NFPA 1982
Standard on Personal Alert Safety Systems (PASS)

1998 Edition

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

IMPORTANT NOTICE ABOUT THIS DOCUMENT

NFPA codes and standards, of which the document contained herein is one, are developed through a consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on fire and other safety issues. While the NFPA administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in its codes and standards.

The NFPA disclaims liability for any personal injury, property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this document. The NFPA also makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making this document available, the NFPA is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is the NFPA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

The NFPA has no power, nor does it undertake, to police or enforce compliance with the contents of this document. Nor does the NFPA list, certify, test or inspect products, designs, or installations for compliance with this document. Any certification or other statement of compliance with the requirements of this document shall not be attributable to the NFPA and is solely the responsibility of the certifier or maker of the statement.

NOTICES

All questions or other communications relating to this document and all requests for information on NFPA procedures governing its codes and standards development process, including information on the procedures for requesting Formal Interpretations, for proposing Tentative Interim Amendments, and for proposing revisions to NFPA documents during regular revision cycles, should be sent to NFPA headquarters, addressed to the attention of the Secretary, Standards Council, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

Users of this document should be aware that this document may be amended from time to time through the issuance of Tentative Interim Amendments, and that an official NFPA document at any point in time consists of the current edition of the document together with any Tentative Interim Amendments then in effect. In order to determine whether this document is the current edition and whether it has been amended through the issuance of Tentative Interim Amendments, consult appropriate NFPA publications such as the *National Fire Codes*® Subscription Service, visit the NFPA website at www.nfpa.org, or contact the NFPA at the address listed above.

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.

The NFPA does not take any position with respect to the validity of any patent rights asserted in connection with any items which are mentioned in or are the subject of this document, and the NFPA disclaims liability of the infringement of any patent resulting from the use of or reliance on this document. Users of this document are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

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 that is not in compliance with applicable laws, and this document may not be construed as doing so.

Licensing Policy

NFPA 1982

Standard on

Personal Alert Safety Systems (PASS)

1998 Edition

This edition of NFPA 1982, *Standard on Personal Alert Safety Systems (PASS),* was prepared by the Technical Committee on Respiratory Protection and Personal Alarm Equipment, released by the Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment, and acted on by the National Fire Protection Association, Inc., at its Annual Meeting held May 18–21, 1998, in Cincinnati, OH. It was issued by the Standards Council on July 16, 1998, with an effective date of August 5, 1998, and supersedes all previous editions.

This edition of NFPA 1982 was approved as an American National Standard on August 6, 1998.

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 the third edition, the Subcommittee on PASS undertook a complete revision of their work that was completed in December 1991. The document was passed onto the Technical Committee on Fire Service Protective Clothing and Equipment and 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.

Since the third edition, the entire project for fire service protective clothing and equipment was reorganized by the Standards Council in January 1995. The new project has a Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment and seven technical committees operating within the Project. The former standing Subcommittee on PASS was combined with the Subcommittee on SCBA into the new Technical Committee on Respiratory Protection and Personal Alarm Equipment and has the responsibility for NFPA 1982.

This fourth edition represents a complete revision to the third edition and includes PASS that are integrated with SCBA and automatic activation of all PASS. It was presented to the membership of the Association at the 1998 Annual Meeting in Cincinnati, OH, on May 20, 1998, and issued by the Standards Council on July 16, 1998.

Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment

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

Wayde B. Miller, *Secretary*
Mine Safety Appliances Co., FL [M]
Rep. Compressed Gas Assn./Mine Safety Appliances Co.

Thomas Augherton, Safety Equipment Inst., VA [RT]
Dennis W. Browner, Scott Aviation, NC [M]
Rep. Industrial Safety Equipment Assn.
Robert H. Chiostergi, Southern Mills Inc., GA [M]
Robert A. Freese, Globe Mfg. Co., NH [M]
William L. Grilliot, Morning Pride Mfg. Co., OH [M]
Rep. Fire and Emergency Mfrs. and Services Assn., Inc.
Virgil Hathaway, San Diego Fire Dept., CA [U]
Rep. Southern Area Fire Equipment Research
James S. Johnson, Lawrence Livermore Nat'l Labs, CA [RT]
Cy Long,Texas Commission on Fire Protection, TX [E]
David G. Matthews, UK Fire Brigades Assn., England [SE]
Rep. Int'l Standards Organization
Jim Minx, Oklahoma State Firefighters Assn., OK [C]
Bob Montgomery, Hoechst Celanese Corp., NC [M]
Ted Putnam, USDA Forest Service, MT [E]
Jeffrey O. Stull, Int'l Personnel Protection, Inc., TX [SE]
Frank P. Taylor, Lion Apparel, Inc., OH [M]
Robert D. Tutterow, Jr., Charlotte Fire Dept., NC [M]
Rep. Fire Industry Equipment Research Organization
Bruce H. Varner, City of Carrollton Fire Dept., TX [U]
Rep. Int'l Fire Service Training Assn.
Harry Winer, U.S. Navy, MA [RT]
Thomas L. Wollan, Underwriters Laboratories Inc., NC [RT]

Alternates

Janice C. Bradley, Industrial Safety Equipment Assn., VA [M]
(Alt. to D. W. Browner)
Nicholas J. Curtis, Lion Apparel, Inc., OH [M]
(Alt. to F. P. Taylor)
Robert Dahl, The DuPont Co., DE [M]
(Alt. to B. Montgomery)
Patricia A. Freeman, Globe Mfg. Co., NH [M]
(Alt. to R. A. Freese)
Patricia A. Gleason, Safety Equipment Inst., VA [RT]
(Alt. to T. Augherton)
William M. Lambert, Mine Safety Appliances Co., PA [M]
(Alt. to W. B. Miller)
Daniel P. Ryan, Underwriters Laboratories Inc., NC [RT]
(Alt. to T. L. Wollan)
Tricia Vogelpohl, Springs Industries, Inc., SC [M]
(Alt. to R. H. Chiostergi)

Nonvoting

Don R. Forrest, United Firefighters of LA City, CA [L]
Bryan C. Heirston, Oklahoma State Dept. of Labor, OK [L]
Rep. Int'l Assn. of Fire Fighters
Richard Mangan, USDA Forest Service, MT [RT]
Kirk H. Owen, Plano Fire Dept., TX [U]
Rep. NFPA Fire Service Section
Ray F. Reed, Dallas Fire Dept., TX

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 membership may have occurred. A key to classifications is found at the back of this document.

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: This Committee shall have primary responsibility for documents on the design, performance, testing, and certification of protective clothing and protective equipment manufactured for fire and emergency services organizations and personnel, to protect against exposures encountered during emergency incident operations. This Committee shall also have the primary responsibility for documents on the selection, care, and maintenance of such protective clothing and protective equipment by fire and emergency services organizations and personnel.

Technical Committee on Respiratory Protection and Personal Alarm Equipment

Ray F. Reed, *Chair*
Dallas Fire Dept., TX [U]

Paul D. Hiltman, *Secretary*
Int'l Safety Instruments, GA [M]

Thomas Augherton, Safety Equipment Inst., VA [RT]
Eric Beck, Mine Safety Appliances Co., PA [M]
Kenneth R. Ethridge, Texas Commission on Fire Protection, TX [E]
Don R. Forrest, United Firefighters of Los Angeles City, CA [L]
Rep. Int'l Assoc. of Fire Fighters
Eugene Giorgini, Scott Aviation, NY [M]
A. Ira Harkness, U.S. Navy Coastal Sys. Station, FL [RT]
James S. Johnson, Lawrence Livermore Nat'l Labs, CA [RT]
Stephen J. King, New York City Fire Dept., NY [U]
Robert A. Kolenda, City of Pittsburgh, Bureau of Fire, PA [U]
Mark I. Piland, City of Virginia Beach Fire Dept., VA [U]
Frank Savino, SGS/US Testing, NJ [RT]
Robert H. Sell, National Draeger, Inc., PA [M]
Brian J. Sharkey, USDA Forest Service, MT [RT]
Richard L. Stein, Survivair, CA [M]
Rep. Industrial Safety Equipment Assoc.
Karen E. Strumlock, Intertek Testing Services NA Inc., NY [RT]
Samuel Terry, U.S. Nat'l Inst. for Occupational Safety & Health, WV [E]

Alternates

Donald G. Beason, Lawrence Livermore Nat'l Lab, CA [RT]
(Alt. to J. S. Johnson)
Carol E. Burtner, Safety Equipment Inst., VA [RT]
(Alt. to T. Augherton)
Richard A. Erth, Mine Safety Appliances Co., PA [M]
(Alt. to E. Beck)
Darius L. Goodin, U.S. Dept. of the Navy-Coastal Systems Station, FL [RT]
(Alt. to A. I. Harkness)
Robert E. Gray, Int'l Safety Instruments, Inc., GA [M]
(Alt. to P. D. Hiltman)
Robert William O'Gorman, Intertek Testing Services Inc., NY [RT]
(Alt. to K. E. Strumlock)
Frank Pepe, SGS/US Testing, NJ [RT]
(Alt. to F. Savino)
Robert F. Sterner, National Draeger, PA [M]
(Alt. to R. H. Sell)

Nonvoting

Glen E. Gardner, U.S. Occupational Safety & Health Admin., DC [E]

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 membership may have occurred. A key to classifications is found at the back of this document.

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: This Committee shall have primary responsibility for documents on protective equipment that provides respiratory protection for fire fighters or other emergency services responders during incidents involving operations conducted in hazardous or oxygen deficient atmospheres. These operations include the activities of rescue, fire suppression, hazardous materials mitigation, and property conservation where exposures to an oxygen deficient atmosphere or an atmosphere contaminated with harmful particulate, fog, fume, mist, gas, smoke, spray, or vapor will or could occur.

Contents

NFPA 1982

Standard on

Personal Alert Safety Systems (PASS)

1998 Edition

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

Information on referenced publications can be found in Chapter 7 and Appendix B.

Chapter 1 Administration

1-1 Scope.

1-1.1* This standard shall specify minimum design, performance, and certification requirements and test methods for all Personal Alert Safety Systems (PASS) to be used by fire fighters and other emergency services personnel who engage in rescue, fire fighting, and other hazardous duties.

1-1.2 This standard shall apply to the design, manufacturing, and certification of all new PASS including, but not limited to, Stand-Alone PASS and SCBA-Integrated PASS. This standard shall not apply to any PASS manufactured to previous editions of this standard.

1-1.3 The requirements of this standard shall not apply to accessories that might be attached to PASS unless specifically addressed herein.

1-1.4 Nothing herein is intended to restrict any jurisdiction or manufacturer from exceeding these minimum requirements.

1-2 Purpose.

1-2.1 The purpose of this standard shall be to provide minimum requirements for all PASS including, but not limited to, PASS that are designed as a stand-alone device or as a device that is integrated with an SCBA, that are intended to be utilized by fire fighters and other emergency services personnel during emergency operations, and that emit an audible alarm signal to summon aid in the event the PASS user 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 or emergency services personnel can be exposed.

1-2.3 This standard is not intended to serve as a detailed manufacturing or purchase specification but shall be permitted to be referenced in purchase specifications as minimum requirements.

1-3 Definitions.

Accessories. Those items that are attached to PASS but that are not necessary to meet the requirements of this standard.

Alarm. A functional mode in which the PASS *alarm signal* is activated by hand.

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

Annunciator. The component of a PASS device designed to emit audible signals.

Approved.* Acceptable to the authority having jurisdiction.

Authority Having Jurisdiction.* The organization, office, or individual responsible for approving equipment, an installation, or a procedure.

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.

Component. Any material, part, or subassembly used in the construction of PASS or any portion of PASS.

Drip. To run or fall in drops or blobs.

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 that is 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, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets identified standards or has been tested and found suitable for a specified purpose.

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

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

Model. The collective term used to identify a group of individual PASS of the same basic design and components from a single manufacturer produced by the same manufacturing and quality assurance procedures that are covered by the same certification.

Motion Detector. A component of 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 PASS is deactivated.

PASS. Acronym for Personal Alert Safety Systems. *(See Personal Alert Safety Systems.)*

PASS/SCBA Device. Term for the entire assembled equipment that integrally combines a PASS into an SCBA, where the SCBA-Integrated PASS is removable or nonremovable. *(See also Personal Alert Safety Systems (PASS), SCBA-Integrated PASS, and Stand-Alone PASS.)*

Personal Alert Safety Systems (PASS). Devices that are certified as being compliant with this standard, that sense movement or lack of movement, and that automatically activate an audible *alarm signal* (which can also be manually activated) to alert and to assist others in locating a fire fighter or emergency services person who is in danger. *(See also SCBA-Integrated PASS and Stand-Alone PASS.)*

Pre-Alarm Signal. An audible warning that is identifiable as an indication that a PASS is about to sound the *alarm signal*.

Product Label. A label or marking affixed to each PASS by the manufacturer. Such labels contain compliance statements; certification statements; general information; care, maintenance, or similar data. The 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 or be part of the product label.

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

Sensing. A functional mode in which the PASS motion detector is activated and is monitoring the motion of the wearer, and causes *pre-alarm signal* and subsequent transfer to the *alarm signal* after not detecting motion after a specified period of time.

SCBA. Acronym for Self-Contained Breathing Apparatus.

SCBA-Integrated PASS. A removable or nonremovable PASS that is an integral part of a PASS/SCBA device. *(See also PASS/SCBA Device, and Stand-Alone PASS.)*

Removable. An SCBA-Integrated PASS that is designed and intended to be readily removed from the PASS/SCBA device to be used independently of the SCBA.

Nonremovable. An SCBA-Integrated PASS that is not designed and not intended to be readily removed from the PASS/SCBA device so that it cannot be used independently of the SCBA.

Shall. Indicates a mandatory requirement.

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

Specimen. The item that undergoes testing.

Stand-Alone PASS. A PASS that is not an integral part of any other item of protective clothing or protective equipment. *(See also PASS/SCBA Device, and SCBA-Integrated PASS.)*

Surrogate Cylinder. A breathing gas cylinder only for testing in which the mass of the breathing air is replaced by a substitute mass.

1-4 Units.

1-4.1 In this standard, values for measurement are followed by an equivalent in parentheses, but only the first value stated 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 All individual 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. Manufacturers shall not claim compliance with a portion(s) or segment(s) of the requirements of this standard and shall not use the name or identification of this standard, NFPA 1982, in any statements about their respective products unless the product is certified to this standard.

2-1.2 All certification shall be performed by a certification organization that meets at least the requirements specified in Section 2-2, and that is accredited for personal protective equipment in accordance with ANSI Z34.1, *Third-Party Certification Programs for Products, Processes, and Services*.

2-1.3 All individual compliant PASS shall be labeled and listed. All individual compliant PASS shall also have a product label or labels that meet the requirements specified in Section 3-1.

2-1.4* The certification organization's label, symbol, or identifying mark shall be attached to the product label or shall be part of the product label.

2-1.5 The certification organization shall not certify any PASS to the 1993 edition of this standard on or after 1 March 1999.

2-1.6 The certification organization shall not permit any manufacturer to label any PASS as compliant with the 1993 edition of this standard on or after 1 March 1999.

2-1.7 The certification organization shall require manufacturers to remove all certification labels and product labels indicating compliance with the 1993 edition of this standard from all PASS that are under the control of the manufacturer on 1 March 1999. The certification organization shall verify this action is taken.

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* The certification organization shall have laboratory facilities and equipment available for conducting proper tests, 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, perfor-

mance verification, proficiency testing, and staff qualification and training programs.

2-2.5 The certification organization shall require the manufacturer to establish and maintain a program of production inspection and testing that at least meets the requirements specified in Section 2-4 or Section 2-5. The certification organization shall audit the manufacturer's quality assurance program to ensure that the quality assurance program provides continued product compliance with this standard.

2-2.6 The certification organization and the manufacturer 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* The certification organization shall have a follow-up inspection program of the manufacturing facilities of the certified product, with at least two random and unannounced visits per 12-month period. As part of the follow-up inspection program, the certification organization shall select sample product at random from the manufacturer's production line, from the manufacturer's in-house stock, or from the open market. Sample product shall be inspected and tested by the certification organization to verify the product's continued compliance.

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 certification organization shall require the manufacturer to have a product recall system as part of the manufacturer's quality assurance program.

2-2.10 The certification organization's operating procedures 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.

2-2.11 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 For both initial certification and recertification of PASS, the certification organization shall conduct both inspection and testing as specified in this section.

2-3.2 All inspections, evaluations, conditioning, and testing for certification or for recertification shall be conducted by the certification organization.

2-3.3 Any inspection, evaluation, conditioning, or testing conducted by a product manufacturer shall not be used in the certification or recertification process.

2-3.4 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.

2-3.5 Inspection by the certification organization shall include a review of all product labels to ensure that all required label attachments, compliance statements, certification statements, and other product information are at least as specified in Section 3-1.

2-3.6 Inspection by the certification organization shall include a review of the user information required by Section 3-2 to ensure that the information has been developed and is available.

2-3.7 Inspection by the certification organization for determining compliance with the design requirements specified in Chapter 4 shall be performed on whole and complete PASS devices.

2-3.8* Testing conducted by the certification organization in accordance with the testing requirements of Chapter 6, for determining product compliance with the applicable performance requirements specified in Chapter 5, shall be performed on whole and complete PASS devices. Where 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, unless otherwise specified herein.

2-3.9 PASS shall be tested for initial certification to this edition of NFPA 1982, *Standard on Personal Alert Safety Systems (PASS),* and shall meet the performance requirements of the test series specified in the test matrix in either Table 2-3.9(a) or Table 2-3.9(b) as applicable for the type of PASS being certified.

2-3.9.1 Where there is more than one test for a single test specimen required by Table 2-3.9(a) or Table 2-3.9(b), the order of testing shall be from top to bottom of the test specimen column as shown in the table.

2-3.9.2 When testing removable SCBA-Integrated PASS, test specimens 1, 2, and 3 and test specimens 16, 17, and 18, as identified in Table 2-3.9(a), shall be in the SCBA-Integrated PASS configuration.

2-3.9.3 When testing specimen PASS in accordance with Section 5-3, Electronic Temperature Stress; Section 5-4, Corrosion Resistance; Section 5-5, Immersion/Leakage Resistance; Section 5-6, Case Integrity; Section 5-8, Impact Resistance; and Section 5-12, Heat and Flame Resistance, one specimen PASS, instead of all three specimens tested in each test series, shall be selected to be used for evaluation of the requirements of 5-1.2, Alarm Signal. The one specimen PASS that is selected shall be chosen at random from each of the respective series of three specimens for each test.

2-3.10 After initial certification to this edition of NFPA 1982 compliant PASS shall be tested annually for recertification within 12 months from the previous certification or recertification.

2-3.10.1 Recertification shall occur each year of the 4 years following initial certification. If there is no revision to this edition of NFPA 1982 by the fifth year following initial certification, compliant PASS shall be required to undergo full certification testing as specified in 2-3.9 in the fifth year.

Table 2-3.9(a) Test Matrix for Stand-Alone PASS and Removable SCBA-Integrated PASS

Test Order	Specimens 1–3	Specimens 4–6	Specimens 7–9	Specimens 10–12	Specimens 13–15	Specimens 16–18	Specimens 19–21
1	Sound Pressure Section 6-1 Specimens 1–3	Shock Sensitivity Section 6-6 Specimens 4–6	Electronic Temp Stress — Elevated 6-2.4 Specimens 7–9	Water Drainage Section 6-10 Specimens 10–12	Case Integrity Section 6-5 Specimens 3–15	Impact Vibration Section 6-8 Specimens 16–18	Intrinsic Safety Section 5-13 Specimens 19–21
2	Signal Frequencies Section 6-13 Specimens 1–3	Impact Acceleration— Ambient Section 6-7 Specimen 4	Electronic Temp Stress — Low 6-2.5 Specimens 7–9	Corrosion Section 6-3 Specimens 10–12	Retention System Section 6-9 Specimens 13–15		
3	Heat/Flame Test 1 6-12.13 Specimen 1	Impact Acceleration— Cold Section 6-7 Specimen 5	Electronic Temp Stress — Shock 6-2.6 Specimens 7–9	Product Label Durability Section 6-14 Specimens 10–12	Heat Resistance Section 6-11 Specimens 13–15		
4	Heat/Flame Test 2 6-12.14 Specimen 2	Impact Acceleration— Elevated Section 6-7 Specimen 6	Product Label Durability Section 6-14 Specimens 7–9				
5	Heat/Flame Test 3 6-12.15 Specimen 3		Immersion/ Leakage Section 6-4 Specimens 7–9				
6			Product Label Durability Section 6-14 Specimens 7–9				

Table 2-3.9(b) Test Matrix for Nonremovable SCBA-Integrated PASS

Test Order	Specimens 1–3	Specimens 4–6	Specimens 7–9	Specimens 10–12	Specimens 13–15	Specimens 16–18
1	Sound Pressure Section 6-1 Specimens 1–3	Shock Sensitivity Section 6-6 Specimens 4–6	Electronic Temp Stress — Elevated 6-2.4 Specimens 7–9	Water Drainage Section 6-10 Specimens 10–12	Case Integrity Section 6-5 Specimens 13–15	Intrinsic Safety Section 5-13 Specimens 16–18
2	Signal Frequencies Section 6-13 Specimens 1–3	Impact Vibration Section 6-8 Specimens 4–6	Electronic Temp Stress — Low 6-2.5 Specimens 7–9	Corrosion Section 6-3 Specimens 10–12		
3	Heat/Flame Test 1 6-12.13 Specimen 1		Electronic Temp Stress — Shock 6-2.6 Specimens 7–9	Product Label Durability Section 6-14 Specimens 10–12	Heat Resistance Section 6-11 Specimens 3–15	
4	Heat/Flame Test 2 6-12.14 Specimen 2		Product Label Durability Section 6-14 Specimens 7–9			
5	Heat/Flame Test 3 6-12.15 Specimen 3		Immersion/ Leakage Section 6-4 Specimens 7–9			
6			Product Label Durability Section 6-14 Specimens 7–9			

2-3.10.2 Only one test specimen shall be required for each test specified in either Table 2-3.9(a) or Table 2-3.9(b) as applicable for the type of PASS being recertified.

2-3.10.3 Where there is more than one test for a single test specimen PASS required by Table 2-3.9(a) or Table 2-3.9(b), the order of testing shall be from top to bottom of the test specimen column as shown in the tables.

2-3.10.4 When testing removable SCBA-Integrated PASS, test specimens 1, 2, and 3 and test specimens 16, 17, and 18, as identified in Table 2-3.9(a), shall be in the SCBA-Integrated PASS configuration.

2-3.11 Where PASS is equipped with an accessory or accessories, certification testing shall include accessories and each accessory shall be certified as complying with Section 4-5.

2-3.12 Any change in the design, construction, or material of a compliant PASS shall necessitate new inspection and testing to verify compliance to all applicable requirements of this standard that the certification organization determines can be affected by such change. This recertification shall be conducted before labeling the modified PASS as being compliant with this standard.

2-3.13 The certification organization shall not allow any modifications, pretreatment, conditioning, or other such special processes of the PASS or any PASS component, including accessories, prior to the product's submission for evaluation and testing by the certification organization. The certification organization shall accept, from the manufacturer for evaluation and testing for certification, only PASS or PASS components that are the same in every respect to the actual final product or component. Other than as specifically permitted herein, the certification organization shall not allow the substitution, repair, or modification of any PASS or any PASS component during testing.

2-3.14* All testing and inspection shall be performed utilizing the battery power source(s) specified on the PASS in accordance with 3-1.7(f).

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 conformance to 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 assure 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 certification organization to determine that the program is sufficient to ensure continued product compliance with this standard.

2-5 ISO Registration for Manufacturers.

2-5.1 The manufacturer shall provide and operate a quality assurance program that meets the requirements of this section and that includes a product recall system as specified in 2-2.9.

2-5.2 The manufacturer shall be registered to ISO 9001, *Quality Systems — Model for Quality Assurance in Design, Development, Production, Installation, and Servicing*.

2-5.3 All PASS components shall be required to be assembled in a facility that is registered at least to ISO 9002, *Quality Systems — Model for Quality Assurance in Production, Installation, and Servicing.*

2-5.4 The ISO registration requirements shall have an effective date of 1 September 2000.

2-5.5 Until 1 September 2000, or until the date the manufacturer becomes ISO registered, whichever occurs first, the manufacturer shall comply with Section 2-4.

Chapter 3 Labeling and Information

3-1 Product Labeling Requirements.

3-1.1 Each PASS device shall have a product label(s) permanently and conspicuously attached.

3-1.2 Multiple label pieces shall be permitted in order to carry all statements and information required to be on the product label.

3-1.3 All worded portions of the required product label(s) shall be printed at least in English.

3-1.4 Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

3-1.5* The certification organization's label, symbol, or identifying mark shall be attached to the product label or shall be part of the product label. The label, symbol, or identifying mark shall be at least 6 mm ($^1/_4$ in.) in height and shall be placed in a conspicuous location.

3-1.6 The following statement shall be legibly printed on the product label(s) and placed in a conspicuous location. All letters shall be at least 2 mm ($^1/_{16}$ in.) in height.

"THIS PASS MEETS THE REQUIREMENTS OF NFPA 1982, *STANDARD ON PERSONAL ALERT SAFETY SYSTEMS (PASS),* 1998 EDITION."

3-1.7 At least the following information shall also be legibly printed on the product label(s) and placed on each PASS in a user-accessible location. All letters shall be at least 2 mm ($^1/_{16}$ in.) in height.

(a) Manufacturer name, identification, or designation
(b) Country of manufacture
(c) Model name, number, or design
(d) Identification/lot/serial number
(e) Month and year of manufacture, not coded
(f) Recommended battery type and size

3-1.8 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*.

3-1.9 All product labels also shall meet the requirements specified in Section 5-14.

3-2 User Information.

3-2.1 The PASS manufacturer shall provide, with each PASS, at least the user information that is specified in 3-2.4.

3-2.2 The PASS manufacturer shall attach the required user information, or packaging containing the user information, to the PASS in such a manner that it is not possible to initially use the PASS without being aware of the information.

3-2.3 The required user information, or packaging containing the user information, shall be attached to the PASS so that a deliberate action is necessary to remove it. The PASS manufacturer shall provide notice that the user information is to be removed ONLY by the end user.

3-2.4 The PASS manufacturer shall provide at least the following instructions and information with each PASS:

(a) Pre-use information
Safety considerations
Limitations of PASS
Marking recommendations and restrictions
A statement that most performance properties of the PASS cannot be tested by the user in the field
Warranty information
(b) Preparation for use
Preferred mounting position and orientation for optimal performance
Training instructions
Recommended storage practices
(c) Inspection frequency and details
(d) Proper use consistent with NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*.
(e) Maintenance and cleaning
Cleaning instructions and precautions
Battery testing and replacement
Adjustments, if applicable
Maintenance criteria
Painting
Decontamination procedures
(f) Retirement criteria and considerations
(g) Procedure for reporting PASS problems to the manufacturer and to the certification organization as provided for 2-2.8.

Chapter 4 Design Requirements

4-1 Mode Selection.

4-1.1 PASS shall incorporate a mode selection device or devices to allow for operation in at least three modes: (1) *off*, (2) *alarm*, and (3) *sensing*.

4-1.2* The mode selection device(s) shall be designed to provide automatic activation from the *off* mode to the *sensing* mode without the user setting the mode selection device.

4-1.2.1 Such automatic activation shall be permitted to be, but not limited to, linked to activation of SCBA, linked to removal from storage or transportation positions, by pull-away tether to a fixed position, or by remote activation.

4-1.2.2 Such automatic activation shall be designed so that when the PASS is automatically activated it shall be able to be switched by the user from the *sensing* mode to the *alarm* mode with the mode selection device but shall not be able to be switched by the user to remain in the *off* mode until the automatic activation means is also deactivated.

4-1.3 All mode selection devices shall be protected against accidental change of operation or impact damage.

4-1.4 All mode selection devices shall be rated for a service life of not less than 50,000 cycles.

4-1.5 All mode selection devices shall be capable of being switched to the *alarm* or *sensing* mode by a single gloved hand. The fingers of gloves utilized for this function test shall have a thickness of 2.5 mm to 4 mm ($^3/_{32}$ in. to $^5/_{32}$ in.).

4-1.6 Only one action shall be required to switch the mode selection device(s) from any mode to *alarm*.

4-1.7 When PASS is sounding the *alarm signal* it shall require at least two separate and distinct manual actions to silence the *alarm signal*.

4-1.7.1 Any action to silence the *alarm signal* and the actual silencing of the *alarm signal* shall not permit the PASS to remain in the *off* mode.

4-1.7.2 The silencing of the *alarm signal* shall automatically reset the PASS to the *sensing* mode.

4-1.8 PASS shall be provided with a light source capable of providing a visual indication of mode status as well as an audible source capable of providing an aural indication of a change in the mode selection when switching from *off* to *sensing*, *off* to *alarm*, or *alarm* to *sensing*.

4-2 Motion Detector.

4-2.1 Pass shall incorporate a motion detector and shall sound the *alarm signal* specified in 4-3.3 when the PASS is motionless for 30 seconds, +5/−0. The *alarm signal* shall be preceded by a *pre-alarm signal*, specified in 4-3.2, that shall sound 10 seconds, +3/−0 seconds, before the sounding of the *alarm signal*.

4-2.2 The motion detector shall be operable regardless of the angle of deployment of the PASS.

4-2.3 Pass shall be designed so that any failure of the motion detector shall cause the PASS to sound the *alarm signal*, specified in 4-3.3, within 30 seconds, +5/−0 seconds, of such failure. The PASS manufacturer shall submit a failure modes analysis to the certification organization for verification of this requirement.

4-3 Signals.

4-3.1 Operational Signal.

4-3.1.1 PASS shall emit an audible *operational signal* within 1 second of being switched to *sensing* mode, indicating to the user that the device is functioning properly.

4-3.1.2 When the PASS is in the *off* mode and the battery voltage is at or below the level specified in 4-3.4.1, the *operational signal* shall not sound when the PASS is switched to the *sensing* mode.

4-3.2 Pre-Alarm Signal.

4-3.2.1 The PASS shall have at least an audible primary *pre-alarm signal*. The primary *pre-alarm signal* shall be a distinct and different sound from the *alarm signal*.

4-3.2.2 In addition to the primary *pre-alarm signal*, other tones shall be permitted.

4-3.2.3 PASS shall be permitted to incorporate a supplementary *pre-alarm signal* or signals in addition to the audible primary pre-alarm signal to enhance the ability of the user to detect and identify the pre-alarm status. Supplementary *pre-alarm signals* shall be variable in a continuous pattern or shall be recurrent.

4-3.2.3.1 The supplementary *pre-alarm* shall use a signal or signals to alert senses other than hearing.

4-3.2.3.2 When activated, the supplementary *pre-alarm signal* shall not diminish the performance of the primary *pre-alarm signal* below the requirements of this standard.

4-3.2.3.3 The design of the supplementary *pre-alarm signal* shall be such that failure of the supplementary *pre-alarm signal* shall not affect the activation or operation of the primary *pre-alarm signal*.

4-3.2.4 PASS shall sound the *pre-alarm signal(s)* no more than 13 seconds prior to the sounding of the alarm signal.

4-3.2.5 During the *pre-alarm signal(s)* sounding, all other audible signals shall be rendered inactive.

4-3.2.6 PASS shall be designed to have at least a motion-induced cancellation of functioning of the *pre-alarm signal(s)* prior to the sounding of the *alarm signal*.

4-3.2.7 Cancellation of the sounding of the primary *pre-alarm signal* and cancellation of functioning of the supplementary *pre-alarm signal(s)* shall not require the use of the user's hand(s).

4-3.2.8 PASS shall reset to the *sensing* mode upon cancellation of the *pre-alarm signal*.

4-3.3 Alarm Signal.

4-3.3.1 PASS shall sound the *alarm signal* when switched to the *alarm* mode. The *alarm signal* shall have a duration of at least 1 hour at a sound pressure level of not less than 95 dBA.

4-3.3.2 While in the *sensing* mode, PASS shall sound the *alarm signal* when activated by the motion detector when the PASS is motionless for 30 seconds, +5/−0 seconds. When activated by the motion detector, the *alarm signal* shall be preceded by the *pre-alarm signal*, which shall sound 10 seconds, +3/−0 seconds, before the sounding of the *alarm signal*.

4-3.3.3 During the *alarm signal* sounding, all other audible signals shall be rendered inactive.

4-3.3.4 The *alarm signal* shall be audible in a variable or non-continuous tone.

4-3.3.5 The *alarm signal*, once activated, shall not be deactivated by the motion detector.

4-3.3.6 Any action to silence the *alarm signal* and the actual silencing of the *alarm signal* shall not permit the PASS to remain in the *off* mode.

4-3.3.7 The silencing of the *alarm signal* shall automatically reset the PASS to the *sensing* mode.

4-3.4 Low Battery Warning Signal.

4-3.4.1 While in the *sensing mode*, PASS shall emit a recurrent audible *low battery warning signal* when the battery voltage is depleted to the level that will maintain the *alarm signal* level of at least 95 dBA for at least 1 hour.

4-3.4.2 Batteries shall be discharged at a rate that is equal to the average current draw, ±10 percent of the same model PASS, while in the *alarm* mode. The rate shall be determined by measurement by the certification organization.

4-3.4.3 The *low battery warning signal* sound shall be distinct and different from the *pre-alarm signal(s)* and the *alarm signal*.

4-3.4.4 The *low battery warning signal* shall have an interval of not greater than 30 seconds.

4-3.4.5 While in the *off* mode and with the battery voltage at or below the level specified in 4-3.4.1, the system that causes the activation of the *low battery warning signal* shall cancel the *operational signal* so that it shall not sound when the PASS is switched to the *sensing* mode.

4-4 General Design Requirements.

4-4.1 PASS that is designed as an independent device and that is not an integral part of any other item of protective clothing or protective equipment shall be designated as *Stand-Alone PASS*.

4-4.2 PASS that is designed as an integral part of an SCBA, whether or not the PASS portion of the PASS/SCBA device can be readily removed from the SCBA to also be used independently of the SCBA, shall be designated as *SCBA-Integrated PASS*.

4-4.2.1 An SCBA-Integrated PASS that is designed and intended to be readily removed from the PASS/SCBA device, so that it can also be used independently of the SCBA, shall be designated as *Removable SCBA-Integrated PASS*.

4-4.2.2 An SCBA-Integrated PASS that is not designed and not intended to be readily removed from the PASS/SCBA device so that it cannot be used independently of the SCBA shall be designated as *Nonremovable SCBA-Integrated PASS*.

4-4.3* 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 4-1 and shall not affect the performance of the PASS.

4-4.4* The battery compartment(s) shall be isolated from the operating components so as to prevent damage to the operating components from battery leakage.

4-5 Accessory Design Requirements.

4-5.1 Any accessories attached to or part of any PASS shall not interfere with the function(s) of the PASS or with the function(s) of any of the PASS component parts as required by this standard.

4-5.2 Any accessories attached to or part of any PASS shall not degrade the designed protection or performance of the PASS below the requirements of this standard.

Chapter 5 Performance Requirements

5-1 Sound Pressure Level.

5-1.1 Primary Pre-Alarm Signal.

5-1.1.1 Specimen Stand-Alone PASS shall be tested for the sound pressure level of the primary *pre-alarm signal* as specified in 6-1.1, 6-1.2, and 6-1.4 of Section 6-1, Sound Pressure Level Tests. The primary *pre-alarm signal* shall have an initial sound pressure level of at least 60 dBA to 95 dBA. Within 6 to 10 seconds the sound pressure level shall increase, in at least 2 distinct sound pressure level increments, to at least 100 dBA and shall remain at or above 100 dBA for an additional 3 to 5 seconds. The entire primary *pre-alarm signal* shall not sound for more than 13 seconds.

5-1.1.2 Specimens of all PASS/SCBA devices, with either removable or nonremovable SCBA-Integrated PASS as specified in 4-4.2.2, shall be tested for the sound pressure level of the primary *pre-alarm signal* as specified in 6-1.1, 6-1.2, and 6-1.3 of Section 6-1, Sound Pressure Level Tests. The primary *pre-alarm signal* shall have an initial sound pressure level of at least 60 dBA to 95 dBA. Within 6 to 10 seconds the sound pressure level shall increase, in at least 2 distinct sound pressure level increments, to at least 100 dBA and shall remain at or above 100 dBA for an additional 3 to 5 seconds. The entire primary *pre-alarm signal* shall not sound for more than 13 seconds.

5-1.1.3 Specimen PASS/SCBA devices with removable SCBA-Integrated PASS, as specified in 4-4.2.1, shall have the PASS portion removed from the PASS/SCBA device and the PASS portion alone shall also be tested for the sound pressure level of the primary *pre-alarm signal* as specified in 6-1.1, 6-1.2, and 6-1.4 of Section 6-1, Sound Pressure Level Tests. The primary *pre-alarm signal* shall have an initial sound pressure level of at least 60 dBA to 95 dBA. Within 6 to 10 seconds the sound pressure level shall increase, in at least 2 distinct sound pressure level increments, to at least 100 dBA and shall remain at or above 100 dBA for an additional 3 to 5 seconds. The entire primary *pre-alarm signal* shall not sound for more than 13 seconds.

5-1.2 Alarm Signal.

5-1.2.1 Specimen PASS shall be tested for sound pressure level of the *alarm signal* as specified in 6-1.1, 6-1.2, and 6-1.5 of Section 6-1, Sound Pressure Level Tests, and shall have the sound pressure level be not less than 95 dBA for an uninterrupted duration of not less than 1 hour.

5-1.2.2 Specimen PASS shall function properly as specified in 4-3.3.

5-1.2.3 The *alarm signal,* once activated, shall not be deactivated by the motion detector.

5-1.3 Low Battery Warning Signal.

5-1.3.1 Specimen Stand-Alone PASS shall be tested for the sound pressure level of the *low battery warning signal* as specified in 6-1.1, 6-1.2, and 6-1.7 of Section 6-1, Sound Pressure Level Tests. Specimen PASS shall have the sound pressure level be between 70 and 100 dBA and shall have the signal continue to sound until the battery voltage is depleted to the level that will no longer operate the PASS but not less than 1 hour. After 1 hour, the *low battery warning signal* sound pressure level shall be permitted to drop below 70 dBA. Specimen PASS shall function properly as specified in 4-3.4.

5-1.3.2 Specimens of all PASS/SCBA devices, with either removable or nonremovable SCBA-Integrated PASS as specified in 4-4.2.1 and 4-4.2.2, shall be tested for the sound pressure level of the *low battery warning signal* as specified in 6-1.1, 6-1.2, and 6-1.6 of Section 6-1, Sound Pressure Level Tests. Specimen PASS shall have the sound pressure level be between 70 and 100 dBA and shall have the signal continue to sound until the battery voltage is depleted to the level that will no longer operate the PASS but not less than 1 hour. After 1 hour, the *low battery warning signal* sound pressure level shall be permitted to drop below 70 dBA. Specimen PASS shall function properly as specified in 4-3.4.

5-1.3.3 Specimen PASS/SCBA devices with removable SCBA-Integrated PASS, as specified in 4-4.2.1, shall have the PASS portion removed from the PASS/SCBA device and the PASS portion alone shall also be tested for the sound pressure level of the *low battery warning signal* as specified in 6-1.1, 6-1.2, and 6-1.7 of Section 6-1, Sound Pressure Level Tests. Specimen PASS shall have the sound pressure level be between 70 and 100 dBA and shall have the signal continue to sound until the battery voltage is depleted to the level that will no longer operate the PASS but not less than 1 hour. After 1 hour, the *low battery warning signal* sound pressure level shall be permitted to drop below 70 dBA. Specimen PASS shall function properly as specified in 4-3.4.

5-2 Signal Frequency.

5-2.1* Specimen PASS shall be tested for primary *pre-alarm signal* frequency as specified in Section 6-13, Signal Frequency Test, and shall be at least an audible signal. The primary *pre-alarm signal* shall consist of a minimum of two primary frequencies, each primary frequency shall not be less than 1000 Hz nor more than 2000 Hz, and shall have these frequencies sounded either sequentially or simultaneously.

5-2.2 Specimen PASS shall be tested for signal frequency as specified in Section 6-13, Signal Frequency Test, shall have the *alarm signal* consist of a minimum of three primary frequencies, shall have each primary frequency be not less than 1000 Hz nor more than 4000 Hz, and shall have these frequencies be sounded either sequentially or simultaneously.

5-3 Electronic Temperature Stress.

5-3.1 Specimen PASS shall be tested for resistance to electronic temperature stress as specified in Section 6-2, Electronic Temperature Stress Test, and shall be evaluated for proper functioning as specified in Section 4-3, Signals, and shall meet the requirements specified in 5-1.2, Alarm Signal.

5-4 Corrosion Resistance.

5-4.1 Specimen PASS shall be tested for resistance to corrosion as specified in Section 6-3, Corrosion Test, and shall be

evaluated for proper functioning as specified in Section 4-3, Signals, and shall meet the requirements specified in 5-1.2, Alarm Signal.

5-5 Immersion/Leakage Resistance.

5-5.1 Specimen PASS shall be tested for resistance to leakage as specified in Section 6-4, Immersion/Leakage Test.

5-5.2 For Test Procedure 1, the specimen PASS shall be evaluated for proper functioning as specified in Section 4-3, Signals; shall meet the requirements specified in 5-1.2, Alarm Signal; and shall have no water inside its battery compartment(s).

5-5.3 For Test Procedure 2, there shall be no water in the electronics compartment(s).

5-6 Case Integrity.

5-6.1 Specimen PASS shall be tested for integrity of the case as specified in Section 6-5, Case Integrity Test, and shall be evaluated for proper functioning as specified in Section 4-3, Signals, and shall meet the requirements specified in 5-1.2, Alarm Signal.

5-6.2 The PASS shall support the test weight without affecting case integrity or causing visible damage.

5-7 Shock Sensitivity.

5-7.1 Specimen PASS shall be tested for signal cancellation sensitivity as specified in Section 6-6, Shock Sensitivity Test, and the *pre-alarm signal* shall not cancel.

5-8 Impact Resistance.

5-8.1 Impact-Acceleration Resistance.

5-8.1.1 Specimen Stand-Alone PASS shall be tested for resistance to impact as specified in Section 6-7, Impact-Acceleration Resistance Test, and shall be evaluated for proper functioning as specified in Section 4-3, Signals, and shall meet the requirements specified in 5-1.2, Alarm Signal.

5-8.1.2 Specimen PASS/SCBA devices with removable SCBA-Integrated PASS, as specified in 4-4.2.1, shall have the PASS portion removed from the PASS/SCBA device. The PASS portion alone shall be tested for resistance to impact as specified in Section 6-7, Impact-Acceleration Resistance Test, shall be evaluated for proper functioning as specified in Section 4-3, Signals, and shall meet the requirements specified in 5-1.2, Alarm Signal.

5-8.1.3 PASS/SCBA devices with nonremovable SCBA-Integrated PASS, as specified in 4-4.2.2, shall not be required to meet the requirements of 5-8.1.

5-8.2 Impact-Vibration Resistance.

5-8.2.1 Specimen Stand-Alone PASS shall be tested for resistance to vibration as specified in Section 6-8, Impact-Vibration Resistance Test, shall be evaluated for proper functioning as specified in Section 4-3, Signals, and shall meet the requirements specified in 5-1.2, Alarm Signal.

5-8.2.2 Specimen PASS/SCBA devices, with the PASS portion in the integrated configuration, shall be tested for resistance to vibration as specified in Section 6-8, Impact-Vibration Resistance Test, shall be evaluated for proper functioning as specified in Section 4-3, Signals, and shall meet the requirements specified in 5-1.2, Alarm Signal. In addition, following the vibration conditioning, specimen PASS/SCBA devices shall be tested for air flow performance as specified in Section 6-1, Air Flow Performance Test, of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service*, and shall have the facepiece pressure be not less than 0.00 mm (0.00 in.) water column nor greater than 90 mm ($3^1/_2$ in.) water column above ambient pressure from the time the air flow test begins until the time the test is concluded.

5-9 Retention System.

5-9.1 Specimen PASS shall be tested for durability of the retention system as specified in Section 6-9, Retention System Test, and the retention system shall withstand a static force of not less than 445 N (100 lbf).

5-9.2 PASS/SCBA devices with nonremovable SCBA-Integrated PASS, as specified in 4-4.2.2, shall not be required to meet 5-9.1.

5-10 Water Drainage.

5-10.1 Specimen PASS shall be tested for water drainage as specified in Section 6-10, Water Drainage Test, and shall have the sound pressure level of the *alarm signal* be not less than 95 dBA at the 60 second mark.

5-11 Heat Resistance.

5-11.1 Specimen PASS shall be tested for resistance to heat as specified in Section 6-11, Heat Resistance Test, shall not melt, drip, or ignite.

5-11.2 For both removable and nonremovable SCBA-Integrated PASS as specified in 4-4.2, only the SCBA-Integrated PASS portion of the PASS/SCBA device shall be tested for resistance to heat as specified in Section 6-11, Heat Resistance Test, and shall not melt, drip, or ignite.

5-12 Heat and Flame Resistance.

5-12.1 Specimen PASS shall be tested for resistance to heat and flame as specified in Section 6-12, Heat and Flame Test – Test 1, and shall function as follows:

(a) The *alarm signal* shall sound and continue to sound, as specified in 4-3.3.
(b) The afterflame shall not exceed 2.2 seconds.
(c) Nothing shall fall off the PASS, and the PASS shall not fall from its mounted position.
(d) At least two separate and distinct manual actions shall be required to change the mode selection device from *alarm* to *sensing* in order to silence the alarm as specified in 4-1.7.
(e) The primary *pre-alarm signal* sound pressure level shall be as specified in 5-1.1, and the supplementary *pre-alarm signals* shall function as designed.
(f) The *alarm signal* sound pressure level shall be as specified in 5-1.2.

5-12.2 Specimen PASS shall be tested for resistance to heat and flame as specified in Section 6-12, Heat and Flame Test – Test 2, and shall function as follows:

(a) PASS shall emit the *operational signal*, as specified in 4-3.1.
(b) The afterflame 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 *sensing* to *pre-alarm*, as specified in 4-2.1.

(e) The primary *pre-alarm signal* shall sound as specified in 4-3.2.
(f) PASS shall cycle from *pre-alarm* to *alarm*, as specified in 4-2.1.
(g) The *alarm signal* shall sound as specified in 4-3.3.
(h) At least two separate and distinct manual actions shall be required to change the mode selection device from *alarm* to *sensing* in order to silence the alarm as specified in 4-1.7.
(i) The primary *pre-alarm signal* sound pressure level shall be as specified in 5-1.1, and supplementary *pre-alarm signals* shall function as designed.
(j) The *alarm signal* sound pressure level shall be as specified in 5-1.2.

5-12.3 Specimen PASS shall be tested for resistance to heat and flame as specified in Section 6-12, Heat and Flame Test – Test 3, and shall function as follows:

(a) PASS shall emit the *operational signal*, as specified in 4-3.1.
(b) The afterflame 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 *sensing* to *alarm*, as specified in 4-1.5 and 4-1.6.
(e) The *alarm signal* shall sound, as specified in 4-3.3.
(f) At least two separate and distinct manual actions shall be required to change the mode selection device from *alarm* to *sensing* in order to silence the alarm as specified in 4-1.7.
(g) The primary *pre-alarm signal* sound pressure level shall be as specified in 5-1.1, and supplementary *pre-alarm signals* shall function as designed.
(h) The *alarm signal* sound pressure level shall be as specified in 5-1.2.

5-13 Intrinsic Safety.

5-13.1 Specimen PASS shall be tested for intrinsic safety as specified in ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1 Hazardous Locations*, and shall meet the requirements for Class I, Division 1 hazardous locations.

5-14 Product Label Durability.

5-14.1 Specimen PASS with product labels shall be tested for durability and legibility as specified in Section 6-14, Product Label Durability Test, and the product labels shall remain attached to the PASS and shall be legible to the unaided eye.

Chapter 6 Test Requirements

6-1 Sound Pressure Level Tests.

6-1.1 Specimen 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.

6-1.2 Where the audio test mannequin is specified in this section, the test mannequin shall be a Central Display, Inc., Model MA32 medium size mannequin or equivalent. The audio test mannequin shall have the sound level meter microphone mounted at the left ear as shown in Figure 6-1.2.

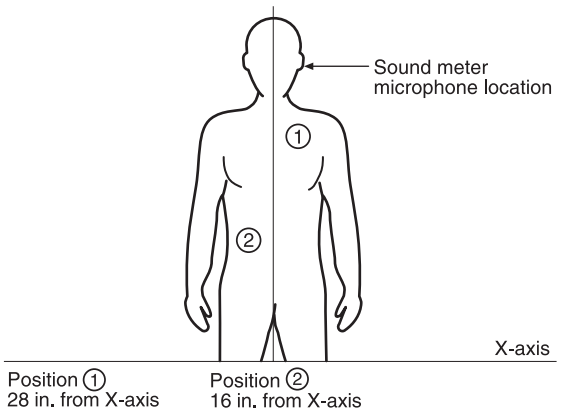


Figure 6-1.2 Audio test mannequin.

6-1.3 Pre-Alarm Signal Test for all PASS/SCBA Devices.

6-1.3.1 Specimen PASS/SCBA devices shall be mounted on the audio test mannequin in the preferred mounting position and orientation for optimal performance as specified by the PASS manufacturer in accordance with 3-2.4(b).

6-1.3.2 Before starting the test, the specimen PASS battery voltage shall be discharged to the level at which the PASS first emits the low battery warning signal specified in 4-3.4.

6-1.3.3 The sound pressure level for the primary *pre-alarm signal* shall be measured at the left ear on the mannequin for the entire duration of the pre-alarm.

6-1.3.4 The primary *pre-alarm signal* sound pressure level shall be recorded and evaluated for the entire duration to determine pass/fail.

6-1.3.5 The specimen PASS primary *pre-alarm signal* functions specified in 4-3.2 shall be evaluated to determine pass/fail.

6-1.4 Pre-Alarm Signal Test for Stand-Alone PASS and PASS/SCBA Devices with Removable SCBA-Integrated PASS.

6-1.4.1 Testing shall include three specimens for Stand-Alone PASS or three specimens for PASS portions removed from the PASS/SCBA devices. Specimen PASS/SCBA devices shall have the PASS portion removed from the PASS/SCBA device.

6-1.4.2 Specimen PASS shall first be mounted on the audio test mannequin at Position 1, as shown in Figure 6-1.2, in each preferred mounting position and orientation for optimal performance as specified by the PASS manufacturer in accordance with 3-2.4(b).

6-1.4.3 Before starting the test, the specimen PASS battery voltage shall be discharged to the level at which the PASS first emits the low battery warning signal specified in 4-3.4.

6-1.4.4 The primary *pre-alarm signal* shall be measured at the left ear of the mannequin with the PASS in each preferred mounting position and orientation for optimal performance as specified by the PASS manufacturer in accordance with 3-2.4(b).

6-1.4.5 Then the specimen PASS shall be mounted on the audio test mannequin in Position 2, as shown in Figure 6-1.2,

in each preferred mounting position and orientation for optimal performance as specified by the PASS manufacturer in accordance with 3-2.4(b).

6-1.4.6 Before starting the test, the specimen PASS battery voltage shall be discharged to the level at which the PASS first emits the low battery warning signal specified in 4-3.4.

6-1.4.7 The primary *pre-alarm signal* shall be measured at the left ear of the mannequin with the PASS in each preferred mounting position and orientation for optimal performance as specified by the PASS manufacturer in accordance with 3-2.4(b).

6-1.4.8 The *pre-alarm signal* sound pressure levels for each test shall be recorded and evaluated for the entire duration to determine pass/fail.

6-1.4.9 The specimen PASS *pre-alarm signal* functions specified in 4-3.2 shall be evaluated to determine pass/fail.

6-1.5 Alarm Signal Test.

6-1.5.1 The sound pressure level for the *alarm signal* shall be measured in a spherical radius at a distance of 3 m (9.9 ft) in from the specimen PASS enunciator.

6-1.5.2 Before starting the test, the specimen PASS battery voltage shall be discharged to the level at which the PASS first emits the *low battery warning signal* specified in 4-3.4.

6-1.5.3 The *alarm signal* sound pressure level shall be recorded and evaluated for the entire duration to determine pass/fail.

6-1.5.4 The specimen PASS *alarm signal* functions specified in 4-3.3 shall be evaluated to determine pass/fail.

6-1.6 Low Battery Warning Signal Test for all PASS/SCBA Devices.

6-1.6.1 Specimen PASS/SCBA devices shall be mounted on the audio test mannequin in the preferred mounting position and orientation for optimal performance as specified by the manufacturer in 3-2.4(b).

6-1.6.2 Before starting the test, the specimen PASS battery voltage shall be discharged to the level at which the PASS first emits the *low battery warning signal* specified in 4-3.4.

6-1.6.3 The sound pressure level for the *low battery warning signal* shall be measured at the left ear of the mannequin for 1 hour.

6-1.6.4 The *low battery warning signal* sound pressure level shall be recorded and evaluated for the entire duration to determine pass/fail.

6-1.6.5 Specimen PASS *low battery warning signal* functions specified in 4-3.4 shall be evaluated to determine pass/fail.

6-1.7 Low Battery Warning Signal Test for Stand-Alone PASS and PASS/SCBA Devices with Removable SCBA-Integrated PASS.

6-1.7.1 Testing shall include three specimens for Stand-Alone PASS and three specimens for PASS portions removed from the PASS/SCBA devices. Specimen PASS/SCBA devices shall have the PASS portion removed from the PASS/SCBA device.

6-1.7.2 Specimen PASS shall first be mounted on the audio test mannequin in Position 1, as shown in Figure 6-1.2, in each preferred mounting position and orientation as specified by the PASS manufacturer in accordance with 3-2.4(b).

6-1.7.3 Before starting the test, the specimen PASS battery voltage shall be discharged to the level at which the PASS first emits the *low battery warning signal* specified in 4-3.4.

6-1.7.4 The sound pressure level for the *low battery warning signal* shall be measured at the left ear of the mannequin in each preferred mounting position and orientation as specified by the PASS manufacturer in accordance with 3-2.4(b).

6-1.7.5 Then the specimen PASS shall be mounted on the audio test mannequin in Position 2, as shown in Figure 6-1.2, in each preferred mounting position and orientation as specified by the PASS manufacturer in accordance with 3-2.4(b).

6-1.7.6 Before starting the test, the specimen PASS battery voltage shall be discharged to the level at which the PASS first emits the *low battery warning signal* specified in 4-3.4.

6-1.7.7 The sound pressure level for the *low battery warning signal* shall be measured at the left ear of the mannequin for 1 hour in each preferred mounting position and orientation as specified by the PASS manufacturer in accordance with 3-2.4(b).

6-1.7.8 The *low battery warning signal* sound pressure levels for each test shall be recorded and evaluated for the entire duration to determine pass/fail.

6-1.7.9 Specimen PASS *low battery warning signal* functions specified in 4-3.4 shall be evaluated to determine pass/fail.

6-2 Electronic Temperature Stress Test.

6-2.1 Specimen PASS shall be subjected to a series of three temperature stress tests identified as Test Procedure 1 for elevated temperature, Test Procedure 2 for low operating temperature, and Test Procedure 3 for temperature shock. Three specimen PASS shall be used for all three test series. Each specimen PASS tested shall be complete with power source.

6-2.2 The test chamber or cabinet shall be capable of maintaining the required conditions throughout the envelope of air surrounding the specimen PASS being tested, and these conditions shall be continuously monitored.

6-2.3 For all three tests, three specimen 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 specimen PASS shall be allowed to stabilize at ambient conditions prior to proceeding to the next test.

6-2.4 Test Procedure 1.

6-2.4.1 Specimen PASS shall be placed in the test apparatus that has been stabilized at 49°C (120°F). After 6 hours, the temperature shall be raised within 1 hour to 71°C (160°F) and maintained for 4 hours. The temperature shall then be decreased within 1 hour to 49°C (120°F).

6-2.4.2 This cycle shall be repeated twice.

6-2.4.3 After the second cycle, the temperature shall be raised to 71°C (160°F) for 4 hours.

6-2.4.4 Specimen PASS shall be removed following the specified conditioning, and testing shall begin within 30 seconds of removal from conditioning.

6-2.4.5 Specimen PASS shall be operated according to the manufacturer's instructions to determine the proper functioning as specified in Section 4-3, Signals, and the *alarm signal* sound pressure level shall be recorded and evaluated as specified in 5-1.2 to determine pass/fail.

6-2.5 Test Procedure 2.

6-2.5.1 Specimen PASS shall be placed in the test apparatus that has been stabilized at −20°C (−4°F) and maintained for a minimum of 4 hours.

6-2.5.2 Specimen PASS shall be removed following the specified conditioning, and testing shall begin within 30 seconds of removal from conditioning.

6-2.5.3 Specimen PASS shall be operated according to the manufacturer's instructions to determine the proper functioning as specified in Section 4-3, Signals, and the *alarm signal* sound pressure level shall be recorded and evaluated as specified in 5-1.2 to determine pass/fail.

6-2.6 Test Procedure 3.

6-2.6.1 Specimen PASS shall be placed in the test apparatus that has been stabilized at −20°C (−4°F), cold condition, for 4 hours. Specimen PASS shall be removed from the cold condition and shall be placed within 5 minutes into another test apparatus that has been stabilized at 71°C (160°F) hot condition. After 4 hours, specimen PASS shall be returned to cold condition test apparatus for another 4 hours.

6-2.6.2 This cycle shall be repeated twice.

6-2.6.3 Specimen PASS shall be removed following the specified conditioning, and testing shall begin within 30 seconds of removal from conditioning.

6-2.6.4 Specimen PASS shall be operated according to the manufacturer's instructions to determine the proper functioning as specified in Section 4-3, Signals, and the *alarm signal* sound pressure level shall be recorded and evaluated as specified in 5-1.2 to determine pass/fail.

6-3 Corrosion Test.

6-3.1 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*.

6-3.2 Specimen PASS shall be subjected to a 5 percent, ±1 percent, salt solution fog at a chamber temperature of 35°C (95°F) for 48 hours in the typical wearing position as if worn by a user, as specified by the manufacturer. The PASS shall then be stored in an environment of 22°C, ±3°C (72°F, ±5°F) at 50 percent, ±5 percent, relative humidity for a minimum of 48 hours.

6-3.3 Specimen PASS shall be removed following the specified conditioning, and testing shall begin within 30 seconds of removal from conditioning.

6-3.4 Specimen PASS shall be operated according to the manufacturer's instructions to determine the proper functioning as specified in Section 4-3, Signals, and the *alarm signal* sound pressure level shall be recorded and evaluated as specified in 5-1.2 to determine pass/fail.

6-4* Immersion/Leakage Test.

6-4.1 The test water container shall be capable of covering the uppermost point of the specimen PASS with a depth of 1 m (3.3 ft) of water and shall maintain the PASS at that depth.

6-4.2 The water temperature shall be 18°C, ±10°C (64°F, ±18°F) and the water temperature shall not change more than 3°C (5°F) for the duration of the test.

6-4.3 Specimen PASS shall be conditioned at a temperature of 27°C, ±3°C (49°F, ±5°F) above the temperature of the water for a minimum of 2 hours prior to immersion in the test water container.

6-4.4 Test Procedure 1.

6-4.4.1 Specimen PASS shall be immersed in the test water container for 2 hours. After 2 hours, the specimen PASS shall be removed from the test water container and shall be wiped dry.

6-4.4.2 Specimen PASS shall be removed following the specified conditioning, and testing shall begin within 30 seconds of removal from conditioning.

6-4.4.3 The battery compartment(s) of the specimen PASS shall be opened, and each battery compartment shall be inspected for water leakage to determine pass/fail.

6-4.4.4 Specimen PASS shall be operated according to the manufacturer's instructions to determine the proper functioning as specified in Section 4-3, Signals, and the *alarm signal* sound pressure level shall be recorded and evaluated as specified in 5-1.2 to determine pass/fail.

6-4.5 Test Procedure 2.

6-4.5.1 The specimen PASS shall be reimmersed in the test water container for an additional 5 minutes. The battery compartment(s) shall be open, and the battery shall not be installed.

6-4.5.2 After the 5-minute immersion, the specimen PASS shall be removed from the test water container and shall be wiped dry.

6-4.5.3 The electronic compartment(s) of the specimen PASS shall be opened and inspected for water leakage to determine pass/fail.

6-5 Case Integrity Test.

6-5.1 Specimen PASS shall be subjected to a test weight of 200 kg (442 lb). 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.

6-5.2 The test weight shall remain on each surface of the specimen PASS case for 1 minute, +15/−0 seconds.

6-5.3 After removal of the test weight, each surface of the specimen PASS case shall be examined to determine pass/fail.

6-5.4 Signal testing shall begin within 30 seconds following the final inspection of the case.

6-5.5 Specimen PASS shall be operated according to the manufacturer's instructions to determine the proper functioning as specified in Section 4-3, Signals, and the *alarm signal* sound pressure level shall be recorded and evaluated as specified in 5-1.2 to determine pass/fail.

6-6 Shock Sensitivity Test.

6-6.1 Specimen PASS shall be subjected to one test series conducted on each test orientation as specified in Figure 6-6.1. A single test series shall consist of dropping the test ball three times.

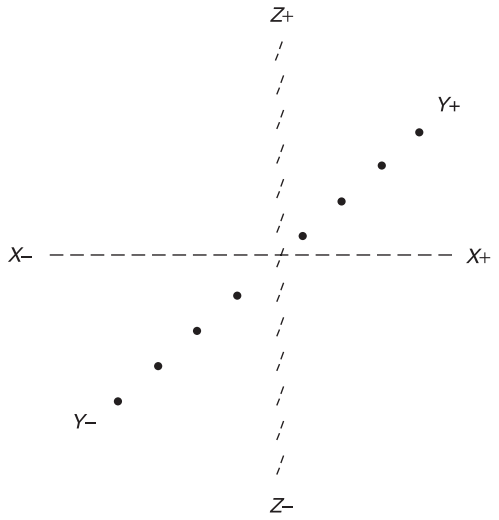


Figure 6-6.1 Test orientation.

6-6.2 Specimen PASS shall be placed on a granite surface plate with minimum dimensions of 305 mm width × 305 mm length × 75 mm thickness (12 in. × 12 in. × 3 in.) Specimen PASS shall be in direct contact with the granite surface plate and secured in such a manner to prevent movement of the specimen PASS during the test. The method of securing the specimen PASS shall not interfere with the surface being tested.

6-6.3 Specimen PASS shall be placed in the *sensing* mode. The testing shall be conducted during the sounding of the *pre-alarm signal*.

6-6.4 A 10-mm ($^3/_8$-in.) I.D. × 150-mm (6-in.) 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 specimen PASS being tested. The bottom of the tube shall be within 3 mm ($^1/_8$ in.) of the surface of the specimen PASS but shall not touch the PASS. A stainless steel test ball measuring 8-mm ($^5/_{16}$-in.) 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 specimen PASS.

6-6.5 The sounding of the *pre-alarm signal* shall be monitored to determine pass/fail.

6-7 Impact-Acceleration Resistance Test.

6-7.1 Three specimens of each different type of Stand-Alone or removable SCBA-Integrated PASS shall be subjected to a series of impact-acceleration tests. Nonremovable SCBA-Integrated PASS shall not be subjected to this test.

6-7.1.1 One specimen PASS for ambient temperature conditioning shall be exposed to a temperature of 23°C, ±1°C (73°F, ±2°F) for at least 4 hours.

6-7.1.2 One specimen PASS for cold temperature conditioning shall be exposed to a temperature of −20°C, ±1°C (−4°F, ±2°F) for at least 4 hours.

6-7.1.3 One specimen PASS for elevated temperature conditioning shall be exposed to a temperature of 71°C, ±1°C (160°F, ±2°F) for at least 4 hours.

6-7.2 Each specimen PASS tested shall be complete with power source.

6-7.3 After conditioning, specimen PASS shall be set in the *sensing* mode. Testing shall begin within 30 seconds of removal from conditioning. For each conditioning, the specimen PASS shall be dropped a total of eight 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. The specimen PASS shall not be permitted to bounce a second time.

6-7.4 Following each drop, the specimen PASS shall remain motionless and shall sound the *pre-alarm signal* and the *alarm signal* from the *sensing* mode to evaluate proper functioning as specified in 4-3.3 for determining pass/fail, after which the *alarm signal* shall be stopped and the PASS reset to *sensing* mode for the next drop.

6-7.5 The entire single series of drops shall be completed within 10 minutes of removal from conditioning.

6-7.6 Following the entire single series of drops, specimen PASS signal testing shall begin within 30 seconds.

6-7.7 Specimen PASS shall be operated according to the manufacturer's instructions to determine the proper functioning as specified in Section 4-3, Signals, and the *alarm signal* sound pressure level shall be recorded and evaluated as specified in 5-1.2 to determine pass/fail.

6-8 Impact-Vibration Resistance Test.

6-8.1 Three specimens of SCBA-Integrated PASS or three specimens of Stand-Alone PASS shall be tested to the impact-vibration test on a typical package tester as shown in Figure 514.4-19 of MIL-STD 810E, *Environmental Test Methods*, within a plywood holding box(es) as specified in 6-8.2 and 6-8.3 of this section.

6-8.2 Holding Boxes for PASS/SCBA Devices.

6-8.2.1 Holding boxes for the impact-vibration test shall be constructed with nominal 20-mm ($^3/_4$-in.) plywood and shall be sized to encase the complete specimen PASS/SCBA device in one holding box and specimen PASS/SCBA device components in a second holding box.

6-8.2.2 The tops of the holding boxes shall be permitted to be made of transparent material to allow observation during testing.

6-8.2.3 The first holding box shall be constructed to encase the complete specimen. Where required for integration, SCBA regulators and hoses shall remain attached to the complete PASS/SCBA device. The SCBA facepiece and those components that attach directly to the facepiece, excluding regulators, shall not be included in the first holding box.

6-8.2.4 The travel distance between the widest part of the specimen and the sideboards of the specimen holding box shall be a total of 25 mm, ±5 mm, or 13 mm, ±3 mm per side (1 in., $\pm^3/_{16}$ in., or $^1/_2$ in., $\pm^3/_{32}$ in. per side). The travel distance between the highest point of the specimen and the bottom of the specimen holding box shall be a total of 25 mm, ±5mm (1 in., $\pm^3/_{16}$ in.).

6-8.2.5 The total travel distance shall be measured with all movable components, excluding those components specified in 6-8.2.6, configured to minimize the size of the holding box. The highest point of the specimen shall be measured with the SCBA backplate resting on the bottom of the holding box as shown in Figure 6-8.2.5.

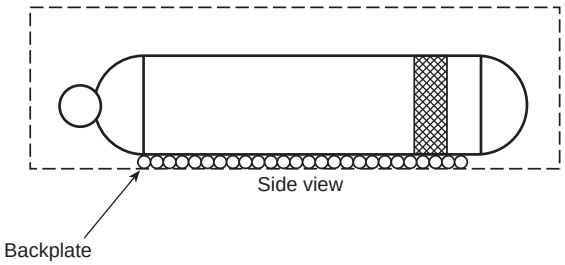


Figure 6-8.2.5 PASS/SCBA device in holding box.

6-8.2.6 The second holding box for SCBA components shall be constructed to encase the SCBA facepiece and those components that attach directly to the facepiece, excluding the regulator and associated hoses.

6-8.2.7 The total travel distance between the widest part of the components and the sideboards of the component holding box shall be 25 mm, ±5 mm, or 13 mm, ±3 mm per side (1 in., $\pm^3/_{16}$ in., or $^1/_2$ in., $\pm^3/_{32}$ in. per side). The travel distance between the highest point of the facepiece and the bottom of the component holding box shall be a total of 25 mm, ±5mm (1.0 in., ±0.2 in.).

6-8.2.8 The total travel distance shall be measured with all movable components, as specified in 6-8.2.6, configured to minimize the size of the component holding box. The highest point of the PASS/SCBA device facepiece shall be measured with the outer portion of the facepiece lens facing the top of the component holding box.

6-8.3 Holding Box for Stand-Alone PASS Devices.

6-8.3.1 The holding box for the impact–vibration test shall be constructed with nominal 20-mm ($^3/_4$-in.) plywood and shall be sized to encase the complete specimen PASS in one holding box.

6-8.3.2 The top of the holding box shall be permitted to be made of transparent material to allow observation during testing.

6-8.3.3 The holding box shall be constructed to encase the complete specimen.

6-8.3.4 The travel distance between the widest part of the specimen and the sideboards of the specimen holding box shall be a total of 25 mm, ±5 mm, or 13 mm, ±3 mm per side (1 in., $\pm^3/_{16}$ in., or $^1/_2$ in., $\pm^3/_{32}$ in. per side). The travel distance between the highest point of the specimen and the bottom of the specimen holding box shall be a total of 25 mm, ±5mm (1 in., $\pm^3/_{16}$ in.).

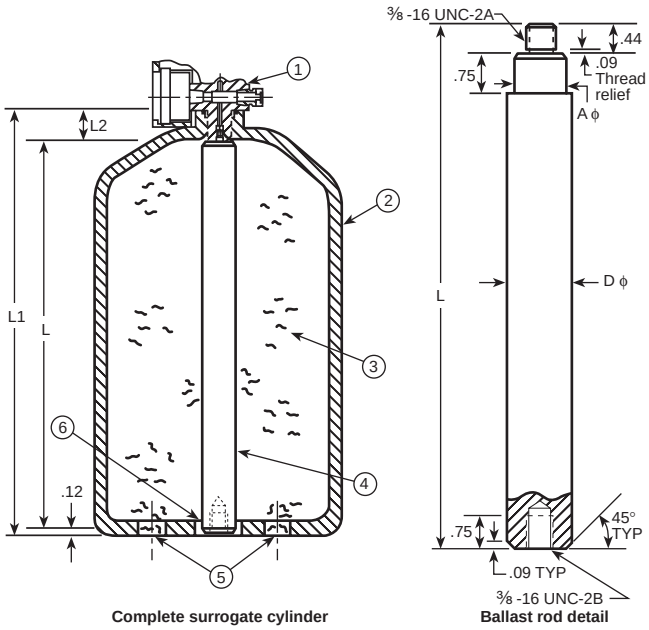
6-8.3.5 The total travel distance shall be measured with any movable components configured to minimize the size of the holding box. The highest point of the specimen shall be measured with the PASS retention mechanism resting on the bottom of the holding box.

6-8.4 Surrogate Cylinder.

6-8.4.1* The breathing gas cylinder of the PASS/SCBA device shall be replaced by a surrogate cylinder.

6-8.4.2 The surrogate cylinder and cylinder valve shall be of identical design and construction as the breathing gas cylinder and cylinder valve of the PASS/SCBA device to be tested.

6-8.4.3 The mass of the breathing gas of a fully pressurized breathing gas cylinder shall be replaced in the surrogate cylinder with a substitute mass. The substitute mass shall consist of a brass rod and surrounding foam constructed as shown in Figure 6-8.4.3.



Item	Description	Quantity
1	Cylinder valve assembly w/gauge and guards, etc.	1
2	SCBA air storage cylinder	1
3	Stepanfoam RI-9619 polyurethane foam system	A/R
4	Ballast rod - ASTM B16 brass, 1/2 hard	A/R
5	Fill/vent holes ¾ – ⅞ inch diameter	2
6	Ballast rod installation hole — diameter A/R	1

Figure 6-8.4.3 Surrogate cylinder.

6-8.4.4 The surrogate cylinder and cylinder valve with the substitute mass shall have the same total mass, ±5 percent, as the fully pressurized breathing gas cylinder and cylinder valve.

6-8.5 The specimens shall be placed unrestrained in the holding boxes specified in 6-8.2 and 6-8.3, as applicable, and shall be vibrated to the level as specified in 1-3.3.3.2 of Method 514.4, Vibration, of MIL-STD 810E, *Environmental Test Methods*.

6-8.6 For PASS/SCBA devices, the vibration shall be conducted with the specimen situated in each of the two positions shown in Figure 6-8.6(a) and Figure 6-8.6(b). The total vibration duration shall be 3 hours, consisting of two 90-minute periods, one period for each position.

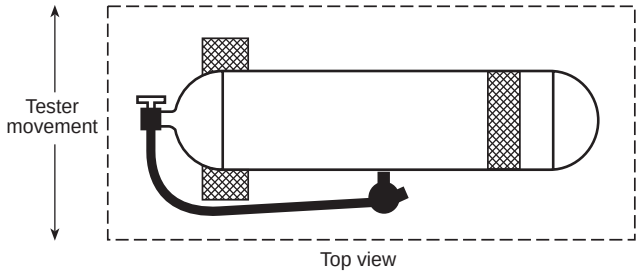


Figure 6-8.6(a) PASS/SCBA device cylinder axis perpendicular to direction of tester movement.

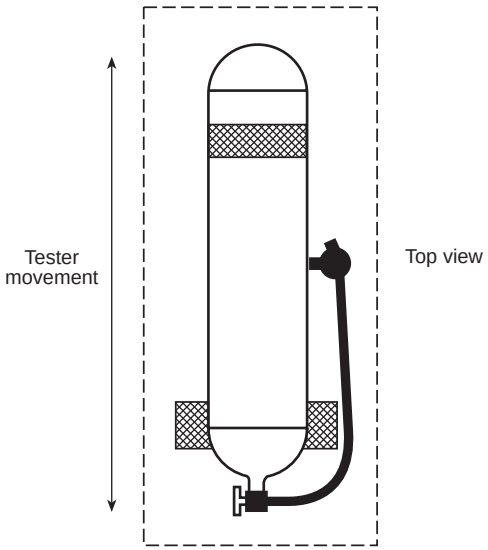


Figure 6-8.6(b) PASS/SCBA device cylinder axis parallel to direction of tester movement.

6-8.7 Specimen PASS shall be removed from the holding boxes following the vibration conditioning, and testing shall begin within 30 seconds of removal.

6-8.8 All types of specimen PASS shall be operated according to the manufacturer's instructions to determine the proper functioning as specified in Section 4-3, Signals, and the *alarm signal* sound pressure level shall be recorded and evaluated as specified in 5-1.2 to determine pass/fail.

6-8.9 Only PASS/SCBA devices shall also be tested as specified in Section 6-1, Air Flow Performance Test, of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service*, for determining pass/fail. Following the vibrating and prior to performing this air flow test, the surrogate cylinder shall be replaced with the fully charged breathing gas cylinder originally provided with the PASS/SCBA device.

6-9 Retention System Test.

6-9.1* Specimen PASS that are to be subjected to the retention system test shall first have the retention system attachment method cycled 500 times.

6-9.2 From a base load of 45 N (10 lbf), the specimen PASS retention system shall have a force applied steadily from 45 N/sec (10 lbf/sec) at a rate between 9.0 N/sec (2 lbf/sec) and 45 N/sec (10 lbf/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 445 N (100 lbf) is attained.

6-9.3 The tester shall note whether or not the retention system separates to determine pass/fail.

6-10 Water Drainage Test.

6-10.1 Specimen PASS shall be subjected to two water drainage tests. The first test shall have the specimen 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 specimen PASS positioned with the annunciator oriented horizontally and facing up.

6-10.2 Water shall be introduced into all openings, indentations, and grilles of the specimen 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.

6-10.3 Specimen PASS shall then be placed in the *alarm* mode and allowed to sound the *alarm signal* for at least 65 seconds without moving. The sound pressure level for the *alarm signal* shall be measured as specified in 5-1.2.

6-10.4 The sound pressure level for the *alarm signal* shall be measured and recorded at the 60-second mark to determine pass/fail.

6-11 Heat Resistance Test.

6-11.1 The test oven shall be a horizontal flow circulating oven with minimum interior dimensions of 610 mm × 610 mm × 610 mm (24 in. × 24 in. × 24 in.). The test oven shall have an airflow rate of 38 to 76 linear m/min (125 to 250 linear ft/min) at the standard temperature and pressure of 21°C (70°F) 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 specimen PASS. The thermocouple shall be equidistant between the vertical centerline of a mounted specimen 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 260°C, +5°/−0°C (500°F, +10°/−0°F) for a minimum of 30 minutes.

6-11.2 Specimen PASS shall be mounted on a test fixture that includes an aramid belt that is at least 51 mm (2 in.) wide and fastened to mounting posts spaced 305 mm, +25/−0 mm (12 in., +1/−0 in.) apart. The test fixture shall be designed to allow the specimen PASS to be attached to the belt by the retention system according to the specimen PASS manufacturer's instructions.

6-11.2.1 For SCBA-Integrated PASS, only the SCBA-Integrated PASS portion of the PASS/SCBA device shall be mounted on an alternate test fixture.

6-11.2.2 The alternate test fixture shall be designed to allow the SCBA-Integrated PASS to be attached in the same configuration as the SCBA-Integrated PASS mounting assembly attaches to the PASS/SCBA device. The test fixture shall allow mounting of the SCBA-Integrated PASS for testing so that no portion of the PASS will touch any oven surface, and shall meet the requirements of 6-11.3.

6-11.2.3 The alternate test fixture with the SCBA-Integrated PASS mounted for testing shall not degrade the oven recovery time specified in 6-11.3.

6-11.3 The test fixture with the specimen PASS attached shall be placed in the test oven. The specimen PASS shall be set to the *off* mode. There shall be no obstructions between the specimen PASS and the air flow. The test fixture shall position the specimen 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 260°C, +5°/–0°C (500°F, +10°/–0°F) for the duration of the test.

6-11.4 Specimen 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 260°C, +5°/–0°C (500°F, +10°/–0°F).

6-11.5 After the specified exposure, the specimen PASS shall be removed and shall be examined to determine pass/fail.

6-12 Heat and Flame Test.

6-12.1 A test mannequin meeting the requirements specified in Figure 6-12.1 shall be provided.

6-12.2* The test mannequin shall have a protective covering. The protective covering shall be designed and constructed as follows.

6-12.2.1 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 6-10 of NFPA 1971, *Standard on Protective Ensemble for Structural Fire Fighting*.

6-12.2.2 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.

6-12.2.3 The thermal liner shall be constructed of a 3 oz/sq yd rip stop pajama check Nomex III® face cloth, quilt stitched to 100 percent Nomex III® batting of approximately 6 oz/sq yd.

6-12.2.4 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.

6-12.2.5 The moisture barrier shall be completely sewed to the thermal liner at its perimeter, with the neoprene side facing outward from the thermal liner. All edges shall be sewed together and bound with nonwicking moisture barrier material. The liner/moisture barrier shall be no more than 76 mm (3 in.) from the coat hem.

6-12.2.6 The moisture barrier and thermal liner shall be completely detachable from the outer shell.

6-12.2.7 The protective covering shall be stitched with Kevlar® thread using a minimum of 6 to 8 stitches per 25 mm (1 in.). 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.

6-12.2.8 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.

6-12.2.9 Outside sleeve seams shall be felled, while inside seams shall be lock stitched.

6-12.2.10 The protective covering shall measure 890 mm (35 in.) in length measured from the center of the back collar seam to the hem. The protective covering size shall be 112-mm (44-in.) chest by 86-mm (34-in.) sleeve.

6-12.2.11 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.

6-12.3 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 Section 5-5 of NFPA 1971, *Standard on Protective Ensemble for Structural Fire Fighting*.

6-12.4 The heat and flame test apparatus shall be as specified in Figures 6-12.4(a) and 6-12.4(b).

6-12.5 The test oven shall be a vertical forced circulating air oven with an internal velocity of 61 linear m (200 linear ft) per minute. The test oven shall have minimum dimensions of 914 mm depth × 914 mm width × 1220 mm height (36 in. × 36 in. × 48 in.).

6-12.6 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 0°C (32°F) reference point with an ice bath containing ice and deionized or distilled water. Boiling water shall be used to set the 100°C (212°F) reference value. The reference temperatures shall be corrected to standard temperatures using a barometric pressure correction.

6-12.7 For calibration prior to the heat and flame test, the calibration mannequin, as specified in Figure 6-12.7, shall be exposed to direct flame contact for 10 seconds using the heat and flame test apparatus as specified in Figure 6-12.4(a) and 6-12.4(b). All peak temperature readings shall be within a temperature range of 815° to 1150°C (1500° to 2102°F). The average mean of all peak temperature readings shall be no higher than 950°C (1742°F).

6-12.8 The test oven recovery time, after the door is closed, shall not exceed 1 minute.

6-12.9 Specimen 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, or other means, on the outside or over the mannequin protective covering. Specimen PASS shall be attached in such a manner that the PASS is facing a burner array.

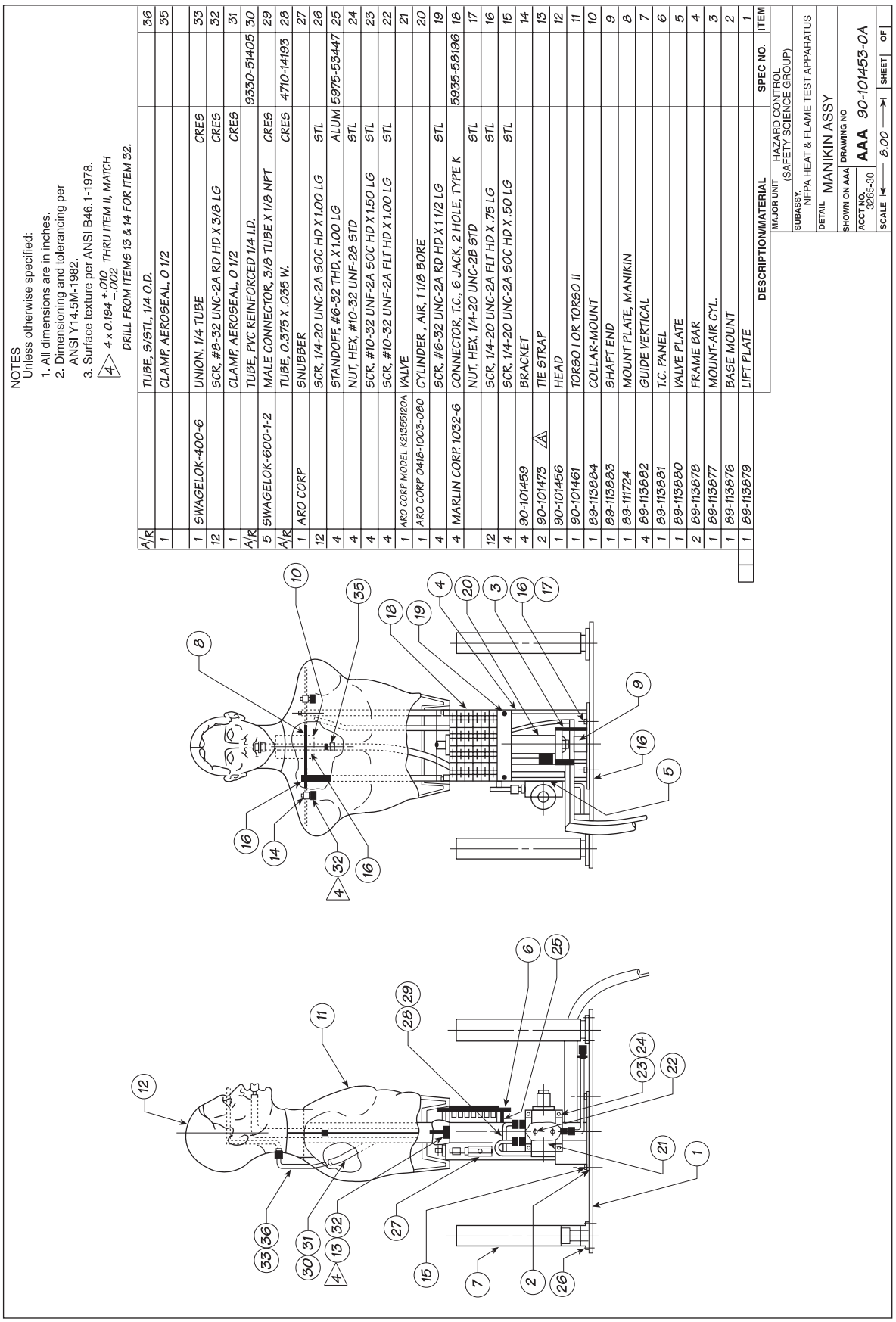


Figure 6-12.1 Heat and flame test mannequin.

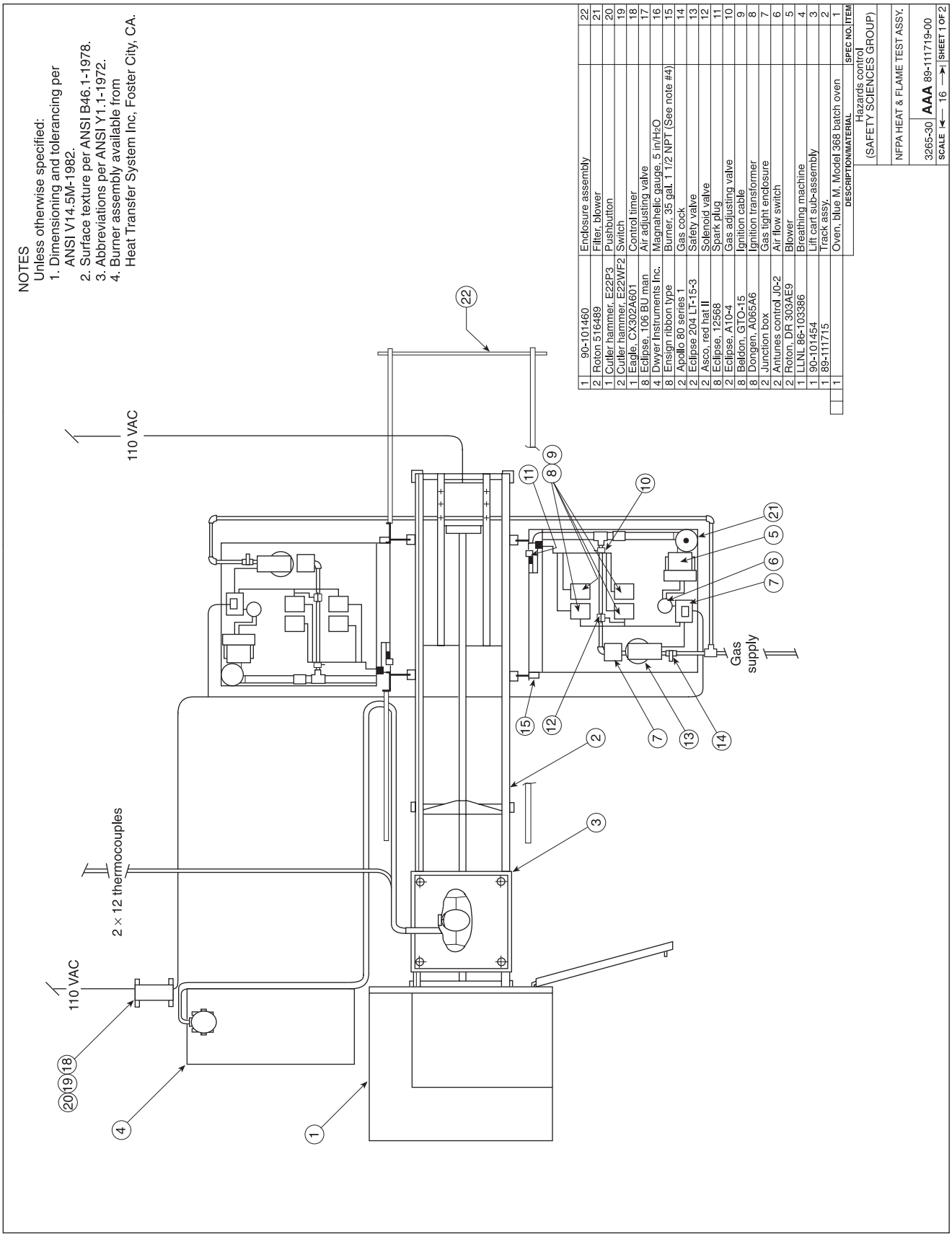


Figure 6-12.4(a) Heat and flame test apparatus (top view).

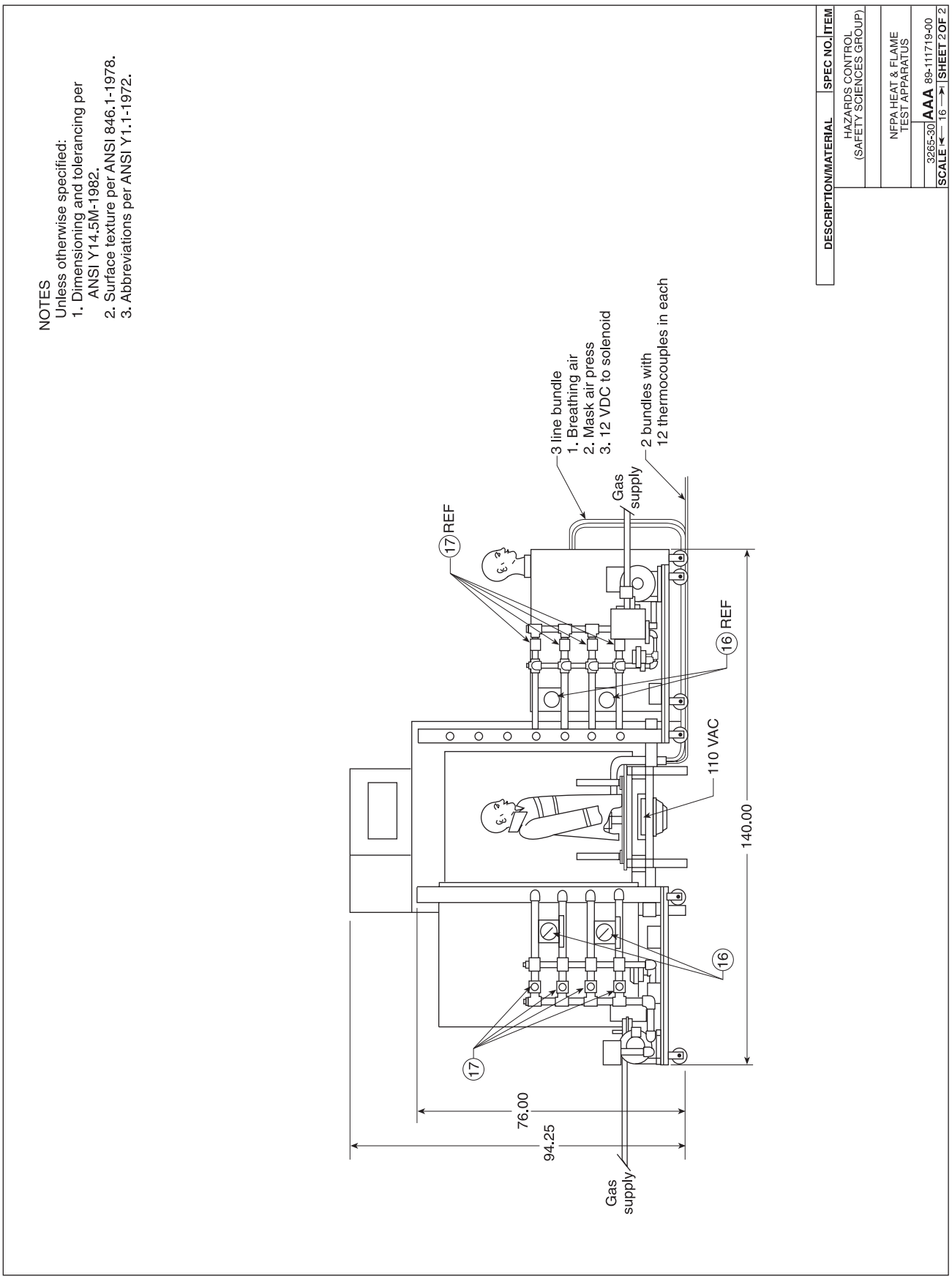


Figure 6-12.4(b) Heat and flame test apparatus (side view).

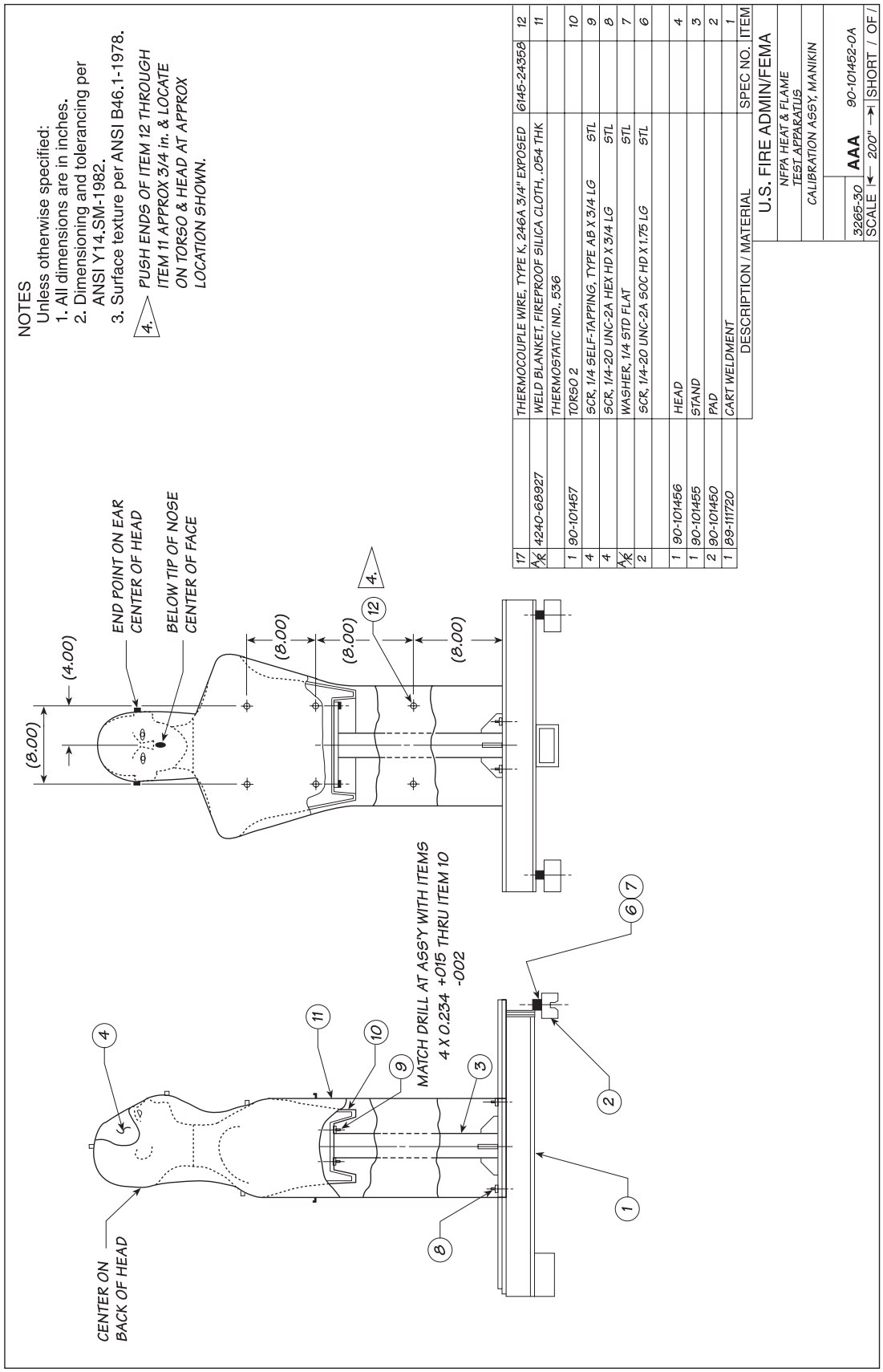


Figure 6-12.7 Calibration mannequin.