ANSI/NFPA 1982 An American National Standard August 20, 1993

NFPA 1982 Personal Alert Safety Systems (PASS) for Fire Fighters 1993 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101

NOTICE

All questions or other communications relating to this document should be sent only to NFPA Headquarters, addressed to the attention of the Committee responsible for the document.

For information on the procedures for requesting Technical Committees to issue Formal Interpretations, proposing Tentative Interim Amendments, proposing amendments for Committee consideration, and appeals on matters relating to the content of the document, write to the Secretary, Standards Council, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

A statement, written or oral, that is not processed in accordance with Section 16 of the Regulations Governing Committee Projects shall not be considered the official position of NFPA or any of its Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation.

Users of this document should consult applicable Federal, State and local laws and regulations. NFPA does not, by the publication of this document, intend to urge action which is not in compliance with applicable laws and this document may not be construed as doing so.

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.

---

1. Adoption by Reference — Public authorities and others are urged to reference this document in laws, ordinances, regulations, administrative orders or similar instruments. Any deletions, additions and changes desired by the adopting authority must be noted separately. Those using this method are requested to notify the NFPA (Attention: Secretary, Standards Council) in writing of such use. The term "adoption by reference" means the citing of title and publishing information only.

2. Adoption by Transcription — A. Public authorities with lawmaking or rule-making powers only, upon written notice to the NFPA (Attention: Secretary, Standards Council), will be granted a royalty-free license to print and republish this document in whole or in part, with changes and additions, if any, noted separately, in laws, ordinances, regulations, administrative orders or similar instruments having the force of law, provided that: (1) due notice of NFPA's copyright is contained in each law and in each copy thereof; and, (2) that such printing and republication is limited to numbers sufficient to satisfy the jurisdiction's lawmaking or rulemaking process. **B.** Once this NFPA Code or Standard has been adopted into law, all printings of this document by public authorities with lawmaking or rulemaking powers or any other persons desiring to reproduce this document or its contents as adopted by the jurisdiction in whole or in part, in any form, upon written request to NFPA (Attention: Secretary, Standards Council), will be granted a nonexclusive license to print, republish, and vend this document in whole or in part, with changes and additions, if any, noted separately provided that due notice of NFPA's copyright is contained in each copy. Such license shall be granted only upon agreement to pay NFPA a royalty. This royalty is required to provide funds for the research and development necessary to continue the work of NFPA and its volunteers in continually updating and revising NFPA standards. Under certain circumstances, public authorities with lawmaking or rulemaking powers may apply for and may receive a special royalty when the public interest will be served thereby.

3. Scope of License Grant — The terms and conditions set forth above do not extend to the index to this document.

(For further explanation, see the Policy Concerning the Adoption, Printing and Publication of NFPA Documents which is available upon request from the NFPA.)

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.

NFPA has no power or authority to police or enforce compliance with the contents of this document and any certification of products stating compliance with requirements of this document is made at the peril of the certifier.

Join over 63,000 professionals like yourself. Belong to NFPA!

You can have impact on issues that affect the fire safety industry—How?

When you belong to NFPA you'll receive special membership benefits that help you make informed decisions and make your voice a stronger one in the fire safety community. Your benefits include:

1. **Voting privileges** on proposed changes to existing codes and standards, and on new codes and standards.
2. The ***NFPA Journal***, *Fire News* newsletter, and *NFPA Journal Reference Directory & Buyers' Guide*—your source for fire statistics, reports, investigations, manufacturers, and codes and standards references.
3. **10% discount** on all products and services.
4. **Special invitations** to Annual, Fall, and Regional Meetings—where you can compare notes with your colleagues and take a position on issues that affect you. All these benefits—plus the pride and confidence that comes with membership in an internationally acclaimed organization can be yours for annual dues of $95.00. Join today!

☐ **YES! Send me an application to join my colleagues at NFPA today!**

Name _____ Date _____

Address _____ Signature _____

City, State, Zip _____

Code PA1

You can't beat this value on NFPA codes and standards...

Stay up-to-date on fire codes with this super, money-saving service!

In the dynamic world of fire protection, you need to keep up with current fire code requirements, recent changes, and new developments. The *National Fire Codes® Subscription Service* makes that an easier job! This complete service delivers every NFPA code and standard directly to you—over 280 essential codes in all! As a subscriber, you automatically receive new and revised documents from NFPA's Annual and Fall Meetings—as soon as they are published. Plus, additional mailings keep you informed of changes as they happen, so you are always working with the latest requirements.

☐ **YES! Start my subscription today! (Item No. 2H-NFCSS) $600.00 (NFPA Members $540.00*)**

Total amount enclosed $ _____ NFPA Member No. _____

☐ I enclose a check (payable to NFPA).

☐ Please bill me.

Name _____

Address _____

City, State, Zip _____

For easy ordering, call toll-free
1-800-344-3555!
Monday–Friday, 8:30 AM–8:00 PM, ET

* *Prices subject to change.*

Thank you for your purchases!

NFPA listens to our customers. Please let us know what you think.

What types of products would you like to see more of?

- ☐ seminars
- ☐ code handbooks
- ☐ general reference books
- ☐ videos
- ☐ training packages
- ☐ informational brochures
- ☐ electronic media
- ☐ other _____

In what subject area(s) would you like to see more products?

- ☐ electrical
- ☐ Fire Prevention Week
- ☐ public education
- ☐ other _____
- ☐ life safety
- ☐ fire service
- ☐ hazardous materials

How can NFPA better serve your needs?

_____

_____

_____

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 3376 BOSTON, MA

POSTAGE WILL BE PAID BY ADDRESSEE

NATIONAL FIRE PROTECTION ASSOCIATION
1 BATTERYMARCH PARK
PO BOX 9101
QUINCY MA 02269-9904

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 3376 BOSTON, MA

POSTAGE WILL BE PAID BY ADDRESSEE

NATIONAL FIRE PROTECTION ASSOCIATION
1 BATTERYMARCH PARK
PO BOX 9101
QUINCY MA 02269-9904

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 3376 BOSTON, MA

POSTAGE WILL BE PAID BY ADDRESSEE

NATIONAL FIRE PROTECTION ASSOCIATION
1 BATTERYMARCH PARK
PO BOX 9101
QUINCY MA 02269-9904
Attn: Product Development

NFPA 1982

Standard on

Personal Alert Safety Systems (PASS) for Fire Fighters

1993 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 24-27, 1993, in Orlando, FL. It was issued by the Standards Council on July 23, 1993, with an effective date of August 20, 1993, and supersedes all previous editions.

The 1993 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, MO, and released on June 9, 1983.

Between the first and second editions, the name of the technical committee changed to the Technical Committee on Fire Service Protective Clothing and Equipment. A subcommittee was organized to manage this document and is named the Subcommittee on Personal Alert Safety Systems (PASS). The second edition was presented to the membership of the Association at the 1988 Annual Meeting in Los Angeles, CA, and had an effective date of June 28, 1988.

For this third edition, the Subcommittee on PASS undertook a complete revision to bring the document into the same style format as other documents in this series. The subcommittee's work was completed in December, 1991, and the document was passed onto the Technical Committee on Fire Service Protective Clothing and Equipment. This third edition was presented to the membership of the Association at the 1993 Annual Meeting in Orlando, FL, and was issued with an effective date of August 20, 1993.

Technical Committee on Fire Service Protective Clothing and Equipment

Richard M. Duffy, *Chair*
Int'l Assn. of Fire Fighters, DC

Wayde B. Miller, *Secretary*
Mine Safety Appliances Co., PA
(Nonvoting)

Peter V. Ackerman, South Plainfield, NJ
Rep. Nat'l Assn. of Fire Fighters
Donald Aldridge, Lion Apparel Inc., OH
Curtis Berger, Menlo Park Fire Protection District, CA
Rep. Northern Area Fire Equipment Research Organization
Joseph A. Bigler, Mine Safety Appliances Co., PA
Rep. Compressed Gas Assn.
Donna P. Brehm, Virginia Beach Fire Dept., VA
Dennis W. Browner, Scott Aviation, NY
Rep. Industrial Safety Equipment Assn.
Rand-Scott Coggan, City of Redmond Fire Dept., WA
Rep. Int'l Assn. of Fire Chiefs
Christopher E. Coombs, Cairns & Brother, Inc., NJ
Paul H. Crawford, Riverside Fire Dept., CA
Rep. Southern Area Fire Equipment Research
Patricia A. Freeman, Globe Fire Fighters Suits, NH
Glen E. Gardner, U.S. Occupational Safety & Health Admin., DC
Daniel Gohlke, W. L. Gore & Assoc., MD
William L. Grilliot, Morning Pride Mfg. Co., Inc., OH
Cliff Haskell, IAFF Local 522, CA
Rep. Int'l Assn. of Fire Fighters
David A. Heywood, U.S. Testing Co., CA
Cy Long, Texas Commission on Fire Protection, TX
Robert T. McCarthy, U.S. Fire Administation, MD
Jim Minx, IAFF Local 1524, OK
Rep. Int'l Assn. of Fire Fighters
Kirk H. Owen, Plano Fire Dept., TX
Rep. NFPA Fire Service Section
Ray Reed, Dallas Fire Fighters Assn., TX
Alexander W. Santora, New York City Fire Dept., NY
Charles C. Soros, Seattle Fire Dept., WA
Jeffrey O. Stull, Texas Research Inst., Inc., TX
Bruce H. Varner, Phoenix Fire Dept., AZ
James H. Veghte, Biotherm, Inc., OH
Kay M. Villa, Nat'l Inst. of Standards and Technology, MD
Thomas L. Wollan, Underwriters Laboratories Inc., NC

Alternates

Roger L. Barker, North Carolina State University, NC
(Alt. to P. A. Freeman)
Don R. Forrest, United Firefighters of LA City, CA
(Alt. to C. Haskell)
Mary I. Grilliot, Morning Pride Mfg. Co., Inc., OH
(Alt. to W. L. Grilliot)
Tom Hillenbrand, Underwriters Laboratories Inc., IL
(Alt. to T. L. Wollan)
Raymond J. Kelley, Pawtucket Fire Fighters Local 1261, RI (Alt. to K. H. Owen)
Dominick A. Martucci, U.S. Testing Co., NJ
(Alt. to D. A. Heywood)
Joseph Reyes, IAFF Local 341, TX
(Alt. to J. Minx)
Robert J. Richter, Cairns & Brother Inc., NJ
(Alt. to C. E. Coombs)
Kenneth L. Simmons, Phoenix Fire Dept., AZ
(Alt. to B. H. Varner)
Joanne E. Slattery, U.S. Dept. of Labor OSHA, DC
(Alt. to G. E. Gardner)
Frank P. Taylor, Lion Apparel, Inc., OH
(Alt. to D. Aldridge)
Robert Vettori, Nat'l Inst. of Standards and Technology, MD
(Alt. to K. M. Villa)
Frank E. Wilcher, Industrial Safety Equipment Assn., Inc., VA
(Alt. to ISEA Rep.)

Subcommittee on PASS
(Personal Alert Safety Systems)

Don R. Forrest, *Chair*
United Firefighters of LA City, CA

Paul Deberjeois, Lifeline Safety Products, TX
Kim Goryance, Antenna Specialists, OH
David A. Heywood, U.S. Testing Co., CA
James Ponwitz, Cairns & Brother, Inc., NJ
Alexander W. Santora, New York City Fire Dept., NY
James H. Schwartz, Arlington Cnty Fire Dept., VA
Bruce H. Varner, Phoenix Fire Dept., AZ

Alternate

Mark Crandall, Lifeline Safety Products, TX
(Alt. to P. Deberjeois)

Nonvoting

Peter A. Frank, Product Innovation Safety Ltd., England

Bruce W. Teele, NFPA Staff Liaison

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.

Committee Scope: The Committee shall have primary responsibility for documents on the design, construction, and performance criteria for protective clothing and equipment for the fire service including chemical protective clothing and aircraft rescue and fire fighting protective clothing.

Contents

NFPA 1982

Standard on

Personal Alert Safety Systems (PASS) for Fire Fighters

1993 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 6 and Appendix B.

Chapter 1 Administration

1-1 Scope.

1-1.1* This standard specifies minimum design and performance criteria, 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 does not provide criteria for specialty PASS for use in proximity, approach, or entry fire fighting situations; or hazardous chemical operations.

1-1.3 This standard is not intended to serve as a detailed manufacturing or purchase specification, but can be referenced in purchase specifications as minimum requirements.

1-2 Purpose.

1-2.1 The purpose of this standard shall be to set minimum requirements for personal alert safety systems (PASS), which are to be worn by fire fighters during emergency operations, and which will emit an audible alarm signal to summon aid in the event the fire fighter becomes incapacitated or needs assistance.

1-2.2* Controlled laboratory tests used to determine compliance with the performance requirements of this standard shall not be deemed as establishing PASS performance levels for all situations to which fire fighting personnel can be exposed.

1-2.3 Nothing herein is intended to restrict any jurisdiction or manufacturer from exceeding these minimum requirements.

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.

Approach Fire Fighting. Limited, specialized exterior fire fighting operations at incidents involving fires producing very high levels of conductive, convective, and radiant heat, such as bulk flammable gas and bulk flammable liquid fires. Specialized thermal protection from exposure to high levels of radiant heat is necessary for the persons involved in such operations due to the limited scope of these operations and the greater distance from the fire that these operations are conducted. Not entry, proximity, or structural fire fighting. (*See also Entry Fire Fighting, Proximity Fire Fighting, and Structural Fire Fighting.*)

Approved.* Acceptable to the "authority having jurisdiction."

Authority Having Jurisdiction.* The "authority having jurisdiction" is the organization, office, or individual responsible for "approving" equipment, an installation, or a procedure.

Automatic. A functional mode in which the PASS motion detector is activated and is sensing the motion of the wearer, and causes an alarm signal after not sensing motion after a specified period of time.

Certification/Certified. A system whereby a certification organization determines that a manufacturer has demonstrated the ability to produce a product that complies with the requirements of this standard, authorizes the manufacturer to use a label on listed products that comply with the requirements of this standard, and establishes a follow-up program conducted by the certification organization as a check of the methods the manufacturer uses to determine compliance with the requirements of this standard.

Certification Organization. An independent, third-party organization that determines product compliance with the requirements of this standard with a label/listing/follow-up program.

Compliance/Compliant. Meeting or exceeding all applicable requirements of this standard.

Drip. To run or fall in drops or blobs.

Entry Fire Fighting. Extraordinarily specialized fire fighting operations that can include the activities of rescue, fire suppression, and property conservation at incidents involving fires producing very high levels of conductive, convective, and radiant heat; such as aircraft fires, bulk flammable gas fires, and bulk flammable liquid fires. Highly specialized thermal protection from exposure to extreme levels of conductive, convective, and radiant heat is necessary for persons involved in such extraordinarily specialized operations due to the scope of these operations and that direct entry into flames is made. Usually these operations are exterior operations; not structural fire fighting. (*See also Approach Fire Fighting, Proximity Fire Fighting, and Structural Fire Fighting.*)

Follow-up Program. The sampling, inspection, tests, or other measures conducted by the certification organization on a periodic basis to determine the continued compliance of listed products that are being produced by the manufacturer to the requirements of this standard.

Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Listed.* Equipment or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

Manual. A functional mode in which the PASS/alarm signal is activated by hand.

Manufacturer. The entity that assumes the liability and provides the warranty for the compliant product.

Melt. To change from solid to liquid, or be consumed, by action of heat.

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.

PASS. See Personal Alert Safety System.

Personal Alert Safety System (PASS). A device that is certified as being compliant with this standard that emits an audible alarm to notify others and assist in locating a fire fighter in danger.

Product Label. A label or marking affixed to the PASS unit by the manufacturer containing general information, warnings, care, maintenance, or similar data. This product label is not the certification organization's label, symbol, or identifying mark; however, the certification organization's label, symbol, or identifying mark can be attached to it or be part of it.

Proximity Fire Fighting. Specialized fire fighting operations that can include the activities of rescue, fire suppression, and property conservation at incidents involving fires producing very high levels of conductive, convective, and radiant heat, such as aircraft fires, bulk flammable gas fires, and bulk flammable liquid fires. Specialized thermal protection from exposure to high levels of radiant heat, as well as thermal protection from conductive and convective heat, is necessary for persons involved in such operations due to the scope of these operations and the close distance to the fire that these operations are conducted although direct entry into flame is NOT made. Usually these operations are exterior operations but might be combined with interior operations; not structural fire fighting, but might be combined with structural fire fighting operations; and not entry fire fighting. (*See also Approach Fire Fighting, Entry Fire Fighting, and Structural Fire Fighting.*)

Sample. A specified number of PASS units taken from a manufacturer's current production lot.

Shall. Indicates a mandatory requirement.

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

Structural Fire Fighting. The activities of rescue, fire suppression, and property conservation in buildings, enclosed structures, vehicles, vessels, or like properties that are involved in a fire or emergency situation.

1-4 Units.

1-4.1 In this standard, values for measurement are followed by an equivalent in parentheses, but only the first stated value shall be regarded as the requirement. Equivalent values in parentheses shall not be considered as the requirement as these values might be approximate.

Chapter 2 Certification

2-1 General.

2-1.1 Personal alert safety systems (PASS) that are labeled as being compliant with this standard shall meet or exceed all applicable requirements specified in this standard and shall be certified.

2-1.2 All certification shall be performed by an approved certification organization.

2-1.3 Compliant units shall be labeled and listed. Such units shall also have a product label or labels that meet the requirements specified in Section 2-5.

2-2 Certification Program.

2-2.1* The certification organization shall not be owned or controlled by manufacturers or vendors of the product being certified. The certification organization shall be primarily engaged in certification work and shall not have a monetary interest in the product's ultimate profitability.

2-2.2 The certification organization shall refuse to certify products to this standard that do not comply with all applicable requirements of this standard.

2-2.3* The contractual provisions between the certification organization and the manufacturer shall specify that certification is contingent on compliance with all applicable requirements of this standard. There shall be no conditional, temporary, or partial certifications. Manufacturers shall not be authorized to use any label or reference to the certification organization on products that are not manufactured in compliance with all applicable requirements of this standard.

2-2.4* For certification, laboratory facilities and equipment for conducting proper tests shall be available, a program for calibration of all instruments shall be in place and operating, and procedures shall be in use to ensure proper control of all testing. Good practice shall be followed regarding the use of laboratory manuals, form data sheets, documented calibration and calibration routines, performance verification, proficiency testing, and staff qualification and training programs.

2-2.5 Manufacturers shall be required to establish and maintain a program of production inspection and testing that meets the requirements of Section 2-4.

2-2.6 The manufacturers and the certification organization shall evaluate any changes affecting the form, fit, or function of the certified product to determine its continual certification to this standard.

2-2.7* Product certification shall include a follow-up inspection program with at least two random and unannounced visits per 12-month period.

2-2.8 The certification organization shall have a program for investigating field reports alleging malperformance or failure of listed products.

2-2.9 The operating procedures of the certification organization shall provide a mechanism for the manufacturer to appeal decisions. The procedures shall include the presentation of information from both sides of a controversy to a designated appeals panel.

2-2.10 The certification organization shall be in a position to use legal means to protect the integrity of its name and label. The name and label shall be registered and legally defended.

2-3 Inspection and Testing.

2-3.1 Sampling levels for inspection to determine compliance with this standard shall be established by the certification organization and the manufacturer to ensure a reasonable and acceptable reliability at a reasonable and acceptable confidence level that products certified as being compliant with the standard are compliant.

2-3.2 Sampling levels for the test series for certification shall consist of 18 PASS units. PASS units shall be subjected to the test or tests specified in the test matrix, Table 2-3.2. Where there is more than one test for a specific sample PASS, the order of testing for that sample PASS shall be from top to bottom as shown in Table 2-3.2.

2-3.3* Testing for determining compliance with the performance requirements specified in Chapter 4 shall be performed on complete PASS units. When a PASS incorporates additional features, including but not limited to heat sensors, radio signaling or transmitting devices, etc., the presence of those additional features shall not cause the PASS to fail any performance requirement of this standard. Where a PASS is an integral part of another item of protective clothing or protective equipment, that item with the PASS incorporated shall be tested as a whole.

2-3.4 No substitution or repair of any PASS components shall be allowed during testing.

Table 2-3.2 Test Matrix

Test Order	Samples 1-3	Samples 4-6	Samples 7-9	Samples 10-12	Samples 13-15	Samples 16-18
1	Sound Pressure (Section 4-1) Samples 1-3	Shock Sensitivity (Section 5-6) Samples 4-6	Retention System (Section 5-8) Samples 7-9	Water Drainage (Section 5-9) Samples 10-12	Heat/Flame Test #1 -Manual Mode- (5-11.13) Sample 13	Intrinsic Safety (3-4.3) Samples 16-18
2	Case Integrity (Section 5-5) Samples 1-3	Impact Resistance -Ambient- (5-7.2.1) Sample 4		Heat Resistance (Section 5-10) Samples 10-12	Heat/Flame Test #2 -Automatic Mode- (5-11.14) Sample 14	
3	Electronic Temperature Stress -Elevated- (5-2.3.1) Samples 1-3	Impact Resistance -Cold- (5-7.2.2) Sample 5			Heat/Flame Test #3 -Automatic Mode- (5-11.15) Sample 15	
4	Electronic Temperature Stress -Low- (5-2.3.2) Samples 1-3	Impact Resistance -Elevated- (5-7.2.3) Sample 6				
5	Electronic Temperature Stress -Shock- (5-2.3.3) Samples 1-3					
6	Corrosion (Section 5-3) Samples 1-3					
7	Immersion/Leakage (Section 5-4) Samples 1-3					

2-3.5* All testing and inspection shall be performed utilizing the battery power source(s) specified on PASS in accordance with 2-5.1.2(d).

2-4 Manufacturer's Quality Assurance Program.

2-4.1 The manufacturer shall provide and maintain a quality assurance program that includes a documented inspection and product recall system. The manufacturer shall have an inspection system to substantiate compliance with this standard.

2-4.2 The manufacturer shall maintain written inspection and testing instructions. The instructions shall prescribe inspection and test of materials, work in process, and completed articles. Criteria for acceptance and rejection of materials, processes, and final product shall be part of the instructions.

2-4.3 The manufacturer shall maintain records of all pass/fail tests. Pass/fail records shall indicate the disposition of the failed material or product.

2-4.4 The manufacturer's inspection system shall provide for procedures that ensure the latest applicable drawings, specifications, and instructions are used for fabrication, inspection, and testing.

2-4.5 The manufacturer shall, as part of the quality assurance program, maintain a calibration program of all instruments used to ensure proper control of testing. The calibration program shall be documented as to the date of calibration and performance verification.

2-4.6 The manufacturer shall maintain a system for identifying the appropriate inspection status of component materials, work in process, and finished goods.

2-4.7 The manufacturer shall establish and maintain a system for controlling nonconforming material, including procedures for the identification, segregation, and disposition of rejected material. All nonconforming materials or products shall be identified to prevent use, shipment, and intermingling with conforming materials or products.

2-4.8 The manufacturer's quality assurance program shall be audited by the third-party certification agency to determine that the program is sufficient to ensure continued product compliance with this standard.

2-5 Product Labeling.

2-5.1 Each PASS unit shall have a product label or labels permanently attached.

2-5.1.1 The following information shall appear on a product label placed in a conspicuous location and shall be printed in letters at least $1/16$ in. (1.5 mm) in height:

"THIS PASS MEETS ALL REQUIREMENTS OF NFPA 1982, STANDARD ON PERSONAL ALERT SAFETY SYSTEMS (PASS) FOR FIRE FIGHTERS, 1993 EDITION."

2-5.1.2 At least the following information shall appear on a product label(s) placed on each PASS unit in a user-accessible location, and shall be printed in letters at least $1/16$ in. (1.5 mm) in height:

(a) Manufacturer's name

(b) Model number of design

(c) Lot or serial number

(d) Recommended battery type and size

(e) Month and year of manufacture (uncoded)

(f) Country of manufacturer.

2-5.1.3 The PASS product label shall bear the certification label, symbol, or identifying mark of the certification organization denoting compliance. The label, symbol, or identifying mark printing shall be in at least $1/4$-in. (6-mm) high letters. The label, symbol, or identifying mark shall be permitted to appear on the product label placed in the user-accessible location.

2-5.1.4 PASS also shall meet the labeling requirements for Class I, Division 1 hazardous locations of ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1 Hazardous Locations.*

2-5.2 All portions of the required product labels shall be printed at least in English.

2-5.3 All product labels also shall meet the requirements specified in Section 4-12.

2-6 User Information.

2-6.1 The PASS manufacturer shall provide, with each PASS unit, instructions for maintenance, decontamination, cleaning, painting, storage, and frequency and details of inspection.

2-6.2 The PASS manufacturer shall provide, with each PASS unit, specific instructions regarding the use, operation, and limitations of the PASS, training materials, and warranty details.

Chapter 3 Design Requirements

3-1 Mode Selection.

3-1.1 Personal alert safety systems (PASS) shall incorporate a mode selection device or devices to allow for operation in three modes: (1) *off*, (2) *manual*, and (3) *automatic*. All modes of operation shall be clearly indicated to the user for the mode in use.

3-1.2 All mode selection devices shall be protected against accidental change of operation or impact damage.

3-1.3 All mode selection devices shall be rated for a service life of not less than 50,000 cycles.

3-1.4 All mode selection devices shall be capable of being switched to the *manual* or *automatic* mode by a single gloved hand. Gloves utilized for this function test shall have a thickness of 0.10 in. to 0.15 in. (2.5 mm to 3.8 mm).

3-1.5 Only one action shall be required to switch the mode selection device(s) from any mode to *manual*.

3-1.6 When the PASS is sounding the *alarm signal*, either in the *automatic* mode or after being switched from the

automatic mode to the *manual* mode, it shall require at least two separate and distinct manual actions to silence the *alarm signal*.

3-1.7 PASS shall be provided with a visual indication of mode status and an audible indication of a change in mode selection when switching from *off* to *automatic*, *off* to *manual*, or *manual* to *automatic*.

3-2 Motion Detector.

3-2.1 PASS shall incorporate a motion detector that shall sense movement and automatically sound the *alarm signal* specified in 3-3.3 if no movement is sensed for 30 seconds, ±5 seconds. The *alarm signal* shall be preceded by a *pre-alert signal*, specified in 3-3.2, that shall sound 7 seconds, +3/–0 seconds, before the sounding of the *alarm signal*.

3-2.2 The motion detector shall be operable independent of the angle of deployment of the PASS.

3-2.3 PASS shall sound the *alarm signal* specified in 3-3.3 within 30 seconds, ±5 seconds, of failure of the motion detector to warn of such failure.

3-3 Signals.

3-3.1 Operational Signal.

3-3.1.1 PASS shall emit an audible signal within 1.0 second of being switched to *automatic* mode, indicating to the user that the unit is functioning properly.

3-3.2 Pre-Alert Signal.

3-3.2.1 The *pre-alert signal* shall have a frequency not less than 1000 Hertz (Hz) nor more than 4000 Hz.

3-3.2.2 PASS shall sound the *pre-alert signal* 7 seconds, +3/–0 seconds, preceding sounding of the *alarm signal*.

3-3.2.3 During the *pre-alert signal* sounding, all other audible signals shall be rendered inactive.

3-3.2.4 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*.

3-3.2.5 PASS shall provide for a motion-induced cancellation of the *alarm signal* after the *pre-alert signal* and prior to the sounding of the *alarm signal*.

3-3.2.6 Cancellation of the sounding of the *pre-alert signal* shall not require the use of the user's hand(s).

3-3.2.7 PASS shall return to the *automatic* mode upon cancellation of the *pre-alert signal*.

3-3.3 Alarm Signal.

3-3.3.1 The *alarm signal* shall consist of a minimum of three primary frequencies. Each primary frequency shall not be less than 1000 Hertz (Hz) nor more than 4000 Hz. These frequencies shall be sounded either sequentially or simultaneously.

3-3.3.2 PASS shall sound the *alarm signal* when placed in the *manual* mode.

3-3.3.3 PASS shall sound the *alarm signal* when activated by the motion sensor if no movement is sensed for 30 seconds, ±5 seconds. When activated by the motion sensor, the *alarm signal* shall be preceded by the *pre-alert signal*, which shall sound 7 seconds, +3/–0 seconds, before the sounding of the *alarm signal*.

3-3.3.4 During the *alarm signal* sounding, all other audible signals shall be rendered inactive.

3-3.3.5 The *alarm signal* shall be audible in a variable or noncontinuous tone.

3-3.3.6 The *alarm signal* shall not be deactivated by the motion sensor.

3-3.4 Low Battery Warning Signal.

3-3.4.1 While in the *automatic* mode, PASS shall emit an audible *low battery warning signal* that is distinct and different from the *pre-alert* and *alarm signals*.

3-4 General Design Requirements.

3-4.1* Where the PASS is secured by the retention system in a wearing position in accordance with the manufacturer's instructions, the retention system shall not affect the proper function of the mode selection device or devices specified in Section 3-1 and shall not affect the performance of the PASS.

3-4.2* The battery compartment shall be isolated from the operating components so as to prevent damage to the operating components from battery leakage. Wires between compartments shall be sealed.

3-4.3 PASS shall meet the requirements for Class I, Division 1 hazardous locations of ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1 Hazardous Locations.*

Chapter 4 Performance Requirements

4-1 Sound Pressure Level.

4-1.1 Pre-Alert Signal.

4-1.1.1 When tested as specified in Section 5-1, Sound Pressure Level Testing, personal alert safety systems (PASS) shall function properly as specified in 3-3.2, and the *pre-alert signal* sound pressure level shall be between 70 and 85 dBA.

4-1.2 Alarm Signal.

4-1.2.1 When tested as specified in Section 5-1, Sound Pressure Level Testing, PASS shall function properly as specified in 3-3.3, and the *alarm signal* sound pressure level shall not be less than 95 dBA for an uninterrupted duration of not less than 1 hour.

4-1.2.2 The *alarm signal* shall not be deactivated by the motion sensor.

4-1.3 Low Battery Warning Signal.

4-1.3.1 When tested as specified in Section 5-1, Sound Pressure Level Testing, PASS shall function properly as specified in 3-3.4, and the *low battery warning signal* sound pressure level shall be between 70 and 85 dBA.

4-2 Electronic Temperature Stress.

4-2.1 When tested as specified in Section 5-2, Electronic Temperature Stress Testing, PASS shall function properly as specified in Sections 3-2 and 3-3.

4-3 Corrosion Resistance.

4-3.1 When tested as specified in Section 5-3, Corrosion Resistance Testing, PASS shall function properly as specified in Sections 3-2 and 3-3.

4-4 Immersion/Leakage Resistance.

4-4.1 When tested as specified in Section 5-4, Immersion/Leakage Testing, PASS shall function properly as specified in Sections 3-2 and 3-3, there shall be no water inside the battery compartment, and there shall be no water in the electronics compartment.

4-5 Case Integrity.

4-5.1 When tested as specified in Section 5-5, Case Integrity Testing, PASS shall function properly as specified in Sections 3-2 and 3-3, and the PASS shall support the test weight without affecting case integrity or causing visible damage.

4-6 Shock Sensitivity.

4-6.1 When tested as specified in Section 5-6, Shock Sensitivity Testing, the PASS *pre-alert signal* shall not cancel.

4-7 Impact Resistance.

4-7.1 When tested as specified in Section 5-7, Impact Resistance Testing, PASS shall function properly as specified in Sections 3-2 and 3-3.

4-8 Retention System.

4-8.1 When tested as specified in Section 5-8, Retention System Testing, PASS shall function properly as specified in Sections 3-2 and 3-3, and the PASS retention system shall withstand a static force of 100 lb, +1/–0 lb (445 N, +5/–0 N).

4-9 Water Drainage.

4-9.1 When tested as specified in Section 5-9, Water Drainage Testing, the PASS shall operate as specified in 3-3.3 and 4-1.2.

4-10 Heat Resistance.

4-10.1 When tested as specified in Section 5-10, Heat Resistance Testing, PASS shall not melt, drip, or ignite.

4-11 Heat and Flame Resistance.

4-11.1 When tested as specified in Section 5-11, Heat and Flame Testing — Test 1, PASS shall function as follows:

(a) The *alarm signal* shall sound and continue to sound, as specified in 3-3.3.

(b) The after-flame shall not exceed 2.2 seconds.

(c) Nothing shall fall off the PASS, and the PASS shall not fall from its mounted position.

(d) Two separate and distinct manual actions shall be required to change the mode selection device from *manual* to *off*, as specified in 3-1.6.

(e) The *pre-alert signal* sound pressure level shall be as specified in 4-1.1.

(f) The *alarm signal* sound pressure level shall be as specified in 4-1.2.

4-11.2 When tested as specified in Section 5-11, Heat and Flame Testing — Test 2, PASS shall function as follows:

(a) PASS shall emit the operational signal, as specified in 3-3.1.

(b) The after-flame shall not exceed 2.2 seconds.

(c) Nothing shall fall off the PASS, and the PASS shall not fall from its mounted position.

(d) PASS shall cycle from *automatic* to *pre-alert*, as specified in 3-2.1.

(e) The *pre-alert signal* shall sound as specified in 3-3.2.

(f) PASS shall cycle from *pre-alert* to *alarm*, as specified in 3-2.1.

(g) The *alarm signal* shall sound as specified in 3-3.3.

(h) Two separate and distinct manual actions shall be required to change the mode selection device from *manual* to *off*, as specified in 3-1.6.

(i) The *pre-alert signal* sound pressure level shall be as specified in 4-1.1.

(j) The *alarm signal* sound pressure level shall be as specified in 4-1.2.

4-11.3 When tested as specified in Section 5-11, Heat and Flame Testing — Test 3, the PASS shall function as follows:

(a) PASS shall emit the operational signal, as specified in 3-3.1.

(b) The after-flame shall not exceed 2.2 seconds.

(c) Nothing shall fall off the PASS, and the PASS shall not fall from its mounted position.

(d) The mode selection device shall be capable of being switched from *automatic* to *manual*, as specified in 3-1.4 and 3-1.5.

(e) The *alarm signal* shall sound, as specified in 3-3.3.

(f) Two separate and distinct manual actions shall be required to change from *manual* to *off*, as specified in 3-1.6.

(g) The *pre-alert signal* sound pressure level shall be as specified in 4-1.1.

(h) The *alarm signal* sound pressure level shall be as specified in 4-1.2.

4-12 Product Label Durability.

4-12.1 When tested as specified in Section 5-12, Product Label Durability Testing, product labels shall remain attached to the PASS and shall be legible to the unaided eye.

Chapter 5 Test Requirements

5-1 Sound Pressure Level Testing.

5-1.1 Sample personal alert safety systems (PASS) shall be tested for sound pressure levels of the signals 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. All sound pressure level measurements shall be made with the sound level meter ballistics set to the peak response setting.

5-1.1.1 The sound pressure level for the *pre-alert signal* shall be measured at a distance of 3.3 ft (1 m).

5-1.1.2 The sound pressure level for the *alarm signal* shall be measured at a distance of 9.9 ft (3 m).

5-1.1.3 The sound pressure level for the *low battery warning signal* shall be measured at a distance of 3.3 ft (1 m). The test shall be conducted when the battery can no longer maintain the 95 dBA sound for a period of 1 hour.

5-1.2 Prior to conducting these tests, the sample PASS batteries shall be discharged to the level at which the PASS first emits the *low battery warning signal* specified in 3-3.4.

5-1.3 The sound pressure levels for each signal and the duration that the signal is emitted shall be measured and recorded to determine pass/fail.

5-2 Electronic Temperature Stress Testing.

5-2.1 Sample PASS shall be subjected to a series of three temperature stress tests identified as Test 1 for elevated temperature, Test 2 for low operating temperature, and Test 3 for temperature shock. Different sample PASS shall be used for each of the three test series. Each sample PASS tested shall be complete with power source.

5-2.2 The test chamber or cabinet shall be capable of maintaining the required conditions throughout the envelope of air surrounding the sample PASS being tested, and these conditions shall be continuously monitored.

5-2.3 For all three tests, different sample PASS shall be conditioned and used for each of the three test series. The conditioning shall be at the specified temperatures and exposure times. Following each test, the sample PASS shall be allowed to stabilize at ambient conditions prior to proceeding to the next test.

5-2.3.1 For Test 1, the sample PASS shall be placed in the test apparatus that has been stabilized at 120°F (49°C). After 6 hours, the temperature shall be raised within 1 hour to 160°F (71°C) and maintained for 4 hours. The temperature shall then be decreased within 1 hour to 120°F (49°C). This cycle shall be repeated twice. After the second cycle, the temperature shall be raised to 160°F (71°C) for 4 hours.

5-2.3.2 For Test 2, the sample PASS shall be placed in the test apparatus that has been stabilized at -40°F (-40°C) and maintained for a minimum of 4 hours.

5-2.3.3 For Test 3, the sample PASS shall be placed in the test apparatus that has been stabilized at -40°F (-40°C), cold condition, for 4 hours. Sample PASS shall be removed from the cold condition and shall be placed within 5 minutes into another test apparatus that has been stabilized at 160°F (71°C), hot condition. After 4 hours, sample PASS shall be returned to cold condition test apparatus for another 4 hours. This cycle shall be repeated twice. Sample PASS shall then be allowed to stabilize at ambient conditions.

5-2.4 For all three tests, sample PASS shall be removed following the specified conditioning, and function testing shall begin within 30 seconds of removal from conditioning. For each test, sample PASS shall then be operated according to the manufacturer's instructions to determine the proper functioning as specified in Sections 3-2 and 3-3 for determining pass/fail.

5-3 Corrosion Testing.

5-3.1 A salt fog chamber shall be used for testing and shall meet the requirements of ASTM B 117, *Standard Test Method for Salt Spray (Fog) Testing.*

5-3.2 Sample PASS shall be subjected to a 5 percent, ±1 percent, salt solution fog at a chamber temperature of 95°F (35°C) for 48 hours in the typical wearing position as if worn by a fire fighter, as specified by the manufacturer. The PASS shall then be stored in an environment of 72°F, ±5°F (22°C, ±3°C) at 50 percent ±5 percent relative humidity, for a minimum of 48 hours.

5-3.3 The sample PASS shall then be operated according to the manufacturer's instructions to determine the proper functioning as specified in Sections 3-2 and 3-3 for determining pass/fail.

5-4 Immersion/Leakage Testing.

5-4.1 The test water container shall be capable of covering the uppermost point of the sample PASS with a depth of 3.3 ft (1 m) of water and shall maintain the PASS at that depth.

5-4.2 The water shall be 64°F, ±18°F (18°C, ±10°C) and the temperature of the water shall not change more than 5°F (3°C) for the duration of the test.

5-4.3 Sample PASS shall be conditioned prior to immersion at a temperature of 49°F, ±5°F (27°C, ±3°C) above the temperature of the water for a minimum of 2 hours. Sample PASS shall then be immersed in the test water container for 2 hours. After 2 hours, the sample PASS shall be removed from the test water container and shall be wiped dry.

5-4.4 The sample PASS shall then be operated according to the manufacturer's instructions to determine the proper functioning as specified in Sections 3-2 and 3-3 for determining pass/fail.

5-4.5* The battery compartment of the sample PASS shall be opened and inspected for water leakage to determine pass/fail.

5-4.6* The sample PASS shall then be reimmersed in the test water container for an additional 5 minutes. The battery compartment shall be open, and the battery shall not be installed.

5-4.7 After 5 minutes, the sample PASS shall be removed from the test water container and shall be wiped dry. The sample PASS shall be opened and inspected for water leakage to determine pass/fail.

5-5 Case Integrity Testing.

5-5.1 Sample PASS shall be subjected to a test weight of 442 lb (200 kg). The test weight shall be placed on each surface of the PASS case. The test weight shall be placed so as to avoid impact loading.

5-5.2 The test weight shall remain on each surface of the sample PASS case for 1 minute, +15/–0 seconds.

5-5.3 After removal of the test weight, each surface of the sample PASS case shall be examined to determine pass/fail.

5-5.4 The sample PASS shall then be operated according to the manufacturer's instructions to determine the proper functioning as specified in Sections 3-2 and 3-3 for determining pass/fail.

5-6 Shock Sensitivity Testing.

5-6.1 Sample PASS shall be subjected to one test series conducted on each test orientation as specified in Figure 5-6.1. A single test series shall consist of dropping the test ball three times.

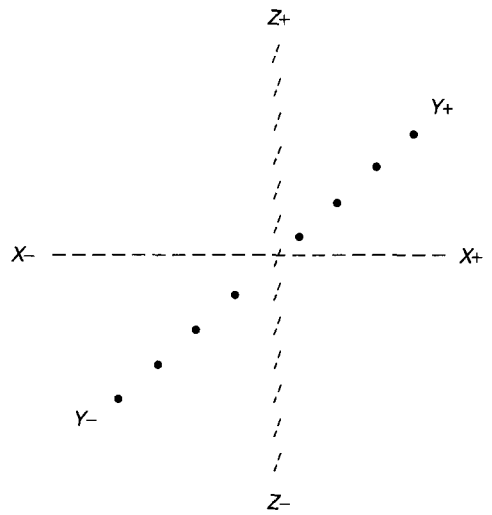


Figure 5-6.1 Test orientation.

5-6.2 Sample PASS shall be placed on a granite surface plate with minimum dimensions of 12 in. (width) × 12 in. (length) × 3 in. (thickness) (30.5 cm × 30.5 cm × 7.6 cm). Sample PASS shall be in direct contact with the granite surface plate and secured in such a manner to prevent movement of the sample PASS during the test. The method of securing the sample PASS shall not interfere with the surface being tested.

5-6.3 The sample PASS shall be placed in the *automatic* mode. The testing shall be conducted during the sounding of the *pre-alert signal.*

5-6.4 A 0.375-in. (9.5-mm) I.D. × 6-in. (15.2-cm) long tube shall be positioned, with the long axis perpendicular within ±2 degrees, in a vertical orientation over the center of the surface of the sample PASS being tested. The bottom of the tube shall be within 0.125 in. (3.2 mm) of the surface of the sample PASS, but shall not touch the PASS. A stainless steel test ball measuring 0.313 in. (8 mm) O.D. shall be held at the top of the tube, then dropped through the tube and allowed to fall on the surface of the sample PASS.

5-6.5 The sounding of the *pre-alert signal* shall be monitored to determine pass/fail.

5-7 Impact Resistance Testing.

5-7.1 Three sample PASS shall be subjected to a series of impact tests; one for impact at ambient temperature, one for impact at cold temperature, and one for impact at elevated temperature. A different sample PASS shall be used for each of the three impact test series. Each sample PASS tested shall be complete with power source.

5-7.2 A different sample PASS shall be conditioned and used for each of the three impact test series. The conditioning at the specified temperatures shall be an exposure of at least 4 hours.

5-7.2.1 For the impact test series at ambient temperature, the sample PASS shall be exposed to a temperature of 73°F, ±2°F (23°C, ±1°C).

5-7.2.2 For the impact test series at cold temperature, the sample PASS shall be exposed to a temperature of -40°F, ±2°F (-40°C, ±1°C).

5-7.2.3 For the impact test series at elevated temperature, the sample PASS shall be exposed to a temperature of 160°F, ±2°F (71°C, ±1°C).

5-7.3 The sample PASS shall be removed from conditioning and set in the *automatic* mode. Testing shall begin within 30 seconds of removal from conditioning. For each conditioning, the sample PASS shall be dropped a total of eight times from a distance of 9.9 ft (3 m) onto a concrete surface so that impact is on each face and on one corner and one edge of the PASS. The sample PASS shall not be permitted to bounce a second time.

5-7.4 Following each drop, the sample PASS shall remain motionless and shall sound the *pre-alert* and *alarm signals* from the *automatic* mode to determine the proper functioning as specified in 3-3.3 for determining pass/fail, after which the *alarm signal* shall be stopped and the PASS reset to *automatic* mode for the next drop.

5-7.5 The entire single series of drops shall be completed within 10 minutes of removal from conditioning.

5-8 Retention System Testing.

5-8.1* Sample PASS that are to be subjected to the retention system test shall first have the retention system attachment method cycled 500 times.

5-8.2 From a base load of 10 lb (45 N), the sample PASS retention system shall have a force applied steadily from 10 lb/sec (45 N) at a rate between 2.01 lb/sec (9.0 N/sec) and 10 lb/sec (45 N/sec). The force shall be applied perpendicular to the plane of the PASS, as intended to be worn in accordance with the manufacturer's instructions. The force shall be applied until separation of the retention system occurs.

5-8.3 The force at which the retention system separates shall be marked or noted to determine pass/fail.

5-9 Water Drainage Testing.

5-9.1 Sample PASS shall be subjected to two water drainage tests. The first test shall have the sample PASS positioned with the annunciator oriented in the position it is intended to be worn, in accordance with the manufacturer's instructions. The second test shall have the sample PASS positioned with the annunciator oriented horizontally, facing up.

5-9.2 Water shall be introduced into all openings, indentations, and grilles of the sample PASS until water overflows from each such opening, indentation, and grille. The filling method shall ensure that no air bubbles remain in any of the openings, indentations, and grilles.

5-9.3 The sample PASS shall then be placed in the *manual* mode and allowed to sound for at least 65 seconds without moving. The sound pressure level for the *alarm signal* shall be measured as specified in 5-1.1 and 5-1.1.2.

5-9.4 The sound pressure level for the *alarm signal* shall be measured and recorded at the 60-second mark to determine pass/fail.

5-10 Heat Resistance Testing.

5-10.1 The test oven shall be a horizontal flow circulating oven with minimum interior dimensions of 24 in. × 24 in. × 24 in. (61 cm × 61 cm × 61 cm). The test oven shall have an airflow rate of 125 to 250 linear ft/min (38 to 76 linear m/min) at the standard temperature and pressure of 70°F (21°C) at 1 atmosphere, measured at the center point of the oven. A test thermocouple shall be positioned so that it is level with the horizontal centerline of a mounted sample PASS. The thermocouple shall be equidistant between the vertical centerline of a mounted sample PASS placed in the middle of the oven and the oven wall where the airflow enters the test chamber. The thermocouple shall be an exposed bead type J or K, No. 30 AWG thermocouple. The test oven shall be heated and the test thermocouple stabilized at 500°F, +10°/–0°F (260°C, +3°/–0°C) for a minimum of 30 minutes.

5-10.2 Sample PASS shall be mounted on a test fixture that includes an aramid belt that is at least 2 in. (5.1 cm) wide and fastened to mounting posts spaced 12 in., +1/–0 in. (30.5 cm, +2.5/–0 cm) apart. The test fixture shall be designed to allow the sample PASS to be attached to the belt by the retention system according to the sample PASS manufacturer's instructions.

5-10.3 The test fixture with the sample PASS attached shall be placed in the test oven. The sample PASS shall be set to the *off* mode. The test fixture shall be oriented in the test oven so that the belt is perpendicular to the airflow. There shall be no obstructions between the sample PASS and the test oven fan. The test fixture shall position the sample PASS equidistant from all interior oven surfaces. The test oven door shall not remain open more than 15 seconds. The air circulation shall be shut off while the door is open and turned on when the door is closed. The total test oven recovery time shall not exceed 30 seconds. The thermocouple reading shall remain at 500°F, +10°/–0°F (260°C, +3°/–0°C) for the duration of the test.

5-10.4 The sample PASS, mounted as specified, shall be exposed in the test oven for 5 minutes, +15/–0 seconds. The test exposure time shall begin when the test thermocouple recovers to 500°F, +10°/–0°F (260°C, +3°/–0°C).

5-10.5 After the specified exposure, the sample PASS shall be removed and shall be examined to determine pass/fail.

5-11 Heat and Flame Testing.

5-11.1 A test mannequin meeting the requirements specified in Figure 5-11.1 shall be provided.

5-11.2* The test mannequin shall have a protective covering. The protective covering shall be designed and constructed as follows.

5-11.2.1 The assembled protective covering composite consisting of an outer shell, moisture barrier, and thermal liner shall have an average thermal protective performance (TPP) of not less than 35.0 when tested in accordance with Section 5-2 of NFPA 1971, *Standard on Protective Clothing for Structural Fire Fighting*.

5-11.2.2 The outer shell shall be 40 percent PBI®/60 percent Kevlar® rip stop weave, weighing approximately 7.5 oz/sq yd, with a water-repellent finish. Color shall be natural, undyed.

5-11.2.3 The thermal liner shall be constructed of a 3 oz/sq yd rip stop pajama check Nomex III® facecloth, quilt stitched to 100 percent Nomex III® batting of approximately 6 oz/sq yd.

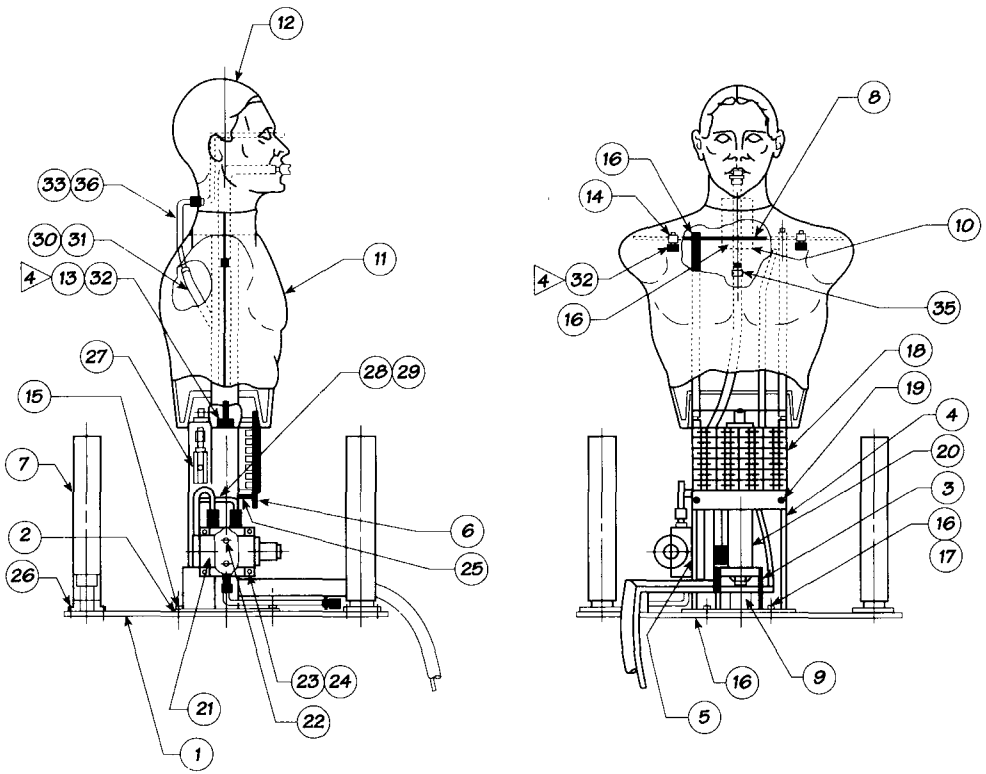
5-11.2.4 The moisture barrier shall be constructed of approximately 2.25 oz/sq yd polyester/cotton fabric that is coated with approximately 6.5 oz/sq yd of flame-resistant neoprene.

5-11.2.5 The moisture barrier shall be completely sewn to the thermal liner at its perimeter, with the neoprene side facing outward from the thermal liner. All edges shall be sewn together and bound with nonwicking moisture barrier material. The liner/moisture barrier shall be no more than 3 in. (7.62 cm) from the coat hem.

5-11.2.6 The moisture barrier and thermal liner shall be completely detachable from the outer shell.

5-11.2.7 The protective covering shall be stitched with Kevlar® thread using a minimum of 6 to 8 stitches per in. (2.54 cm). All major seams are to be double stitched and felled locked, with all inside seams to be finished with Kevlar® thread. All stress points shall be reinforced. No metal shall pass from the outside of the protective covering through the moisture barrier and liner to cause the transfer of heat to the mannequin when the protective covering is completely assembled. The protective covering, including the front closure, shall be constructed in a manner that provides secure and complete moisture and thermal protection. If nonpositive fasteners, such as snaps or hook- and pile-tape, are utilized in garment closures, positive locking fasteners, such as hooks and dees or zippers, shall also be utilized. Pockets and fluorescent retroreflective trim shall not be installed.

5-11.2.8 The collar shall be of four-piece construction consisting of outer shell material on both the back, or outside, and next to the mannequin neck. The two inner layers shall consist of a thermal liner and moisture barrier. No throat strap shall be attached.



NOTES
Unless otherwise specified:
1. All dimensions are in inches.
2. Dimensioning and tolerancing per ANSI Y14.5M-1982.
3. Surface texture per ANSI B46.1-1978.
4. 4 x 0.194 $^{+.010}_{-.002}$ THRU ITEM II, MATCH DRILL FROM ITEMS 13 & 14 FOR ITEM 32.

A/R		TUBE, S/STL, 1/4 O.D.			36
1		CLAMP, AEROSEAL, O 1/2			35
1	SWAGELOK-400-6	UNION, 1/4 TUBE	CRES		33
12		SCR, #8-32 UNC-2A RD HD X 3/8 LG	CRES		32
1		CLAMP, AEROSEAL, O 1/2	CRES		31
A/R		TUBE, PVC REINFORCED 1/4 I.D.		9330-51405	30
5	SWAGELOK-600-1-2	MALE CONNECTOR, 3/8 TUBE X 1/8 NPT	CRES		29
A/R		TUBE, 0.375 X .035 W.	CRES	4710-14193	28
1	ARO CORP	SNUBBER			27
12		SCR, 1/4-20 UNC-2A SOC HD X 1.00 LG	STL		26
4		STANDOFF, #6-32 THD, X 1.00 LG	ALUM	5975-53447	25
4		NUT, HEX, #10-32 UNF-2B STD	STL		24
4		SCR, #10-32 UNF-2A SOC HD X 1.50 LG	STL		23
4		SCR, #10-32 UNF-2A FLT HD X 1.00 LG	STL		22
1	ARO CORP MODEL K21355120A	VALVE			21
1	ARO CORP 0418-1003-080	CYLINDER , AIR, 1 1/8 BORE			20
4		SCR, #6-32 UNC-2A RD HD X 1 1/2 LG	STL		19
4	MARLIN CORP. 1032-6	CONNECTOR, T.C., 6 JACK, 2 HOLE, TYPE K		5935-58196	18
		NUT, HEX, 1/4-20 UNC-2B STD	STL		17
12		SCR, 1/4-20 UNC-2A FLT HD X .75 LG	STL		16
4		SCR, 1/4-20 UNC-2A SOC HD X .50 LG	STL		15
4	90-101459	BRACKET			14
2	90-101473 ⚠	TIE STRAP			13
1	90-101456	HEAD			12
1	90-101461	TORSO I OR TORSO II			11
1	89-113884	COLLAR-MOUNT			10
1	89-113883	SHAFT END			9
1	89-111724	MOUNT PLATE, MANIKIN			8
4	89-113882	GUIDE VERTICAL			7
1	89-113881	T.C. PANEL			6
1	89-113880	VALVE PLATE			5
2	89-113878	FRAME BAR			4
1	89-113877	MOUNT-AIR CYL.			3
1	89-113876	BASE MOUNT			2
1	89-113879	LIFT PLATE			1
		DESCRIPTION/MATERIAL		SPEC NO.	ITEM

MAJOR UNIT	HAZARD CONTROL (SAFETY SCIENCE GROUP)
SUBASSY.	NFPA HEAT & FLAME TEST APPARATUS
DETAIL	MANIKIN ASSY
SHOWN ON AAA	DRAWING NO AAA 90-101453-0A
ACCT NO. 3265-30	
SCALE 8.00	SHEET OF

Figure 5-11.1 Heat and flame test mannequin.

5-11.2.9 Outside sleeve seams shall be felled, while inside seams shall be lock stitched.

5-11.2.10 The protective covering shall measure 35 in. (88.9 cm) in length measured from the center of the back collar seam to the hem. The protective covering size shall be 44-in. chest by 34-in. sleeve (111.8 cm by 86.4 cm).

5-11.2.11 The complete protective covering shall be discarded and shall not be used where the damage to any portion indicates the covering can no longer provide thermal protection for the test mannequin.

5-11.3 Where the test headform portion of the mannequin will not be protected by items of protective clothing or protective equipment during testing, the test headform shall be fully covered with an undyed, protective hood covering for protection of the headform during testing. The protective hood covering shall meet the performance requirements of 6-1.3 of NFPA 1971, *Standard on Protective Clothing for Structural Fire Fighting*.

5-11.4 The heat and flame test apparatus shall be as specified in Figures 5-11.4(a) and (b).

5-11.5 The test oven shall be a vertical forced circulating air oven with an internal velocity of 200 linear ft (61 linear m) per minute. The test oven shall have minimum dimensions of 36 in. (depth) × 36 in. (width) × 48 in. (height) (91 cm × 91 cm × 122 cm).

5-11.6 The test oven shall be calibrated using a 30-gauge exposed bead, Type J iron/constantan wire reference thermocouple that has been calibrated to set the 32°F (0°C) reference point with an ice bath containing ice and deionized or distilled water. Boiling water shall be used to set the 212°F (100°C) reference value. The reference temperatures shall be corrected to standard temperatures using a barometric pressure correction.

5-11.7 For calibration prior to the heat and flame test, the calibration mannequin, as specified in Figure 5-11.7, shall be exposed to direct flame contact for 10 seconds using the heat and flame test apparatus as specified in Figure 5-11.4. All peak temperature readings shall be within a temperature range of 1500°F to 2102°F (815°C to 1150°C). The average mean of all peak temperature readings shall be no higher than 1742°F (950°C).

5-11.8 The test oven recovery time, after the door is closed, shall not exceed 1 minute.

5-11.9 Sample PASS shall be attached to the front or rear of the test mannequin by the retention system, in accordance with the manufacturer's instructions, by means of a loop, belt, SCBA strap, etc., that is on the outside or over the mannequin protective covering. Sample PASS shall be attached in such a manner that the unit is facing a burner array.

5-11.10 Sample PASS shall be subjected to three different test series of the heat and flame test identified in this section as Test 1, Test 2, and Test 3. Different sample PASS shall be used for each of the three test series.

5-11.11 For all three tests, sample PASS mounted on the test mannequin shall first be placed in the test oven that has been preheated to 203°F ±4°F (95°C ±2°C) for 15 minutes. The test exposure time of 15 minutes shall begin after the door is closed and the oven temperature recovers to 203°F (95°C).

5-11.12 At the completion of the 15-minute exposure, the oven door shall be opened and the sample PASS, mounted on the test mannequin, shall be moved out of the oven and into the center of the burner array.

5-11.13 For Test 1, the sample PASS mode selection device shall be set in the *manual* mode, then exposed to the flame and drop sequences of the test.

5.11.13.1 Sample PASS shall be observed for the sounding of the alarm signal to determine pass/fail as specified in 4-11.1(a).

5-11.14 For Test 2, the sample PASS mode selection device shall be set in the *automatic* mode, then exposed to the flame and drop sequences.

5.11.14.1 Sample PASS shall be observed for the sounding of the operational signal to determine pass/fail as specified in 4-11.2(a).

5-11.15 For Test 3, the sample PASS mode selection device shall be set in the *automatic* mode, then exposed to the flame and drop sequences.

5.11.15.1 Sample PASS shall be observed for the sounding of the operational signal to determine pass/fail as specified in 4-11.3(a) of this standard.

5-11.16 After setting the mode selection device to the applicable setting for Test 1, Test 2, or Test 3, as indicated in 5-11.13, 5-11.14, or 5-11.15, the sample PASS in all three tests shall then be exposed to direct flame contact for 10 seconds, +0.25/–0 seconds. This exposure shall begin within 20 seconds of removal of the sample PASS from the test oven.

5-11.16.1 For all three tests, sample PASS shall be observed for any after-flame, and the after-flame duration shall be recorded to determine pass/fail as specified in 4-11.1(b), 4-11.2(b), and 4-11.3(b).

5-11.16.2 For Test 1, sample PASS shall be observed for the continued sounding of the *alarm signal* to determine pass/fail as specified in 4-11.1(a).

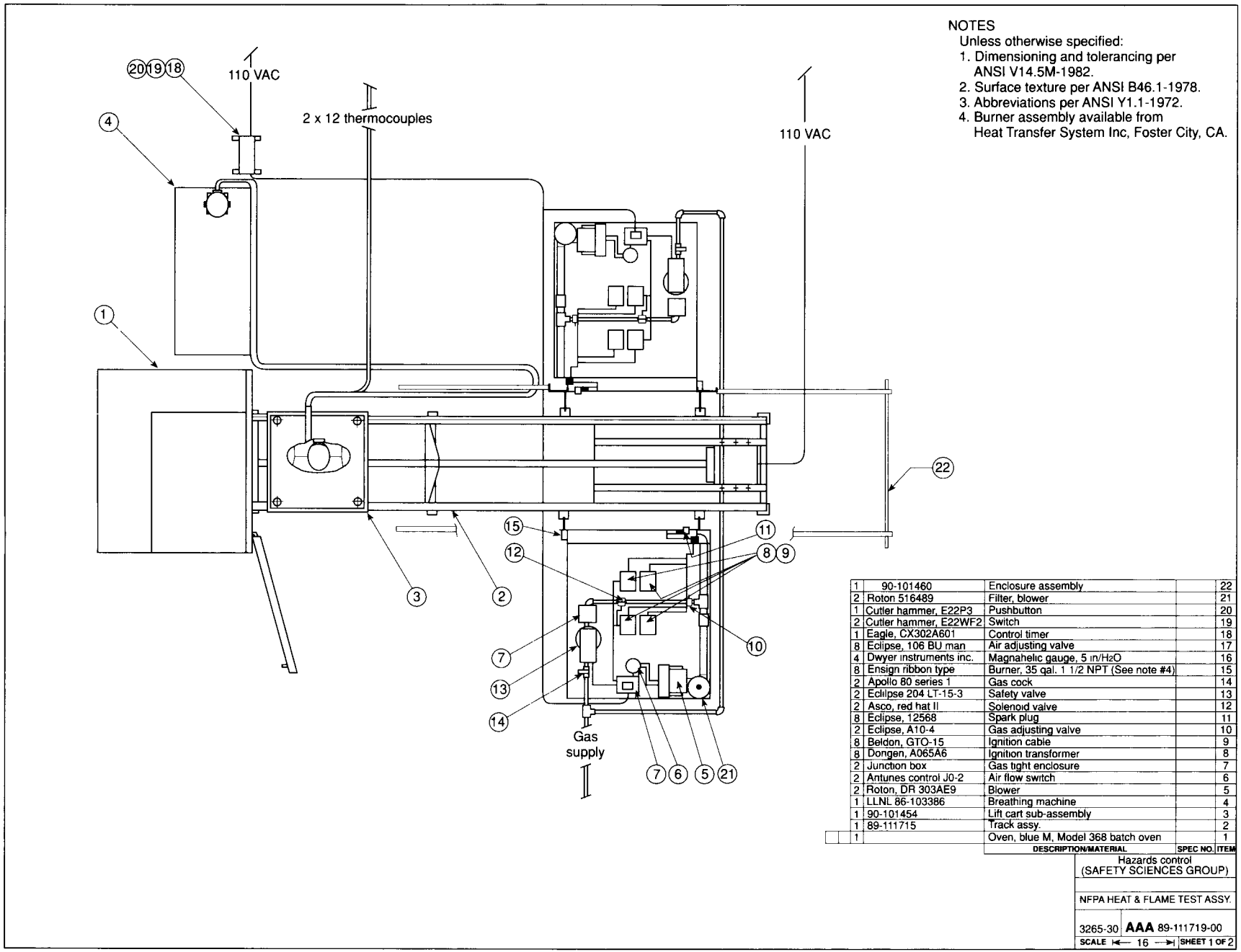
5-11.17 For all three tests, within 20 seconds of completing the direct flame exposure, sample PASS mounted on the test mannequin shall be raised 6 in., +0.25/–0 in. (15.24 cm, +6.3/–0 mm) and dropped freely.

5-11.17.1 For all three tests, sample PASS shall be observed to determine pass/fail as specified in 4-11.1(c), 4-11.2(c), and 4-11.3(c).

5-11.18 For Test 1, following the drop sequence, sample PASS shall be observed for the continued sounding of the *alarm signal* to determine pass/fail as specified in 4-11.1(a). The sample PASS mode selection device then shall be set to *off*.

5-11.18.1 The sample PASS shall be observed for the proper functioning of the mode selection device to determine pass/fail as specified in 4-11.1(d).

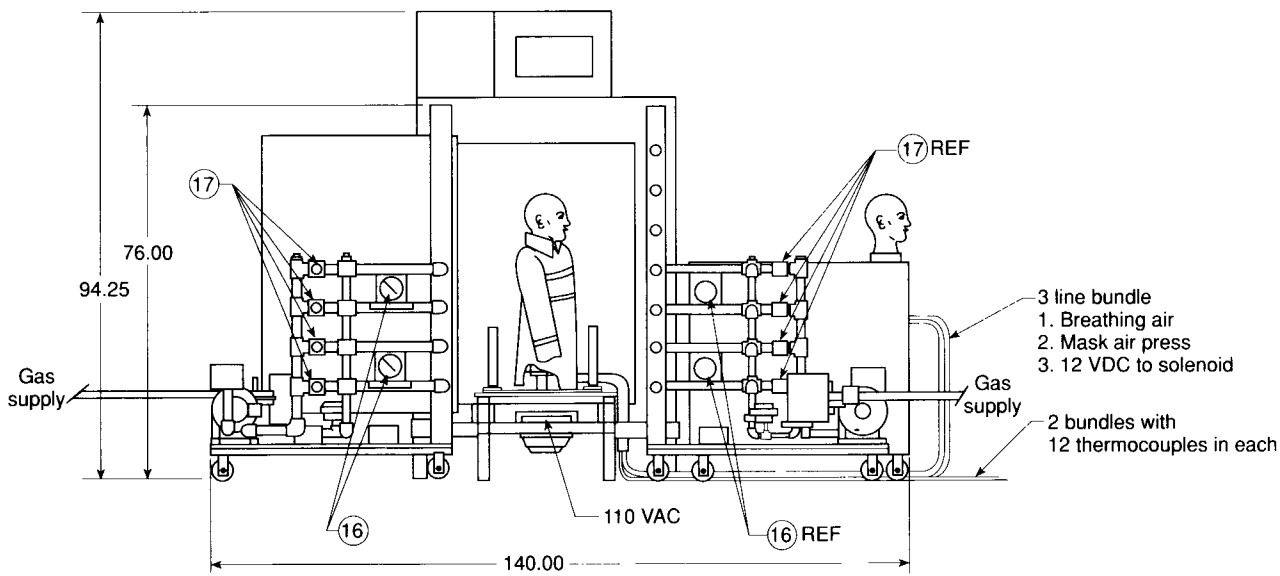
5-11.19 For Test 2, following the flame and drop sequence, sample PASS shall remain motionless and allowed to cycle to the *pre-alert signal* and then to the *alarm signal*. Following the sounding of the *alarm signal*, the mode selection device shall be set to *off*.



ITEM	SPEC NO.	DESCRIPTION/MATERIAL
22		90-101460 Enclosure assembly
21		Roton 516489 Filter, blower
20		Cutler hammer, E22P3 Pushbutton
19		Cutler hammer, E22WF2 Switch
18		Eagle, CX302A601 Control timer
17		Eclipse, 106 BU man Air adjusting valve
16		Dwyer instruments inc. Magnahelic gauge, 5 in/H2O
15		Ensign ribbon type Burner, 35 gal. 1 1/2 NPT (See note #4)
14		Apollo 80 series 1 Gas cock
13		Eclipse 204 LT-15-3 Safety valve
12		Asco, red hat II Solenoid valve
11		Eclipse, 12568 Spark plug
10		Eclipse, A10-4 Gas adjusting valve
9		Beldon, GTO-15 Ignition cable
8		Dongen, A065A6 Ignition transformer
7		Junction box Gas tight enclosure
6		Antunes control J0-2 Air flow switch
5		Roton, DR 303AE9 Blower
4		LLNL 86-103386 Breathing machine
3		90-101454 Lift cart sub-assembly
2		89-111715 Track assy.
1		Oven, blue M, Model 368 batch oven

Figure 5-11.4(a) Heat and flame test apparatus top view.

NOTES
Unless otherwise specified:
1. Dimensioning and tolerancing per ANSI Y14.5M-1982.
2. Surface texture per ANSI 846.1-1978.
3. Abbreviations per ANSI Y1.1-1972.



DESCRIPTION/MATERIAL	SPEC NO.	ITEM
HAZARDS CONTROL (SAFETY SCIENCES GROUP)		
NFPA HEAT & FLAME TEST APPARATUS		
3265-30 AAA 89-111719-00		
SCALE 16	SHEET 2 OF 2	

Figure 5-11.4(b) Heat and flame test apparatus side view.

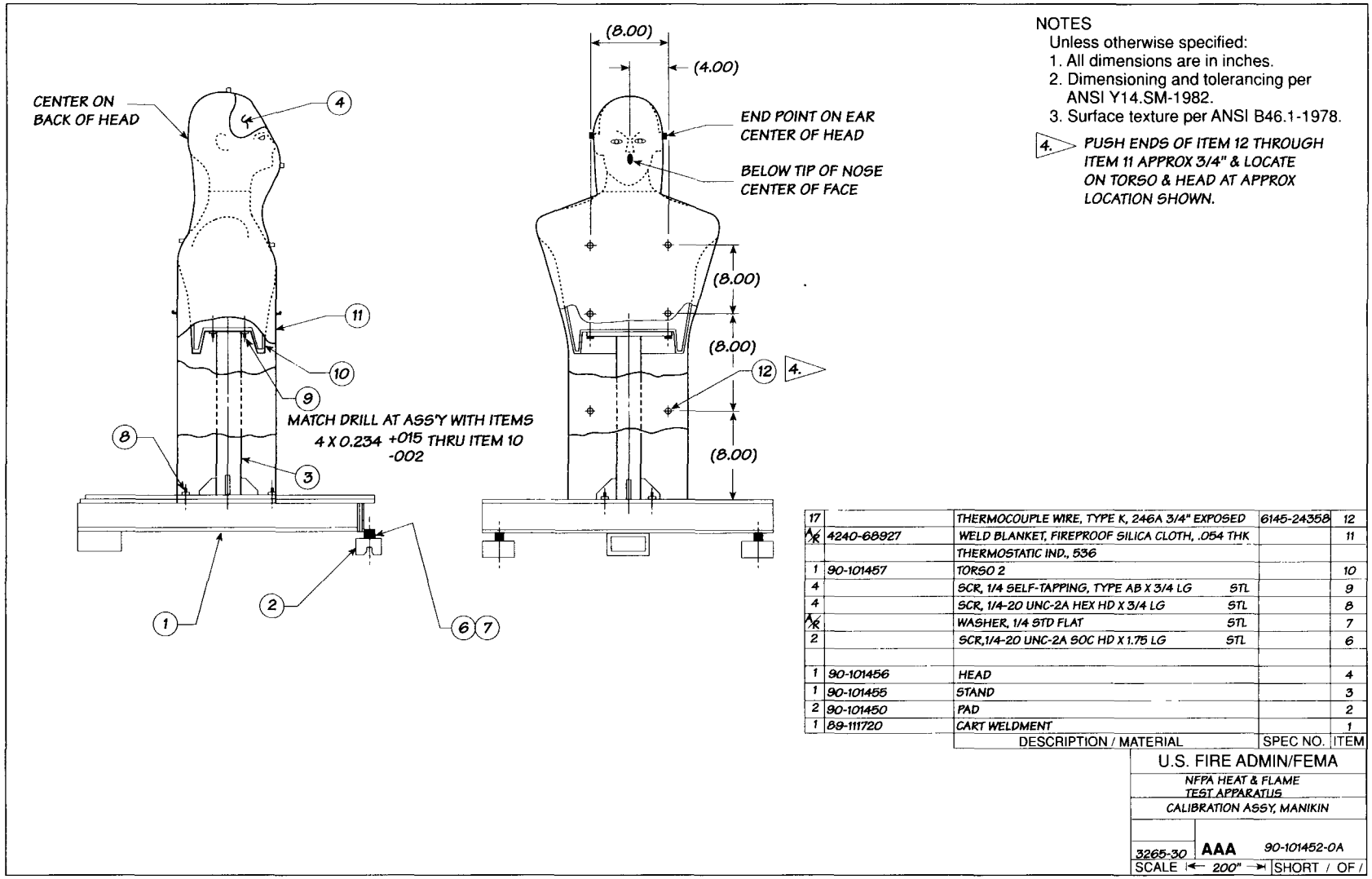


Figure 5-11.7 Calibration mannequin.

5-11.19.1 Sample PASS shall be observed for the proper cycling to determine pass/fail as specified in 4-11.2(d) and 4-11.2(f). Sample PASS shall be observed for the sounding of the *pre-alert signal* and the *alarm signal* to determine pass/fail as specified in 4-11.2(e) and 4-11.2(g). Sample PASS shall be observed for the proper functioning of the mode selection device to determine pass/fail as specified in 4-11.2(h).

5-11.20 For Test 3, following the flame and drop sequences, the sample PASS mode selection device shall be set to *manual*. If the sample PASS begins to sound the *pre-alert signal* prior to being set to *manual*, the sample PASS shall be jarred to cancel the *pre-alert signal* before setting to *manual*. Following the sounding of the *alarm signal*, the mode selection device shall be set to *off*.

5-11.20.1 Sample PASS shall be observed for the proper functioning of the mode selection device while switching to *manual* to determine pass/fail as specified in 4-11.3(d). Sample PASS shall be observed for the sounding of the *alarm signal* to determine pass/fail as specified in 4-11.3(e). Sample PASS shall be observed to determine the proper functioning of the mode selection device while switching to *off* to determine pass/fail as specified in 4-11.3(f).

5-11.21 For all three tests, sample PASS shall be removed from the test mannequin and shall be tested for the *pre-alert signal* sound pressure level as specified in 4-1.1 to determine pass/fail as specified in 4-11.1(e), 4-11.2(i), and 4-11.3(g). Sample PASS shall then be tested for the *alarm signal* sound pressure level as specified in 4-1.2 to determine pass/fail as specified in 4-11.1(f), 4-11.2(j), and 4-11.3(h).

5-12 Product Label Durability Testing.

5-12.1 Sample PASS with all product labels attached shall be subjected to the tests specified in Sections 5-2, 5-3, and 5-4.

5-12.2 After each test, the product labels shall be examined to determine pass/fail. The product labels shall be permitted to be wiped clean with an untreated cloth prior to being examined.

Chapter 6 Referenced Publications

6-1 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.

6-1.1 NFPA Publication. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 1971, *Standard on Protective Clothing for Structural Fire Fighting*, 1991 edition.

6-1.2 ANSI Publications. American National Standards Institute, 11 W. 42nd St., New York, NY 10036.

ANSI S1.13, *Methods for Measurement of Sound Pressure Level*, 1986.

ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1 Hazardous Locations*, 1988.

6-1.3 ASTM Publication. American Society for Testing of Materials, 1916 Race St., Philadelphia, PA 19103.

ASTM B 117, *Standard Test Method for Salt Spray (Fog) Testing*, 1985.

Appendix A Explanatory Material

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

A-1-1.1 NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, requires that each wearer involved in rescue, fire fighting, or other hazardous duties be provided with and use a PASS device.

PASS units should be worn on protective clothing and used whenever the member is involved in fire suppression or similar activities, regardless of whether SCBA is worn. This might require the PASS to be moved from one protective clothing item to another, or for the department to purchase additional PASS units for use where structural protective clothing is not worn, as in the case of wildland fire fighting, technical rescue, high-angle rescue, etc.

PASS is designed to assist in the location of a fire fighter who is incapacitated or in need of assistance.

Every fire department should establish a system of fire fighter accountability that provides for the tracking and inventory of all members in accordance with Section 4-3 of NFPA 1561, *Standard on Fire Department Incident Management System*, and Section 6-3 of NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*.

A-1-2.2 Although PASS that are in compliance with this standard have been tested to stringent requirements, there is no inherent guarantee against PASS failure or fire fighter injury. The best designed PASS cannot 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.

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

A-1-3 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

A-1-3 Authority Having Jurisdiction. The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since jurisdictions and "approval" agencies vary as do their responsibilities. Where public safety is primary, the "authority having jurisdiction" may be a federal, state, local or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department, building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the "authority having jurisdiction." In many circumstances the property owner or his designated agent assumes the role of the "authority having jurisdiction"; at government installations, the commanding officer or departmental official may be the "authority having jurisdiction."

A-1-3 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The "authority having jurisdiction" should utilize the system employed by the listing organization to identify a listed product.

A-2-2.1 The certification organization should have a sufficient breadth of interest and activity so that the loss or award of a specific business contract would not be a determining factor in the financial well-being of the agency.

A-2-2.3 The contractual provisions covering certification programs should contain clauses advising the manufacturer that if requirements change, the product should be brought into compliance with the new requirements by a stated effective date through a compliance review program involving all currently listed products.

Without these clauses, certifiers would not be able to move quickly to protect their name, marks, or reputation. A product safety certification program would be deficient without these contractual provisions and the administrative means to back them up.

A-2-2.4 Investigative procedures are important elements of an effective and meaningful product safety certification program. A preliminary review should be carried out on products submitted to the agency before any major testing is undertaken.

A-2-2.7 Such factory inspections should include, in most instances, witnessing of production tests. With certain products, the certification organization inspectors should select samples from the production line and submit them to the main laboratory for countercheck testing. With other products, it might be desirable to purchase samples in the open market for test purposes.

A-2-3.3 Some manufacturers of PASS offer units that incorporate temperature sensing, radio transmission of distress signals, or other features that are not addressed by this document. This document requires that the PASS, including all additional features installed on or in the PASS unit, comply with all requirements of this standard.

The user might wish to investigate these features with the individual manufacturer to determine if they wish to specify such additional features.

Certification of the PASS applies to the basic unit only and not for any additional features.

A-2-3.5 Users should be aware that batteries vary in structural integrity, current capacity, shelf life, and ability to function under differing peak loads, duty cycles, and temperature extremes. Substitution of power sources beyond those recommended by the device manufacturer may cause unsatisfactory PASS performance during testing or in actual use.

A-3-4.1 The retention system should not cause the fire fighter's protective clothing and protective equipment to become degraded, such as what would occur if the outer shell of protective coats or trousers, helmets, belts, etc., were pierced.

A-3-4.2 Removal of the battery cover and battery for inspection for water, and performing the extended immersion test with battery cover removed, is to provide a test for the isolation requirement between the battery compartment and electronics compartment stated in 3-4.2. The extended test is also meant to verify that the electronics compartment maintains a watertight seal when the battery cover is removed.

A-5-4.5 Removal of the battery cover and battery for inspection for water, and performing the extended immersion test with battery cover removed, is to provide a test for the isolation requirement between the battery compartment and electronics compartment stated in 3-4.2. The extended test is also meant to verify that the electronics compartment maintains a watertight seal when the battery cover is removed.

A-5-4.6 See A-5-4.5.

A-5-8.1 The cycling of the retention system in 5-8.1 is intended to ensure the PASS will remain attached to the wearer after it has been attached and removed repeatedly during its service life.

A-5-11.2 The criteria for the protective covering for the test mannequin described in 5-11.2 is not a specification for a garment that is suitable for use as protection during fire fighting operations, and must not be construed as such. The protective covering has been selected solely for the purpose of protecting the test mannequin and providing a reproducible exterior configuration to support the PASS being tested. The intention of this standard is to test the PASS and not the protective covering.

Appendix B Referenced Publications

B-1 The following documents or portions thereof are referenced within Appendix A for informational purposes only and thus should not 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.

B-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 1992 edition.

NFPA 1561, *Standard on Fire Department Incident Management System*, 1990 edition.

Index