

ANSI/ISEA 107-2015 Made Easy

A Quick Reference to High-Visibility Safety Apparel

See www.safetyequipment.org for a complete copy of the ANSI/ISEA 107-2015 standard

The American National Standard for High-Visibility Safety Apparel and Accessories (ANSI/ISEA 107-2015) is a standard established by American National Standards Institute, Inc. Construction, maintenance, utility, emergency responders, airport ramp personnel and many categories of off-road workers are routinely exposed to potential injury hazards from their low visibility while on the job. This standard provides guidelines for the selection and use of high-visibility safety apparel such as shirts, rainwear, outerwear, safety vests, headwear, and other high-visibility accessories to improve worker visibility during the day, in low-light conditions, and at night. Notable changes from the third edition (ANSI/ISEA 107-2010) include new type designations for high visibility safety apparel (HVSA); recombination of the ANSI/ISEA 107 and 207 standards into one document; and expansion of the scope of high visibility accessories. The appendices have been updated to include additional examples of garment designs and trim patterns.

This information, ANSI/ISEA 107-2015 Made Easy: A Quick Reference to High-Visibility Safety Apparel, summarizes the main provisions of the standard including minimum performance criteria and basic design requirements. This is not an authoritative guide. You should obtain a copy of the standard and refer to it for more detailed and complete information. And remember, there is more to designing a high-visibility safety garment than meeting the minimum performance specifications and design guidelines of the ANSI/ISEA 107-2015 standard. Garment designs should incorporate the full range of user needs for functionality, comfort, durability, image, and any additional hazards.

ANSI/ISEA 107 and Related U.S. Regulations

The ANSI/ISEA 107-1999 standard was the first U.S. standard for the design and performance of high visibility safety apparel. In November 2008, 23 CFR part 634 was the first U. S. Federal regulation applied to worker high visibility apparel in Federal Aid highway environments, and required the use of performance Class 2 or 3 ANSI/ISEA 107 garments. The 23 CFR part 634 regulation was then incorporated into the 2009 edition of the Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD), to extend its application to all public access roadways. The MUTCD requires all workers, including construction, maintenance, utility, emergency and incident responders, and volunteers, operating on or near any public access roadway, to wear high-visibility safety apparel.

The 2015 revision of ANSI/ISEA 107 combines the previously separate 107 and 207 standards into a single document for administrative simplicity. The new version includes a "Type" structure that keeps off-road ("Type O"), roadway ("Type R"), and public safety ("Type P") garments separate by application, and more closely aligns with the definitions and implementation of the U.S. Federal worker high visibility regulation residing in the Manual on Uniform Traffic Control Devices (MUTCD). Under the new standard, any Type R roadway garments are compliant for workers on or near a public access roadway, and Type P public safety garments add a compliance option for emergency and incident responders.

As previously designated, firefighters may use retroreflective turnout gear compliant to NFPA standards when exposed to flame, heat, and / or hazardous materials during emergency operations.

ANSI/ISEA 107-2015 focuses on the following:

- Design
- Requirements for Background and Combined-Performance Retroreflective Materials
- Photometric and Physical Performance Requirements for Retroreflective Materials
- Care Labeling

Definitions

Background material: Colored fluorescent material intended to be highly conspicuous, but not intended to comply with the requirements of this standard for retroreflective material.

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

Combined-performance material: A retroreflective material that is also a fluorescent material.

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 D3)

High Visibility Safety Apparel (HVSA): Personal protective safety clothing intended to provide conspicuity during both daytime and nighttime, and other low-light condition usage.

High Visibility Accessory: A high-visibility item or items that can help define the human form and, when combined with movement, enhance nighttime conspicuity.

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

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.

Roadway: An area designed, or ordinarily used for the purposes of vehicular travel.

Accredited laboratory: A laboratory having a certificate of accreditation meeting the requirements ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories for the collection and analysis of data within the parameters of this standard.

Design

The ANSI/ISEA 107-2015 standard provides design guidelines and specifies the photometric requirements, minimum amounts of component materials, colors, and placement to create garments and headwear for the purpose of enhancing the visibility of workers. Refer to Section 6 of the standard for more detailed information. The selection of components and classes of apparel should be made based upon what is appropriate for the hazard and with the safety of the worker in mind.

Component Colors

There are three different colors for background and combined-performance material from which to choose: fluorescent yellow-green, fluorescent orange-red and fluorescent red. Users should consider the work and natural environment to determine the most conspicuous color for daytime use. Is the environment urban or rural, heavy foliage or desert? Are work zone devices and equipment yellow or orange? Choose the fluorescent color that achieves the highest degree of worker contrast.

Garment Types and Classes

Three type designations for high visibility safety apparel are new to the ANSI 107-2015 standard. These types will help the user to choose options according to work environment. This also made it easier to combine ANSI 107 with the previous ANSI 207 classification and still keep the public safety options separate from other occupational garments. The types are further broken down into classes 1, 2 or 3.

Type “O” garments are for occupational workers who are not required by MUTCD 2009 to wear high visibility safety apparel, but may still work in an environment with moving equipment/vehicles and accompanying struck-by hazards, and visibility is a concern.

Type “R” garments are for occupational workers who are exposed to roadway traffic and who work in an environment with moving equipment/vehicles. This type designation and the classes within it now describe and make up the PPE that is federally mandated per the MUTCD 2009.

Type “P” garments are derived from the previous ANSI 207 standard. This type designation gives additional options for fire, police, and EMS personnel who have other potential hazards that require them to access equipment on their person. Type P garments differ from type R garments mainly in the area requirements for background material.

Three classes of high-visibility safety apparel help the user to choose the proper garments based on expected work environment risks. The classes state the minimum amount of background and retroreflective material, and specify placement of retroreflective material as well as any technical requirements for garment design.

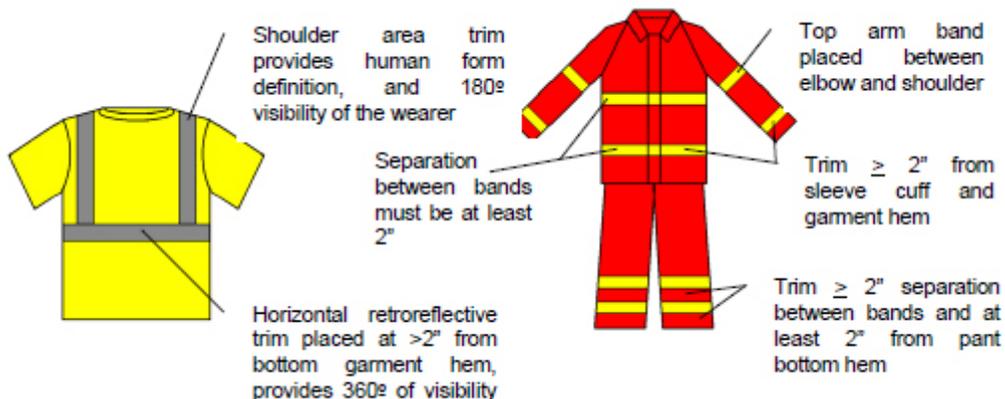
Retroreflective Material Placement

Class 1 and 2 garments, such as vests and T-shirts, and Class 3 garment configurations, such as a vest with Class E pants ensembles, coveralls, outerwear and rainwear should achieve the following:

- Use of retroreflective band widths appropriate for the garment class
- Provide 360° visibility with horizontal gaps of 50mm or less
- Garments without reflective material encircling the sleeves are required to have 150 cm² (23.25 in²) of reflective material in the shoulder area, to provide 180° visibility of the wearer. Shoulder area is defined as measuring down from the shoulder high point, on the front and back of the garment. The requirement of 23.25 in² is the total amount of reflective material required in the shoulder area including the front and back of the garment, e.g., shoulder area retroreflective material amount front + rear ≥ 23.25 in².15 cm (5.9 in)

- Appropriate separation distances of vertical and horizontal bands placed on the torso, sleeves and trouser areas.
- Appropriate retroreflective band placement and garment design.
- In addition to trim, retroreflective patterns such as logos, design icons, or identification text may contribute to the maximum area requirements specified in Table 1.
- A footnote in Table 1 of ANSI/ISEA 107-2015 includes a background fabric area reduction exception for the smallest garment offered in each design, to better accommodate smaller sized workers.

Fabric and Reflective Requirements Broken Down by Type and Class					
Garment Type Designation	Type "0" Off-road	Type "R" Roadway	Type "P" Fire, Police, EMS Personnel		
Performance Class	Class 1	Class 2	Class 3	Class 2	Class 3
Background Material Amounts	217 in ²	775 in ²	1240 in ²	450 in ²	775 in ²
Reflective Material Amounts	155 in ²	201 in ²	310 in ²	201 in ²	310 in ²
Width Minimums of Reflective Material	1"	1.38" (1" for split trim designs)	2" (1" for split trim designs)	2" (1" for split trim designs)	2" (1" for split trim designs)
Previous Standard and Class	ANSI 107, Class 1	ANSI 107, Class 2	ANSI 107, Class 3	ANSI 207, PSV	NEW!



Requirements for Background and Combined-Performance Materials

Section 8 of the standard provides specifications for color, brightness, fabric strength, and moisture resistance after various exposure tests.

- Background and Combined-Performance material needs to be tested for chromaticity /color and luminance and/or brightness without preconditioning; and again for colorfastness after standard cleaning processes and Xenon (UV light) exposure. Table 3 in Section 8 is now the requirement for both background and combined-performance materials.
- Background materials must also be tested for colorfastness after crocking and perspiration tests.
- Other tests for background materials include testing for dimensional change (shrinking) after washing and dry-cleaning, tensile strength, tear resistance, bursting strength of woven material and bursting strength of knitted material.
- If the garment is intended to provide protection during rainfall, background materials also need to be tested as water repellent, water resistant, and /or water proof. See Section 8.5 of the standard for updated definitions.

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

The standard specifies photometric and physical performance requirements for retroreflective and combined-performance materials.

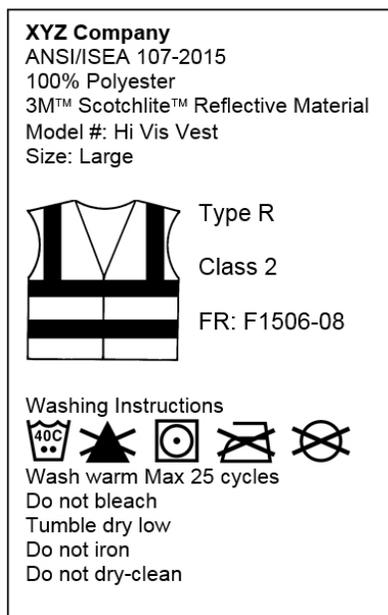
- Initial photometric performance is defined in Table 5 with a combination of 4 entrance, 4 observations, and 2 orientation angles.
- All material must meet the minimum brightness requirements after tests for abrasion resistance, flexing, folding at cold temperatures, variation in temperatures, influence of rainfall, and laundering. When washing is indicated on the care label, the number of cycles shall be tested to the updated laundry test standard ISO 6330 Method 6N, 60°C. This replaces the previous milder ISO 6330 2A wash method, and may impact the wash claims of finished garments.

- Combined-performance material must also meet the minimum luminance or brightness factors after a Xenon exposure test (UV light).

Care Labeling, General Marking and Instructions for Use

Once all materials have been tested against performance requirements and certificates of compliance from a third party testing laboratory have been issued, apparel manufacturers then assemble garments according to the design guidelines in Section 6 of the standard for the appropriate type and class of garment. Only after all the materials' performance and design requirements have been met, can a garment be labeled ANSI/ISEA 107-2015 compliant. Care labeling, general marking and instructions for use are described in Sections 11 to 13 of the standard.

Specific Marking



Marking includes, at a minimum, the following information:

- Manufacturer's name or other means of identification.
- Item number or other identification of the specific style of product.
- Size.
- This ANSI/ISEA standard name including year (ANSI/ISEA 107-2015).
- Compliance with flame resistance can be indicated in one of 2 ways:
 1. The letters "FR" on the label followed by the designation of the ASTM or NFPA standard specification from the list of allowed standards in Section 10.5.
 2. Garments which fully meet the third party certification requirements to NFPA 1977, or 2112, may use the separate label indicated by the NFPA standard to indicate FR compliance.

- If garment is not flame resistant, label must include the statement, "This garment is not flame resistant as defined by ANSI/ISEA 107-2015."
- Pictogram showing the garment Type, Class and Level of performance for the retroreflective material. Universal pictogram can be used or a pictogram that represents the garment being labeled.
- Maximum number of wash processes (i.e.: Max 50).

Answers To Some Frequently Asked Questions:

1. Are there other differences between the ANSI/ISEA 107-2010 and ANSI/ISEA 107-2015 standards? Yes. There are additional differences between the 2010 and 2015 editions of this standard. See the companion document, "Highlights of ANSI/ISEA 107-2015 What's Changing," or talk with a 3M Application Engineer for additional information.

2. Do U.S. Federal regulations require the use of high-visibility safety apparel for construction workers working in highway/construction work zones at risk of being struck by traffic? Yes. Section 6D.03 of the

2009 Manual on Uniform Traffic Control Devices (MUTCD) specifies the kinds of high visibility safety apparel which workers must use when operating on or near public access roadways.

3. Does this edition of the standard replace the 2010 edition? ANSI 107-2015 replaces the ANSI 107-2010 version as the current version of the standard. If and when the Federal Highway Administration issues a letter of interpretation accepting ANSI/ISEA 107-2015 garments as performance equivalent to previous additions, then 2015 garments may be used to comply with the MUTCD requirements as explained in the letter; the letter may be hoped to issue a month or two after the standard is released.

4. What version of ANSI 107 does MUTCD 2009 require? For all workers, including emergency responders, within the right-of-way who are exposed either to traffic or to work vehicles and construction equipment within a Temporary Traffic Control zone, MUTCD 2009 Section 6D.03 requires Class 2 or Class 3 garments of ANSI/ISEA 107-2004 or equivalent revisions, such as ANSI/ISEA 107-2010 or ANSI/ISEA 107-2015 as noted in question 3. Section 6E.02 requires ANSI/ISEA 107-2004 Class 2 or 3 for flaggers- FL orange-red or yellow green are required background colors. Section 7D.04 requires ANSI/ISEA 107-2004 Class 2 for Adult Crossing Guards¹.

5. Can NFPA 701 be used to claim flame resistance for an ANSI 107-2015 garment? No.

6. I have only found larger-sized garments that meet the standard. I have smaller workers that need appropriately fitting garments to work safely. Is this being addressed? Type R “roadway” Class 2 and Class 3 garments have an allowance for a reduced minimum area requirement, but only for the smallest size garment that is offered in a given design. This should allow for better accommodation of garment sizing for smaller workers.

7. Why were the ANSI/ISEA 107 and ANSI/ISEA 207 standards combined into one document? When standards are updated, the references they contain are also updated. When ANSI/ISEA 107 and 207 were on a staggered revision schedule it created a situation where materials compliant to both were subject to different test methods for the same properties. Similarly, improvements in one standard had to wait for carry over into the other. Bringing the standards into the same document makes them easier and less complicated to implement.

8. What is the new structure of the combined ANSI/ISEA 107 and 207? 107 and 207 were separate because the types of garments they specify have different attributes and requirements among their user groups. A new garment “type structure” for high visibility clothing was implemented to create a framework that kept them separate by intended application and for specification purposes, but made it easy to determine which garments would meet MUTCD regulatory requirements. Type O “off-road” garments are a new designation for workers operating in environments with vehicle or machinery struck-by hazards, but no exposure to roadways. Type R “roadway” garments are suitable to meet the MUTCD regulatory requirements. Type P “public safety” garments can be used by emergency and incident responders and law enforcement personnel to comply with the MUTCD.

9. If a garment passes Type R requirements does it automatically pass Type O and P? Will it need to be labeled with all designations, i.e., Type O, R, and P? A garment only needs to be marked for the claim the manufacturer is making. Sometimes manufacturers claim compliance to multiple standards or requirements, and can include separate conforming labels as an indication.

10. Has the treatment of accessories changed? Accessories are now more broadly defined to include gloves, hats, bandanas, etc., and may be labeled as ANSI/ISEA 107 compliant. The new requirements give conscientious accessory manufacturers the option of using good quality ANSI/ISEA 107-2015-compliant high visibility materials and labeling as such through self-certification, to better differentiate themselves from look-alike accessories that may appear “high visibility,” but use generic non-compliant materials which may be of lesser quality.

11. Do the high visibility materials on compliant accessories count toward area minimums together with garments if they are worn together? No. The accessory category was expanded to provide safety professionals with more options to help workers be safe and comfortable in high visibility gear, while at the same time being able to demonstrate that their safety program goes “above and beyond” minimum legal requirements, by issuing certified compliant accessories built with high quality materials.

12. Are “biomotion” design concepts integrated into standard requirements? Garments with sleeves or pant legs are required to include high visibility materials in these key areas, because they have been shown in multiple scientific studies to be the most effective placement to enhance conspicuity.

1 Manual on Uniform Traffic Control Devices 2009 Edition pages 564-566, 745

<https://www.reflectiveapparel.com/ansi-isea-107-2015.aspx>