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ISO 18526-3:2020



Australian/New Zealand Standard™

Eye and face protection — Test methods

Method 3: Physical and mechanical properties



AS/NZS ISO 18526.3:2021

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Eye and face protection — Test methods

Method 3: Physical and mechanical properties

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Preface

This Test Method was prepared by the Joint Standards Australia/Standards New Zealand Committee SF-006, Eye and Face Protection.

The objective of this document is to specify the reference test methods for determining the physical and mechanical properties of eye and face protectors.

This document does not apply to any eye and face protection products for which the requirements standard(s) specifies other test methods.

Other test methods can be used if shown to be equivalent and include uncertainties of measurement no greater than those required of the reference method.

This document is identical with, and has been reproduced from, ISO 18526-3:2020, *Eye and face protection — Test methods — Part 3: Physical and mechanical properties*.

As this document has been reproduced from an International Standard, a full point substitutes for a comma when referring to a decimal marker.

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The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by ISO/TC 94, *Personal safety — Personal protective equipment*, Subcommittee SC 6, *Eye and face protection*.

This first edition of ISO 18526-3:2019 cancels and replaces ISO 4855:1981, which has been technically revised.

A list of all parts in the ISO 18526 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This family of documents was developed in response to the worldwide stakeholders' demand for minimum requirements and test methods for eye and face protectors traded internationally. ISO 4007 gives the terms and definitions for all the various product types. The test methods are in the ISO 18526 series, while the requirements for occupational eye and face protectors are in the ISO 16321 series. Eye protection for specific sports is mostly dealt with by the ISO 18527 series. A guidance document, ISO 19734¹⁾, for the selection, use and maintenance of eye and face protectors is in preparation.

1) Under preparation. Stage at the time of publication: ISO/CD 19734:2020.

NOTES

Australian/New Zealand Standard

Eye and face protection — Test methods

Method 3: Physical and mechanical properties

1 Scope

This document specifies the reference test methods for determining the physical and mechanical properties of eye and face protectors.

This document does not apply to any eye and face protection products for which the requirements standard(s) specifies other test methods.

Other test methods can be used if shown to be equivalent and include uncertainties of measurement no greater than those required of the reference method.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 48-2, *Rubber, vulcanized or thermoplastic — Determination of hardness — Part 2: Hardness between 10 IRHD and 100 IRHD*

ISO 4007, *Personal protective equipment — Eye and face protection — Vocabulary*

ISO 18526-2:2020, *Eye and face protection — Test methods — Part 2: Physical optical properties*

ISO 18526-4, *Eye and face protection — Test methods — Part 4: Headforms*

ISO 18527-2, *Eye and face protection for sports use — Part 2: Requirements for eye protectors for Squash and eye protectors for Racquetball and Squash 57*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4007 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Preparatory information

Before testing, refer to the product's requirement standard for the information needed to apply the tests in this document, for example:

- the number of test samples²⁾;
- preparation of test samples;
- the selection of test samples (if included in this document);
- any prior conditioning or testing;

2) For the purpose of this document, "test sample" is taken to be the object under test, e.g. "lens", "filter", or "complete protector" as specified in the product's requirements standard.

- test method (if more than one are included in this document);
- any deviations from the method(s);
- characteristics to be assessed subjectively (if appropriate);
- pass/fail criteria.

5 General test requirements

Unless otherwise specified, the values stated in this document are expressed as nominal values. Except for temperature limits, values that are not stated as maxima or minima shall be subject to a tolerance of ± 5 %.

Unless otherwise specified, the ambient temperature for testing shall be between 16 °C and 32 °C but if any temperature limits are specified, these shall be subject to an accuracy of ± 2 °C. Relative humidity shall be maintained at (50 ± 20) %.

Unless otherwise specified, the test samples shall be tested at the reference points (for testing) as defined in ISO 4007.

The tests shall be performed by trained observers.

For each of the required measurements performed in accordance with this document, a corresponding estimate of the uncertainty of measurement shall be evaluated in accordance with [Annex A](#).

6 Physical test methods

6.1 Physical inspection

6.1.1 Principle

This test is intended to demonstrate that prior to applying any other test methods, the protector is free from visible defects or sharp edges.

6.1.2 Procedure

The test shall be carried out as follows:

- Inspect the mounting and surfaces of the lens of the complete test sample.
- Inspect all exposed surfaces of the protector for projections regarding sharp edges or other features that are likely to cause discomfort or injury to the wearer or interfere with vision.

6.1.3 Test report

Record surface and internal defects detected in the lenses and other components of the test sample that are likely to cause discomfort or injury to the wearer or interfere with the wearer's vision.

6.2 Field of view

6.2.1 Principle

This test is intended to demonstrate that the protector provides a minimum field of view for the wearer.

6.2.2 Apparatus

6.2.2.1 Headform, according to ISO 18526-4.

6.2.2.2 Goniometric device, to determine the rotation of the headform ([6.2.2.1](#)) in the horizontal and vertical planes.

NOTE A type A or type B goniometer can be used for purely horizontal or purely vertical measurements, see References [\[2\]](#) and [\[3\]](#).

6.2.2.3 CW-laser, emitting light in visible range, with beam diameter (2 ± 1) mm.

6.2.2.4 Detector, placed at the corneal vertex of the headform ([6.2.2.1](#)).

6.2.3 Procedure

The test shall be carried out as follows:

- Mount the test sample on the headform in accordance with the fitting information supplied by the manufacturer.
- Set the goniometric device to indicate 0° in the horizontal and vertical directions, with its axes of rotation passing through the right corneal vertex position of the headform. The angular setting of the goniometer shall be made with an uncertainty of measurement not exceeding 1° .
- Direct the laser beam so that it passes through the corneal vertex position of the right eye of the headform, along the horizontal line perpendicular to the facial plane of the headform.

NOTE Laser source and detector position are interchangeable.

- Rotate the headform to the left about the vertical axis to the position where the edge of the lens or the mounting prevents half of the laser beam from reaching the corneal vertex position. This is the temporal field of view. Record the angle to the nearest degree.
- Repeat by rotating the headform to the right to establish the nasal field of view.
- Return the headform to the 0° setting in the horizontal. Rotate the headform down to establish the superior field, and up for the inferior field.
- Repeat for the left eye.
- For a protector fitted with a single lens to cover both eyes, the field to the right should be measured as the temporal field for the right eye, the field to the left should be measured as the temporal field for the left eye; the superior and inferior fields may be measured for either eye.

6.2.4 Test report

Record the angular size of the temporal, nasal, superior and inferior fields of view of each lens of the test sample. For a single lens covering both eyes, record the right, left, superior and inferior fields of view.

6.3 Area to be protected — Assessment from the frontal direction

6.3.1 Principle

This test is intended to demonstrate that the protector satisfies the frontal protection requirement by showing that there is no direct path from the front to the area to be protected.

6.3.2 Apparatus

6.3.2.1 Headform, according to ISO 18526-4.

6.3.2.2 Steel rod, 2 mm nominal diameter, (125 ± 25) mm long with a flat, untapered, end.

6.3.3 Procedure

The test shall be carried out as follows:

- Mount the test sample on the specified headform ([6.3.2.1](#)) in accordance with the information to be supplied by the manufacturer, if provided.
- Mount the steel rod ([6.3.2.2](#)) horizontally and perpendicular to the line joining the corneal vertices.
- Probe to the limits of the area to be protected specified in the applicable product requirement standard, attempting to touch the surface of the headform.
- If the position of the test sample in front of the face of the headform is adjustable, carry out the assessment at the largest wearing distance for the specified headform.

6.3.4 Test report

Report whether or not the test sample prevents any portion of the end of the rod from touching the specified area to be protected on the headform.

6.4 Area to be protected — Assessment from the lateral direction

6.4.1 Principle

This test is intended to demonstrate that the protector satisfies the lateral protection requirement by showing that there is no direct path from the side to the area to be protected.

6.4.2 Apparatus

6.4.2.1 Headform, according to ISO 18526-4.

6.4.2.2 Steel rod, 2 mm nominal diameter, (125 ± 25) mm long with a flat, untapered, end.

6.4.3 Procedure

The test shall be carried out as follows:

- Mount the test sample on the headform ([6.4.2.1](#)) in accordance with the information to be supplied by the manufacturer, if provided.
- Mount the steel rod ([6.4.2.2](#)) horizontally and parallel to the line joining the corneal vertices.
- Repeat the procedure of [6.3.3](#) from the lateral direction on both sides of the test sample.

6.4.4 Test report

Report whether or not the test sample prevents any portion of the end of the rod from touching the specified area to be protected on the headform.

6.5 Retention by headbands and harnesses (sit and fit)

6.5.1 Principle

This test is intended to demonstrate that the protector fits comfortably and securely throughout a number of physical movements.

6.5.2 Procedure

The test shall be carried out as follows:

- The test sample shall be donned by two different trained observers and adjusted appropriately.
- When wearing the test sample, undertake the following accelerated movements, starting from a standing position:
 - turn head left and right;
 - tilt head back and forward;
 - standing jump on the spot five times.

6.5.3 Test report

Record any significant physical discomfort or insecurity of the fit of the test sample.

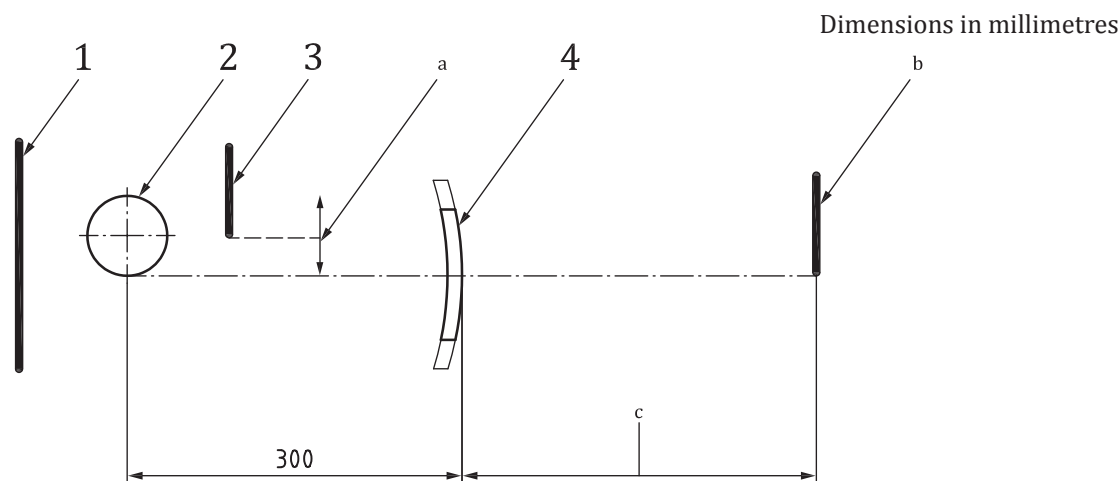
6.6 Visual assessment of material and surface quality of lenses

6.6.1 Principle

This test is intended to demonstrate that the material and surfaces of the lenses of a protector are free from visible defects.

6.6.2 Apparatus

A suitable apparatus is shown in [Figure 1](#).



Key

- | | | | |
|---|---|---|--------------------------------------|
| 1 | matt black background (150 mm × 360 mm) | a | Range of adjustment. |
| 2 | diffuse linear light source ≥400 lm | b | Plane of the trained observer's eye. |
| 3 | adjustable opaque shade or mask | c | Unobstructed vision, ≈400 mm. |
| 4 | movable test sample | | |

Figure 1 — Arrangement of apparatus for assessment of quality of material and surface

6.6.3 Procedure

The test shall be carried out as follows:

- Assess the quality of material and surfaces of the lens(es) of the test sample by visual inspection with the aid of an apparatus such as that in [Figure 1](#).
- Illuminate the lens by means of the diffuse linear light source and adjust the amount of illumination by means of the adjustable opaque black mask.
- Except for a marginal area 5 mm wide at the edge of the lens, record the presence of defects that would be likely to impair vision. Examples of defects include bubbles, scratches, inclusions, dull spots, striae, pitting, mould marks, scouring, grains, pocking, scaling and undulation.

NOTE An alternative method of inspection in current use consists of an illuminated grid as a background to be viewed through the lens which is held at various distances from the eye.

6.6.4 Test report

Record the presence of defects within the area to be inspected according to the product's requirement standard.

6.7 Resistance to thermal exposure

6.7.1 Principle

This test is intended to determine the ability of the components of the protector to resist deformation after exposure to high temperature in the environment.

6.7.2 Procedure

The test shall be carried out as follows:

- Place the complete test sample in an oven preheated to the specified temperature and maintain at this temperature for the prescribed time.
- Remove the test sample from the oven and immediately examine its components for indication of deformation.

6.7.3 Test report

Record any instances of deformation of components of the complete test sample.

6.8 Resistance to ultraviolet radiation

6.8.1 Principle

This test is intended to determine the ability of the lenses or filters to resist damage due to exposure to high intensity ultraviolet radiation. The test may be carried out for ultraviolet radiation from solar and/or artificial sources.

6.8.2 Solar ultraviolet radiation

6.8.2.1 Apparatus

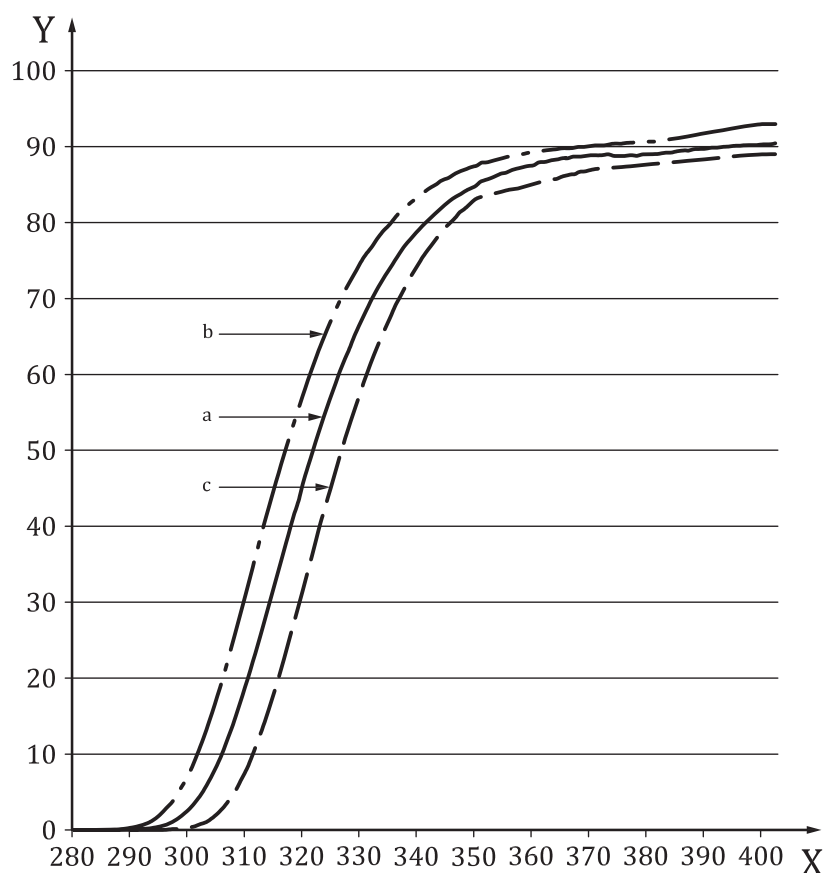
6.8.2.1.1 Fused-silica envelope high-pressure xenon lamp.

- The power of the lamp shall be between (450 ± 50) W.
- The spectral transmittance of the lamp envelope shall be at least 30 % at 200 nm.
- New lamps shall be burned in for at least 150 h.

The lamp shall not be used after 2 000 h of operation.

NOTE A suitable lamp reference is XBO-450 OFR.

6.8.2.1.2 Long wavelength pass filter, with the spectral transmittance shall be as defined in [Figure 2](#) and [Annex B](#), placed between the lamp and the test sample. A shift of ± 5 nm is permitted.



Key

- X wavelength, in nm
- Y spectral transmittance, in %
- a Nominal value.
- b Upper limit.
- c Lower limit.

NOTE The cut-on $\lambda_c = 320$ nm is defined as the wavelength at which $\tau_{\lambda,c} = 46$ %.

Figure 2 — Spectral transmittance of the long wavelength pass filter

6.8.2.2 Procedure

The test shall be carried out as follows:

- Stabilize the lamp current at $(25,0 \pm 0,2)$ A.
- The air temperature in the immediate area of the test sample shall be (28 ± 5) °C.
- Expose the front surface of the test sample to radiation from the lamp. The angle of incidence of the radiation on the test sample's front surface shall be essentially perpendicular. The distance from the axis of the lamp to the nearest point on the test sample shall be (300 ± 10) mm. The exposure time shall be $(50,0 \pm 0,2)$ h at a lamp power of (450 ± 50) W unless otherwise specified in the requirements.

NOTE 1 It is deemed that the required irradiation will be fulfilled, without calibration or further verification, provided that the specified apparatus and test methods are applied.

NOTE 2 This test method can be used as a conditioning exposure for other test methods.

6.8.2.3 Test report

Record any damage that occurs.

6.8.3 Ultraviolet radiation from artificial sources

6.8.3.1 Apparatus

6.8.3.1.1 Fused-silica envelope high-pressure xenon lamp.

- The power of the lamp shall be between (450 ± 50) W.
- The spectral transmittance of the lamp envelope shall be at least 30 % at 200 nm.
- New lamps shall be burned in for at least 150 h.

The lamp shall not be used after 2 000 h of operation.

NOTE A suitable lamp reference is XBO-450 W/4.

- The lamp housing shall be vented to prevent exposure of the operator to ozone generated by the lamp.

6.8.3.2 Procedure

The test shall be carried out as follows:

- Stabilize the lamp current at $(25,0 \pm 0,2)$ A.
- The air temperature in the immediate area of the test sample shall not exceed (28 ± 5) °C.
- Expose the front surface of the test sample to radiation from the lamp. The angle of incidence of the radiation on the test sample's front surface shall be essentially perpendicular. The distance from the axis of the lamp to the nearest point on the test sample shall be (300 ± 10) mm. The exposure time shall be $(50,0 \pm 0,2)$ h at a lamp power of (450 ± 50) W unless otherwise specified in the requirements.

NOTE 1 It is deemed that the required irradiation will be fulfilled, without calibration or further verification, provided that the specified apparatus and test methods are applied.

NOTE 2 This test method can be used as a conditioning exposure for other test methods.

6.8.3.3 Test report

Record any damage that occurs.

6.9 Resistance to corrosion

6.9.1 Principle

This test is intended to determine the capability of metal components that are attached or fixed to any protector to resist corrosion. This test method does not apply to lenses (including those with metalized coatings) and electrical equipment, such as in automatic welding filters.

6.9.2 Reagents and materials

6.9.2.1 Boiling saline solution and saline solution at ambient temperature.

Both solutions shall be in containers of sufficient dimensions to submerge the metal parts. The saline solution shall contain 10 % by mass of technical or higher grade NaCl (sodium chloride) in deionised/distilled water.

6.9.3 Procedure

The test shall be carried out as follows:

- Using a clean dry cloth, clean the test sample's metal parts to remove all contamination, particularly oil and grease.
- Immerse the test sample for (15 ± 1) min in an aqueous boiling saline solution.
- Remove the test sample from the boiling saline solution and immediately immerse in the saline solution at ambient temperature for (15 ± 1) min.
- After removal from the saline solution at ambient temperature and without wiping off the adhering liquid, the test sample is allowed to dry for (24 ± 1) h at (23 ± 5) °C.
- The metal parts are then rinsed in lukewarm water and left to dry before inspection.

6.9.4 Test report

Report on whether metal parts of the test sample are functionally impaired by corrosion or if some metallic parts that might come in contact with the wearer's face in normal use show signs of corrosion.

6.10 Resistance to ignition

6.10.1 Principle

The test is intended to show that specified components of the protector resist ignition.

6.10.2 Apparatus

6.10.2.1 Steel rod, (300 ± 50) mm long and $(6,0 \pm 0,5)$ mm diameter with end faces that are flat and perpendicular to its longitudinal axis.

6.10.2.2 Heat source.

6.10.2.3 Thermocouple and temperature indicating device.

6.10.2.4 Timer, capable of measuring an elapsed time of 10,0 s with a resolution of $\pm 0,1$ s.

6.10.3 Procedure

All batteries and electronic parts likely to explode should not be subjected to testing.

The test shall be carried out as follows:

- Heat one end of the steel rod ([6.10.2.1](#)) over a length of at least 50 mm to a temperature of (650 ± 20) °C.

For routine testing, the steel rod may initially be heated in an oven/furnace to a greater temperature, e.g. around 900 °C. After removal, the temperature of the steel rod should be measured by means of the thermocouple ([6.10.2.3](#)) attached at a distance of (20 ± 1) mm from the heated end of the steel rod.