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# **Test method for protective eyewear for use in floorball**

SP Method 4060:2018

Revisions:

May 2006, item 5.5, Testing impact resistance – the test head has been further specified; test temp. specified as  $20 \pm 5$  °C.

May 2006, item 6, Marking – manufacturing period now also includes the month; the text 'SP-Method 4060' replaces the information on the filter category; now permitted to use a pictogram instead of text for the warning to read the instructions / information.

August 2006, item 4.8 and 5. 8, Points excluded from the method, due to interfering between the requirements scratch resistance and antifogging.

March 2011, item 4.9 and 5. 9, Points excluded from the method, due to due to reassessment of the security risk of fogging.

May 2012, item 4.5 and 5.5, Adding a new dummy head size "CSA child" and an adjustment of the eye region area.

April 2015, Introducing alternative test methods for eye protectors without lenses.

September 2018,. Some changes in conetion to the introduce of Regulation EU/2016/425.

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\* Alternative test method for eye-protectors without lens.

## Preface

Appendix 1 describes the relationship between this test method, EU Directive 89/686/EC and Regulation EU/2016/425.

## 0 Introduction

This test method applies only for protective goggles intended for use in floorball games. The protection level is intended to protect against a direct hit from a ball. The test method does not include testing of protection against a blow from a club, contact with another player and/or a fall, as it is extremely difficult to define suitable protection criteria.

Protective goggles reduce the risk of eye injuries. The requirements for optical quality and light transmittance help to maintain good visual conditions that help to avoid injuries. The mechanical requirements ensure the integrity of protection against impacts. The cover requirement is a compromise between safety and useability, which can result in the goggles not providing full protection, or coming loose, at certain angles.

## 1 Scope

This description sets out requirements and test methods for impact strength, optical defects, optical transparency, Scotoma, penetration, UV filtering, scratch and abrasion resistance, protection against condensation, resistance to ageing and the design of protective goggles intended for use in floorball games.

Goggles can be approved in three sizes: senior, junior and kid.

## 2 References

EN 165:1995	Personal eye protection - Vocabulary
EN 166:2001	Personal eye protection - Specifications
EN 167:2001	Personal eye protection - Optical test methods
EN 168:2001	Personal eye protection - Non-optical test methods
EN 1836:1997/A1:2001	Personal eye protection - Sunglasses and sunglare filters for general use
EN ISO 10256	Head and face protection for use in ice hockey
ASTM F803-01	Standard Specification for Eye Protectors For Selected Sports
Joint Policy Statement	Protective Eyewear for Young Athletes (American Academy of Ophthalmology, American Academy of Pediatrics, via Senior Doctor M. Gjötterberg, St. Erik's Eye Hospital, Stockholm)
Z262.6	Specifications for facially featured headforms

## 3 Definitions

Eye-protector	Protective eyewear of which the main purpose is to protect against impact by the ball.
Frame	part of the eye-protector or spectacle in which the the oculars are mounted. The frame may also be fitted with guards mounted on the side-pieces.

Side-piece	That part of the goggles that rests on the ear. The side-pieces may be adjustable, in order to improve the fit.
Protective glass	The transparent part of the eye-protector, through which the user normally looks.
Mineral safety glass	Glass. May be toughened or not toughened.
Organic safety glass	Plastic material.
Head- or neckband	That part of the eye-protector that is fitted around the head in order to keep the eye-protector in place.
Antireflex treatment	One or more coatings on the lens that reduces reflections resulting from optical interference, and thus increases the transmittance.
Anti-fog treatment	One or more coatings on the lens that reduces the formation of fog.
UV filter	Filter that protects the eye against ultra-violet radiation.
Optical class	Oculars for eye-protection without corrective effect are classified into a maximum of 3 optical classes according to their spherical, astigmatic and prismatic imperfections resulting from manufacture.
Spherical Power	Power of lens with spherical power or mean value of the powers in the two principal meridians.
Astigmatic Power	Difference of the maximum vertex powers in the two principal meridians perpendicular to each other.
Prismatic Power	One hundred times the ratio of the apparent displacement of an object by an optical system to the distance of an object by an optical system to the distance of the object. The dimension of this quantity is 1.
Luminance coefficient	The quotient of the luminance of a surface element in a given direction and the illuminance on the surface. Unit: $\text{cd}\cdot\text{m}^{-2}\cdot\text{lux}^{-1}$ .
Reduced luminance coefficient	The luminance coefficient divided by the transmittance of the filter. Unit: $(\text{cd}\cdot\text{m}^{-2})\cdot\text{lux}^{-1}$ .
Scotoma	Blind spot in the field of vision.
Goniometer	Positioning device that moves the headform such that the angular rotation and movement in both the horizontal and vertical directions enables a spherical scan to be made of the fields of vision as seen through a face protector or visor
Dummy head	A CSA dummy head used for certain tests of the eye-protectors. Three sizes are used: one for adult male, one for juvenile male/adult female and one for child.
Sizes	Eye-protectors can be approved in three sizes: senior, junior, kid
PPE	Personal protective equipment.

## 4 Requirements

### 4.1 Materials

Materials used for eye-protectors intended for use with games of floorball may not be significantly affected by sweat and/or hygiene items. Those parts that are in contact with the wearer's head may not contain materials that could cause skin irritation. In 'Information Provided by the Manufacturer', the manufacturer, or his representative in the EU, shall list the names and concentrations of all substances used in the product that are known to be capable of causing allergies or cancer.

Perform this inspection/test as described below in Item 7.

### 4.2 Comfort and utility

The eye-protector may not come off, or slip such that parts of the protected area become unprotected. There must not be any sharp edges or projecting parts that could catch in something during a game. The side-pieces may be adjustable for a best fit. If the main purpose of a headband or neckband is to keep the eye-protector in position, the band must be at least 10 mm wide. The fitting of a headband or neckband to the eye-protector is not an obligatory requirement, provided that the eye-protector pass this test without a headband or neckband. It must be possible to adopt all normal positions, and make all normal movements, as encountered in floorball, without significant discomfort. Eye-protectors can be approved in two sizes, senior and junior.

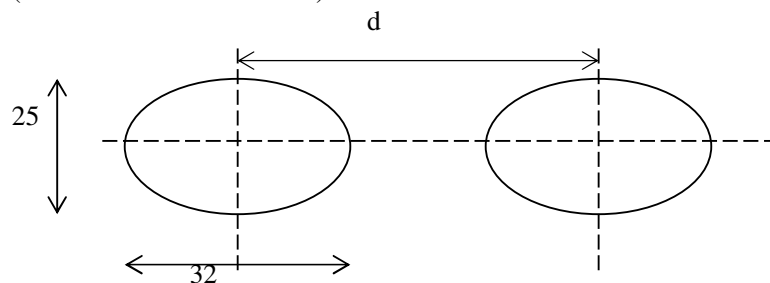
Perform this inspection/test as described below in Item 5.2

### 4.3 Field of view

Define the size of the field of view in relation to the reference head as described in Item 17 of EN 168.

Eye-protectors for use in floorball games shall have a minimum field of view, defined as two ellipses as shown in the figure below, positioned and centred at a distance of 25 mm from the eyes on the reference head. The horizontal axis shall be parallel to and 0.7 mm below the line joining the two eyes. The plane of the ellipses shall be parallel to the rear flat surface of the reference head. The ellipses shall extend 32 mm horizontally and 25 mm vertically. The centre distance between the two ellipses shall be  $d = c + 20$  mm, where  $c$  is the distance between the pupils. Unless otherwise specified by the manufacturer, the distance between the pupils is 64 mm.

(Extract from EN 174:2001)



*Definition of field of view*

## 4.4 Strength

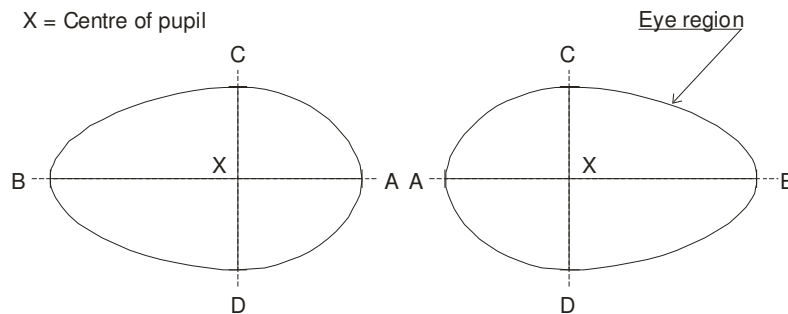
The eye-protector may not show any type of damage after this test. EN 168, Item 3.

## 4.5 Impact resistance

The eye-protector may not show any type of damage after this test, nor may they be in contact with the dummy head (CSA head, adult male 50<sup>th</sup> percentile, juvenile male and adult female and child) inside the eye region.

The eye region is defined by two ellipses where the pupil is the centre, as shown in the figure below. The ellipses shall extend (X – A) and (X – B) mm horizontally and (X – C) and (X – D) mm vertically depending on size of the eye-protector, see table below.

CSA head size	Distance			
	X – A [mm]	X – B [mm]	X – C [mm]	X – D [mm]
Adult	22	32	18	18
Juvenile	20	30	15	15
Child	20	25	15	15



Definition of eye region

## 4.6 Optical properties alternative Scotoma

This test point has two options depending on whether the protective eyewear have or do not have lenses. For eye protection with lenses the test method optical properties will be used and for eye protection without lenses the alternative test method Scotoma.

### Optical properties

The eye-protector shall be designed so that their optical properties / requirements as shown in the table below are fulfilled within the field of view. EN 167, Item 3.

Optical class	Spherical power $m^{-1}$	Astigmatic power $m^{-1}$	Difference in prismatic power		
			Horizontal		Vertical
			Base out, cm/m	Base in, cm/m	cm/m
1	$\pm 0,09$	0,09	0,75	0,25	0,25
2	$\pm 0,12$	0,12	1,00	0,25	0,25

Alternatively, the lenses may be ground by a qualified and registered optician to suit the specific needs of the individual user.

### Scotoma

The eye-protector shall be designed so that there shall be no overlapping bilateral scotomas in the peripheral field of vision. EN ISO 10256, Item 5.4.4.

## 4.7 Optical transmittance alternative determination of penetration characteristics

This test point has two options depending on whether the protective eyewear have or do not have lenses. For eye protection with lenses the test method optical transmittance will be used and for eye protection without lenses the alternative test method determination of penetration characteristics.

### Optical transmittance

Eye-protectors shall be designed such that they have the properties, and fulfil the requirements, in respect of optical transmittance as shown in the table below, taken from EN 167, Items 6 and 7.

Filter category	UV range			Visible range		Infra-red range
	Maximum value for spectral transmittance		Maximum value of UVA transmittance	Light transmittance $t_v$		Maximum infra-red transmittance
	280 nm to 315 nm	315 nm to 350 nm	315 nm to 380 nm	From %	To %	
0	0.1 $t_v$	$t_v$	$t_v$	80.0	100	$t_v$
1				43.0	80.0	

Uniformity of transmittance: any relative differences in transmittance may not exceed 10 %, as measured within a circle of diameter 40 mm around the reference point..

### Determination of penetration characteristics

Eye-protectors shall be designed so that no contact with the dummy head within its designated protected area. (see point 4.5) occur.

## 4.10 Resistance to elevated temperatures

No part of the eye-protector may show any visible distortion when tested in accordance with EN 168, Item 5.

# 5 Testing

## 5.1 General

Performing the tests requires seven complete sets of eye-protectors for each size, junior and senior. However, if a longer test time can be accepted, it is sufficient to have four complete sets of eye-protectors for each size. One set of eye-protector of each size shall be retained as a reference.

### 5.1.1 Conditioning

Store the eye-protectors at a temperature of  $+23 \pm 2$  °C and a relative humidity of  $50 \pm 5$  % for 24 hours before testing, or under conditions, and for a time, as specified in the respective test methods.

### 5.1.2 Test conditions (climate)

Test the eye-protector at a temperature of  $+23 \pm 2$  °C and a relative humidity of  $50 \pm 5$  %, or under conditions, and for a time, as specified in the respective test methods..

## 5.2 Comfort and utility

The eye-protector shall be worn, in accordance with the manufacturer's instructions, by a person who is representative of the size group concerned. He/she shall check that all normal positions and movements as encountered in floorball can be adopted or made without significant discomfort, and that the eye-protectors fit comfortably and do not easily come loose or slip.

Inspect any means of adjustment of the sidepieces intended to improve the fit of the eye-protector, and visually inspect the eye-protector for sharp edges or projecting parts.

## 5.3 Field of view

Test the field of view using a perimeter and dummy reference head, as shown in Figure 2 in EN 174.

Fit the eye-protector so that the two axes of rotation, A and B, together with the geometrical axis C, intersect on the front surface of one eye. Align the beam from a laser, having a beam width of  $1 \pm 0,5$  mm, along the C-axis. Place a transparent screen, centred between the two eyes, at a distance of  $250 \pm 5$  mm from the front surface of the eye. On this screen, draw two ellipses, having a horizontal dimension of 320 mm and a vertical dimension of 250 mm, and with a centre/centre distance of  $d' = c + (200 \pm 1)$  mm between them, where c is the inter-pupil distance of 64 mm unless otherwise specified by the manufacturer. The horizontal axis must be parallel to, and 7 mm below, the line joining the two eyes. The plane of the ellipses must be parallel to the rear flat surface of the dummy reference head.

Rotate the whole around axes A and B, so that the laser beam follows the circumference of the ellipses. In doing so, the beam must not be interrupted by the frame or side-pieces of the goggles.

Repeat this test for each eye.

## 5.4 Strength

Perform this test as described in EN 168, Item 3.

The strength can be measured in two ways: on unmounted lenses or on complete goggles, depending on which is the more suitable when considering the design of the goggles. In either case, perform the test at temperatures of  $+55$  °C and  $-5$  °C, using a steel ball with a diameter of 22 mm and a mass of 43 gram, dropped from a height of 1,3 meter and therefore giving an impact velocity of about 5.1 m/s.



## 5.5 Impact resistance

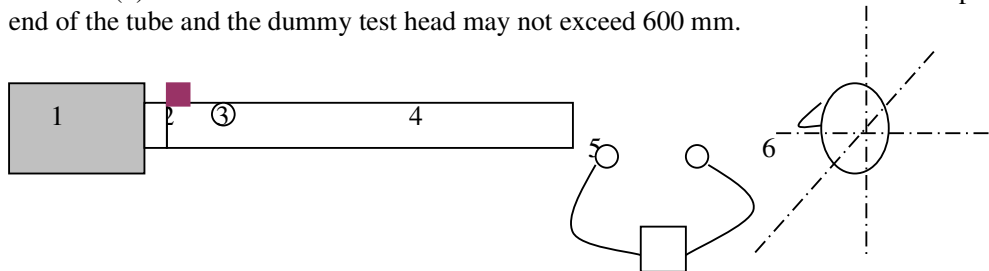
This test method is based on the ASTM F803 and EN ISO 10256 standards, and tests the efficiency of the eye-protectors in protecting against a strike by a ball.

The principle is based on firing a floorball ball (see specification below) at a velocity of  $(36 \pm 2 \text{ m/s})$  at a number of specified positions on the eye-protector fitted to a dummy test head (CSA head, adult male 50<sup>th</sup> percentile, juvenile male/adult female and child). As the impact velocity is important, the velocity of the ball must be measured each time it is fired, and must be within the limits given above. The uncertainty of measurement must not exceed 0,5 m/s. If the measured velocity falls outside the permitted range, the test must be regarded as failed, and must be repeated.

Perform the test as described and shown below, in a laboratory at a temperature of  $20 \pm 5 \text{ }^\circ\text{C}$ .

- Fit the eye-protector to a dummy test head, positioning them for the best fit.
- Place a piece of carbon paper inside the eye-protector, to indicate any penetration or deformation of the eye-protector resulting from the impact. Alternatively, equivalent methods using crack indicator spray or modelling clay may be used.
- Use a new set of eye-protectors after each impact. Three sets of eye-protectors must have successfully passed this test for the results to be approved.
- Position the dummy test head as required in order to meet the following impact position requirements:
  - the optical centres of the lenses;
  - the hinges of the side pieces, at  $90^\circ$  impact angle;
  - any other positions regarded as critical when considering the design of the eye-protectors.
- Inspect the eye-protector for any damage after this test.
- Inspect the eye region of the dummy head, looking for contact marks. If there is any doubt over interpretation of the results, repeat the tests.

The test equipment consists of a pressure vessel (1) for compressed air, an air valve (2), a pressurising valve (3), a tube (4), a sensor (5) for measuring the velocity, and a dummy test head (6) which can be rotated around its vertical axis. The distance between the open end of the tube and the dummy test head may not exceed 600 mm.



Ball specification (ball without holes):

- Diameter:  $72 \pm 1 \text{ mm}$
- Mass:  $23 \pm 1 \text{ g}$

## 5.6 Optical properties alternative Scotoma

This test point has two options depending on whether the protective eyewear have or do not have lenses. For eye protection with lenses the test method optical properties will be used and for eye protection without lenses the alternative test method Scotoma.

### Optical properties

Perform this test as described in EN 167, Item 3.

The optical properties to be tested relate to spherical, astigmatic and prismatic powers. Measurements can be made using an optical test bench, or using the projection method described in the standard. Position the lens/lenses in whichever type of test equipment is used in such a way as to simulate the direction of view of a person wearing the eye-protector.

### Scotoma

Method for measuring bilateral scotoma Perform this test as described in EN ISO 10256, Annex D.

## 5.7 Optical transmittance determination of penetration characteristics

This test point has two options depending on whether the protective eyewear have or do not have lenses. For eye protection with lenses the test method optical transmittance will be used and for eye protection without lenses the alternative test method determination of penetration characteristics.

### Optical transmittance

Perform this test as described in EN 167, Items 6 and 7.

Measure the transmittance along the visual axis of the lens and perpendicular to the surface of the lens. If the visual axis of the lens is not defined, make the measurement along the geometrical centre of the lens.

Investigate the uniformity of transmittance using a beam diameter of 5 mm over the surface of the lens, except for a 5 mm wide band around the edge of the lens, which is not investigated.

### Determination of penetration characteristics

Fit the eye-protector to a dummy test head, positioning them for the best fit. Attempt to make contact with the dummy head by trying to enter a Floorball ball, in principle without force, through all of the openings of the eye protector within its designated protected area.


## 5.10 Resistance to elevated temperatures

Perform this test as described in EN 168, Item 5.

Measure the resistance to elevated temperatures on a complete set of eye-protectors.

## 6 Marking

Each set of eye-protector shall be marked so that the following information can be easily read by the user throughout the expected life of the product:

- a) Product name or manufacturer's name
- b) Model name (if applicable)
- c) Size ("Senior", "Junior" or "Kid")
- d) Manufacturing period (year and quarter/month)
- e) The text 'SP Method 4060'
- f) Instruction to read the instructions/information provided by the manufacturer by means of this symbol , which can be downloaded from SP's web site.
- g) The text 'For Floorball Use'

The use of symbols is preferred to that of text.

Text shall be written in the official language or languages of the country in which the goggles are intended to be sold.

## 7 Information to be supplied by the manufacturer

The following information shall be provided with each pair of eye-protectors in the official language or languages of the country of use.

### Manufacture's instructions and information

- a) A description of what risk(s) the eye-protector is designed to protect against.
- b) Name and address of the manufacturer and/or the manufacturer's representative within the EU.
- c) Instructions for cleaning, storage and care.
- d) A warning against the use of unsuitable cleaning materials.
- e) Instructions for suitable handling for transport and storage.
- f) Instructions on putting on and taking off the eye-protector, and on how to adjust them to a correct fit.
- g) Advice that it is important that the eye-protector should fit well and securely.
- h) Information on the limitations of protection provided by the eye-protector, i.e. that they are intended only to protect the face when playing floorball with a light ball. The eye-protectors are not approved for protecting against the shocks of a fall etc.
- i) Instructions on what approved spare parts are available, and on any approved accessories (if available).
- j) A recommendation to inspect the eye-protector for damage before use, and not to use the eye-protector if there is any damage that could reduce their protection or cause injury to the user or to any other person.
- k) If the manufacturer claims that the life of the eye-protector is limited, the recommended date after which the eye-protector should not be used must be shown.
- l) An explanation of the markings on the eye-protector.

- m) The meaning of any symbols used in the marking.
- n) A reference to Regulation EU/2016/245.
- o) Name and address of the Notified Body that has performed EU type testing .
- p) A reference to this test method (SP Method 4060).
- q) The internet address where the EU declaration of conformity can be accessed.

## **8 Report**

Each test report shall contain at least the following information

### **8.1 Name and address**

The name and address of the test laboratory, with details of the place of testing if this differs from the laboratory's address.

### **8.2 Identification**

Clear identification of the test report and of each page of it, together with indication of the total number of pages in the report.

### **8.3 The client**

The name and address of the client.

### **8.4 Item for testing**

Description and identification of the item tested.

### **8.5 Dates**

The date of arrival of the item for testing, together with the date of performing the tests and the date of issue of the report.

### **8.6 Test method**

Description and identification of the test method(s) and/or procedure(s).

### **8.7 Sampling**

When appropriate, a description of the method of sampling of the product.

### **8.8 Non-compliances, additional requirements or exceptions**

Information on each non-compliance, additional item or requirement, or exception from the method of testing.

### **8.9 Results**

Details of measurements and results, supported where applicable by tables, diagrams, etc., and by information on observed defects, faults, non-compliances etc.

## **8.10 Signature**

Signature of the person responsible for the tests, with his/her title or equivalent confirmation.

## **8.11 The report**

A statement that, without written permission from the test laboratory, the report may not be reproduced other than in its entirety.

## Appendix 1: The relationship between this test method and Regulation EU/2016/425

Regulation (EU) 2016/425, Appendix 2		Section in this Test Method	Refers to standard:
1.1	Design principles		
1.1.1	Ergonomics	4.2	EN 166/6
1.1.2	Levels and classes of protection		
1.1.2.1	Optimum level of protection		
1.1.2.2	Classes of protection appropriate to different levels of risk		
1.2	Innocuousness of PPE		
1.2.1	Absence of inherent risks and other nuisance factors		
1.2.1.1	Suitable constituent materials	4.1	EN 174/4.2
1.2.1.2	Satisfactory surface condition of all PPE parts in contact with the user	4.2	EN 166/6
1.2.1.3	Maximum permissible user impediment	4.2	EN 166/6
1.3	Comfort and effectiveness		
1.3.1	Adaptation of PPE to user morphology	1 4.2	EN 166/6
1.3.2	Lightness and strength	4.4; 4.5	EN 174; EN 168; ASTM
1.4.	Manufacturer's instructions and information	7	EN 166/10
2.1.	PPE incorporating adjustment systems	4.2; 7	EN 166/6; 10
2.2.	PPE enclosing the parts of the body to be protected	4.2	EN 166/6
2.3.	PPE for the face, eyes and respiratory organs	0; 1	All
2.4.	PPE subject to ageing	4.10; 5.10; 7	EN 168/5
2.9.	PPE incorporating components which can be adjusted or removed by the user	7	EN 166/10
2.12.	PPE bearing one or more identification markings or indicators directly or indirectly relating to health and safety	6; 7	EN 166/9; 10
2.13.	PPE capable of signalling the user's presence visually		
2.14.	Multi-risk PPE	0; 1; 7	EN 166/10
3.1.	Protection against mechanical impact		
3.1.1.	Impact caused by falling or ejected objects, and collisions of parts the body with an obstacle	4.5; 5.5	EN 168/4; ASTM F803-01
3.3.	Protection against mechanical injury		
3.9.	Radiation protection		
3.9.1.	Non-ionising radiation	4.7	EN 1836/4; EN 167/6.7