



INTERNATIONAL SAFETY
EQUIPMENT ASSOCIATION

The Catalyst for Safety Worldwide

ANSI / ISEA

107-2020

American National Standard for High-Visibility Safety Apparel

NOTE: Appendix E contains examples of forms to be used for testing combined-performance and retroreflective materials and background materials, and includes an example of a Declaration of Conformity. All forms are available for download in Adobe Acrobat format on www.safetysafetyequipment.org.

4.4 Declaration of Conformity

The issuer of the declaration of conformity shall have quality control procedures in place to ensure the continued conformity of the product, as delivered or accepted, with the stated requirements of the declaration of conformity. The issuer of the declaration of conformity shall have procedures in place to re-evaluate the validity of the declaration of conformity, in the event of:

- a. changes significantly affecting the design or specification of the product;
- b. changes in the standards to which conformity of the product is stated;
- c. changes in the ownership or structure of the supplier, if relevant; or
- d. relevant information indicating that the product may no longer conform to the specified requirements.

5 Types and Classes

5.1 HVSA Types

HVSA types are designated by the work environment in which the wearer is performing a task.

Apparel includes, but is not limited to, clothing such as vests, jackets, pants, shirts, rainwear and coveralls.

5.1.1 Type O (“off-road”) – Occupational HVSA for Non-Roadway Use

Type O HVSA provides daytime and nighttime visual conspicuity enhancement for workers in occupational environments which pose struck-by hazards from moving vehicles, equipment and machinery, but which will not include exposure to traffic on public access roadway rights-of-way or roadway temporary traffic control (TTC) zones.

5.1.2 Type R (“roadway”) – Occupational HVSA for Roadway Use

Type R HVSA provides daytime and nighttime visual conspicuity enhancement for workers in occupational environments which include exposure to traffic (vehicles using the roadway for purposes of travel) from public access roadway rights-of-way, or roadway temporary traffic control (TTC) zones or from work vehicles and construction equipment within a roadway temporary traffic control (TTC) zone.

5.1.3 Type P (“public safety”) – Occupational HVSA for Emergency and Incident Responders and Law Enforcement Personnel

Type P HVSA provide daytime and nighttime visual conspicuity enhancement for emergency and incident responders and law enforcement personnel in occupational environments which include exposure to traffic (vehicles using the roadway for purposes of travel) from public access roadway rights-of-way, or roadway temporary traffic control (TTC) zones, or from work vehicles and construction equipment within a roadway temporary traffic control (TTC) zone or from equipment and vehicles within the activity area. Type P HVSA provides additional options for emergency responders, incident responders and law enforcement who have competing hazards or require access to special equipment.

5.2 Performance Classes

Performance Classes present within each type of HVSA are specified in terms of the minimum area of high-visibility materials to be incorporated. Performance Classes provide a range of design options corresponding with the needs of the user in the expected risk environment. Type O includes one Performance Class and Type R and Type P each have two Performance Classes.

5.2.1 Performance Class 1 (Type O)

Performance Class 1 provides the minimum amount of high-visibility materials required to differentiate the wearer visually from non-complex work environments, in scenarios in which the struck-by hazards will not be approaching at roadway speeds, and therefore operative detection and identification distances

in the work environment can be shorter than in other situations without compromising safety.

5.2.2 Performance Class 2 (Type R or P)

Performance Class 2 provides for the use of additional amounts of high-visibility materials, which may allow design opportunities to define the human form more effectively. Performance Class 2 HVSA have the potential to provide longer detection and identification distances, and increased conspicuity performance compared to Performance Class 1 HVSA.

NOTE: Performance Class 2 HVSA is considered a minimum practice for HVSA in roadway rights-of-way and temporary traffic control (TTC) zones, as required in the 2009 edition of the MUTCD.

5.2.3 Performance Class 3 (Type R or P)

Performance Class 3 can offer greater visibility to the wearer in both complex backgrounds and through a full range of body movements by mandatory placement of background, retroreflective and combined-performance materials on sleeves and pant legs (if present). Regardless of the area of materials used, a sleeveless garment or vest alone shall not be considered Performance Class 3.

5.3 Supplemental Class E

Pants, bib overalls, shorts, and gaiters shall be designated Class E. Class E items shall not be worn alone for the purposes of meeting HVSA PPE requirements. When a Class E item is worn with Performance Class 2 or Class 3, the overall classification shall be Performance Class 3.

6. Design

6.1 Ergonomics

HVSA should be designed and manufactured taking into account the following considerations:

- a. The materials and components of the garment should not be known to affect the wearer adversely.
- b. Parts of the garment that come into contact with the end user should be free of roughness, sharp edges and projections that could cause irritation or injuries.

- c. The garment should be designed for correct fit and positioning on the user and should be designed to ensure that it remains in place for the expected period of use, anticipating environmental factors as well as movements the wearer could adopt during the course of work.

6.2 Apparel Configurations (Refer to Appendix D for examples)

6.2.1 General

HVSA shall incorporate the minimum areas of materials specified in Table 1. The minimum material area should be measured on the smallest size garment of the style, with the elastic bands collapsed and adjustable closures at their smallest adjustment.

HVSA shall be designed to permit maximum visibility of the wearer. The most effective deployment of high-visibility materials on a garment is distribution at the ends of the limbs to mark the human form and accentuate human motion.

6.2.2 Type O HVSA

Type O Class 1 HVSA shall utilize at least one horizontal band of retroreflective or combined-performance material around the torso, and shall include at least the minimum amounts of retroreflective or combined-performance material in the shoulder area if encircling bands are not present on sleeves.

Harnesses meeting requirements for Type O HVSA are permissible.

NOTE: Harnesses complying with this standard are not intended to provide protection against fall from heights.

6.2.3 Type R HVSA

6.2.3.1 Type R Class 2

Type R Class 2 HVSA shall utilize at least one horizontal band of retroreflective or combined-performance material around the torso, and shall include at least the minimum amounts of retroreflective or combined-performance material in the shoulder area if encircling bands are not present on sleeves.

Table 1. Minimum Areas of Visible Materials

Garment Type	Performance Class	Background Material	Retroreflective or Combined-Performance Materials	Minimum Width Retroreflective Material
Type O Off-road and Non-Roadway Use	Class 1	0.14 m ² (217 in ²)	0.10 m ² (155 in ²)	25 mm (1 in.)
Type R Roadway and Temporary Traffic Control Zones	Class 2*	0.50 m ² (775 in ²)	0.13 m ² (201 in ²)	25 mm (1 in.) ## 35 mm (1.38 in.)
	Class 3**	0.80 m ² (1240 in ²)	0.20 m ² (310 in ²)	25 mm (1 in.) ## 50 mm (2 in.)
<p>*For the smallest size offered in Type R, Performance Class 2, a minimum of 0.35 m² (540 in²) of background material may be used to accommodate small-sized workers. All subsequent larger sizes must use 0.50 m² (775 in²).</p> <p>**For the smallest size offered in Type R, Performance Class 3, a minimum of 0.65 m² (1000 in²) of background material may be used to accommodate small-sized workers. All subsequent larger sizes must use 0.80 m² (1240 in²).</p>				
Type P Emergency and Incident Responders and Law Enforcement Personnel	Class 2	0.29 m ² (450 in ²)	0.13 m ² (201 in ²)	25 mm (1 in.) ## 50 mm (2 in.)
	Class 3	0.50 m ² (775 in ²)	0.20 m ² (310 in ²)	25 mm (1 in.) ## 50 mm (2 in.)
Supplemental Items# Pants, Overalls, Shorts, Rain Pants and Gaiters	Class E	0.30 m ² (465 in ²)	0.07 m ² (109 in ²)	25 mm (1 in.) ## 50 mm (2 in.)
<p># When a Supplemental Class E item is worn with Performance Class 2 or 3, the overall classification for the ensemble shall be Performance Class 3.</p> <p>## For use with split-trim designs (See Section 6.3.1.2)</p> <p>NOTE: Combined-performance materials can be counted toward the minimum area requirements for background material specified in Table 1.</p>				

6.2.3.2 Type R Class 3

Type R Class 3 HVSA shall utilize one or more horizontal bands of retroreflective or combined-performance material around the torso, and shall include one or more encircling bands on the sleeves.

6.2.4 Type P HVSA

6.2.4.1 Type P Class 2

Type P Class 2 HVSA shall utilize at least one horizontal band of retroreflective or combined-performance material around the torso, and shall include at least the minimum amounts of retroreflective or combined-performance material in the shoulder area if encircling bands are not present on sleeves.

6.2.4.2 Type P Class 3

Type P Class 3 HVSA shall utilize at least one horizontal band of retroreflective or combined-performance material around the torso, and shall include one or more encircling bands on the sleeves.

6.3 Construction Requirements

6.3.1 Retroreflective and Combined-Performance Materials

6.3.1.1 Minimum Widths

The width of the retroreflective or combined-performance materials incorporated into the HVSA shall not be less than the dimensions specified in Table 1.

6.3.1.2 Split-trim designs

Retroreflective or combined-performance material may be utilized in a split-trim design. The split-trim design shall consist of two stripes of retroreflective or combined-performance material with minimum width of 25 mm (1 in.) that are positioned as a parallel pair on compliant fluorescent background material of the same or contrasting color, or on a non-compliant material of any color. The two paired stripes of retroreflective or combined-performance material shall not be separated by more than 50 mm (2 in.).

6.3.1.3 Spacing between Multiple Bands

Whenever multiple bands are placed on the HVSA, the minimum distance between bands of retroreflective or combined-performance material shall be at least equal to the width of the band.

6.3.2 Placement of Retroreflective and Combined-Performance Materials

6.3.2.1 Distance from Bottom Edge of HVSA

Horizontal retroreflective or combined-performance materials shall be placed at least 50 mm (2 in.) above the bottom of the hem of the torso, long sleeve and long pant HVSA styles.

6.3.2.2 Encircling Arms and Legs

Horizontal retroreflective or combined-performance materials placed on arms or legs shall encircle them in such a manner to provide 360° visibility of the wearer at all viewing angles in a horizontal plane.

6.3.2.3 Long Sleeves

If upper bands of retroreflective or combined-performance materials are placed on long sleeves, the bands shall be placed between the elbow and the shoulder. Lower bands can be placed between the elbow and wrist but shall be at least 50 mm (2 in.) above the bottom of the sleeve.

6.3.3 Gaps

Gaps in retroreflective or combined-performance materials shall not be more than 50 mm (2 in.) horizontally to enable fastening or for seam allowance.

6.3.4 360° Visibility

Retroreflective or combined-performance and background materials for all garment types and performance classes shall be positioned on items in such a way as to provide 360° visibility of the wearer at all viewing angles in a horizontal plane.

A contiguous band of background or combined-performance material shall fully encircle the wearer. Retroreflective or combined-performance material that intersects this band

shall be permitted. This band may be divided by other materials but the gap within the band shall not exceed 50 mm (2 in.).

6.3.4.1 Performance Class 1

This band shall fully encircle the torso and shall be a minimum of 25 mm (1 in.) wide. The torso is defined as the trunk of the body extending from the underarm to the hip area.

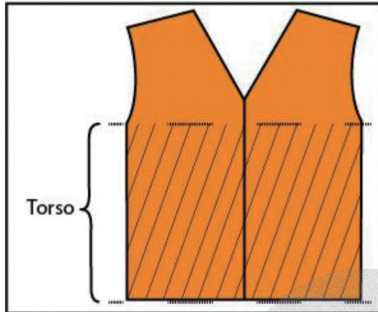


Figure 1. Torso area.

6.3.4.2 Performance Class 2

This band shall fully encircle the torso and shall be a minimum of 35 mm (1.38 in.) wide for Type R and 50 mm (2 in.) wide for Type P. Additionally, a minimum of 150 cm² (23.3 in.²) shall be present in the shoulder area for HVSA where encircling bands are not present on sleeves. Identification of the shoulder area is specified in Section 6.3.6.

6.3.4.3 Performance Class 3

This band shall fully encircle the torso and each arm and shall be a minimum of 50 mm (2 in.) wide.

6.3.4.4 Performance Class E

This band shall fully encircle each leg and shall be a minimum of 50 mm (2 in.) wide.

6.3.5 Material Use and Balance of Design

Garments shall be balanced in design so that not less than 40% of the minimum required amount of retroreflective or combined-performance and background materials specified in Table 1 is present on both the front and the back when laid flat.

Additional retroreflective or combined-performance and background materials may be

incorporated into garments as determined by the user.

NOTE: Finished garments are required to incorporate the minimum total amount of visible materials in their construction. As an example, a garment that incorporates 40% of the material on the front of the garment is to have the remaining 60% of material applied to the back of the garment.

6.3.6 Shoulder Area

HVSA without retroreflective or combined-performance material that encircles the arm shall have a minimum of 150 cm² (23.3 in.²) of retroreflective material or combined-performance material in the shoulder area to provide 180° visibility of the wearer.

See Figure 2.

The shoulder area is identified when the HVSA is folded flat with the front of the garment fully exposed and measuring 15 cm (5.9 in.) down from the shoulder high point, front and back.

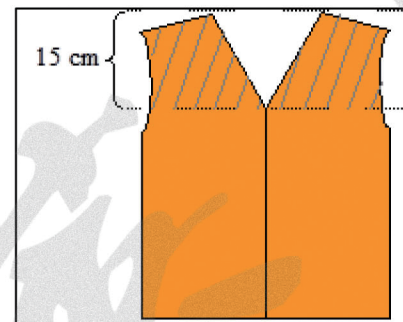


Figure 2. Shoulder area

7 Criteria for Optional Features and Testing

7.1 Pockets

Pockets of matching or contrasting compliant high-visibility materials shall not create gaps in retroreflective or combined-performance material of more than 50 mm (2 in.) horizontally.

7.2 Identification Panels, Lettering and Logos (Type R and P)

Identification panels, lettering and logos shall not create gaps in retroreflective or combined-performance material of more than 50 mm (2 in.) horizontally.

Identification panels, lettering and logos of contrasting non-compliant material shall not exceed a total of 465 cm² (72 in²) on the front and/or rear of the HVSA and such total amount may contribute to the minimum amount of visible background material specified in Table 1.

Identification panels, lettering and logos of contrasting non-compliant material shall cover no more than 142 cm² (22 in²) of the minimum amount of visible retroreflective or combined-performance material specified in Table 1.

7.3 Identification of Personnel (Type P)

A method of identifying the public safety entity such as an identification panel and/or trim may be incorporated into the HVSA. Public safety industries may be identified with the specific names and colors:

Red: Fire Service
Green: Emergency Medical Service (EMS)
Blue: Law Enforcement

7.4 Flame Resistance

Material for high-HVSA which is to be marked as being flame-resistant shall be tested in accordance with one of the specifications or standards listed in Section 10.5.

7.5 Single-Use Disposable Coveralls

HVSA marked as single-use disposable coveralls shall meet the requirements in accordance with Section 11.

7.6 Overall Luminance

Any article of HVSA meeting the requirements of ANSI/ISEA 107-2020 may be optionally tested for overall luminance according to ASTM E1501-99(2004), *Standard Specification for Nighttime Photometric Performance of Retroreflective Pedestrian Markings for Visibility Enhancement*, with the following settings:

The field of view must include all retroreflective areas on the garment at the test distance (50 feet). The illuminated area shall encompass the entire field of view and encompass all retroreflective markings on the garment. Measurements of luminous intensity are collected; R_i is calculated and reported. A diagram or annotated image indicating the point identified as the garment center must be included in the report.

Results of this test may be optionally reported by the garment manufacturer on the ANSI/ISEA 107 Declaration of Conformity. (Refer to Appendix H for additional information).

8 Requirements for Background and Combined-Performance Retroreflective Materials

8.1 Color

Table 2 specifies the performance requirements for the different colors of background and combined-performance materials. (Refer to Appendix A for plot of coordinates.)

8.1.1 Background and Combined-Performance Materials Prior to Exposure Tests

For background and combined-performance material, the chromaticity shall lie within one of the areas defined in Table 2 and the total luminance factor (Y expressed as a percentage) shall be not less than the corresponding minimum in Table 2, when measured in accordance with Section 10.2.

The mean value of the total luminance factor and chromaticity coordinates of background and combined-performance material shall comply with the requirements of Table 2 when measured at each of the two rotation angles defined in Section 10.3.

Table 2. Color of background and combined-performance material			
Color	Chromaticity coordinates		Minimum total luminance factor
	x	y	Y (%)
Fluorescent yellow-green	0.387	0.610	70
	0.356	0.494	
	0.398	0.452	
	0.460	0.540	
Fluorescent orange-red	0.610	0.390	40
	0.535	0.375	
	0.570	0.340	
	0.655	0.345	
Fluorescent red	0.655	0.345	25
	0.570	0.340	
	0.595	0.315	
	0.690	0.310	

8.1.2 Colorfastness of Background and Combined-Performance Materials After Xenon Test

The color after exposure shall be within one of the areas defined by the coordinates in Table 2 and the total luminance factor (Y expressed as a percentage) shall be not less than the corresponding minimum values in Table 2.

The colorfastness of the test sample shall be determined in accordance with AATCC 16.3-2014, *Colorfastness to Light Xenon Arc*. Expose the materials to 40 AATCC Fading Units (170 kJ/m²@420nm).

8.2 Colorfastness of Background Material

8.2.1 Colorfastness to Crocking

The colorfastness to crocking both dry and wet shall be at least a grade 3.0 by the Gray Scale for Staining in accordance with AATCC 8-2016, *Colorfastness to Crocking: Crockmeter Method*.

8.2.2 Colorfastness to Perspiration

The color fastness to perspiration shall be at least a grade 4.0 for color change by the Gray Scale for Color Change and at least a grade 3.0 for staining by the Gray Scale for Staining in accordance with AATCC 15-2013, *Colorfastness to Perspiration*.




Table 3. Colorfastness (per care label)		
Care process	Fastness, grade of the gray scale, at least	Test method
Domestic laundry	Color change: Grade 4.5; Staining: Grade 3.0	AATCC 61-2013-2A modified to use 105°F
Commercial laundry	Color change: Grade 4.5; Staining: Grade 3.0	AATCC 61-2013-3A modified to use 145°F
Dry-cleaning	Color shade change: 4	AATCC 132-2013
Hypochlorite bleaching Domestic	Color shade change: 4	AATCC 61-2013-5A
Hypochlorite bleaching Commercial	Color shade change: 4	AATCC 61-2013-4A
Hot-pressing	Color change: 4.5 Staining: 3.0	AATCC 133-2013
Water	Color change & Staining: Grade 3	AATCC 107-2013

8.2.3 Colorfastness — When Laundered, Dry-cleaned, Hypochlorite Bleached and Hot-pressed

When the care label requirements are as specified in Table 3, the colorfastness shall be determined in accordance with the performance requirements and test methods stated in Table 3.

Specimens shall be dried hanging in air at a temperature not exceeding 60°C (140°F) with parts in contact only at the lines of stitching.

Hot-pressing: Samples shall be pressed in the dry state only. The hot-pressing shall be tested in accordance with the ironing instructions on the garment care label, where

-  is a temperature of $110 \pm 2^{\circ}\text{C}$ ($230 \pm 4^{\circ}\text{F}$)
-  is $150 \pm 2^{\circ}\text{C}$ ($302 \pm 4^{\circ}\text{F}$) and
-  is $200 \pm 2^{\circ}\text{C}$ ($392 \pm 4^{\circ}\text{F}$)

8.3 Dimensional Change of Background Material

8.3.1 The dimensional change of background material shall not exceed $\pm 4\%$ in length and $\pm 4\%$ in width for woven fabrics.

The dimensional change of background material shall not exceed $\pm 7\%$ in length and $\pm 5\%$ in width for knit fabrics and all other materials.

8.3.2 Preparation of the specimen material shall be done in accordance with ASTM D1776-16, *Standard Practice for Conditioning and Testing Textiles*.

8.3.3 Dimensional change shall be evaluated by preparing one sample per test method in accordance with Section 8.3.2 and then subjecting the sample to five cleaning cycles in accordance with the following applicable standards:

-- AATCC 135-2018 (3) (III) (A) (iii), *Dimensional Changes of Fabrics after Home Laundering*;

-- AATCC 158-2016, *Dimensional Changes on Dry-cleaning in Perchloroethylene: Machine Method*

-- AATCC 96-2012 (IIIc) (A) and/or (E), *Dimensional Changes in Commercial Laundering of Woven and Knitted Fabrics Except Wool*

8.4 Mechanical Properties of Background Materials

8.4.1 Bursting Strength of Knitted Materials and Other Nonwoven Constructions (Uncoated, Coated or Laminate) other than Single-Use Disposable Coveralls

The minimum bursting strength shall be 178 N (18.1 kgf; 40 lbf). Bursting strength shall be tested in accordance with ASTM D3787-07 (2016), *Standard Test Method for Bursting Strength of Textiles - Constant-Rate-of-Traversal*

(CRT) Ball Burst Test or ASTM D6797-07 (2015) *Standard Test Method for Bursting Strength of Fabrics Constant-Rate-of-Extension (CRE) Ball Burst Test*.

8.4.2 Tear Resistance of Woven Materials (Uncoated, Coated or Laminate)

Background materials shall be tested in accordance with ASTM D1424-09 (2019), *Standard Test Method for Tearing Strength of Fabrics by Falling-Pendulum Type (Elmendorf) Apparatus* at a minimum requirement of 13 N (1.3 kg; 2.92 lbf) in both directions.

8.5 Performance under Wet Conditions

8.5.1 Background material to be marketed as providing water repellency protection shall be tested in accordance with AATCC 22-2017, *Water Repellency: Spray Test* with an original requirement of 90 and after five laundry cycles a requirement of 70.

8.5.2 Background material to be marketed as providing water resistance protection shall be tested initially and after five launderings, in accordance with AATCC 35-2018, *Water Resistance: Rain Test* using a pressure head setting of 0.6 m (24 in.), and a continuous water spray for 2 minutes. The average water penetration shall be less than or equal to 1.0 gram.

8.5.3 Background material to be marketed as providing waterproof protection shall be tested in accordance with AATCC 127-2017, *Water Resistance: Hydrostatic Pressure Test* testing with water to the face side with a minimum requirement of 200 cm (79 in.) originally and after five launderings.

8.6 Water Vapor Permeability for Background Materials Classified as Breathable

Background material which is marketed as waterproof and classified as breathable, shall be tested in accordance with ASTM E96-16, *Standard Test Methods for Water Vapor Transmission of Materials*, Procedure B - (upright for microporous) with a minimum requirement not lower than $600 \text{ g/m}^2/24 \text{ hours}$ ($1.94 \text{ oz./ft}^2/24 \text{ hours}$); or Procedure BW- (inverted for hydrophilic) with a minimum requirement not lower than $3,600 \text{ g/m}^2/24 \text{ hours}$ ($11.79 \text{ oz./ft}^2/24 \text{ hours}$).

9 Photometric and Physical Performance Requirements for Retroreflective and Combined-Performance Materials

9.1 Retroreflective Performance Requirements Prior to Test Exposure

Retroreflective materials shall comply with the requirements of Table 4, before test exposures. Measurements shall be made by the method described in Section 10.3.

When measured at the two rotation angles $\varepsilon_1 = 0^\circ$ and $\varepsilon_2 = 90^\circ$, retroreflective material shall comply with the minimum requirements for the coefficient of retroreflection stated in Table 4, at one of the two rotation angles; and shall be not less than 75% of the values stated in Table 4 at the other rotation angle.

The values for retroreflective material are for any color.

Table 4. Minimum coefficient of retroreflection in $\text{cd}/(\text{lx} \cdot \text{m}^2)$ for retroreflective or combined-performance material				
Observation angle	Entrance angle			
	5°	20°	30°	40°
0.20° [12']	330	290	180	65
0.33° [20']	250	200	170	60
1.00°	25	15	12	10
1.50° [1°30']	10	7	5	4

9.2 Retroreflective Performance Requirements after Test Exposure

The samples tested in accordance with Section 9.1 shall be exposed as specified in Table 5. After exposure each test specimen shall meet the following photometric requirements.

The coefficient of retroreflection R_A , measured at observation angle 0.20° [12'] and entrance angle 5°, shall be not less than 100 $\text{cd}/(\text{lx} \cdot \text{m}^2)$ at one of the two orientations described in Section 10.3 and shall be not less than 75 $\text{cd}/(\text{lx} \cdot \text{m}^2)$ at the other orientation.

Table 5. Test exposure, retroreflective and combined-performance material

Test Exposure	Test Method
Abrasion	Section 10.4.1
Flexing	Section 10.4.2
Folding at cold temperatures	Section 10.4.3
Temperature variation	Section 10.4.4
Washing	Section 10.4.5.2
Dry-cleaning	Section 10.4.5.3
Wet performance	Section 10.4.6

10 Test Methods

10.1 Sampling and Conditioning

10.1.1 Specimens

Test specimens shall be taken at random from commercially available quantities representative of commercially available quality.

10.1.2 Preparation of Specimens

The size, shape and quantity shall be as required for each test procedure.

10.1.3 Number of Tests

Unless otherwise specified, a minimum of one sample is required, and three specimens shall be taken from it for testing for compliance with the minimum requirements. The average of the three specimens shall comply with the minimum requirement.

10.1.4 Conditioning of Specimens

The specimens shall be conditioned for at least 24 hours at $20 \pm 2^\circ\text{C}$ ($68 \pm 2^\circ\text{F}$) and $65 \pm 5\%$ relative humidity. If the tests are carried out in other conditions, the tests shall be conducted within 5 minutes after withdrawal from the conditioning atmosphere.

10.2 Determination of Color

The color shall be measured in accordance with the procedures defined in ASTM E1164–17 *Standard Practice for Obtaining Spectrometric Data for Object-Color Evaluation* and the specimens shall not consist of more than two layers of the same material, with the following conditions:

- a. Set the spectrophotometer at a wavelength range of 400-700 nm and at intervals of 10 nm.
- b. Use illumination D65 and 45/0 or 0/45 geometry with 2° standard observer and a black underlay with a reflectance of less than 0.04.

10.3 Method for Determination of Retroreflective Photometric Performance

The coefficient of retroreflection R_A shall be determined in accordance with the procedure defined in ASTM E808-01 (2016), *Standard Practice for Describing Retroreflection* and ASTM E809-08 (2013), *Standard Practice for Measuring Photometric Characteristics of Retroreflectors*.

For segmented or perforated material tested alone, the background material should have a R_A of less than 0.5.

Measurements shall be made on square samples of 10 cm x 10 cm (4 in. x 4 in.) or of the size of the pretested samples.

R_A for the sample shall be measured at the specified observation angle and entrance angle for both the 0°, and 90° positions of the rotation angle ε . The position 0° is determined by one of the following means:

- A clear datum mark on each sample.
- A clear instruction given by the manufacturer of the material.

If no mark or instruction exists, the position $\varepsilon = 0^\circ$ can be chosen as the vertical position of the retroreflective sample on the garment.

NOTE: The measurement of photometric performance of some retroreflective materials can be affected by the size of the area being measured. It is highly recommended that the testing of photometric performance is conducted using an instrument and

method which takes this into consideration. By default, compliant materials shall exhibit acceptable nominal photometric performance when measured over their full width.

While using a portable retroreflectometer can be helpful in monitoring the retroreflective performance of retroreflective materials, the method used (i.e. the size of the aperture) must provide consistent results in measurements taken from several different locations on the material. A portable retroreflectometer is not acceptable for testing for purposes of qualifying compliant materials.

Photometric measurements for the purpose of testing retroreflective and combined-performance materials for compliance this standard shall be conducted by an accredited testing facility.

10.4 Retroreflection after Test Exposure

10.4.1 Abrasion

The test specimen shall be abraded in accordance with ISO 12947-2:2016, *Textiles- Determination of the abrasion resistance of fabrics by the Martindale method – Part 2: Determination of specimen breakdown*, using a worsted wool abradent. The specimens shall be measured after 5,000 cycles, using a weight of 9 kPa [1.3 lb/in²].

Measurements shall be made after reconditioning to the atmosphere in accordance with Section 10.1.4 for at least 2 hours.

10.4.2 Flexing

The test specimen shall be flexed in accordance with ISO 7854:1995, *Rubber- or plastics-coated fabrics - Determination of resistance to damage by flexing (dynamic method)*, Method A. The specimens shall be measured after 7,500 cycles.

Measurements shall be made after reconditioning to the atmosphere in accordance with Section 10.1.4 for at least 2 hours.

10.4.3 Folding at Cold Temperatures

The test specimen shall be exposed and folded in accordance with ISO 4675:2017, *Rubber or plastic coated fabric - Low-temperature bend test* at a temperature of $-20 \pm 1^\circ \text{C}$ ($-4 \pm 2^\circ \text{F}$). Measurements shall be made after reconditioning to the atmosphere in accordance with Section 10.1.4 for at least 2 hours.

ANSI/ISEA 107-2020
(REVISION OF ANSI/ISEA 107-2015)

**American National Standard for
High-Visibility Safety Apparel**

Secretariat
International Safety Equipment Association

Approved September 8, 2020
American National Standards Institute, Inc.

10.4.4 Exposure to Temperature Variation

Specimens of retroreflective tape or combined-performance material of 10 cm (4 in.) length shall be exposed continuously to a cycle of changing temperatures:

- for 12 hours at $50 \pm 2^\circ \text{C}$ ($122 \pm 2^\circ \text{F}$) immediately followed by
- 20 hours at $-30 \pm 2^\circ \text{C}$ ($-22 \pm 4^\circ \text{F}$).

Measurements shall be made after reconditioning to the atmosphere in accordance with Section 10.1.4 for at least 2 hours.

10.4.5 Washing, Dry-cleaning

10.4.5.1 General. When the care label indicates that the garment is suitable for washing, the retroreflective material shall meet the minimum performance requirements of Section 9.2, after a minimum of five washing cycles. The procedure defined in Section 10.4.5.2 shall be applied.

When the care label indicates that the garment is suitable for dry-cleaning, the procedure defined in Section 10.4.5.3 shall be applied.

When the care label indicates that the garment is suitable for both washing and dry-cleaning, the procedure defined in Sections 10.4.5.2 and 10.4.5.3 shall be applied separately on separate test samples.

10.4.5.2 Washing According to Care Label. Three clothing fabric specimens 30 cm x 30 cm (12 in. x 12 in.) shall be prepared with two stripes of retroreflective or combined-performance material of 25 cm (10 in.) length with a distance between the two stripes of 5 cm (2.0 in.) and a width as provided.

The test samples shall be washed in accordance with ISO 6330:2012, *Textiles - Domestic washing and drying procedures for textile testing*, Method 6N. The specified wash cycle shall be applied to the test sample for the number of times determined by the manufacturer and to be mentioned in Instructions for Use per Section 14.1. After each wash cycle the samples shall be dried at $50 \pm 5^\circ \text{C}$ ($122 \pm 9^\circ \text{F}$).

A wash cycle consists of washing and drying.

10.4.5.3 Dry-cleaning According to Care Label. Specimen is prepared in accordance with Section 10.4.5.2. The test sample shall be dry-cleaned in accordance with ISO 3175-2:2017 *Textiles - Professional care, dry cleaning and wet cleaning of fabric and garments – Part 2: Procedure for testing performance when cleaning and finishing using tetrachloroethene (perchloroethylene)*. The test sample shall be cleaned for the number of times determined by the manufacturer and to be mentioned in Instructions for Use per Section 14.1.

10.4.6 Retroreflective Wet Performance

Samples shall be tested in accordance with Sections 9.2, 10.1, and 10.3, and Appendix B of this standard.

10.5 Flame Resistance

Manufacturers may opt to have HVSA evaluated for flame resistance and marked accordingly. HVSA marked as flame resistant shall comply with the requirements of one of the following specifications or standards in its entirety:

ASTM F1506-19, *Standard Performance Specification for Flame Resistant and Electric Arc Rated Protective Clothing Worn by Workers Exposed to Flames and Electrical Arcs*

ASTM F1891-19, *Standard Specification for Arc and Flame Resistant Rainwear*

ASTM F2302-19, *Standard Performance Specification for Labeling Protective Clothing which Provides Resistance to Incidental Exposures to Heat or Open Flame*

ASTM F 2733-17, *Standard Specification for Flame Resistant Rainwear for Protection Against Flame Hazards*

NFPA 1977, *Standard on Protective Clothing and Equipment for Wildland Firefighting*, 2016

NFPA 2112, *Standard on Flame-Resistant Clothing for Protection of Industrial Personnel Against Short Duration Thermal Exposures from Fire*, 2018

11 High-Visibility Single-Use Disposable Coveralls

High-visibility safety apparel marked as single-use disposable coveralls shall comply with Sections 4-7 and 13-14 in their entirety and with 11.1 through 11.3 as described below:

11.1 Requirements for Background and Combined-Performance Retroreflective Materials

High-visibility single-use disposable coveralls shall meet the requirements of Section 8.1.1 for background and combined-performance materials prior to test exposure.

11.2 Retroreflective Performance Requirements

High-visibility single-use disposable coveralls shall meet the requirements of Sections 9 and 10 for retroreflective and combined-performance materials prior to test exposure, except for Sections 10.4.5.1 – 10.4.5.3, which become optional for material used exclusively on high-visibility single-use disposable coveralls.

11.3 Seam Strength for Single-Use Disposable Coverall Construction (Full Garment)

Seams used in the construction of high-visibility single-use disposable coveralls shall be tested for strength. The minimum measured seam strength shall be 40 N (9 lbf) when tested in accordance with ASTM D1683/D1683M-17 (2018), *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, Procedure A.

12. Care Labeling

Washing or cleaning instructions shall be indicated in accordance with ASTM D5489-18, *Standard Guide for Care Symbols for Care Instructions on Textile Products*, as relevant.

NOTE: Washing or cleaning instructions are not required for single-use disposable coveralls.

13 Marking

13.1 General

Each piece of apparel shall be marked. The marking shall be:

- on the product itself or on labels attached to the product;
- permanently affixed so as to be visible and legible;
- durable for the appropriate number of cleaning processes.

NOTE: The use of numbers not smaller than 2 mm (0.08 in.) and pictograms not smaller than 10 mm (0.39 in.) is recommended. Numbers and pictograms are recommended to be black on white background.

13.2 Specific Marking

The marking of garments shall include the following information:

- a. Name, trademark or other means of identification of the manufacturer or authorized representative;
- b. Designation of the product type commercial name or code;
- c. Size designation;
- d. Number of this specific ANSI standard (ANSI/ISEA 107-2020);
- e. Statement regarding flame resistance which shall be conveyed in one of the following ways:

(1) To indicate that the HVSA has been evaluated per the one of the specifications or standards cited in Section 10.5, Flame Resistance,

A. The label shall include the letters FR followed by the designation of the ASTM specification used to evaluate flame resistance; or.

B. Attachment of a separate label indicating certification to NFPA 1977 or 2112.

(2) If none of the flame resistant specifications or standards in Section 10.5

are met, the label shall include the following statement:

This garment is not flame resistant as defined by ANSI/ISEA 107-2020 Section 10.5.

- f. Pictogram showing the HVSA type, performance class and flame resistance status. The pictogram may be either the universal representation (Figure 3) or an accurate drawing representing the specific garment.

NOTE: Markings indicating garment type, performance class, and flame resistance statement may be on either side or split on the sides of the pictogram. Refer to Figure 3 and Appendix F for examples.

NOTE: For supplemental items Performance Class E, only the markings Y (indicating Performance Class) and Z (indicating the flame resistance statement) are required.

- g. Statement regarding single-use disposable coveralls shall include the following language:

- This garment meets the single-use disposable coverall requirements of ANSI/ISEA 107-2020, Section 11.
- SINGLE-USE ONLY.
- DO NOT REMOVE THIS LABEL.



Figure 3 Pictogram

NOTE: The markings beside the pictogram shall indicate the following: Marking X indicates the garment type, in accordance with Table 1. Marking Y indicates the Performance Class in accordance with Table 1. Marking Z indicates the HVSA's flame resistance statement in accordance with Section 13.2

(e) and shall be represented as either "FR" or "Not FR".

Refer to Appendix F for examples of HVSA labeling.

14 Instructions for Use

14.1 Product Information

Garments shall be supplied to the customer with information written at least in English.

The following minimum information shall be given:

- a. Fitting; how to put on and take off, if relevant.
- b. Necessary warnings of misuse.
- c. Limitations on use.
- d. Storage; how to store and maintain correctly, with maximum periods between maintenance checks.
- e. Maintenance and cleaning; how to clean or decontaminate correctly, with complete washing or dry-cleaning instructions.
- f. The number of cleaning processes without impairment of its performance level, as determined by the manufacturer.

NOTE: Visibility of background and retroreflective materials will degrade with exposure and use.

14.2 Service Life Guidelines

All items do have a limited lifetime that will vary depending of the item and use. Variables can include, but are not limited to: type of item, type of environment, laundering method and length of exposure to environment. It is the responsibility of the issuing entity, authorized on-site person, employer or wearer to periodically evaluate the minimum required visibility performance level relative to a new ANSI/ISEA 107 garment in terms of:

- a. Background material.
- b. Retroreflective or combined-performance materials.
- c. General fit and state of the garment.

High visibility garments should be repaired or replaced such as when they are torn, noticeably faded, soiled, cracked, burned, heavily abraded, or damaged.

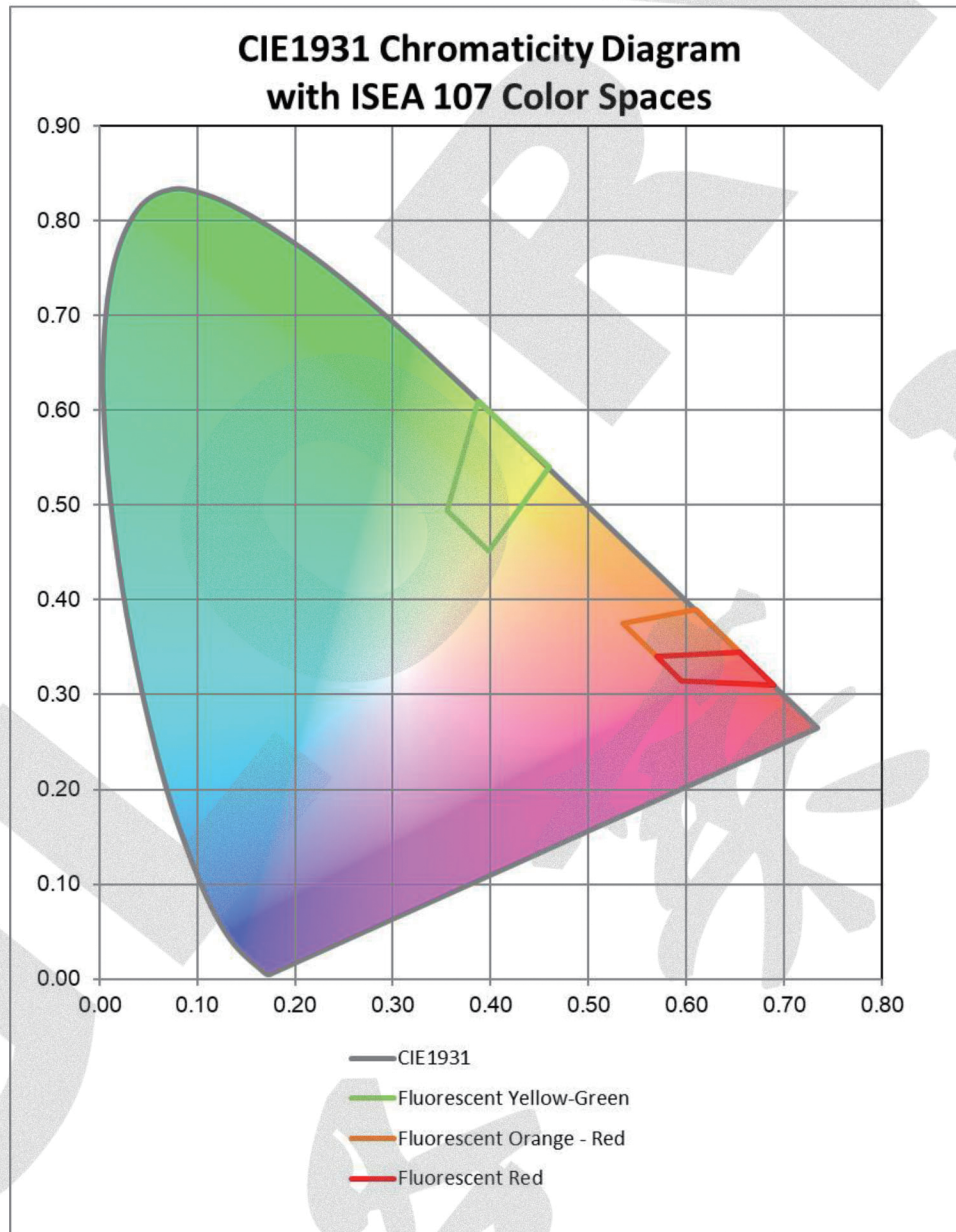
Refer to Appendix G for U.S. Federal Highway Administration recommendations and additional information.

GLO RY
瑞
麻
烟

Appendix A

Color of background and combined-performance material

The graph below plots the chromaticity coordinates required for compliant high-visibility background and combined-performance materials as required by ANSI/ISEA 107-2020, Section 8.1



Appendix B

Method of Measuring Wet Performance of Retroreflective Material

B1. Principle

A specimen of the material is mounted in a vertical plane and subjected to a continuous spray of water droplets.

Measurements shall be made of the coefficient of retroreflection of the wetted surface while the spray is maintained, simulating the optical behavior of a surface in continuous wetting.

B2. Apparatus

A suitable apparatus for mounting the specimen in the spray of water is illustrated in Figure B-1.

The specimen A is supported on the vertical specimen holder B above the catch trough C and drain D. The specimen holder is rigidly attached to the goniometer table (not shown) but is held away from it. The spray nozzle E is rigidly supported in a position, which is fixed relative to the specimen and is supplied with tap water at constant but adjustable pressure through a flexible joint F or hose.

The nozzle shall be of the full cone type and shall have an orifice of diameter 1.19 mm (3/64 in.) with an appropriately designed feed pipe producing a substantially uniform solid cone spray.

The nozzle shall be 1.0 m (39 in.) above the center of the specimen and shall be angled so that the spray strikes the specimen at an angle of $10^\circ \pm 5^\circ$ to the vertical. The specimen, specimen holder and spray nozzle are enclosed in a cover G designed to protect the optical apparatus from water.

Preferably, the cover is made of or incorporates large areas of rigid transparent plastic material for visibility and has at least one removable panel or door for access. A square aperture H of side 15 cm (6 in.) is provided for the light path and a gutter J protects this aperture from falling water. The region of the cover near to this aperture is painted matte black to reduce stray reflections.

B3. Procedure

Care shall be taken to avoid stray light.

Calibrate the apparatus for measuring the coefficient of retroreflection R_A , with the wet testing apparatus in place, under both dry and wet conditions and determine a correction for change in stray light between these two conditions.

Adjust the nozzle and water supply so that the specimen will be subjected to a spray of ordinary tap water such that the whole face of the specimen is within the envelope of the spray, the angle between the surface of the specimen and the water striking it is 10° , and the flow rate striking the specimen is equivalent to a rainfall, in millimeters per hour, of 284 mm/hour ($50/\tan 10^\circ$) as measured in a horizontal collector.

Calibration of the flow rate must be conducted each day prior to testing and/or following any changes in the adjustable pressure valve setting. The flow rate measurement is taken after water pressure at the nozzle is stable and the spray is maintained at a constant rate for a minimum of 2 minutes prior to collecting and measuring the equivalent rainfall.

Without interrupting the calibrated water flow, insert the target specimen. Mount a flat, square specimen of the material of side not less than 50 mm (2 in.) in a vertical plane on the vertical specimen holder so that the holder does not protrude beyond the edge of the specimen at any point. Measurements

shall be conducted as stated in Section 10.4.6. Measure the photometric performance after 2 minutes of exposure, while maintaining water spray.

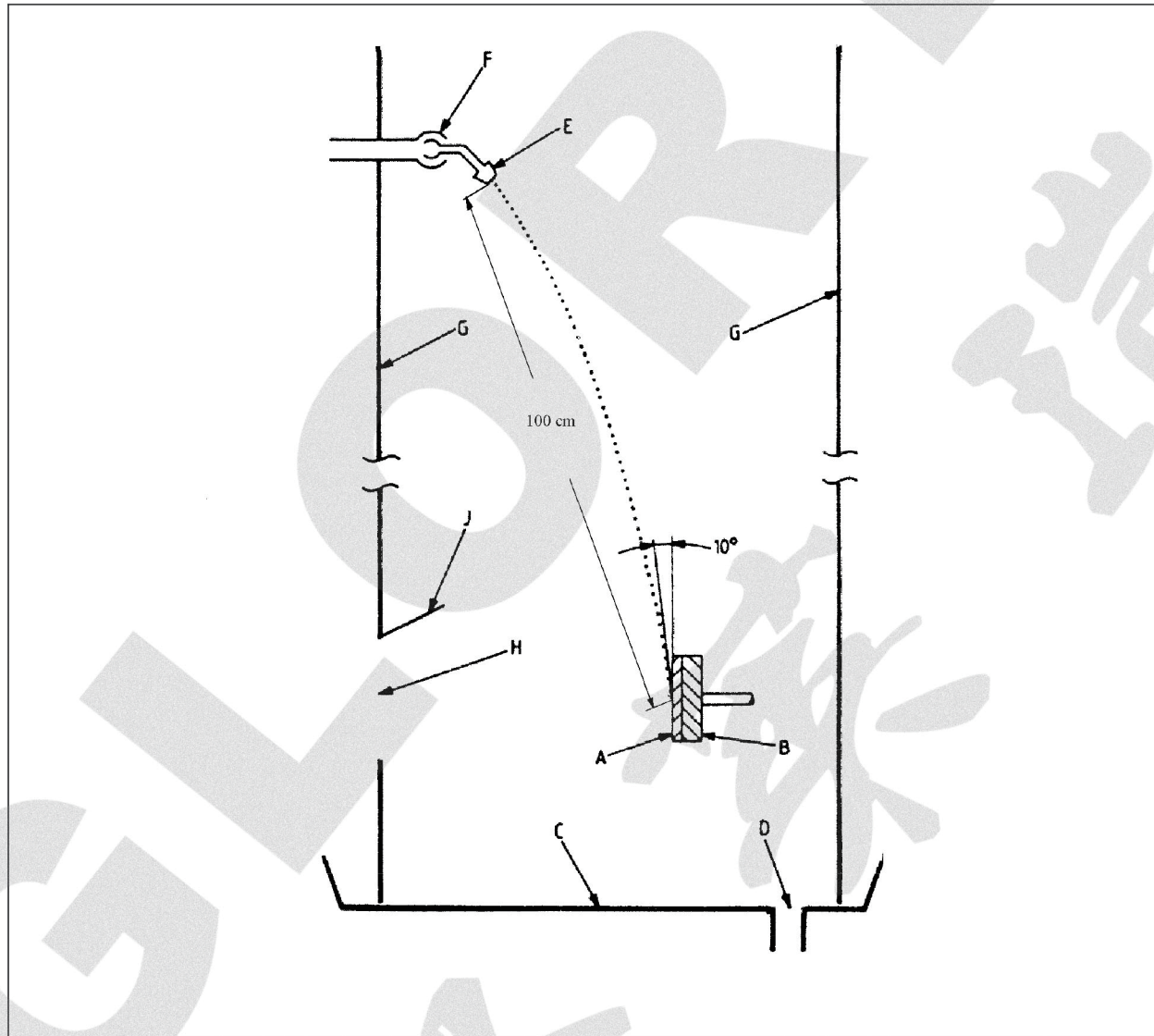


Figure B-1. Apparatus for wet retroreflection test

Appendix C

Suggested Type and Class Guidelines and Scenarios

(Appendix C is not part of ANSI/ISEA 107-2020, but is included for information only.)

HVSA should be chosen after a basic hazard assessment has been completed by a trained person designated by the employer, taking into account the expected threat environment, work activities, competing hazards, job classifications, and use policies.

1. Type O HVSA Scenarios – Occupational HVSA for Non-Roadway Use

Type O HVSA provides daytime and nighttime visual conspicuity enhancement for workers in occupational environments which pose struck-by hazards from moving vehicles, equipment and machinery, but which will not include exposure near to traffic on public access roadway rights-of-way or roadway temporary traffic control (TTC) zones. Examples of pedestrian workers who could operate in this class may include:

1. those workers directing vehicle operators to parking/service locations;
2. workers retrieving shopping carts from parking areas;
3. those exposed to the hazards of warehouse equipment traffic;
4. oil and gas extraction workers;
5. refinery workers; and
6. mine workers.

Example Type O worker scenarios, for occupational activities which may:

1. permit full and undivided attention to approaching traffic;
2. provide ample separation of the pedestrian worker from conflicting vehicle traffic; and
3. permit optimum conspicuity in backgrounds that are not complex.

2. Type R HVSA Scenarios – Occupational HVSA for Use in Proximity to Roadways

Type R HVSA provides daytime and nighttime visual conspicuity enhancement for workers in occupational environments which include exposure to traffic (vehicles using the roadway for purposes of travel) from public access roadway rights-of-way or roadway temporary traffic control (TTC) zones, or from work vehicles and construction equipment within a roadway temporary traffic control (TTC) zone. The Type R designation includes multiple Classes of HVSA. Examples of pedestrian workers intended for this HVSA Type may include all the workers required to comply with United States Federal Regulations on worker visibility in the Manual on Uniform Traffic Control Devices (MUTCD), who are operating on or near public access roadways. Other categories of workers may also benefit from the conspicuity enhancement performance that this Type of HVSA provides. Examples of workers who could operate in this class may include:

1. roadway construction workers;
2. utility workers;
3. survey crews;
4. railway workers;
5. forestry workers;
6. school crossing guards;
7. parking and/or toll gate personnel;
8. airport baggage handlers/ground crew;
9. emergency response personnel;
10. law enforcement personnel;
11. incident site investigators;
12. roadway maintenance workers;
13. flagging crews;
14. towing operators; and
15. road assistance/courtesy patrols.

Example Type R worker scenarios, for occupational activities where risk levels exceed those for Type O such as where:

1. greater visibility is desired during inclement weather conditions;
2. complex backgrounds are present;
3. employees are performing tasks which divert attention from approaching vehicle traffic;
4. vehicle or moving equipment speeds exceed those in Type O scenarios; or
5. work activities take place in closer proximity to vehicle traffic.

Suggested Performance Class: 2 or 3 typical based upon certain conditions

3. Type P HVSA Scenarios – Occupational HVSA for Emergency and Incident Responders and Law Enforcement Personnel

Type P offers a range of HVSA for specifiers to choose from to address the range of potential hazards experienced by emergency and incident responders and law enforcement personnel. Type P HVSA provide daytime and nighttime visual conspicuity enhancement for emergency and incident responders and law enforcement personnel in occupational environments which include exposure to traffic (vehicles using the roadway for purposes of travel) from public access roadway rights-of-way or roadway temporary traffic control (TTC) zones, or from work vehicles and construction equipment within a roadway temporary traffic control (TTC) zone, or from equipment and vehicles within the emergency activity area. Type P HVSA provides additional options for emergency responders, incident responders and law enforcement personnel who have competing hazards or require access to special equipment. Workers intended for this HVSA Type may include all the emergency and incident responders and law enforcement personnel required to comply with United States Federal Regulations on worker visibility in the Manual on Uniform Traffic Control Devices (MUTCD), who are operating on or near public access roadways. Examples of pedestrian workers who could operate in this class may include:

1. law enforcement personnel;
2. emergency response personnel;
3. road closure personnel;
4. firefighting personnel; and
5. incident site investigators;

NOTE It is the intention of these Performance Class Guidelines and Scenarios to serve as an assessment tool only. Certain specific conditions such as atmospheric, sight/stop-distances, training, regulations, proximity, and others must be taken into account in any final hazard/safety assessment. Vehicle speed should not be considered in isolation to these variables. Extreme conditions might exist which require performance levels in excess of Performance Class 3. PPE should be selected to optimize color conspicuity between the wearer and the work environment.

Appendix D

Examples of Garment Design

(Appendix D is not part of ANSI/ISEA 107-2020, but is included for information only).

Illustrations D1 – D20 included in ANSI/ISEA 107-2020 are examples of configurations capable of meeting the criteria set forth in this standard. Other configurations may be acceptable if they meet the criteria established in this standard, including the placement of retroreflective or combined-performance material as summarized in the table below.

Illustrations D21 – D26 are included to demonstrate examples of configurations that do not meet the criteria set forth in this standard.

Required Placement of Retroreflective or Combined-Performance Material				
	Material Placement on Garments			
TYPE AND CLASS				
	Shoulders	Legs	Sleeves	Torso
Type O, Class 1	180° visibility required if no sleeves (6.3.6)	360° visibility optional (6.3.2.2)	360° visibility optional (6.3.2.2)	360° visibility required (6.3.4)
Type R, Class 2 Type P, Class 2	180° visibility required if no sleeves (6.3.6)	360° visibility optional (6.3.2.2)	360° visibility optional (6.3.2.2)	360° visibility required (6.3.4)
Type R, Class 3 Type P, Class 3	N/A	360° visibility optional (6.3.2.2)	360° visibility required (6.3.2.2)	360° visibility required (6.3.4)
Supplemental Class E	N/A	360° visibility required (6.3.2.2)	N/A	N/A

**American
National
Standard**

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether they have approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no persons shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Published by

**International Safety Equipment Association
1901 North Moore Street, Arlington, Virginia 22209 USA**

Copyright 2020 by ISEA

All rights reserved.

No part of this publication may be reproduced
in any form, in an electronic retrieval system or
otherwise, without the prior written permission
of the publisher.

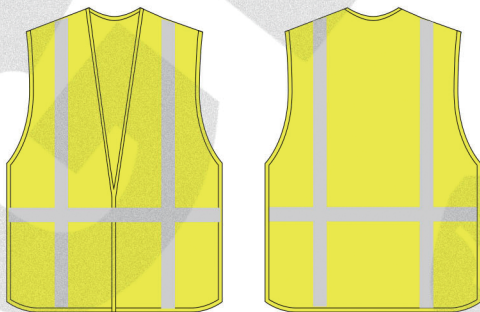
Printed in the United States of America



D1. Compliant Type O, Performance Class 1 - Coverall



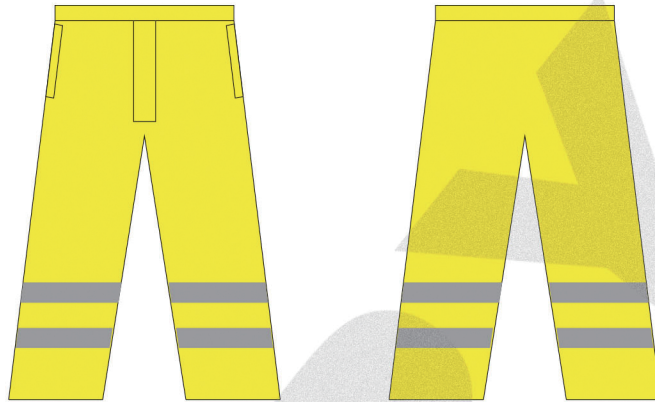
D2. Compliant Type O, Performance Class 1 – Uniform Top and Bottom



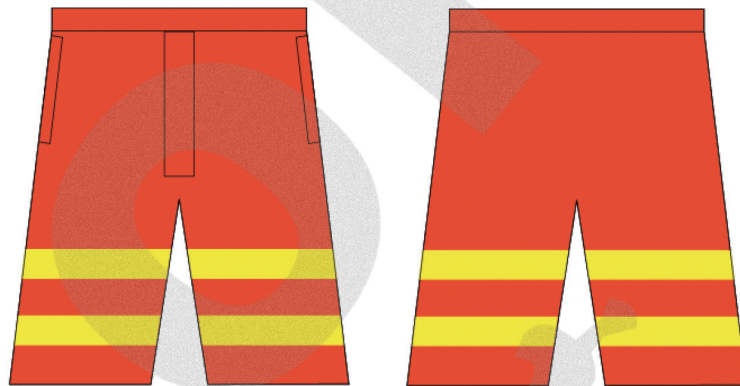
**D3. Compliant Type O,
Performance Class 1 - Vest**



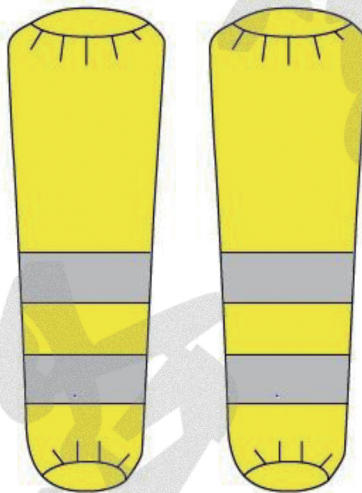
**D4. Compliant Type O,
Performance Class 1 - Harness**



D5. Compliant Class E, Supplemental Item - Pants



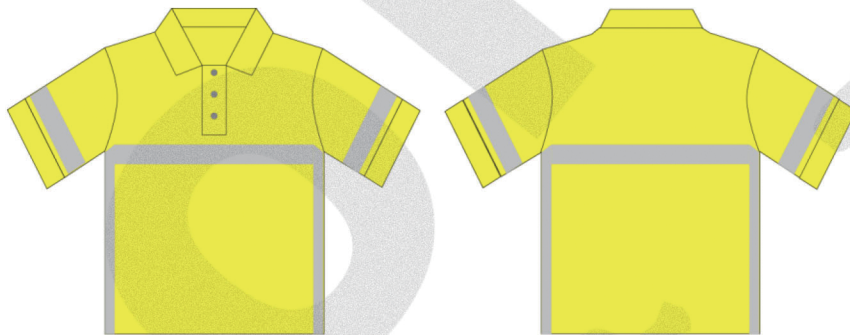
D6. Compliant Class E, Supplemental Item - Shorts



D7. Compliant Class E, Supplemental Item - Gaiters



D8. Compliant Type P, Performance Class 2 – Vest (split-trim design)



D9. Compliant Type P, Performance Class 2 – Polo Shirt



D10. Compliant Type P, Performance Class 2 – Vest



**D11. Compliant Type P,
Performance Class 3 - Jacket**

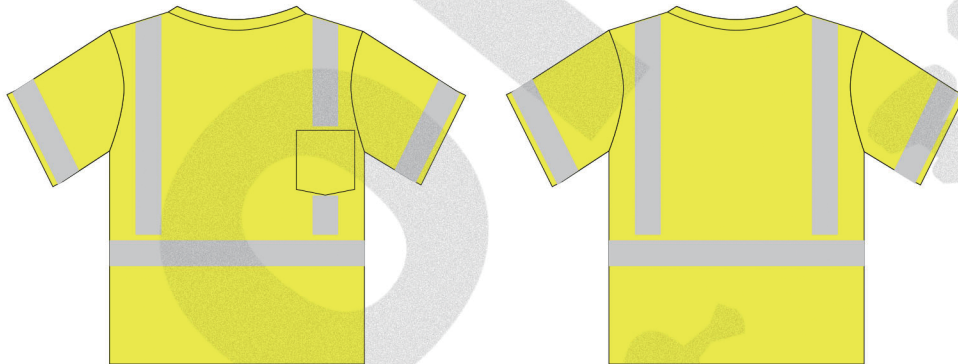


**D12. Compliant Type P, Performance Class 3 -
Jacket with Colorblocking**





D13. Compliant Type R, Performance Class 2 – Vest with Front Pocket on Vertical Stripe



D14. Compliant Type R, Performance Class 2 – T-shirt Design with Front Pocket



D15. Compliant Type R, Performance Class 2 – Vest



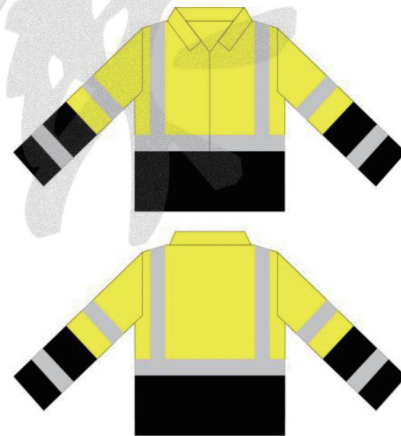
D16. Compliant Type R, Performance Class 3 – Jumpsuit



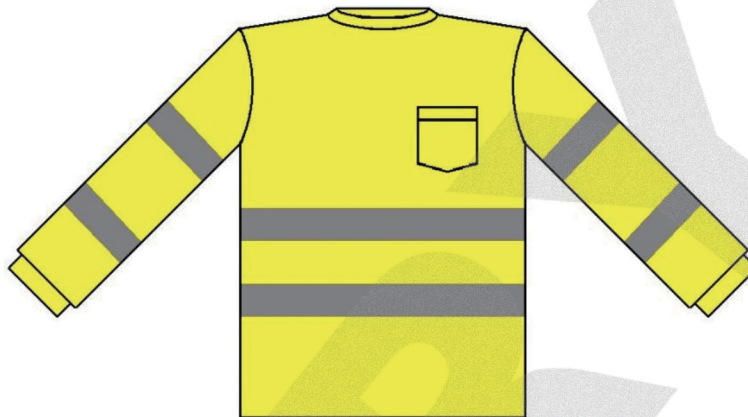
D17. Compliant Type R, Performance Class 3 – Short-sleeve Jacket/shirt with Single Arm Band



**D18. Compliant Type R,
Performance Class 3 - Jacket with Front Pocket**



**D19. Compliant Type R,
Performance Class 3 - Jacket with
Colorblocking on Bottom**



D20. Compliant Type R, Performance Class3 – Long-Sleeve Shirt Design with No Shoulder Strip



**D21. Non-compliant Vest Design
(pockets covering horizontal band)**



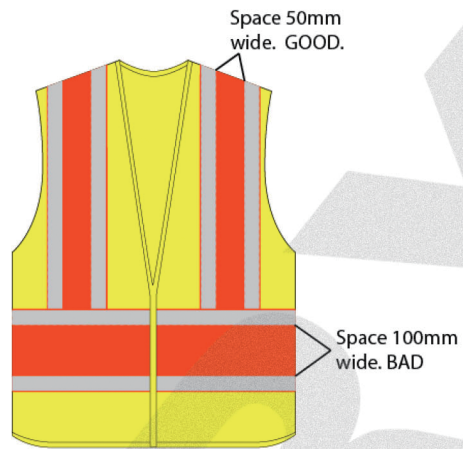
D22. Non-compliant Jacket Design
(trim placed too close to bottom edge of hem)



D23. Non-compliant Short Sleeve Shirt Design
(design not balanced, per Section 6.3.5 – less than 40% of background material on front)



D24. Non-compliant Jacket Design
(gap greater than 50 mm [2 in.] on horizontal torso band)



D25. Non-compliant Vest Design
(spacing on torso retroreflective band greater than 50 mm [2 in.])



D26. Non-compliant Long Sleeve Shirt Design
(no retroflective material on either the sleeves or shoulder area)

Appendix E Test Reports

Appendix E contains the certificates to be used for certification of the high-visibility items, retroreflective material and background materials. All forms are available for download in Adobe Acrobat format on www.safetyequipment.org.

E1. Background Material Testing Report (4 pages)

E2. Combined-Performance and Retroreflective Material Testing Report (2 pages)

E3. Declaration of Conformity (2 pages)

Foreword

(This Foreword is not part of American National Standard ANSI/ISEA 107-2020)

This 2020 version of ANSI/ISEA 107 represents the fifth edition of the voluntary industry consensus standard addressing high-visibility safety apparel used in occupational settings. Since its initial publication in 1999, the standard has been the authoritative document for the design, performance or materials for high visibility PPE in the United States, having been codified into U.S. Department of Transportation, Federal Highway Administration (FHWA) regulations and incorporated by reference into other relevant worker protection standards.

ANSI/ISEA 107-2020 retains the long-standing Type-Performance Class designation of garments, whereby the Type is based on the expected use setting and the Performance Class is identified based on the amount of visible materials and design attributes incorporated into the finished garment. The criteria for high-visibility accessories have been removed in favor of continuing to emphasize the configurations and design requirements that contribute to the Type-Performance Class designation. Wearers and users should be encouraged to utilize high-visibility accessories including gloves, hoods, and head coverings to enhance their visibility.

It has been recognized that there are many work applications where worker visibility is imperative and the working environment itself can cause the garment to become soiled easily. To accommodate these scenarios, the updated ANSI/ISEA 107 version includes specific criteria for a single-use disposable coverall. It should be noted that this coverall configuration complies with the requisite minimum material amounts and color requirements imposed on all compliant high-visibility safety apparel and that the associated material integrity requirements are only applicable to single-use disposable coveralls, for which unique marking is applied. Updates have also been made to the tests methods in an effort to align more closely with other material integrity tests and to recognize current versions used for evaluating the materials.

The 2020 edition of the standard is introducing the concept of measuring the overall nighttime luminance of a garment by including optional language that allows a manufacturer to test a garment according to ASTM E1501. The committee believes that this standardized method and the data it generates throughout the next revision cycle will allow wearers to more easily compare the nighttime performance of garments and manufacturers to improve the design and performance of HVSA.

This revision was prepared by members of the High Visibility Products Group of the International Safety Equipment Association (ISEA). The following companies were members of the group at the time of the approval of the standard:

Arcwear.com
Blauer Manufacturing
Bulwark FR
Carhartt
DuPont
ERB Industries
Ergodyne
Global Glove & Safety
Ironwear
M.L. Kishigo Manufacturing
Lakeland Industries
3M Company
Majestic Glove
MCR Safety

NASCO Industries
National Safety Apparel
OccuNomix International
ORAFOL Americas, Inc.
Pacific Safety Supply
Performance Textiles, Inc. (div. of Brand and Oppenheimer)
Protective Industrial Products
Pyramex Safety
Radians, Inc.
Safe Reflections
Surewerx
Tingley Rubber
Vartest Laboratories
VisionVest

E1. Background Material Testing Report

Nominal Material Description: Fabric Weight: Fabric Content: Fabric Type:	Test Lab(s):
Fabric ____ Non-Fabric ____ (check one) Lot #:	Address:
Manufacturer:	Contact Person:
Color:	Date Tested:

TESTS FOR ALL MATERIALS

Test/Method	Section	ANSI/ISEA 107-2020 Minimum Requirement	Test Result	Pass/Fail/NA
Determination of Color ASTM E1164-17 (Single layer)	8.1.1 8.1.2 10.2	Test specimen must fulfill the colorimetric requirements of Table 2 for background material	<i>As submitted:</i> x = y = %Y = <i>After 40x Xenon:</i> x = y = %Y =	
Determination of Color ASTM E1164-17 (Two layers of the same material)	8.1.1 8.1.2 10.2	Test specimen must fulfill the colorimetric requirements of Table 2 for background material	<i>As submitted:</i> x = y = %Y = <i>After 40x Xenon:</i> x = y = %Y =	
Colorfastness Croaking AATCC 8-2016	8.2.1	Dry 3.0 Wet 3.0		
Colorfastness Perspiration AATCC 15-2013	8.2.2	Color change 4.0 Staining 3.0	Acetate: Cotton: Nylon: Polyester: Acrylic: Wool: Other (specify):	

Background Material Testing Report (page 2 of 4)

TESTS FOR ALL MATERIALS (cont)				
Test/Method	Section	ANSI/ISEA 107-2020 Minimum Requirement	Test Result	Pass/ Fail/ NA
Bursting Strength (Knitted/Other Nonwovens) – not applicable to single-use disposable coveralls ASTM D3787-07 (2016); or ASTM D6797-07 (2015)	8.4.1	178 N (18.1fkgf) (40 lbf)		
Tear Resistance (Woven) – <i>not applicable to single-use disposable coveralls</i> ASTM D1424-09 (2019)	8.4.2	13 N (1326 gf) (2.92 lbf) Average force machine Average force cross-machine		
Seam Strength (single-use disposable coveralls only) ASTM D1683/D1683M -17 (2018)	11.3	40 N (9 lbf)		

TESTS AS CARE LABEL DICTATES				
Test/Method	Section	ANSI/ISEA 107-2020 Minimum Requirement	Test Result	Pass/ Fail/ NA
Colorfastness Domestic/Commercial Laundry AATCC 61-2013-3A 160°F	8.2.3 Table 3	Color change 4.5 Staining 3.0	Acetate: Cotton: Nylon: Polyester: Acrylic: Wool: Other (specify):	
Colorfastness Domestic Laundry AATCC 61-2013-2A 105°F (modified)	8.2.3 Table 3	Color change 4.5 Staining 3.0	Acetate: Cotton: Nylon: Polyester: Acrylic: Wool: Other (specify):	
Colorfastness Commercial Laundry AATCC 61-2013-3A 145°F (modified)	8.2.3 Table 3	Color change 4.5 Staining 3.0	Acetate: Cotton: Nylon: Polyester: Acrylic: Wool: Other (specify):	
Colorfastness Water AATCC 107-2013	8.2.3 Table 3	Color change 3.0 Staining 3.0	Acetate: Cotton: Nylon: Polyester: Acrylic: Wool: Other (specify):	

Background Material Testing Report (page 3 of 4)

TESTS AS CARE LABEL DICTATES (cont)				
Test/Method	Section	ANSI/ISEA 107-2020 Minimum Requirement	Test Result	Pass/Fail/NA
Colorfastness Hypochlorite Bleaching (commercial) AATCC 61-2013-4A	8.2.3 Table 3	Fading 4.0		
Colorfastness Hypochlorite Bleaching (domestic) AATCC 61-2013-5A	8.2.3 Table 3	Fading 4.0		
Colorfastness Hot-pressing AATCC 133-2013 **coated fabrics are exempt	8.2.3 Table 3	Color change 4.5 Staining 3.0		
Colorfastness Dry cleaning AATCC 132-2013	8.2.3 Table 3	Color change 4.0		
Dimensional change Domestic AATCC 135-2018 (3)IIIA(iii) @105°F	8.3.1	Woven L \pm 4% W \pm 4%	5th Cycle Length = Width =	
		Knit or Other Fabric L \pm 7% W \pm 5%	5th Cycle Length = Width =	
Dimensional change Commercial AATCC 96-2012 IIIC-A and/or E@145°F	8.3.1	Woven L \pm 4% W \pm 4%	5th Cycle Length = Width =	
		Knit or Other Fabric L \pm 7% W \pm 5%	5th Cycle Length = Width =	

Background Material Testing Report (page 4 of 4)

TESTS AS CARE LABEL DICTATES (cont)				
Test/Method	Section	ANSI/ISEA 107-2020 Minimum Requirement	Test Result	Pass/ Fail/ NA
Dimensional change Drycleaning AATCC 158-2016	8.3.1	Woven $L \pm 4\%$ $W \pm 4\%$	5th Cycle Length = Width =	
		Knit or Other Fabric $L \pm 7\%$ $W \pm 5\%$	5th Cycle Length = Width =	
Water Repellency AATCC 22-2017	8.5.1	90 new, 70 after 5 washings		
Water Resistance AATCC 35-2018	8.5.2	≤ 1 gram of water penetration Level 1		
Waterproof AATCC 127-2017	8.5.3	200 cm new and after 5 washings		
Breathability ASTM E96-16 Procedure B or BW	8.6	Procedure B 600 g/m ² /24 hr microporous Procedure BW 3600 g/m ² /24 hr hydrophilic		

E2. Combined-Performance and Retroreflective Material Testing Report

Nominal Material Description:	Test Lab(s):
Lot #:	Address:
Manufacturer:	Contact Person:
Color:	Date Tested:
Test Report No. (identifier):	

COLOR REQUIREMENTS FOR COMBINED-PERFORMANCE MATERIALS

Test	Section	ANSI/ISEA 107-2020 Minimum Requirement	Test Result	Pass/Fail
Color, prior to Exposure Tests	8.1.1, 10.2	The chromaticity shall lie within the area defined in Table 2. (Attach color plot to test report.)	x = y =	
	8.1.1, 10.2	The daytime luminance factor (%Y) shall meet or exceed the minimums defined in Table 2.	%Y =	
Colorfastness after Xenon Test	8.1.2, 10.2	The chromaticity shall lie within the area defined in Table 2. (Attach color plot to test report.)	x = y =	
	8.1.2, 10.2	The daytime luminance factor (%Y) shall meet or exceed the minimums defined in Table 2.	%Y =	

Combined-Performance and Retroreflective Material Testing Report (page 2 of 2)

PHOTOMETRIC PERFORMANCE REQUIREMENTS

Take measurements at $\varepsilon_1 = 0^\circ$ and $\varepsilon_2 = 90^\circ$. Record maximum value on left side of test result column and the other value on right side of test result column.

ANSI/ISEA 107-2020 Minimum Requirement Section 9.1, Table 4			Test Result cd/(lx·m ²)	Pass/ Fail
Observation Angle	Entrance Angle	Minimum cd/(lx·m ²)		
12' (0.2°)	5°	330 / 248		
	20°	290 / 218		
	30°	180 / 135		
	40°	65 / 47		
20' (0.33°)	5°	250 / 188		
	20°	200 / 150		
	30°	170 / 128		
	40°	60 / 45		
1.0°	5°	25 / 18.8		
	20°	15 / 11.3		
	30°	12 / 9		
	40°	10 / 7.5		
1.5°	5°	10 / 7.5		
	20°	7 / 5.25		
	30°	5 / 3.75		
	40°	4 / 3		

PHYSICAL PERFORMANCE REQUIREMENTS

Test	Section	ANSI/ISEA 107-2020 Minimum Requirement	Test Result	Pass/ Fail
Retroreflection, after abrasion	9.2 , 10.4.1	$R_A (0.2^\circ/5^\circ) > 100 \text{ cd}/(\text{lx} \cdot \text{m}^2)$ at ε_1 $R_A (0.2^\circ/5^\circ) > 75 \text{ cd}/(\text{lx} \cdot \text{m}^2)$ at ε_2	ε_1 : ε_2 :	
Retroreflection, after flexing	9.2, 10.4.2	$R_A (0.2^\circ/5^\circ) > 100 \text{ cd}/(\text{lx} \cdot \text{m}^2)$ at ε_1 $R_A (0.2^\circ/5^\circ) > 75 \text{ cd}/(\text{lx} \cdot \text{m}^2)$ at ε_2	ε_1 : ε_2 :	
Retroreflection, after folding at cold temperatures	9.2, 10.4.3	$R_A (0.2^\circ/5^\circ) > 100 \text{ cd}/(\text{lx} \cdot \text{m}^2)$ at ε_1 $R_A (0.2^\circ/5^\circ) > 75 \text{ cd}/(\text{lx} \cdot \text{m}^2)$ at ε_2	ε_1 : ε_2 :	
Retroreflection, after exposure to temperature variation	9.2, 10.4.4	$R_A (0.2^\circ/5^\circ) > 100 \text{ cd}/(\text{lx} \cdot \text{m}^2)$ at ε_1 $R_A (0.2^\circ/5^\circ) > 75 \text{ cd}/(\text{lx} \cdot \text{m}^2)$ at ε_2	ε_1 : ε_2 :	
Retroreflection, after washing (when applicable)	9.2, 9.4.5	$R_A (0.2^\circ/5^\circ) > 100 \text{ cd}/(\text{lx} \cdot \text{m}^2)$ at ε_1 $R_A (0.2^\circ/5^\circ) > 75 \text{ cd}/(\text{lx} \cdot \text{m}^2)$ at ε_2	ε_1 : ε_2 :	
Retroreflection, after dry cleaning (when applicable)	9.2, 10.4.5	$R_A (0.2^\circ/5^\circ) > 100 \text{ cd}/(\text{lx} \cdot \text{m}^2)$ at ε_1 $R_A (0.2^\circ/5^\circ) > 75 \text{ cd}/(\text{lx} \cdot \text{m}^2)$ at ε_2	ε_1 : ε_2 :	
Retroreflection wet performance	9.2 , 10.4.6	$R_A (0.2^\circ/5^\circ) > 100 \text{ cd}/(\text{lx} \cdot \text{m}^2)$ at ε_1 $R_A (0.2^\circ/5^\circ) > 75 \text{ cd}/(\text{lx} \cdot \text{m}^2)$ at ε_2	ε_1 : ε_2 :	

E3. Declaration of Conformity

Declaration of Conformity to ANSI/ISEA 107-2020, High-Visibility Safety Apparel

Certificate No.
Supplier name and address:
Product information (name, model number, part number or other information as applicable):
Company declares that the above product meets all set requirements as stated in ANSI/ISEA 107-2020 as a compliant high-visibility safety item for Performance Class _____, Type _____; All relevant materials have been tested with documents referenced under this certificate number. This item meets all design requirements and has been measured for appropriate amount of visible reflective material and background materials for the smallest size offered for this product.

1. VISIBLE BACKGROUND MATERIAL:

- Amount of visible background material (smallest size offered): _____

Please list each material that contributes towards the amount **VISIBLE BACKGROUND MATERIAL** listed above. Use separate sheet for addition materials.

Material 1 Identification

Test Lab:	Material Type: <input type="checkbox"/> Knitted <input type="checkbox"/> Woven <input type="checkbox"/> Other: _____
Report #:	Material Content (such as Polyester, Modacrylic, and others):
Date:	Weight: _____ Color: _____
Description:	

Material 2 Identification

Test Lab:	Material Type: <input type="checkbox"/> Knitted <input type="checkbox"/> Woven <input type="checkbox"/> Other: _____
Report #:	Material Content (such as Polyester, Modacrylic, and others):
Date:	Weight: _____ Color: _____
Description:	

Material 3 Identification

Test Lab:	Material Type: <input type="checkbox"/> Knitted <input type="checkbox"/> Woven <input type="checkbox"/> Other: _____
Report #:	Material Content (such as Polyester, Modacrylic, and others):
Date:	Weight: _____ Color: _____
Description:	

Declaration of Conformity (page 2 of 2)**2. VISIBLE RETROREFLECTIVE MATERIAL**

- Amount of visible retroreflective material (smallest size offered) _____

Please list each type of material that contributes towards **VISIBLE RETROREFLECTIVE MATERIAL** listed above.

Material 1 Identification

Test Lab:	
Report #:	
Date:	Style #:
Description:	

Material 2 Identification

Test Lab:	
Report #:	
Date:	Style #:
Description:	

**Use separate sheet for additional materials*

3. OVERALL LUMINANCE

Check here if test report for optional Overall Luminance testing is attached.

The undersigned hereby warrants that he/she is authorized to legally bind the company identified above.

Signed: _____ Title: _____

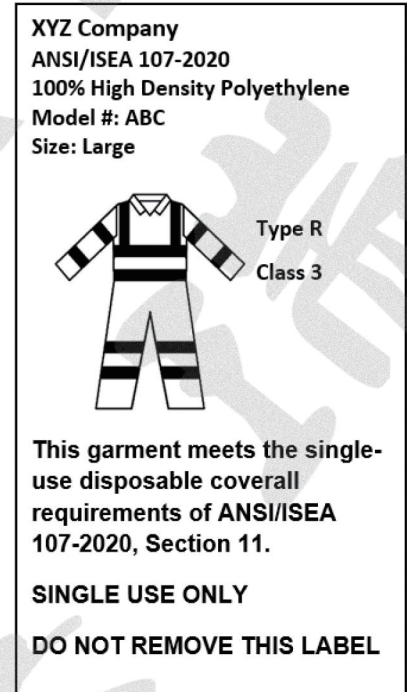
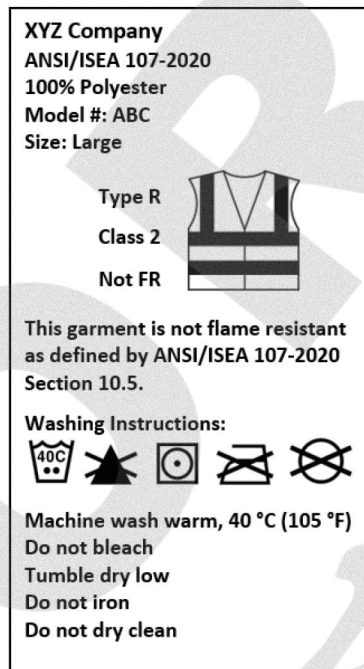
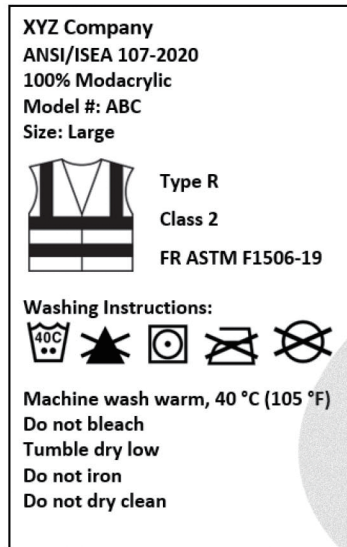
Print Name: _____ Date: _____

Appendix F

Examples of High-Visibility Safety Apparel Labels

(Appendix F is not part of ANSI/ISEA 107-2020, but is included for information only)

The illustrations below represent examples of acceptable HVSA labels meeting the requirements of Section 13, Marking.



Appendix G

High-Visibility Apparel Service Life

(Appendix G is not part of ANSI/ISEA 107-2020, but is included for information only)

All users must be aware that high-visibility PPE garments have a limited lifetime and will wear out depending on their exposure and care. The United States Federal Highway Administration (FHWA) has made the following statement about the expected lifetime of high-visibility PPE garments:

The FHWA research into the service life of the high-visibility garments that are currently in use indicates that the useful service life of the vests depends greatly on the type of activities in which the workers are engaged while wearing the garments. The useful life of garments that are worn on a daily basis is approximately six months. Garments that are not worn on a daily basis are expected to have a useful service life of up to three years. The FHWA realizes that there might be some variation in the useful service life of these garments based on the care provided. [*Federal Register Vol. 71, No. 226 Friday, November 24, 2006 Rules and Regulations p. 67798*]

Actual lifetimes in the field will vary depending on exposure and care conditions, and could range from weeks to years.

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.

American Road and Transportation Builders
Association
American Traffic Safety Services Association
Association of Hazards Materials Professionals
BSNF Railway
Ms. Holly Burgess, CSP
FCx Performance
Georgia Department of Transportation
Laborers' Health and Safety Fund of North
America

Michigan Department of Transportation
North Carolina State University
Reflective Apparel Factory
Roza Sunnyside Valley Irrigation
State of Ohio Public Employment Risk Reduction
Program
Texas Department of Transportation
Westex by Milliken

Suggestions for the improvement of this standard are welcome. Send suggestions to:

International Safety Equipment Association
1901 N. Moore Street
Arlington, VA 22209 USA
isea@safetyequipment.org

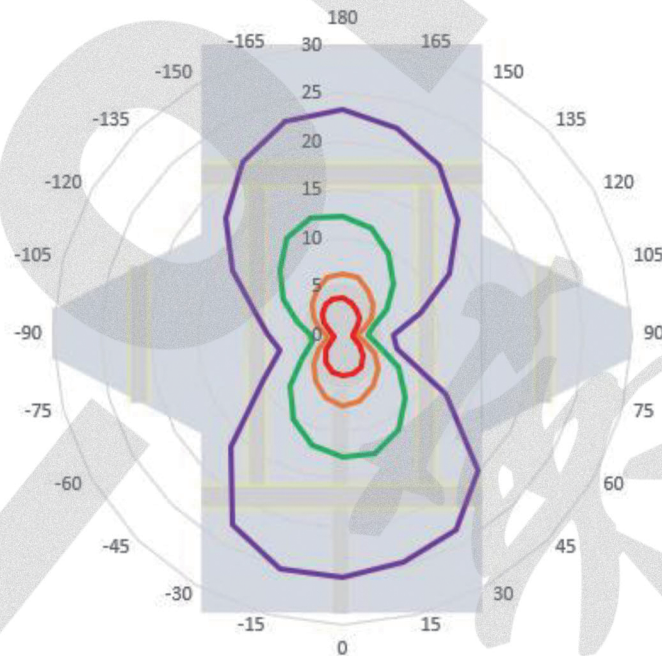
Appendix H

Benefits and Explanation of Optional Testing for Overall Luminance of HVSA

(Appendix H is not part of ANSI/ISEA 107-2020, but is included for information only)

The evaluation of a high visibility garment for its overall nighttime luminance delivers supplemental information about the performance of the garment at all viewing angles. The resulting data illustrates the 360° retroreflective performance of the garment. Safety managers and wearers can use this data as a tool to further assess and compare the protective qualities of one or more garments.

ASTM E1501-99 (2004) describes a method that can be used to mount a garment on a manikin which is then placed on a goniometer and automatically rotated in 15° increments around a vertical axis. Measurements are taken at each interval at 4 observation angles, and R_R is calculated to describe the total amount of light returned by the entire garment. The resulting polar plot demonstrates the relative conspicuity of the garment in a 360° format. For example, the graph below shows that a garment has greater nighttime visibility when viewed from the front and back (0° and 180°, respectively) and less nighttime visibility when viewed from the sides (90° and -90°, respectively).



NORMATIVE REFERENCES

T

The following references are available from the American Association of Textile Chemists and Colorist (AATCC) www.aatcc.org

- AATCC - EP1-2012 Gray Scale for Color Change
- AATCC - EP2-2012 Gray Scale for Staining
- AATCC 8-2016, Tests for colorfastness: Crockmeter method
- AATCC 15-2013, Colorfastness to Perspiration
- AATCC 16.3.-2014 Colorfastness to Light - Xenon Arc
- AATCC 22-2017 Water Repellency: Spray Test
- AATCC 35-2018 Water Resistance: Rain Test
- AATCC 61-2013 Colorfastness to Laundering: Accelerated
- AATCC 96-2012 Dimensional Changes in Commercial Laundering of Woven and Knitted Fabrics Except Wool
- AATCC 107-2013 Colorfastness to Water
- AATCC 127-2017, Water Resistance: Hydrostatic Pressure Test
- AATCC 132-2013 Colorfastness to Dry-cleaning
- AATCC 133-2013 Colorfastness to Heat: Hot Pressing
- AATCC 135-2018 Dimensional Changes of Fabrics After Home Laundering
- AATCC 158-2016, Dimensional Changes on Dry-cleaning in Perchloroethylene: Machine Method

The following references are available from ASTM International www.astm.org

- ASTM D1424-09 (2019), Standard Test Method for Tearing Strength of Fabrics by Falling-Pendulum Type (Elmendorf) Apparatus
- ASTM D1683/D1683M -17 (2018), Standard Test Method for Failure in Sewn Seams of Woven Fabrics, Procedure A
- ASTM D1776-16, Standard Practice for Conditioning Textiles for Testing
- ASTM D3787-07 (2016), Standard Test Method for Bursting Strength of Textiles - Constant-Rate-of-Traversal (CRT) Ball Burst Test
- ASTM D5489-18, Standard Guide for Care Symbols for Care Instructions on Textile Products
- ASTM D6797-07 (2015) Standard Test Method for Bursting Strength of Fabrics Constant-Rate-of-Extension (CRE) Ball Burst Test
- ASTM E96-16, Standard Test Methods for Water Vapor Transmission of Materials
- ASTM E284-17, Standard Terminology of Appearance
- ASTM E808-01 (2016), Standard Practice for Describing Retroreflection
- ASTM E809-08 (2013), Standard Practice for Measuring Photometric Characteristics of Retroreflectors

ASTM E1164-17e1, Standard Practice for Obtaining Spectrometric Data for Object-Color Evaluation

ASTM E1501-99(2004), Standard Specification for Nighttime Photometric Performance of Retroreflective Pedestrian Markings for Visibility Enhancement

ASTM F1506-19, Standard Performance Specification for Flame Resistant and Electric Arc Rated Protective Clothing Worn by Workers Exposed to Flames and Electric Arc

ASTM F1891-19, Standard Specification for Arc and Flame Resistant Rainwear

ASTM F2302-19, Standard Performance Specification for Labeling Protective Clothing which Provides Resistance to Incidental Exposures to Heat or Open Flame

ASTM F2733-17, Standard Specification for Flame Resistant Rainwear for Protection Against Flame Hazards

The following European Norm (EN) and International Organization for Standardization (ISO) references are available from the American National Standards Institute
www.ansi.org

ISO 12947-2:2016, Textiles-Determination of the abrasion resistance of fabrics by the Martindale method – Part 2: Determination of specimen breakdown

ISO 3175-2:2017 Textiles - Professional care, dry cleaning and wet cleaning of fabric and garments – Part 2: Procedure for testing performance when cleaning and finishing using tetrachloroethene (perchloroethylene)

ISO 4675:2017, Rubber or plastic coated fabric - Low-temperature bend test

ISO 6330:2012, Textiles - Domestic washing and drying procedures for textile testing, Method 6N.

ISO 7854:1995 Rubber- or plastics-coated fabrics - Determination of resistance to damage by flexing (dynamic method)

ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories

The following references are available from the National Fire Protection Association (NFPA)
www.nfpa.org

NFPA 1977 Standard on Protective Clothing and Equipment for Wildland Firefighting (2016)

NFPA 2112 Standard on Flame-Resistant Clothing for Protection of Industrial Personnel Against Short Duration Thermal Exposures from Fire (2018)

Table of Contents

SECTION	PAGE
1. Scope	1
2. Purpose.....	1
3. Definitions	1
4. Compliance	2
4.1 Background Materials	2
4.2 Combined-Performance and Retroreflective Materials	2
4.3 Finished HVSA.....	2
4.4 Declaration of Conformity	3
5. Types and Classes	3
5.1 HVSA Types.....	3
5.2 Performance Classes	3
5.3 Supplemental Class E.....	4
6. Design	4
6.1 Ergonomics	4
6.2 Apparel Configurations	4
6.3 Construction Requirements	6
7. Criteria for Optional Features and Testing	7
7.1 Pockets	7
7.2 Identification Panels, Lettering and Logos (Type R and P)	7
7.3 Identification of Personnel (Type P).....	8
7.4 Flame Resistance	8
7.5 Single-Use Disposable Coveralls.....	8
7.6 Overall Luminance	8
8. Requirements for Background and Combined-Performance Retroreflective Materials	8
8.1 Color.....	8
8.2 Colorfastness of Background Material	9
8.3 Dimensional Change of Background Material	10
8.4 Mechanical Properties of Background Material	10
8.5 Performance Under Wet Conditions	10
8.6 Water Vapor Permeability for Background Materials Classified as Breathable.....	10
9. Photometric and Physical Performance Requirements for Retroreflective and Combined- Performance Materials.....	11
9.1 Retroreflective Performance Requirements Prior to Test Exposure.....	11
9.2 Retroreflective Performance Requirements After Test Exposure.....	11

10.	Test Methods	11
10.1	Sampling and Conditioning	11
10.2	Determination of Color	11
10.3	Method for Determination of Retroreflective Photometric Performance	12
10.4	Retroreflection After Test Exposure	12
10.5	Flame Resistance	13
11.	High-Visibility Single-Use Disposable Coveralls	14
11.1	Requirements for Background and Combined-Performance Retroreflective Materials	14
11.2	Retroreflective Performance Requirements	14
11.3	Seam Strength for Single-Use Disposable Coverall Construction (Full Garment) ..	14
12	Care Labeling	14
13.	Marking	14
13.1	General	14
13.2	Specific Marking	14
14.	Instructions for Use	15
14.1	Product Information	15
14.2	Service Life Guidelines	15

APPENDICES

Appendix A - Color of Background and Combined-Performance Material	A-1
Appendix B – Method of Measuring Wet Performance of Retroreflective Material	A-2
B1. Principle	A-2
B2. Apparatus	A-2
B3. Procedure	A-2
Appendix C – Suggested Type and Class Guidelines and Scenarios	A-4
Appendix D – Examples of Garment Design	A-6
Appendix E – Test Reports	A-16
E1. Background Material Testing Report	A-17
E2. Combined-Performance and Retroreflective Material Testing Report	A-21
E3. Declaration of Conformity	A-23
Appendix F – Examples of High-Visibility Safety Apparel Labels	A-25
Appendix G – High-Visibility Apparel Service Life	A-26
Appendix H – Benefits and Explanation of Optional Testing for Overall Luminance of HVSA	A-27

NORMATIVE REFERENCES	A-28
----------------------------	------

American National Standard for High-Visibility Safety Apparel

1 Scope

This standard specifies performance requirements for high-visibility safety apparel. For the purpose of this standard, the term “high-visibility safety apparel (HVSA)” shall be used to mean apparel PPE intended to provide conspicuity to the user in hazardous situations under any light conditions by day and under illumination by vehicle headlights in the dark or other low light conditions.

Performance requirements are included for color, retroreflection, physical properties and minimum areas of background, retroreflective and combined-performance materials, as well as the recommended configuration of the materials. Test methods are provided in the standard to ensure that a minimum level of visibility is maintained when garments are subjected to ongoing care procedures. These specifications may prescribe a wide variety of occupational HVSA, but shall not be applied to firefighter turnout gear.

2 Purpose

Conspicuity is enhanced by high contrast between the garment and the ambient background against which it is seen. This standard provides performance requirements for conspicuous materials to be used in HVSA and specifies minimum amounts of background, retroreflective and combined-performance materials, colors and placement of materials for garments, and supplemental items used to enhance the visibility and safety of workers. Performance Class guidelines are identified with corresponding recommendations for selection based on worker risk hazards, such as complex backgrounds, vehicular traffic and speeds encountered.

3 Definitions

Accredited laboratory: A laboratory having a certificate of accreditation meeting the requirements ISO/IEC 17025:2017, *General requirements for the competence of testing and calibration laboratories* for the collection and analysis of data within the parameters of this standard.

Background material: Colored fluorescent material intended to be highly conspicuous in daytime and dawn/dusk conditions, but not intended to comply with the requirements of this standard for retroreflective material.

Band: A strip or stripe that contrasts with the adjacent material in color, texture, material or function.

Combined-performance material: Material that exhibits both background and retroreflective properties.

Conspicuity: The characteristics of an object influencing the probability that it will come to the attention of an observer, especially in a complex environment which has competing objects.

Declaration of conformity: A statement by the manufacturer or supplier, based on a decision following review, that fulfillment of the requirements specified in this standard has been demonstrated. (Appendix E3)

Flame resistance: The property of a material whereby flaming combustion is prevented, terminated or inhibited following application of a flaming or non-flaming source of ignition with or without subsequent removal of the ignition source.

Fluorescent material: Material that instantaneously emits optical radiation within the visible range at wavelengths longer than absorbed and for which emission ceases upon removal of the source of irradiation. These materials enhance daytime visibility, especially during dawn and dusk.

High-visibility safety apparel (HVSA): Personal protective safety clothing intended to

provide conspicuity during both daytime, nighttime and other low-light condition usage.

Noncompliant material: Any material used in the construction of HVSA, but which does not fully conform to the requirements for background material, combined-performance material or retroreflective material.

Photometric performance: The effectiveness of retroreflective material in returning light to its source and measured in terms of coefficient of retroreflection.

NOTE: The photometric terms and definitions used in this document are defined in ASTM E284-17 and ASTM E808-01 (2016).

PPE: Personal Protective Equipment

Retroreflective material: Material that reflects and returns a relatively high proportion of light in a direction close to the direction from which it came.

Roadway: A general term for denoting a strip of land that has been improved, designed, or is ordinarily used for the purposes of vehicular travel.

Shoulder area: The area of an item of apparel that lies above a horizontal plane located 15 cm (5.9 inches) below the shoulder high-point, as measured along the HVSA. See Figure 2.

Single-use disposable coverall: An item of HVSA that is to be used once and then disposed and that is designed to be worn over clothing to cover a minimum of arms, legs, and torso.

Split-trim: Retroreflective or combined-performance materials consisting of minimum widths positioned as a parallel pair.

Temporary traffic control (TTC) zone: An area of roadway where road user conditions are changed because of a work zone or incident by the use of temporary traffic control devices, flaggers, uniformed law enforcement officers, or other authorized personnel.

Torso area: The trunk of the body extending from the underarm to the hip area. See Figure 1.

Water repellent: The characteristic of a fabric to resist wetting.

Water resistant: The characteristic of fabric to resist wetting and penetration by water.

Waterproof: The resistance of a fabric to the penetration of water under pressure.

4. Compliance

4.1 Background Materials

Fluorescent background materials shall be tested by an independent third-party ISO/IEC 17025 accredited laboratory to verify performance to the requirements specified in Section 8 of this standard. At a minimum, the information found on the form in Appendix E1 shall be provided as a report to the entity that requested the testing. -

4.2 Combined-Performance and Retroreflective Materials

Combined-performance and retroreflective materials shall be tested by an independent third-party ISO/IEC 17025 accredited laboratory to verify performance to the requirements specified in Sections 8 (for combined-performance material) and 9 (for combined-performance and retroreflective material) of this standard. At a minimum, the information found on the form in Appendix E2 shall be provided as a report to the entity that requested the testing.

4.3 Finished HVSA

Manufacturers of the finished HVSA shall verify that materials and supplies used to make HVSA meet the requirements of this standard.

All certificates and test reports that verify the performance of materials used in manufacturing the finished HVSA shall be retained by the manufacturer and be made available to ensure that all HVSA labeled as meeting this standard have completed all of the testing required by the standard.

Manufacturers of the finished HVSA shall provide a declaration of conformity that all requirements for the HVSA are achieved in their entirety. The Declaration of Conformity shall be developed for all models produced by each company. At a minimum, the information found on the form in Appendix E3 shall be provided.