NATO STANDARD

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EYE PROTECTION FOR THE INDIVIDUAL SOLDIER

Edition A, Version 1

OCTOBER 2021

NORTH ATLANTIC TREATY ORGANIZATION

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

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NATO LETTER OF PROMULGATION

15 October 2021

1. The enclosed Allied Engineering Publication AEP-4296, Edition A, Version 1, EYE PROTECTION FOR THE INDIVIDUAL SOLDIER, which has been approved by the nations in the NATO ARMY ARMAMENTS GROUP (NAAG), is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 4296.

2. AEP-4296, Edition A, Version 1, is effective upon receipt.

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4. This publication shall be handled in accordance with C-M(2002)60.

Dimitrios SIGOULAKIS
Major General, GRC (A)
Director, NATO Standardization Office

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS

Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.

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RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
MNE	In the future, The Armed Forces of Montenegro plan to procure goggles and visors whose main purpose will be to protect the soldiers' eyes from injuries caused by ammunition, fragments or other environmental factors (eg: sand, dust, sunlight, etc.) with limitations in monitoring quality.
TUR	a. Turkish Armed Forces has 7 of 10 Military Working Dog categories which mentioned in Annex-B of STANAG 2623. These are Mine Detection Dog, Explosive Detection Dog, Patrol Dog, Drug Detection Dog and Tracker Dog. Mine Detection Dog also serves as Improvised Explosive Device Detection Dog. b. Explosive Detection Dog cannot be used for route search. c. MWD teams are being regularly certificated once a year by subject.
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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ABBREVIATION LIST

AECTP	Allied Environmental Conditions and Test Publications
AEP	Allied Engineering Publication
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
EOD	Explosive Ordnance Disposal
EN	European Standard
FoV	Field of View
g	gram
ISO	International Organization for Standardization
N	Newton
NA	National Authority
NaCl	Sodium Chloride
NATO	North Atlantic Treaty Organization
NSO	NATO Standardization Office
PPE	Personal Protective Equipment
PTFE	Polytetrafluoroethylene
s	second
STANAG	Standardization Agreement

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CHAPTER 1 INTRODUCTION

1.1. AIM

a. The aim of this agreement is to provide guidance for the procurement of eye protection (e.g. spectacles, goggles, visors) intended to protect military users from injuries caused by hand gun munition, (small) fragments or spall and when necessary, environmental factors e.g. sand, dust, glare and sunlight.

b. This agreement establishes common minimum requirements, evaluation criteria, and test methods, for the assessment and selection of eye protection for the Individual Soldier.

c. This will allow NATO nations to specify common performance levels for eye protection; leading to the procurement of eye protection systems that achieve a NATO agreed minimum level of performance, and allow interoperability of eye protection.

1.2. NORMATIVE REFERENCES

a. References as valid on the date of publication of this document apply:

(1) EN 165 (2005) Personal eye-protection – Vocabulary

(2) EN 166 (2001) Personal eye-protection – Specifications

(3) EN 167 (2001) Personal eye-protection – Optical test methods

(4) EN 168 (2008) Personal eye-protection – Non-optical test methods

(5) EN 172 (1994) (+ A1:2000 + A2:2001) Personal eye-protection – Sun glare filters for industrial use.

(6) EN 207 (2017) Personal eye-protection equipment – Filters and eye-protectors against laser radiation (laser eye-protectors)

(7) IEC 60068-2-70 (1995) Environmental testing - Part 2: Tests - Test Xb: Abrasion of markings and letterings caused by rubbing of fingers and hands

(8) AEP 2902 Edition A V1 (2019) – Non Ballistic Test Methods and Evaluation Criteria for Combat Helmets

(9) AEP 2920 Edition A V2 (2016) - Procedures for the Evaluation and Classification of Personal Armour - Bullet and Fragmentation Threats.

(10) STANAG 4370 (2016) Environmental Testing

(11) AEP 73 (2015) Combined operational characteristics, technical specifications, evaluation tests and criteria for protective masks.

(12) AEP 4495 (2016) Guidance for the procurement of Laser Eye Protection (LEP) for the individual military users Ed 1 V2.

(13) ANSI Z80.3-2018 American National Standard for Ophthalmics – Non-prescription Sunglasses and Fashion Eyewear – Requirements

(14) ANSI/ISEA Z87.1-2015, American National Standard for Occupational and Educational Personal Eye and Face Protection Devices

(15) ASTM D1003-13, Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics

(16) ASTM D1044-19, Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion by the Taber Abraser

(17) ASTM D3359-17, Standard Test Methods for Rating Adhesion by Tape Test

(18) ISO 8980-4 (2006) Ophthalmic optics - Uncut finished spectacle lenses- Part 4: Specifications and test methods for anti- reflective coatings

(19) ISO 8980-5 (2005) Ophthalmic optics - Uncut finished spectacle lenses- Part 5: Minimum requirements for spectacle lens surfaces claimed to be abrasion resistant

(20) MIL-PRF-32432A - Military Combat Eye Protection (MCEP) System

(21) SAE-AMS-STD-595, “Colors Used in Government Procurement”

1.3 SCOPE

a. This document covers eye protection requirements for the Individual Dismounted Soldier, while not carrying out specialist tasks, such as mine clearance. The document includes requirements for universal

prescription carriers and lenses to be worn in combination with eye protection.

b. The primary function of eye protectors for the individual soldier as specified in this document is to provide protection of the ocular region against debris, small fragments and spall. In addition spectacles, goggles and visors may provide protection against one or more of the following threats:

- blast overpressure;
- impacts of different severities;
- sunlight, dazzle and UV(A)/UV(B) radiation.

c. In addition, a goggle shall provide protection against:

- dust
- drops and splashes.

d. In addition to the types of protection listed in 1.3.a and 1.3.b a visor may protect the upper part of the face against hand gun munition and blunt impact.

e. The following functions are not covered in this document:

(1) Protection against laser radiation; the requirements for these systems are to be derived from STANAG 4495 Ed.2

(2) Protection against nuclear flash, nuclear radiation, UV(C) light, X-rays and low temperature infrared (IR), radiation emitted by low temperature sources.

(3) Protection against gases and fine dust; the requirements for these protectors are too restrictive for the design of eye protection for the soldier at large.

f. The roles that the scope of this document covers includes:

(1) Dismounted soldier eye protection;
(2) Mounted soldier eye protection;
(3) Parachutist eye protection;
(4) Maritime personnel eye protection.

g. The roles that are outside of the scope of this document includes:

(1) Explosive ordnance disposal and demining;
(2) Aviation;
(3) CBRN;
(4) Engineering (e.g. welding).

(5) Public order control.

h. The components of the spectacle type eye protection include:
   a) Frame consisting of:
      a. Front;
      b. Temples;
      c. Strap (optionally).
   b) Lens(es) (optionally in multiple shades);
   c) Rail attachment clip (optionally);
   d) Carrying case;
   e) Protective sleeve (optionally) for lenses;
   f) Care products;
   g) Instruction card.

i. The components of the goggle type eye protection include:
   a) Frame consisting of:
      a. Front;
      b. Strap.
   b) Lens(es) (optionally in multiple shades);
   c) Rail attachment clip (optionally);
   d) Carrying case;
   e) Protective sleeve (optionally) for lenses;
   f) Care products;
   g) Instruction card.

j. The components of the visor type eye protection include:
   a) Lens;
   b) Front with integrated attachment system for helmet;
   c) Carrying case;
   d) Protective sleeve (optionally) for lenses;
   e) Care products;
   f) Instruction card.

k. Table 1 serves to aide in the identification of relevant requirements in this document for the three versions of eye protection (spectacles/goggle/visor).

l. Compliance with the requirements in this document shall also be ensured when spectacle type or goggle type eye protection is worn together with the universal carrier fitted with prescription lenses.

Table 1 Overview of requirements for the three types of eye protection covered in this document (X designates a mandatory 'shall' requirement shall; x designates a preferred 'should' solution)

Chapter	Spectacles	Goggle	Visor
3 – Protection			
3.2 – Minimum coverage area	X	X	
3.3 – Ballistic protection			X
3.4 – Fragmentation	X	X	X
3.5 – Blunt impact			X
3.6 – Impact	X	X	X
3.7 – Resistance to ignition	X	X	X
3.8 – Intensive sunlight	x	X	
3.9 – Dazzle	x	x	
3.10 – Dust		X	x
3.11 – Droplets and splashes		X	x
3.12 – Blast	X	X	X
4 – Usability			
4.2– Field of view	X	X	X
4.3 – Weight	X	X	
4.4 – Sizing	X	X	
4.5 – Fit, adjustment and retention	X	X	X
4.6 – Donning and doffing	X	X	X
4.7 – Comfort	X	X	
4.8 – Exchange of components	X	X	
4.9 – Fogging	X	X	X
5 – Conspicuity			
5.1 – Detection	X	X	
5.2 – Colour	X	X	
6 – Quality			
6.2 – Workmanship			
6.3 – Optical Quality	X	X	X
6.3.1 – Luminous transmittance for clear glasses	X	X	X
6.3.2 – Luminous transmittance for UV Protective lenses	X	X	
6.3.3 – Luminous transmittance for sun glare lenses	X	X	
6.3.4 – Variations in transmittance	X	X	
6.3.5 – Diffusion of light	X	X	X
6.3.6 – Spherical refractive/power	X	X	X
6.3.7 – Astigmatism refractive power	X	X	X
6.3.8 – Prismatic refractive power	X	X	X
6.3.9 – Resolving power	X	X	X
6.3.10 – Lens back reflection			
6.4 – Material quality	X	X	X
7 – Durability			
7.1 – Scratching of lens	X	X	X
7.1 – Abrasion of lens	X	X	X
7.3 – Adhesion	X	X	X
7.4 – Corrosion of frame	X	X	X
7.5 – Stability at elevated temperature	X	X	X
7.6 – Resistance to UV	X	X	X
7.7 – Chemical resistance	X	X	X

Chapter	Spectacles	Goggle	Visor
7.8 – Environmental testing	X	X	X
8 – Eye correction			
8.2 – Design criteria	X	X	
9 – Compatibility			
9.2 – Helmets	X	X	X
9.3 – Weapons	X	X	
9.4 – Night vision devices	X	X	
9.5 – Communication equipment	X	X	
9.6 – Hearing Protection	X	X	
10 – Safety, Effects on Health and Environment			
10.1 – Safety	X	X	X
10.2 – Health	X	X	X
10.3 – Environment	X	X	X
11 – Additional components			
11.1 – Storage case	X	X	X
11.2 – Pouches sleeve		X	
11.3 – Care and cleaning products	X	X	X
12 – Sustainment			
12.1 – Operational life / storage life	X	X	X
12.2 – Repair	X	X	X
12.3 – Cleaning	X	X	X
13 – Marking			
13.1 – Frame	X	X	X
13.2 – Lenses	x	x	x
14 – Documentation			
14.1 – Instruction Card	X	X	X
14.2 – Technical documentation	X	X	X

CHAPTER 2 SIGNIFICANCE, USE AND LIMITATIONS

2.1 SIGNIFICANCE AND USE

a. The requirements, criteria and test described in this document apply to eye protection (with the exception of face shields) and/or components thereof intended for the functions stated in 1.2.b, c. and d.

b. The test procedures described can equally be used for research and development, qualification of materials or designs, and in the procurement of new equipment.

c. A requirement containing the verb:
shall implies a mandatory functional requirement/necessity;
should implies a preferred solution (wish, desire);
may implies an optional requirement.

d. Where appropriate, performance criteria and test methods were taken from international civilian standards. In case two standards are referenced, both are to be considered equal.

e. It is for the NA to decide which standard is most applicable to their nation's requirement. To remain compliant with international regulations and commercial practices it is advised to be consistent when referring to a standard (e.g. US or European).

2.2 LIMITATIONS

a. This AEP covers the basic requirements for spectacles, goggles and visors for the Individual Soldier. Face shields are not included.

b. According to their intended use the NA may put additional requirements to eye protection.

c. This AEP states minimum performance levels. According to their intended use the NA may specify a higher performance level when necessary.

d. Where specified, requirements define or give reference to eye protection under standard conditions. It is strongly recommended that eye protection is tested at these conditions.

e. For characteristics known to be temperature sensitive the NA shall consider testing at extreme temperatures that are representative of the likely environment where the eye protection will be used. The NA will define these conditions.

f. Test methods and conditions are defined and may be used to establish/determine the extent of performance degradation of eye protection after exposure to adverse environmental conditions and ageing.

g. This document does not specify any details of the construction or management of the test facility.

h. The testing of a product may require the use of materials and/or equipment that could be hazardous. This document does not purport to address the safety aspects associated with their use. It is the responsibility of the test facility using this procedure to establish appropriate health and safety practices and to determine the applicability of any regulatory requirements (that may vary between nations) prior to its use.

i. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable national laws and regulations, unless a specific exemption has been obtained.

j. This procedure and criteria may be updated as further data become available.

k. Compliance with this AEP does not fully ensure the adequacy of eye protection to meet regulations for use on public roads by mounted personnel users. Additionally a check on the recognition of signal lights is required.

3.5 DEFINITIONS

a. Below the terms used in this document are defined.

astigmatism: a condition in a lens of a protector in which there is a difference in refractive power in one meridian from that in another meridian.

attachment: means for fixating the visor to the helmet.

basic plane of the head form: a plane parallel to the plane at the level of the external ear opening (external auditory meatus) and the lower edge of the eye socket (inferior margin of the orbit) of the human head that the head form represents.

care product: means to clean the eye protector.

carrying case: case to securely store and protect all components of the eye protection system.

component: a functional part of a complete device addressed by the performance requirements of this standard.

correcting lenses; corrective lenses; prescription lenses: lenses with optical properties (refractive power, astigmatic power, prismatic power) that correct individual deficiencies in the wearer's eyesight.

diopter (D): a unit of measurement (plus or minus) used to express the refractive power of a lens. It is expressed as the reciprocal of the focusing distance given in meters.

eye protection: any form of equipment covering at least the region of the eye.

eye protection system: the system with all components including products for daily care.

face shield: eye protector covering all or a substantial part of the face.

filter lens: a lens that attenuates specific wavelengths of ultraviolet, visible, and/or infrared radiation.

fracture: a lens will be considered to have fractured if it cracks through its entire thickness into two or more separate pieces, or if any material visible to the naked eye becomes fully-detached from the inner surface.

frame: a structure, which holds the lenses on the wearer. It consists of the front, noose bridge, temples and/or strap (headband).

front: that part of a spectacle or goggle frame that is intended to contain the lenses.

goggle: a protector intended to tightly enclose the orbital area and sits on the face.

haze: the percentage of incident light that is not transmitted in a straight line through the lens but forward scattered, greater than 2.5^{o} diverging.

instruction card: card or booklet with instruction for use and care by the individual user, to be issued with each system.

lens: light transmitting part of a spectacle or goggle type eye protection.

light: optical radiation weighted by its ability to cause visual sensations.

National Authority: the Authority responsible for the specification of Eye Protection within a Nation or Armed Service.

neutrality: a reasonably even distribution of the transmission throughout the visible spectrum to ensure that colour distortion will not be excessive.

operational life: operational life commences from the time of issue of the eye protection to the soldier from supply (new condition). Operational life covers a timeframe that can include storage, use in training or use on operations.

optical radiation: that portion of the electromagnetic spectrum ranging in wavelength from 200 nm to 2000 nm.

pantoscopic tilt: the angle between the plane of the front and the face.

prescription lens (Rx): corrective lens manufactured to the wearer's individual prescription.

prismatic power: "prism": a measure of the angular deviation expressed in prism dioptres (Δ) of a light ray after passing along the viewing path through a lens. One prism dioptre equals a deviation of 1 cm per meter of path length.

protective sleeve: textile sleeve to be slided over the lenses for protection.

rail attachment clip: clip to fasten the frame of the protector to the side rail of the combat helmet.

refractive power: "power": a measure of the ability of a lens to focus light rays, expressed in dioptres (D).

removable lenses: prescription or plano lenses fabricated to fit a single spectacle frame.

replaceable lenses: interchangeable lens/fronts designed for spectacle or goggle that are directly mounted to the frame of the device.

resolving power: the measure of the ability of a lens to form separate distinct images of two objects close together.

RX carrier: a universal framework for holding the corresponding corrective lenses for use of the eye protection by soldiers with impaired vision. Equivalent: prescription lens carrier.

side shield: a permanent or detachable part of a spectacle that provides side impact resistance and that may be an original or aftermarket component.

spectacle: eye protector with lens(es) mounted in a spectacle type frame, with or without lateral protection.

storage life: the time the eye protection is in central or unit supply lines starting from receipt from the manufacture until initial issue while maintained in the original manufacture’s packaging.

strap: user adjustable band around the circumference of the head, improving fit and stability.

temple: that part of a spectacle frame commonly attached to the front and generally extending behind the ear of the wearer.

visor: face screen covering the eye area and other parts of the face while attached onto the helmet. Can be worn combined with a mandible.

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CHAPTER 3 PROTECTION

3.1 Overview

a. Adequate protection of the eyes is important given the vital role and vulnerability of the eyes. A large number of incapacitating injuries are eye wounds, on many occasions caused by fragments which on other, less vulnerable parts of the body would have resulted in minor injuries, only.

b. Dust, glare and ultraviolet (UV A and B) light will also lead to irritation and/or long-term damage to the eyes.

c. The protection requirements are described below.

3.2 Minimum Coverage Area

3.2.1 Requirement

a. The coverage area shall meet the requirements of clause 7.2.8 of EN 166 or clause 5.2.4 of ANSI/ISEA Z87.1 and include lateral (side) coverage as defined in clause 6.1.3 of ANSI/ISEA Z87.1.

b. The vented portion of a goggle shall be such that the openings exclude spherical objects 1.5 mm in diameter or greater.

3.2.1 Test Method

a. Coverage area and lateral coverage shall be determined according to clause 19 of EN 168 or clause 5.2.4 of ANSI/ISEA Z87.1 and 6.1.3 of ANSI/ISEA Z87.1.

3.3 Ballistic Protection

a. Ballistic testing vs 9 mm should be undertaken on eye protection designed to provide high levels of ballistic protection, e.g. visors.

3.3.1 Requirement

a. The V_{proof} on the lens of a visor shall be at least 365 ± 10 $m.s^{-1}$.

b. A complete penetration (CP) occurs when the impacting projectile or any fragment thereof, or any fragment of the lens of the visor perforates the witness sheet.

c. The NA may define any additional acceptance criteria for visors, e.g.
- for the lens: shattering, cracking or displacement from the frame
- for the frame: shattering or cracking.

d. For V_{proof} testing eye protection shall be tested without any means for eye correction.

3.3.2 Test Method

a. A V_{proof} test in accordance with AEP 2920 para 5.7 vs 9 mm FMJ (MEN 9 mm FMJ DM11A1B2) will be undertaken.

b. Visors shall be tested securely attached to the helmet body mounted on a correct size head form, as described in the manufacturer's instructions ensuring that the front horizontal edge of the helmet shell is parallel to the basic plane of the head form.

c. Aluminium foil, positioning ≤ 50 mm from the target to the eye shall be positioned to act as a witness for spall. The impact radius must be ≥ 25 mm.

d. A total of at least 22 fair shots will be used to determine V_{proof}.

e. Shot spacing will be 10 mm from any edge, the spacing between shots shall be a minimum of 10 calibres.

3.4 Fragment Protection

a. Eye protection shall provide protection at one of the levels specified below:

b. A complete penetration (CP) occurs when the impacting projectile or any fragment thereof, or any fragment of the lens or visor perforates the witness sheet.

c. The NA shall define any additional acceptance criteria for eyewear, e.g. shattered, cracked or displaced lenses/ visors and frames.

3.4.1 Requirement

3.4.1.1 Low Energy Fragments

a. The low energy level is defined for projectiles (0.325 g) F3 or R3 fragment simulating projectiles as defined in AEP-2920.

b. V_{proof} shall be at least 177 $m \cdot s^{-1}$.

3.4.1.2 Medium Energy Fragments

a. The medium energy level is defined for projectiles (1.1 g) F5 or R5 fragment simulating projectiles as defined in AEP-2920.

b. V_{proof} shall be at least 177 $m.s^{-1}$.

3.4.1.3 High Energy Fragments

a. Protection against high energy fragments is typically only offered by visors.

b. The high energy level is defined for projectiles (1.1 g) F5 or R5 fragment simulating projectiles) as defined in AEP-2920.

c. V_{proof} shall be at least 500 $m.s^{-1}$.

3.4.2 Test Method

a. V_{proof} test in accordance with AEP-2920 Ed.A V2 para 5.7 will be undertaken for all fragment testing.

b. A total of 22 shots will be used to determine V_{proof}.

c. A mounting system that resembles the normal way of wearing and positioning spectacles and goggles on the head is to be used to retain these targets during testing. b. Visors shall be tested securely attached to the helmet body mounted on a correct size head form, as described in the manufacturer's instructions ensuring that the front horizontal edge of the helmet shell is parallel to the basic plane of the head form. Suitable head forms are described in AEP-2920 and EN 168.

d. Aluminium foil, positioning ≤ 50 mm from the target relative to the eye shall be positioned to act as a witness for spall. The impact radius must be ≥ 25 mm.

e. Shot pattern according to AEP-2920 Ed.A V2 Paragraph 5.8.3.

f. V_{proof} testing eye protection shall be performed without any means for eye correction.

3.5 Blunt impact

3.5.1 Requirement

a. A visor positioned on the helmet shall protect the area around the eyes against blunt impact by ensuring that a known impact to the visor will not cause deformation which may contact the wearers face and cause subsequent injury.

3.5.2 Test Procedure

a. Testing in accordance with AEP 2902 Ed.A V1 paragraph 4.1.3.

3.6 Impact

3.6.1 Requirement

a. Complete eye protectors and frames shall either meet clause 7.1.4.2.2 of EN 166 (increased robustness of complete eye protectors and frames) or clause 6.2.3 (high velocity impact) of ANSI/ISEA Z87.1 as to give sufficient protection against lateral and frontal impacts and to withstand external mechanical factors.

3.6.2 Test Method

a. Testing in accordance with the method specified in clause 3.2 of EN 168 or 9.12 of ANSI/ISEA Z87.1.

3.7 Resistance to Ignition

3.7.1 Requirements

a. Eye protectors shall meet the requirements of clause 7.1.7 of EN 166 or 5.2.2 of ANSI/ISEA Z87.1.

3.7.2 Test Method

b. Testing in accordance with the method specified in clause 7.1.7 of EN 168 or 9.7 of ANSI/ISEA Z87.1.

c. Each externally exposed material (exclusive of textiles or elastic bands) shall be tested.

3.8 Intensive Sunlight

3.8.1 Requirement

a. Lenses intended for use outdoor in bright sunlight shall provide a protection level of 5-2 , 5-2,5 or 5-3,1 according to EN 172 table 1.

3.8.2 Test Method

a. The spectral transmittance of the lens shall be measured with a standard spectrophotometer from 315 nm to 380 nm and the mean transmittance shall be calculated as described in 5.1.3 of EN 172.

3.9 Glare

3.9.1 Requirement

a. Protection against glare under good visibility conditions with a neutral tinted (grey) lens should be considered.

b. The protection level shall not be higher than 5-3,1 according to EN 172 table 1.

3.9.2 Test Method

a. The spectral transmittance of the lens shall be measured with a standard spectrophotometer from 315 nm to 380 nm and the mean transmittance shall be calculated as described in 5.1.3 of EN 172

3.10 Dust

3.10.1 Requirement

a. Goggle type eye protectors shall meet the requirements of clause 7.2.5 (protection against large dust particles) of EN 166 or 8.2 ((large particle) dust hazard) of ANSI/ISEA Z87.1.

3.10.2 Test Method

a. Testing in accordance with the method specified in clause 13 of EN 168 or 9.18 of ANSI/ISEA Z87.1.

3.11 Droplets and Splashes

3.11.1 Requirement

a. Goggle type eye protectors shall meet the requirements of clause 7.2.4 a) (protection against large droplets) of EN 166 or 8.1.1 (droplet and splash hazard) of ANSI/ISEA Z87.1.

3.11.2 Test Method

a. Testing in accordance with the method specified in clause 12 of EN 168 or 9.17.1 of ANSI/ISEA Z87.1.

3.12 Blast

3.12.1 Requirement

a. Eye protection shall remain in place and intact when worn in the vicinity of an explosion with the blast overpressure and duration defined by the NA.

3.12.2 Test Method

a. The NA is to define blast overpressure and duration.

CHAPTER 4 USABILITY

4.1 OVERVIEW

a. To limit the potential detrimental effects of eye protection on situational awareness and sustainability and to ensure usability of the eye protection by the soldier a number of criteria apply.

4.2 Field of view

a. The temporal field of view shall be ≥ 85°, superior field of view ≥ 45°, inferior and nasal field of view ≥ 55°.

b. The field of view shall be determined according to the appropriate method in AEP 73.

4.3 Weight

a. The combined weight of the lenses and frame of low energy fragment spectacle type eye protection shall be ≤ 45 grams.

b. The combined weight of the lenses and frame weight of low energy fragment goggle type eye protection shall be ≤ 150 grams.

4.4 Sizing

a. The eye protection shall be offered in a sufficient number of sizes to accommodate (i.e. fit, adjust, and/or successful use) at least 95% of the user group as specified by the NA while wearing appropriate clothing and individual equipment.

4.5 Fit, Adjustment and Retention

a. A secure fit of the eye protection on the head of the wearer, especially in the case of highly dynamic movements (low crawling, jumping, running, etc.) is required. For this purpose, the following design criteria apply

b. For spectacle type eye protection:

- the frame shall be ergonomically shaped and ensure a close match to the contours of the nose, face and ears.
- the temples should be adjustable in length.
- optionally, the temples are fitted with a removable elastic band to with variable length adjustment.

- the nose piece should be adjustable.

c. For goggle type eye protection:

- the front shall be ergonomically shaped and ensure a close match to the contours of the nose and face.
- a length-adjustable, elastic head strap shall be attached to the front or the temple ends.
- optionally, the front shall be fitted with means to fixate the google onto the helmet.

d. For visor type eye protection:

- the top and two sides of the visor shall be directly adjacent or overlapping the helmet.

4.6 Donning and Doffing

a. Eye protection shall be easily and quickly (maximum time to be decided by NA.) donned and doffed with minimal realigning and readjusting on the head or helmet.

b. Donning/doffing/fastening/adjusting shall be accomplished without removing the combat helmet or gloves.

4.7 Comfort

a. Eye protection shall be free from projections, sharp edges or other defects which are likely to cause discomfort during use.

b. Eye protection shall be designed to be used alone or in conjunction with the equipment identified in Chapter 9.

c. The ability to wear the eye protection for a minimum period without adjustment shall be assessed in a Field User Evaluation (See Chapter 16). The NA shall define the minimum period of wear.

4.8 Exchange of Components

a. It shall be possible for the lenses to be easily inserted or removed (maximum time to be decided by NA).

b. The installation/removal of lenses shall not require the use of tools, and shall be able to be accomplished during day and night.

4.9 Fogging

4.9.1 Requirement

a. Lenses shall remain free from fogging for a minimum of 8 s.

4.9.2 Test Method

a. Testing in accordance with clause 16 of EN 168.

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CHAPTER 5 CONSPICUITY

5.1 Detection

a. The risk of detection of the wearer by light reflected from the eye protection shall be assessed in a Field User Trial, a minimum score of 3 is required.

5.2 Colour

a. Frames shall be available in a standard military colour, preferably Black 357, Tan 499, Foliage Green 504, Coyote Brown or Dark Grey.

b. Retention straps shall match the eyewear frame in solid color. Protective sleeves, carrying case and findings (thread, zippers, webbing, snap hooks, etc.) shall match the eyewear frame. Matte finishes are preferred.

c. The colour of the nose bridge is to be non-reflective.

d. The RX Carrier shall be transparent and matte.

5.3 Test Method

a. The colour and appearance of the frame, carrying case, straps and protective sleeves shall match the standard sample with sources simulating artificial and shall be a good match to the standard sample under incandescent lamplight.

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CHAPTER 6 QUALITY

6.1 Overview

a. Defects which would affect proper functioning of the eye protection are unacceptable.

6.2 Workmanship

a. Parts (zippers, snaps, hook and pile, adjustable eyewear features, etc.) shall function properly.

b. Component interfaces shall be secure.

c. All components shall be present.

d. Stitching shall be complete and secure (i.e., no loose/broken/missing stitching).

e. Components shall be free of rough/sharp edges.

f. Additionally, the NA may establish other defects considered to be unacceptable.

6.3 Optical quality

a. To ensure an undistorted and clear field of view minimum criteria for the optical quality of lenses and visors are formulated in Table 2.

Table 2 Optical Quality Criteria and Test Methods

Chapter	Criterion	Test Method	Alternative criterion	Alternative Test Method
6.3.1 – Luminous transmittance for clear lenses	74,4 % (scale number 2.1.2 of EN 170)	Clause 6 of EN 167:2001	≥85% clear	ANSI Z80.3/
6.3.2 - Luminous transmittance for lenses protecting against (intensive) sunlight [1]	EN 172 5.2 ; 5-3.1 or 5-2.5	Clause 5 of EN 172:1994	10-20% solar	ANSI Z87.1; Section 9.2 Transmittance Test
6.3.3 – Luminous transmittance for lenses protecting against glare	EN 172 5,2, 5-3.1 or 5-2.5	Clause 5 of EN 172:1994		
6.3.4 – Variations in transmittance (filtering) for lenses with filtering action	EN 166: 7.1.2.2.3.1	Clause 7.2 of EN 167:2001		
6.3.5 – Diffusion of Light (haze)	0,75 $cd.m^{-2}.lx^{-1}$	Clause 4 of EN 167:2001	3%	ANSI Z87.1; Section 9.3 Haze Test
6.3.6 – Spherical refractive/power	± 0,06 D	Clause 3.2 of EN 167:2001.	±0.06 D	ANSI Z87.1; Section 9.4,
6.3.7 - Astigmatism refractive power	0,06 D	Clause 3.2 of EN 167:2001.	< 0.06 D	ANSI Z87.1; Section 9.4,
6.3.8 – Prismatic refractive power	0,75 cm/m base out (horizontal) 0,25 cm/m base in, horizontal 0,25 cm vertical	Clause 3.2 of EN 167:2001	$< 0.25\ \Delta$	ANSI Z87.1, Section 9.5
6.2.9 – Resolving power			Pattern 20	ANSI Z87.1 Section 9.4

6.4 Material Quality

a. Materials used in lenses, frames and headbands shall meet the criteria on durability in Chapter 7, Table 3 of this document.

1 Annex A of EN 172 contains recommendations on the shade in relation to the geographical locations

CHAPTER 7 DURABILITY

7.1 Overview

a. To ensure functionality of eye protection during its service life, criteria limiting the deterioration of components and materials caused by operational use and environmental factors apply. These criteria are formulated in Table 3.

Table 3 Durability criteria and Test Methods

Chapter	Criterion	Test Method	Alternative Criterion	Alternative Test Method
7. – Durability				
7.1 – Scratching of lens	EN 166 clause 7.3.1	EN 168 clause 15	≤6% haze	ANSI/ASTM D 1044 CS1OF on flat samples, calibrase wheels for fifty (50) cycles under a 500 g load.
7.2 – Abrasion of lens	No imperfections, no scratches	ASEN 60068-2-70 ABREX method, 50 strokes at pressure of 10 N with wool felt (outside) and soft wool (inside)		Alternative options: ISO 8980-4 ISO 8980-5 ASTM 1044
7.3 – Adhesion of coating	Rate of Adhesion: 5	Tape Test acc. to ASTM 3359-17		
7.4 – Corrosion of frame	EN 166; clause 7.1.6 (see also 8.8)	EN 168; clause 8		
7.5 – Stability at elevated temperature	EN 166; clause 7.1.5.1 (see also 8.8)	EN 168; clause 5		
7.6 – Resistance to ultraviolet radiation (lenses only)	EN 166; clause 7.1.5.2	EN 168; clause 6		

Chapter	Criterion	Test Method	Alternative Criterion	Alternative Test Method
7.7 – Chemical resistance against lubricants (e.g. gun oil)	MIL-PRF 32432A clause 3.8.3	MIL-PRF 32432A GL clause 4.7.3		
7.8. – Environmental Testing	After combined preconditioning still meet minimum requirement for V_{50}	V_{50} acc. to AEP 2920 after STANAG 4370 AECTP 200 (A1, B3, C1, M3) – 3 cycles in climate chamber (72 hours) and AECTP 300 Method 309 Salt Fog		

CHAPTER 8 EYE CORRECTION

8.1 Overview

a. Eye protection shall be made suitable for use by soldiers with visual impairments by means of an insert for prescription lenses (RX carrier).

b. Compliance with all applicable requirements in this document shall also be ensured when eye protection is worn in conjunction with the RX carrier.

8.2 Design Criteria

a. A universal (RX) carrier must be available for use with prescription lenses in the range of ± 8 dioptres.

b. The RX carrier shall firmly (= resistant to mechanical stress and impact during use) be seated inside the eye protection. The seating shall be such that the pantoscopic tilt of the RX carrier is 15 degrees or less. Negative pantoscopic tilts are not acceptable.

c. The RX carrier is replaceable.

d. The RX carrier shall not affect the distance of the eye protection to the head to ensure that no gaps are created in the protection against fragments or ballistic and mechanical effects.

e. When the RX carrier is used properly, there must be no damage of any kind to the inner side of the protective lens due to mechanical effects (e.g. scratching through contact of the RX carrier or prescription lenses with the protective lens).

f. The vertex distance to the prescription lenses shall minimise eyelash contact.

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CHAPTER 9 COMPATIBILITY

9.1 Overview

a. Eye protection is part of the soldier system and is one of the articles of the Head Borne System. Failure of eye protection to allow for proper integration may be cause for a soldier to reject wearing of ballistic glasses or goggles.

b. When considering integration and compatibility with HBS there are two factors to consider: an item of equipment must not impact the ability of the other components of the HBS to be worn in the prescribed position and the HBS must, in turn, not impede the ability of the other item of equipment to be worn/used properly.

c. To ensure compatibility with a nation/user group specific equipment the NA will specify the articles of the HBS to be worn in combination with eye protection.

9.2 Helmets

a. Eye protection shall allow for the comfortable use of a ballistic helmet. This include ensuring pressure points are minimized and retention straps of both items can be utilized.

b. Some configurations allow the attachment of the eye protection to the helmet; when required the method of attachment (e.g. to the side rail of the helmet) needs to be specified by the NA.

9.3 Weapons

a. Eye protection should allow users to use all issued weapon systems without unnecessary modification or adjustment in all firing positions.

b. When using a weapon system, the eye protection shall allow for the user to achieve a sight picture without any impediment and subsequence effect on performance whilst the eye protection remains in the prescribed position.

9.4 Night Vision Devices

a. The eye protection shall allow the user to wear a night vision device (monocular or binocular) in its optimal position. A minimum eye-relief distance of 25 mm can be used as a guideline.

9.5 Communication Equipment

a. The eye protection shall not affect the effective use of in-ear and on-ear communication devices. The seal achieved around or in the ear should not be affected.

b. The combination of eye protection and communication devices should cause a minimum of discomfort by ensuring pressure points are minimized.

9.6 Hearing Protection

a. The eye protection shall not affect the seal achieved by in-ear and on-ear hearing protection devices.

b. The combination of eye protection and hearing protection devices should cause a minimum of discomfort by ensuring pressure points are minimized.

CHAPTER 10 SAFETY, EFFECTS ON HEALTH AND ENVIRONMENT

10.1 Safety

a. Eye-Protection shall be free from projections, sharp edges or other defects which are likely to cause discomfort or injury during use.

10.2 Health

a. No parts of the eye protection which are in contact with the wearer shall be made of materials which are known to cause any skin irritation.

b. Prolonged wearing of the eye protection shall not cause headaches, dizziness, blurred vision, or undue eye strain/fatigue.

c. Chemicals recognized as human carcinogens shall not be used in the manufacture of eye protection or cleaning agents.

10.3 Environment

a. In producing the eye protection, applicable laws, regulations, administrative rules, and technical rules and standards in the area of environmental and hazardous materials law shall be complied with.

b. To comply with national or department policy the NA shall specify the applicable regulations or requirements on the use of materials in their tender documents.

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CHAPTER 11 ADDITIONAL COMPONENTS

11.1 Storage Case

a. With each eye protection a storage case for holding all components of the eye protection shall be provided. This includes any care and cleaning products necessary for daily operational use, the additional lenses as specified by the NA and a RX carrier.

b. The storage case shall be designed to prevent the ingress of sand, dust and rain.

c. The storage case shall be sufficiently sturdy as to protect the components of the eye protection against drops from 2m height onto concrete surface and the pressure of a soldier laying on top of it.

d. The storage case should be equipped with means for attachment to the soldier's carrying system as specified by the NA.

11.2 Pouches/Sleeve

a. Goggle style eye protection shall have a protective sleeve that is an integral part of the assembly, used to cover the lens when not in use (in storage or on top of helmet).

b. Removable lenses shall be securely stored in the storage case and should be protected from scratching by other components.

11.3 Care and Cleaning Products

a. The contractor shall specify or supply materials for care and cleaning of the eye protection.

b. When necessary to ensure operational life, a topical antifog treatment compatible with the eyewear coatings shall be included.

c. All care and cleaning products shall have no detrimental effect on the operational life of the eye protection.

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CHAPTER 12 SUSTAINMENT

12.1 Operational Life / Storage Life

a. Eye protection lenses and visors shall have an operational life of at least 6 months.

b. Eye protection frames shall have an operational life of at least one year.

c. Lenses and visors shall have a storage life of at least three years.

12.2. Repair

a. The user shall be able to replace damaged lenses without tools.

b. Lenses, frame and storage case should be available as replacement parts as defined by the NA.

12.3 Cleaning

a. It shall be possible for the user to clean eye protection quickly, gently and effectively utilizing manufacturer specified or supplied materials.

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CHAPTER 13 MARKING

13.1 Frame

a. Marking (engraving or label), of the Eye protector shall be clearly readable and durable at a location where it does not affect the functioning of the eye protection.

b. The marking shall provide at least the following information: size and date of manufacture. Applicable laws and regulations may require additional information and are to be specified by the NA in tender documents.

c. In addition to, or in lieu of, a QR code or RFID can be applied.

13.2 Lenses

a. The NA shall prescribe the marking (engraving) of the lens. The terminology used in marking shall adhere to EN 166 section 9.2 or Annex 7 of ANSI/ISEA Z87.1.

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CHAPTER 14 DOCUMENTATION

14.1 Instruction Card

a. A water-proof instruction card for use and care in the respective language shall be delivered with each system.

b. The instruction for use and care shall contain the following information:
- sizing instructions, (in case of multiple sizes);
- instructions for inspection and criteria for replacement of lenses and/or frame;
- how to change and clean the protective lenses;
- how to clean the frame, the nose bridge and the elastic head strap;
- how to adjust the frame's temples and/or the elastic head strap in length;
- how to use the RX carrier.

The respective practical instructions shall be depicted schematically or explained by pictograms.

14.2 Technical Documentation

a. Unless otherwise specified by the NA, technical documentation is to be supplied to the NA.

b. The technical documentation shall include the following information:
- design description;
- performance criteria;
- component and part numbers, markings and NATO Stock Numbers;
- basic drawings of all parts including dimensions, tolerances and materials;
- a complete set of material descriptions.

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CHAPTER 15 TEST FACILITY, CALIBRATION AND EQUIPMENT

15.1 Overview

a. This chapter describes the requirements for the equipment to be used in testing.

b. The equipment shall meet the criteria described or referred to in this document. Before the start of the testing all equipment used shall be checked (correct function, inspection, calibration status, etc.) and when necessary shall be recalibrated.

c. The test facility(s) employed shall provide the equipment(s) necessary to meet the requirements stated in the following chapters.

d. The test facility(s) shall make available, at request, copies of the relevant calibration certification and proof of accreditation of the relevant international test standards.

e. All measurements are in SI units, unless otherwise stated.

15.2 Test Equipment

a. All equipment used to test eye protection shall conform to the specification in the standard referred to.

15.3 Pre-conditioning Equipment

a. All equipment used to condition samples prior to testing shall conform to the specification in the standard referred to.

15.4 Sample Size

a. The sample size testing for tender assessment and research and development activities is to be specified by the NA.

b. The minimum sample size for acceptance testing is at least equal to the number stated in the standard referred to unless otherwise stated.

c. The minimum sample size for lot acceptance testing is to be specified by the NA.

d. The test report shall specify how many samples were tested in total for each requirement and how many failed.

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CHAPTER 16 FIELD USER EVALUATION

16.1 Overview

a. In order to validate compliance of the eye protection to the requirements stated below the NA may set-up a Field User Evaluation. This chapter specifies the basic requirements for this evaluation

b. The eye protection will be subjected to a Field User Evaluation. A representative group of users shall verify the usability and compatibility of the eye protection. The eye protection shall be worn in combination with other head borne and personal equipment while performing unit training, weapons firing, field exercises, and other representative tasks. The field user evaluation shall include highly dynamic movements (low crawling, jumping, running, etc.)

c. Users shall rate the performance of the eye protection on the aspects described below. A minimum (as set by the NA) average score from participating soldiers is required for successful completion of this verification.

16.2 Usability

a. The evaluation shall include an assessment of fit, comfort, stability, ease of changing components, ease of fit, resistance to fogging, ease of cleaning, and overall user acceptance/preference.

b. Goggles will also be assessed for seal, adequacy of strap, ease of adjusting strap.

16.3 Compatibility

a. The evaluation shall include integration trials with the combat helmet while conducting representative tasks. Questions should be administered to assess the fit of the eye protection in combination with the helmet, the comfort and ease of fit. Additional question may be administered to identify any issues, the extent of the issue(s), and the effect of such issues.

b. The evaluation shall include representative dry or live firing in standing, kneeling and prone position while wearing eye protection and helmet. Questions should be administered to assess the effect of the eye protection on the ease of firing and related aspects thereof as the ability

to acquire sight picture/sufficient eye relief and obtaining a stable cheek weld.

c. The evaluation shall include a test in which subjects position night vision devices and are asked whether there is sufficient adjustment to allow them to align the optical axes with their line of sight and whether they could obtain adequate eye relief.

d. Users shall conduct integration trials with communication devices while conducting representative tasks. Questions should be administered to rate any detrimental effect of eye protection on speech transmission, interference by surrounding noise and discomfort. Qualifying questions can be administered to ascertain the level of integration issue and the effect.

e. Users shall conduct integration trials with hearing protection while conducting representative tasks. Questions should be administered to rate any effect of eye protection on the sealing of the hearing protection and discomfort. Qualifying questions can be administered to ascertain the level of integration issue and the effect.

16.4 Ease of Replacing Components and Cleaning

a. The Field User Evaluation shall include a scenario in which users install/remove lenses.

b. The Field User Evaluation shall include a trial in which users install/remove any other components (straps, nose bridge).

c. The Field User Evaluation shall include a trial in which users clean the eye protection in accordance with the user instruction.

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