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American National Standard
For Air-Purifying Respiratory
Protective Smoke Escape Devices

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**American National Standard for
Air-Purifying Respiratory Protective Smoke Escape Devices**

Secretariat
International Safety Equipment Association

Approved June 2, 2009
American National Standards Institute, Inc.

American National Standard

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Foreword (This Foreword is not part of American National Standard ANSI/ISEA 110-2009)

The Respiratory Protective Escape Devices (RPED) Group of the International Safety Equipment Association has developed this standard to provide design guidance in the form of a detailed set of performance requirements and testing procedures for manufacturers of hooded air-purifying respiratory protective smoke escape devices (ARPED or RPED). Such devices are intended to be used by persons escaping from fire-generated products of combustion. RPEDs provide head, eye, and respiratory protection from particulate matter, eye irritants, carbon monoxide, and other toxic gases commonly produced by fire.

This revision updates methodologies and procedures to provide criteria that will allow testing laboratories to generate reproducible results, while at the same time removing restrictive language that could impede the testing process. In consultation with testing laboratories, the Consumer Products Safety Commission and the NIOSH National Personal Protective Technologies Laboratory, the revision includes language to ensure that user needs are being met with the addition of criteria for ocular leakage, changes in sizing parameters based on current anthropomorphic studies and to give consideration to current and emerging technologies in RPED product development.

Suggestions for the improvement of this standard are welcome. They should be sent to the ISEA, 1901 N. Moore Street, Suite 808, Arlington, VA 22209 or by email to isea@safetysystem.org.

This standard was processed and approved using consensus procedures prescribed by the American National Standards Institute. The following organizations were contacted prior to the approval of this standard. Inclusion in this list does not necessarily imply that the organization concurred with the submittal of the proposed standard to ANSI.

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American National Standard for Air-Purifying Respiratory Protective Smoke Escape Devices

1. Scope

This standard specifies the minimum requirements for the design, performance, testing, and certification of air-purifying respiratory protective smoke escape devices for the immediate emergency evacuation without entry/re-entry of adult civilians.

The requirements of this standard specify an air-purifying respiratory protective escape device with a laboratory-tested 15-minute service life intended to provide head, eye and respiratory protection from particulate matter, irritants and toxic gases and vapors commonly produced by fire.

This standard shall not apply to the requirements for provision, installation, or use of air-purifying respiratory protective smoke escape devices.

This standard shall not apply to respiratory protective smoke escape devices that are designed for use in circumstances where an oxygen deficiency (oxygen less than 19.5 percent by volume) exists or might exist.

2. Purpose

The purpose of this standard shall be to provide minimum requirements for respiratory protective escape devices that provide limited protection for 15 minutes for adult civilian escape from the byproducts of fire, including particulate matter, carbon monoxide, other toxic gases, and the effects of radiant heat.

Controlled laboratory tests that are used to determine compliance with the performance requirements of this standard shall not be deemed as establishing performance levels for all situations to which individuals can be exposed.

This standard is not intended to be used as a detailed manufacturing or purchase specification but shall be permitted to be referenced as a

minimum requirement in purchase specifications.

3. Definitions

Air-Purifying Respiratory Protective Smoke Escape Device (RPED). An air-purifying respirator used to protect a person while escaping from a fire by removing certain contaminants of fire-generated products of combustion from the inhaled air.

Accessory. An item that may be provided with an RPED that does not affect its ability to meet the requirements of this standard.

Approved. Acceptable to the authority having jurisdiction.

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

Basic Plane. A term for the plane through the centers of the external ear openings and the lower edges of the eye sockets.

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 on the methods the manufacturer uses to determine continued compliance of labeled and listed products 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 labeling/listing/follow-up program.

Civilians. Persons who are members of the general public and who are not fire service

personnel, or other emergency services personnel, performing their official duties during emergency incident operations.

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

Donning Time. The time for equipment in hand to be placed over the head of the wearer and become functional. This time shall include the removal of an operational packaging.

Follow-up Program. The sampling, inspections, 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.

Gas. A fluid that has neither independent shape nor volume and tends to expand indefinitely.

Haze. The percent of incident light that is not transmitted in a straight line through the lens but forward scattered, greater than 2.5° diverging.

Identical Respiratory Protective Escape Device. RPEDs that are produced to the same engineering and manufacturing specifications.

Labeled. Equipment or material 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.

Light Transmission. The ratio of the luminous (approximately 380 nm through 760 nm) radiant power transmitted by an object to the incident luminous radiant power.

Listed. Equipment, materials, or services included in a list published by the certification organization.

Melt. To change from solid to liquid or become consumed by action of heat in a manner that could injure the user.

Model. A term used to identify an RPED, including all variants to its design.

Product Label. A label or marking affixed to the RPED by the manufacturer containing general information, warnings, care, maintenance, or similar data. This product label is not the certification organization's label, symbol, or identifying mark; however, the certification organization's label, symbol, or identifying mark may be attached to it or be part of it. (See: Labeled.)

Ready-to-Use-Configuration. An RPED in its final operational packaging state prior to use which, immediately upon opening or removing this operational package, allows the user to don the RPED.

RPED. A "short hand" acronym for Air-Purifying Respiratory Protective Smoke Escape Device. (See also the definition for "Air-Purifying Respiratory Protective Smoke Escape Device".)

Service Life. The duration of protection provided by the RPED for escape once the operational packaging is opened or removed from an RPED in a ready-to-use configuration.

Shall. Indicates a mandatory requirement.

Shelf Life. The duration that an RPED can be stored under proper conditions in its ready-to-use-configuration and remain suitable for use.

4. Certification

4.1 General

4.1.1 Each RPED model shall be certified to the standard. RPED that are labeled as compliant with this standard shall meet all applicable requirements specified in this standard. The certification program shall meet at least the criteria specified in Section 4.2. Manufacturers shall not claim compliance with any part of the requirements of this standard and shall not use the name or identification of this standard in any statements regarding their respective products unless the product is certified to this standard.

4.1.2 Each compliant RPED model that has been labeled and has entered the stream of

commerce shall maintain its certification status throughout its shelf life.

4.1.3 Compliant RPED shall be labeled and listed. Such RPED shall also have a product label that meets the requirements specified in Section 5.1.

4.1.4 All certification shall be performed by a certification organization that meets at least the requirements specified in Section 4.2, and that is accredited for personal protective equipment in accordance with ISO/IEC Guide 65, *General Requirements for Bodies Operating Product Certification Systems*, current edition.

4.1.5 RPED shall be tested with all accessories.

4.1.6 The RPED shall meet all of the performance requirements of the standard with the accessory installed. The accessory itself shall be required to meet only the requirements of Sections 7.11, 7.12 and 7.13 of this standard.

4.2 Certification Program

4.2.1 For both the initial certification and annual conformance testing of the RPED, the certification organization shall be responsible for all inspection, evaluation, conditioning and testing as specified in this standard.

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

4.2.3 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.

4.2.4 The certification organization and the manufacturer shall identify each model for approval and the variants within each model.

4.2.5 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 4.3. 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.

4.2.6 The certification organization shall have a follow-up inspection program of the manufacturing facilities of the certified product, with at least one random visit 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. The certification organization shall select four samples at random. These samples shall be inspected and tested by the certification organization to verify the product's continued compliance.

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

4.2.8 The certification organization's name and label shall be registered and legally defensible.

4.3 Inspection and Testing

4.3.1 The inspection by the certification organization to determine compliance with the design requirements specified in Section 6 shall be performed on RPED in the ready-to-use configuration.

4.3.2 RPED shall be tested for certification to this edition and shall meet the performance requirements of one test series as specified in Table 1.

Table 1 RPED Initial Certification Testing Matrix

Test Specimen Number						
Test Section		Conditioning Section				
		Vibration 8.2	Puncture/ Tear 8.3	Pressure 8.4	Temperature 8.5	None
9.1	CO ₂	43	43	43	43	
9.2	Donning				1-2	
9.3	Air Flow Resistance	3-4	3-4	3-4	3-4	
9.4	Particulate Filtration	4	4	4	4	
9.5	Inward Leakage Fit					5-14
9.6.1	Light Transmission	15	15	15	15	
9.6.2	Field of Vision				1	
9.6.4	Ocular Leakage					5-14
9.7	Operational Packaging Leakage	16	16	16	16	
9.8	Capacity	17-37	17-37	17-37	17-37	
9.9	Inhalation Temperature	38	38	38	38	
9.10	Soot Particulate	39	39	39	39	
9.11	Flammability	40	40	40	40	
9.12	Molten Polymeric Drip	41	41	41	41	
9.13	Radiant Heat	42	42	42	42	
9.14	Corrosion Resistance	3	3	3	3	

Test Specimen Number	Test Section	Conditioning Requirements
1	9.6.2 Field of Vision	Temperature (Section 8.5)
1-2	9.2 Donning	Temperature (Section 8.5)
3	9.14 Corrosion Resistance	All
3-4	9.3 Air Flow Resistance	All
4	9.4 Particulate Filtration	All
5-14	9.5 Inward Leakage Fit	None
5-14	9.6.4 Ocular Leakage	None
15	9.6.1 Light Transmission	All
16	9.7 Operational Packaging Leakage	All
17-37	9.8 Capacity	All
38	9.9 Inhalation Temperature	All
39	9.10 Soot Particulate	All
40	9.11 Flammability	All
41	9.12 Molten Polymeric Drip	All
42	9.13 Radiant Heat	All
43	9.1 CO ₂	All

Table 2 RPED Annual Conformance Testing Matrix

Test Section	Year 1				Year 2				Year 3			Year 4				Year 5
	9.3	9.4	Table 4 Line 1	Table 4 Line 5	9.3	9.4	Table 4 Line 2	Table 4 Line 6	9.3	9.4	Table 4 Line 3	9.3	9.4	Table 4 Line 4	Table 4 Line 7	RECERTIFICATION
	Test Specimen Number				Test Specimen Number				Test Specimen Number			Test Specimen Number				
Conditioning Section																
Vibration (8.2)	1	2			1	2			1	2		1	2			
Puncture/Tear (8.3)	1	2			1	2			1	2		1	2			
Pressure (8.4)	1	2			1	2			1	2		1	2			
Temperature (8.5)	1	2			1	2			1	2		1	2			
None			3	4			3	4			3			3	4	

NOTE: Testing series repeats after Annual 5 Test Section

4.3.3 After initial certification to this edition, random RPED from production shall be tested annually as specified in Table 2 and shall meet all the applicable performance requirements as specified in Section 7.

4.3.4 Any change in the design, construction, or material of a certified RPED 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. Inspection and testing shall be conducted before labeling the modified RPED as compliant with this standard.

4.3.5 For evaluation and testing for certification, the certification organization shall accept from the manufacturer only RPED or RPED components that are identical in every respect to the final product or component. The certification organization shall not permit the substitution, repair, or modification of any RPED or any RPED component during testing.

4.4 ISO Registration for Manufacturers

4.4.1 The manufacturer shall provide and operate a quality assurance program that meets the requirements of this section and that includes a documented product recall system as specified in Section 4.2.7.

4.4.2 The manufacturer shall be registered to ISO 9001, *Quality Systems — Model for Quality Assurance in Design, Development, Production, Installation, and Servicing* or other equivalent quality assurance system that is acceptable to the third-party certification organization.

4.4.3 The RPED shall be assembled in a facility that is registered at least to ISO 9002, *Quality Systems — Model for Quality Assurance in Production, Installation, and Servicing*.

5. Labeling and Information

5.1 Product Labeling Requirements

5.1.1 Each RPED shall have a product label(s) that is permanently and conspicuously attached to the outside of the ready-to-use packaging.

5.1.2 More than one label piece shall be permitted in order to carry all statements and information that are required to appear on the product label. Label pieces that comprise the product label shall be located adjacent to each other.

5.1.3 At a minimum, the following statement shall be legibly printed on the product label(s) in letters at least 2 mm high:

“THIS ESCAPE DEVICE MEETS THE REQUIREMENTS OF ANSI/ISEA 110-2009, STANDARD ON AIR-PURIFYING RESPIRATORY PROTECTIVE SMOKE ESCAPE DEVICES AS A 15-MINUTE SERVICE LIFE DEVICE.”

5.1.4 At a minimum, the following information shall also be legibly printed on the product label(s). All letters shall be at least 2 mm high.

- (a) Certification organization's label, symbol, or identifying mark;
- (b) Manufacturer's name, identification, or designation;
- (c) Manufacturer's product identification number, lot number, or serial number;
- (d) Month and year of manufacture (not coded); and
- (e) Model name, number, or design.

5.1.5 Each RPED product and product label shall contain the words “for one time use only” in letters at least 2 mm high.

5.1.6 All worded portions of the required product label shall be printed at least in English.

5.1.7 Symbols and other pictorial graphic(s) shall be permitted to be used to supplement the text on the product labels.

5.2 User Information

5.2.1 With each RPED, the RPED manufacturer shall provide, as a minimum, the user information that is specified in Sections 5.2.5 and 5.2.6.

5.2.2 The user information shall clearly state that the RPED cannot be used in an oxygen-deficient atmosphere.

5.2.3 The RPED manufacturer shall attach the required user information, or the packaging that contains the user information, to the RPED or the storage container. User information shall be

conspicuously attached to the device or its packaging.

5.2.4 The RPED manufacturer shall provide notice that the user information is to be removed only by the end user. The user shall have access to the instructions and information without breaking packaging seal.

5.2.5 The RPED manufacturer shall provide at least the following with each RPED:

(a) Pre-use information

1. Safety considerations;
2. Limitations of RPED, including clear direction that the RPED is intended for adult use;
3. Oxygen-deficient atmosphere information required by Section 5.2.2;
4. A statement that increased resistance to breathing is expected when using RPED;
5. A statement that the temperature of inspired air may be hot; and
6. A statement that the RPED cannot be tested by the user.

(b) Recommended storage practices

(c) Instructions for donning and use

(d) Periodic checks or inspections

(e) Whether maintenance and cleaning instructions are required; if so, describe

(f) Service life

(g) Shelf life and instructions for removal from availability for use

5.2.6 The RPED manufacturer shall also provide instructions with each RPED that cover the removal of the RPED from the ready-to-use configuration packaging and all preparations necessary to operate the RPED. Such preparations shall include placing the RPED over the head/face, tightening the straps,

securing the mouth bit, nose clip, oral/nasal cup, as applicable, and adjusting the seals.

6. Design Requirements

6.1 General

6.1.1 The design of the RPED shall provide protection to the wearer's head, eyes, and respiratory system specified by this standard.

6.1.2 The RPED shall consist of at least a hood and a respiratory protection system.

6.1.3 All materials shall be free of sharp edges, burrs, and rough spots.

6.1.4 Materials containing latex shall be labeled as such.

6.1.5 The RPED shall not require the use of hands to maintain the RPED in place on the user or to maintain the proper functioning of the RPED, other than for donning and doffing.

6.1.6 The RPED shall have a tamper seal in its ready-to-use configuration. The tamper seal shall indicate if the ready-to-use configuration of the RPED has been breached.

6.1.7 The tamper seal shall be secured against accidental opening but shall be able to be broken rapidly without the use of tools. Where the tamper seal has been broken, it shall be visually obvious.

6.1.8 The operational packaging seal required by Section 9.7 shall be permitted to be the same as the tamper seal.

6.2 Hood

6.2.1 The RPED shall be designed as a hooded device. The hood shall cover the entire head of the wearer.

6.2.2 The RPED hood shall be available in not more than three separate and distinct sizes that fit all the anatomical dimensions specified in Table 3.

6.2.3 The RPED hood shall include an area for field of vision.

6.2.4 The hood shall be compatible with wearing of eyeglasses.

6.3 Respiratory Protection System

6.3.1 The respiratory protection system shall consist of an air-purifying element and a means of conveying the purified air to the wearer such that the RPED meets the performance requirements of Sections 7.1 through 7.10, except 7.7.

6.3.2 The respiratory protection system shall be designed in such a manner that the air-purifying element(s) shall not be degraded by the CO₂ and humidity of the user's exhaled air.

6.3.3 The air-purifying element(s) shall be designed and installed so that the inhaled atmosphere first passes through the particulate protection component before passing through the gas protection component.

6.4 Accessories

6.4.1 Any accessories that are attached to an RPED shall not interfere with the function of the RPED or with the function of any of the RPED component parts.

6.4.2 Where an RPED is provided with an accessory or accessories that are attached to or integrated with the RPED, the RPED shall meet all of the design and performance requirements of this standard with the accessories installed. In all cases, such accessories shall not degrade the performance of the RPED.

7 Performance Requirements

7.1 Carbon Dioxide (CO₂) Inhalation

7.1.1 RPED shall be tested for CO₂ levels in the inspired airstream as specified in Section 9.1, Carbon Dioxide Test and shall not contain CO₂ concentration levels that exceed 2.5 percent.

7.2 Donning

7.2.1 RPED shall be tested for donning ability as specified in Section 9.2, Donning Test. The