8 times from a distance of 3 m (9.9 ft) onto a concrete surface, so that impact is on each face and on one corner and one edge of the PASS.

4-4.3.3 Following each drop, the PASS unit shall remain motionless and shall sound the Pre-Alert and Alarm Signals from the Automatic mode after which the Alarm Signal shall be stopped and the PASS reset to Automatic mode for the next drop.

4-4.3.4 The entire series of drops shall be completed within 10 minutes of removal from the preconditioning chamber.

4-4.4 Elevated Temperature.

4-4.4.1 PASS shall be preconditioned by exposure to a temperature of 71° C (160° F) for at least 4 hours.

4-4.4.2 The PASS unit shall be removed from the conditioning chamber, and set in the Automatic mode. The PASS unit shall then be dropped a total of 8 times from a distance of 3 m (9.9 ft) onto a concrete surface, so that impact is on each face and on one corner and one edge of the PASS.

4-4.4.3 Following each drop, the PASS unit shall remain motionless and shall sound the Pre-Alert and Alarm Signals from the Automatic mode after which the Alarm Signal shall be stopped and the PASS reset to Automatic mode for the next drop.

4-4.4.4 The entire series of drops shall be completed within 10 minutes of removal from the preconditioning chamber.

4-5 Retention Test.

4-5.1 The PASS retention system shall withstand a static force of 445 N, ±5 N (100 lbs, ±1 lb). The force shall be applied steadily from 45 N (10 lb) at between 9.0 N/second (2.01 lb/sec) and 45 N/second (10 lb/sec). Force shall be applied perpendicular to the plane of the PASS as worn.

4-5.2 The retention system pull test shall be conducted after the retention system attachment method has been cycled 500 times to ensure the PASS will remain attached to the wearer after it has been attached and removed repeatedly during its service life.

4-6 Sound Pressure Level Test.

4-6.1 Sound pressure level for signals shall be determined in accordance with ANSI S1.13, *Methods for Measurement of Sound Pressure Level.* The laboratory measurement defined in ANSI S1.13 shall be used for these tests. Prior to this test, the battery shall be discharged to 80 percent of rated voltage when measured under Alarm Signal load.

4-7 Drainage Test.

4-7.1 PASS shall be tested in accordance with MIL-STD-810D, Test Method 506.2 (Procedure I) with a rainfall rate of 4 in. per hour and a wind velocity of 20 miles per hour, with the PASS unit positioned as specified in this section.

4-7.1.1 The first test shall have the annunciator oriented in its typical wearing position on a fire fighter as specified by the manufacturer.

4-7.1.2 The second test shall have the annunciator oriented horizontally, facing upwards for direct rain impingement.

4-7.2 During each test, the rainfall shall be directed onto the PASS unit, as oriented above, for 30 minutes with the PASS unit in the Off mode.

4-7.3 At the conclusion of the rain exposure, the PASS unit shall be placed in the Manual mode and allowed to sound for 60 seconds without moving. The sound pressure level shall be determined at the 60 second mark.

Chapter 5 Referenced Publications

5-1 The following documents or portions thereof are referenced within this standard and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

5-1.1 NFPA Publications. National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NFPA 493, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division I Hazardous Locations, 1978.*

5-1.2 Other Publications.

ANSI Publications. American National Standards Institute, 1450 Broadway, New York, NY 10018.

ANSI S1.13, *Methods for Measurement of Sound Presure Level,* 1976.

ASTM Publications. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM G 15, *Definitions of Terms Relating to Corrosion and Corrosion Testing,* 1986.

Department of Defense Publications. Navy Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

MIL-STD-810D, *Environmental Test Methods and Engineering Guidelines,* Rev. D. 19 July 1983.

Appendix A

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

A-1-1.1 The use of a Personal Alert Safety System by fire fighters is always assumed to be in hazardous environments. Since it is impossible to predetermine hazardous environments in a fire environment, during overhaul (salvage) operations or other emergency conditions, PASS use should be required at all times.

A-1-1.3 Although PASS that meet this standard have been tested to stringent requirements, there is no inherent guarantee against PASS failure or fire fighter injury. Even the best-designed PASS can not compensate for either abuse or the lack of a PASS training and maintenance program. The severity of these tests should not encourage or condone abuse of PASS in the field.

The environmental and physical tests utilized in this standard alone might not simulate actual field conditions, but are tests devised to put extreme loads on PASS in an accurate and reproducible manner by test laboratories. However, the selection of the environmental tests are based on summary values derived from studies of conditions that relate to field use.

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SUBMITTING PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Contact NFPA Standards Administration for final date for receipt of proposals on a specific document.

INSTRUCTIONS

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

1. For each document on which you are proposing amendment indicate:
   (a) The number and title of the document
   (b) The specific section or paragraph.

2. Check the box indicating whether or not this proposal recommends new text, revised text, or to delete text.

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.

5. Check the box indicating whether or not this proposal is original material, and if it is not, indicate source.

6. If supplementary material (photographs, diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee.

NOTE: The NFPA Regulations Governing Committee Projects in Paragraph 10-10 state: Each proposal shall be submitted to the Council Secretary and shall include:

(a) identification of the submitter and his affiliation (Committee, organization, company) where appropriate, and

(b) identification of the document, paragraph of the document to which the proposal is directed, and

(c) a statement of the problem and substantiation for the proposal, and

(d) proposed text of proposal, including the wording to be added, revised (and how revised), or deleted.

FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Mail to: Secretary, Standards Council
National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269

Date 5/18/85 **Name** John B. Smith **Tel. No.** 617-555-1212

Address 9 Seattle St., Seattle, WA 02255

Representing (Please indicate organization, company or self) Fire Marshals Assn. of North America

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
   - ☐ revised text
   - ☒ deleted text.

3. **Proposal (include proposed new or revised wording, or identification of wording to be deleted):**

   Delete exception.

4. **Statement of Problem and Substantiation for Proposal:**

   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.

5. ☒ **This Proposal is original material.**
   ☐ **This Proposal is not original material; its source (if known) is as follows:** _____

(Note: Original material is considered to be the submitter's own idea based on or as a result of his own experience, thought, or research and, to the best of his knowledge, is not copied from another source.)

I agree to give NFPA all and full rights, including rights of copyright, in this Proposal and I understand that I acquire no rights in any publication of NFPA in which this Proposal in this or another similar or analogous form is used.

John B. Smith

Signature

PLEASE USE SEPARATE FORM FOR EACH PROPOSAL

FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Mail to: Secretary, Standards Council
National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269

Date _____ Name _____ Tel. No. _____

Address _____

Representing (Please indicate organization, company or self) _____

1. a) Document Title: _____ NFPA No. & Year _____

   b) Section/Paragraph: _____

2. Proposal recommends: (Check one) ☐ new text
   ☐ revised text
   ☐ deleted text.

3. Proposal (include proposed new or revised wording, or identification of wording to be deleted):

4. Statement of Problem and Substantiation for Proposal:

5. ☐ This Proposal is original material.
   ☐ This Proposal is not original material; its source (if known) is as follows: _____

(Note: Original material is considered to be the submitter s own idea based on or as a result of his own experience, thought, or research and, to the best of his knowledge, is not copied from another source.)

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Cut Here

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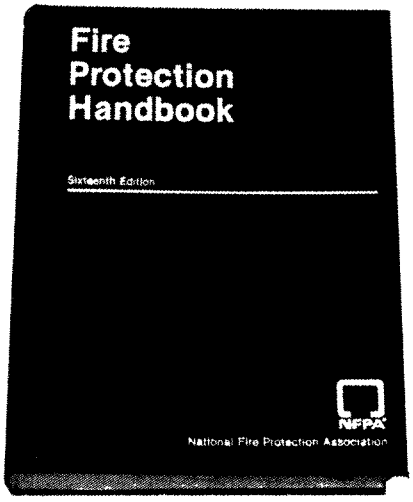

Fire Protection Handbook

Only one comprehensive sourcebook answers the full range of today's fire protection and prevention questions — the *Fire Protection Handbook*. With new fire technologies, new materials, and constantly changing fire hazards, the very nature of fire protection grows more complicated every day. The *Fire Protection Handbook* covers:

- hazardous wastes and materials
- venting
- emergency response
- fire hazards of robotics
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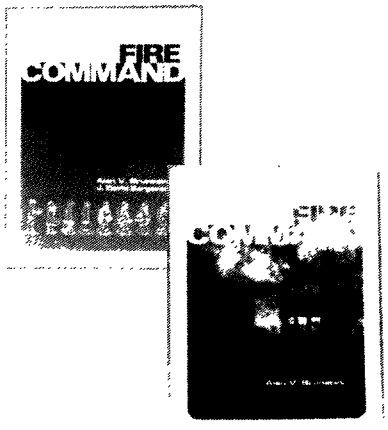

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