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## TACTICAL EYEWEAR

*Good vision is critical to first response operations, and eye protection is essential to preserving it. Exposure to flying debris, thrown objects, blowing sand and dust, abrasive brush, UV radiation, and lasers are just some of the hazards first responders may encounter that can easily damage their eyes. Wearing reliable eye protection significantly reduces the risk of injury. Eye protection also helps responders maintain the clarity of sight needed to safely and effectively carry an operation to completion.*

*Tactical Eyewear falls under the AEL 01ZA-03-EYEP titled Protection, Eye.*

### Overview

Because first responders operate in dangerous and unpredictable environments, they need tactical eyewear that provides clear, undistorted vision and protection from multiple hazards. Threats to the eyes include blunt objects, bullet fragments, airborne debris, chemicals, biohazards, lasers, and explosives. Forms of protective eyewear include spectacles, goggles, face shields, and full-face respirators (Figure 1).



Figure 1. Emergency Responders are exposed to a multitude of eye hazards.  
*Image by Shutterstock.com*

Most spectacles and goggles come in a kit containing interchangeable clear and sunglass lenses with additional specialty lenses available. Options may include colored lenses, polarized lenses, laser-protection lenses, and photochromic lenses, which turn dark in bright sunlight and turn clear again in low-light conditions. For wearers requiring vision correction, some designs offer an optional prescription lens carrier that fits behind the protective lens (Figure 2), while other designs can be worn over eyeglasses. Electronic features, such as heated lenses that aid in de-fogging, are built into some products and powered by battery.

Tactical eyewear for emergency responders is designed to provide both the vision protection and the visual clarity needed for responders to do their jobs. Well-designed goggles should provide a tight seal, and all eye protection should offer frontal and peripheral protection against debris and hazardous substances. For situations requiring greater protection – such as handling explosive ordinance or biohazards – face shields and respirators should be considered. [1]



Figure 2. Blade style spectacle with prescription lens carrier installed.  
*Image courtesy of Revision Military Inc.*

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to help emergency responders improve their procurement decisions.

Located within the Science and Technology Directorate, the National Urban Security Technology Laboratory (NUSTL) manages the SAVER Program and conducts objective operational assessments of commercial equipment and systems relevant to the emergency responder community.

The SAVER Program gathers and reports information about equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL).

SAVER publications focus on answering two main questions: “What equipment is available?” and “How does it perform?”

SAVER knowledge products are created for the nation’s first responders and made available to help them make operational and procurement decisions.

To explore the full reports library and to learn more, visit SAVER online at [www.dhs.gov/science-and-technology/SAVER](http://www.dhs.gov/science-and-technology/SAVER).

For additional information on the SAVER Program, email NUSTL at [NUSTL@hq.dhs.gov](mailto:NUSTL@hq.dhs.gov).

## Protective Eyewear Standards

The American National Standards Institute (ANSI) Z87.1 standard [2] sets forth criteria for the optical quality of eyewear as well as its protectiveness against three important hazards: impact, liquid splash exposures, and non-ionizing radiation, such as ultraviolet (UV) light. Products that meet this standard must be laboratory tested and should bear the marking “Z87” or “Z87+” to indicate a high-velocity impact rating. Safety glasses for many different industries are designed to meet this standard. Compliant products should prevent or minimize damage to the eye from airborne debris, fragments, and chemicals, all of which can cause permanent disruption of vision, up to and including blindness.

Given the unpredictable nature of first response environments, however, a higher level of impact protection may be desired. Products listed on the U.S. military’s Authorized Protective Eyewear List (APEL) offer fragmentation protection that exceeds the requirements set by ANSI Z87.1. Spectacles and goggles (Figure 3) must meet military standard MIL-PRF-32432A [3]. Visors must meet MIL-DTL-43511D [4]. These standards specify tests that subject eyewear to simulated fragments travelling much faster and with more impact energy than that required by the Z87+ rating. APEL products must also be rugged and resistant to an extended temperature range.



Figure 3. Protective goggles  
*Image courtesy of Wiley-X*

## Optical Quality

A high-quality optical lens helps first responders to see fine features and distant objects clearly. Because protective eyewear curves around the face to provide frontal and periphery protection, the lenses are optically corrected to prevent distortion. Wearing poor quality lenses can lead to symptoms such as eye strain, headaches, and nausea, even when the optical imprecision is not obvious to the unaided eye. Operator performance can be affected as a result.

Products with the Z87 marking are tested to ensure high-resolution vision that is free from distortion and other harmful effects.

## Ultraviolet (UV) and Hazardous Light

Over time, excessive exposure to UV radiation can cause damage to the eyes, leading to conditions such as cataracts. This damaging UV exposure can be exacerbated by highly reflective surfaces, such as snow. For this reason, the ANSI Z87.1 specifies a UV scale that begins at U1 protection, which blocks 99.9% of harmful UV energies, and goes up to U6, which blocks 99.99%. Clear lenses for protective eyewear must have at least U1 protection, while sunglass lenses will normally have a higher rating.

Exposure to lasers and other hazardous light sources is also a concern for some responders. Such light sources operate at a variety of wavelengths and emit different “colors” of light, only some of which are visible to the eye. Wearers should choose lenses designed to protect against the particular wavelengths of hazardous light they expect to encounter. Trade-offs associated with wearing such protection often include changes in color perception and difficulty seeing in very dark conditions. It is important to note that lenses currently on the market do not provide protection against *all* lasers or hazardous light sources. Most products protect against a range of wavelengths or against the most common lasers.

## References

- [1] “Eye Protection,” Section 3.1.1.2 in “SAVER Explosive Protection Technology Guide,” United States Department of Homeland Security, Science and Technology Directorate, 2014. [Online]. Available: <https://www.hsdl.org/?view&did=800054>
- [2] *Eye and Face Protection Devices*, ANSI Z87.1, March 2020. [Online]. Available: <https://blog.ansi.org/2020/03/ansi-z87-1-eye-face-protection-standard-isea> [Accessed 16 11 2020].
- [3] *Military Combat Eye Protection (MCEP) System*, MIL-PRF-32432 Revision A, September 2018. [Online]. Available: [http://everyspec.com/MIL-PRF/MIL-PRF-030000-79999/MIL-PRF-32432A\\_55832](http://everyspec.com/MIL-PRF/MIL-PRF-030000-79999/MIL-PRF-32432A_55832) [Accessed 04 03 2021].
- [4] *Visors, Flyers Helmet, Polycarbonate*, MIL-DTL-43511D, 12 October 2006. [Online]. Available: <https://aka.ihsmarket.com/172bcb19-a8a7-4ea7-a5a4-f39dcae2a92> [Accessed 19 11 2020].