Protective Eyewear suite of standards

White paper

BS EN ISO 16321-1:2022+A1:2025
BS EN ISO 16321-2:2021 and
BS EN ISO 16321-3:2022

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Contents

Introduction

The Protective Eyewear standards EN ISO 16321-1:2022, EN ISO 16321-2:2021 and EN ISO 16321-3:2022 were published a couple of years ago, replacing the main standard for eye protection in Europe, EN 166:2001. EN 166 has been the norm for certification of safety eyewear for over 20 years without any changes since its publication in 2001.

The presumption of conformity for both the EU and UK for products certified to EN 166 will no longer apply after 11 November 2025. After this date, new products and certificates that have expired will need to meet the ISO 16321 standard. The new suite of standards EN ISO 16321:2022 Parts 1 to 3 replace BS EN 172:1995, BS EN 169:2002, BS EN 170:2002, BS EN 171:2002, BS EN 166:2002 and BS EN 379:2003+A1:2009, which have also been withdrawn.

There are significant differences between the old EN 166 requirements and test methods and those outlined in the new EN ISO 16321 series of standards. All eyewear manufacturers will need to familiarize themselves with these changes so that their products can be designed and manufactured to meet the new criteria.

First and foremost, the scope of the standard has changed compared to what was covered by EN 166:2001. The EN ISO 16321 series applies only to plano and prescription glasses for occupational use or use in educational establishments. The ISO 16321-1 standard is scheduled to be updated to ISO 16321-1:2022+A1:2025. A detailed summary of the amendments will be provided in due course.

The standard now excludes

- Face protectors intended for live working to protect against short-circuit electric arcs, laser protectors,
- Sports eyewear,
- Protectors for use during medical applications,
- Protectors for medically prescribed applications,
- Protectors specifically intended for protection against solar radiation and protectors intended to protect against ionizing radiation.

There are separate standards to cover these specific use devices.

What’s new in EN ISO 16321-1:2022+A1:2025 Eye and face protection for occupational use – Part 1: General requirements

Headforms

A new range of EN ISO 18526-4:2020 headforms has been introduced to the EN ISO 16321 series of eyewear standards. The change to new headforms has the biggest impact on the standard, as it affects every measurement, test and clause. There are six different sizes of headform available for testing, with 1-M as the default size. These six headforms represent approximately 95% of the world’s population, having been developed following a great deal of intensive international research and covers three age ranges, both genders, and five ethnic groups: White, African, American, Hispanic, and Other.

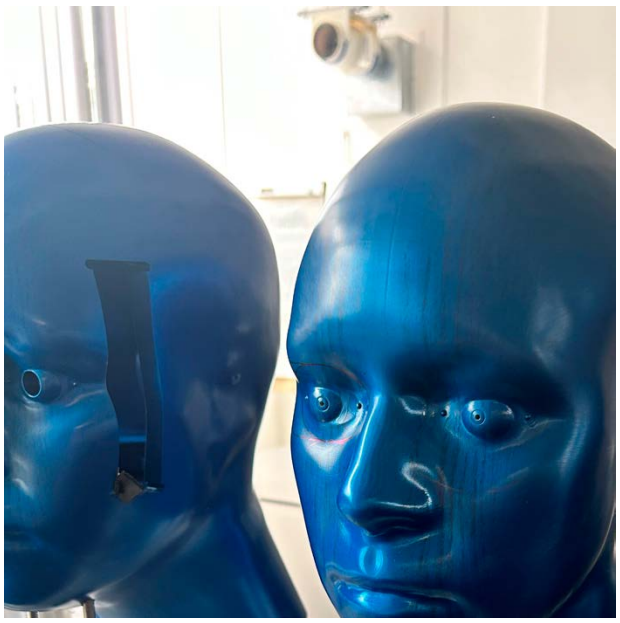
The headform that is selected and used for testing under the new standard will be specified in a product’s user instructions, providing end users with helpful information and to enable a good fit.

Previously, EN 166:2001 specified just two headform sizes: ‘medium’ and ‘small’, and the majority of testing was performed on the medium size.

The new standard,s designated headform sizes are:

Small	Medium	Large
1-S	1-M	1-L
2-S	2-M	2-L

Example of EN ISO 18526-4:2020 Headform 1-M:



Optical requirements

Field of view

Field of view is the measurement of the required unobstructed vision in front of each eye. The test is one of the mandatory clauses applicable to all eyewear. This is because any reduced distance vision, restricted field of view or peripheral blur would indicate potential safety issues with the product.

The new measurement of field of view uses the Goniometric method of assessment. This allows measurements to be taken from many more points of reference to ensure there is no restriction to the natural field of vision for the wearer, setting a minimum field of view of 30o in all directions. The test method used for EN 166:2001 was ellipses placed in front of the eye on the headform, which made testing very subjective as test engineers would have to judge pass/fail criteria based on their own observation.

The field of view requirement also includes new specific criteria for when the eye protectors are to be used for driving.

Luminous transmittance

The luminous transmittance requirement for lenses without deliberate filter action under the new EN ISO 16321-1:2022 is for lenes to allow above 80% transmitted light. For face shields with a lens thickness of more than 2mm and for multiple glazed eye protectors, the luminous transmittance shall be not less than 75%.

This is a change from the EN 166 where the requirement for luminous transmittance was the same for all lenses and greater than 74.4%.

Scattered light

The requirement for all eye protectors is that they should be free of diffusely transmitted light as far as reasonably practicable. Many different lens materials used in safety eyewear may contain inhomogeneities, therefore the test requirement for scattered light is setting a minimum standard to ensure quality of vision. Under EN 166:2001 this feature was covered by measuring small-angle scatter, or light diffusion.

The new standard specifies a different measurement method, wide-angle scatter (haze). The requirement applies to all eye protectors, except welding filters, which are still tested using the small-angle scatter, as the haze method is unsuitable for dark filters.

There is little correlation between these two methods so test results from EN 166:2001 are not valid to meet the new standard requirement.

Physical requirements

Headbands and harnesses

The new requirement is only applicable to eye protectors that incorporate a headband or a harness.

Under the new standard, the requirement for a 10mm wide headband has been replaced by a ‘sit and fit test’, which is a practical performance test. The fit test is intended to demonstrate that the protector, when using a headband or harness, fits comfortably and securely through a number of physical movements including turning the head left and right, tilting the head back and forth, and jumping on the spot.

Basic impact

There is a requirement for all eye protectors to achieve at least the basic level of protection from impact. The impact requirements were detailed in the old EN 166:2001 standard as increased robustness, whereas the new ISO 163321-1 equivalent is the ‘basic impact’ test. The table below shows that there are significant differences in the steel ball characteristics between the old and new standards.

EN 166:2001 Steel ball measurements	EN ISO 16321-1 Steel ball measurements
22 mm diameter	25 mm diameter
43 grams	66 grams

High-speed impact

A high-speed impact resistance test is an optional requirement applicable to all protective eyewear. Under EN 166:2001, test requirements were defined by the type of eye-protector – spectacles, goggles or face shields, with low (F), medium (B) and high (A) energy impacts. Under the new standards there has been a change to the velocity speeds and the introduction of three new impact levels: C, D and E.

See the table below for details.

Under the new standard there is an additional requirement for minimum coverage areas called protection zones: OPZ, EOZ and FPZ. The higher the impact speed, the larger the area of coverage required.

Velocity of the ball	$\left(45 + \frac{1,5}{0}\right)$ m/s	$\left(80 + \frac{2,0}{0}\right)$ m/s	$\left(120 + \frac{3,0}{0}\right)$ m/s
Impact level	C	D	E
Minimum area to be protected	Orbital protection zone (OPZ)	Orbital protection zone (EPZ)	Face protection zone (FPZ)

High mass impact

The high mass impact is an optional test for those eyewear devices that offer protection against high mass objects moving at a moderate speed. The requirement was taken from American standard ANSI Z87.1, but as far as European standards are concerned this is a new requirement. The high mass impact test is conducted with two impact points, frontal left and frontal right, with a pointed steel projectile weighing 500g.

Resistance to thermal exposure

The resistance to thermal exposure is not a new test requirement, but it is an equivalent to the ‘stability at elevated temperature’ test, as referenced in the EN 166:2001 standard. This requirement is for all eye protectors to withstand deformation of any part when being exposed to high temperature in the environment of their use. The main change is the duration of thermal exposure, which at 120 minutes is double that of the old standard.

Penetration of vents and gaps

The penetration test introduced within the EN ISO 16321-1:2022 is a brand new test requirement, which applies to eye protectors that have ventilation or gaps between their components. The opening is tested with a rigid rod to ensure the opening is no larger than 1.5mm in diameter.

Area to be protected

This is a new requirement for all mandatory testing to basic level, but the area of protection changes depending on the declared impact level options.

Optional requirements

It is important to note that there are a number of new optional requirements within EN ISO 16321-1:2022, some of which were not included in the old standard. Optional requirements get assessed only if they are applicable to the type of protector or the special protection characteristics are claimed by the manufacturer.

Optional requirements include:

- resistance against fogging
- resistance to surface damage by fine particles
- protection against gases and fine dust particles
- protection against large dust particles
- protection against molten metals and hot solids
- high mass impact NEW
- protection against radiant heat NEW
- protection against streams of liquids NEW
- lens assessment for anti-reflective coatings NEW
- use in explosive atmospheres NEW
- chemical resistance NEW

Product marking

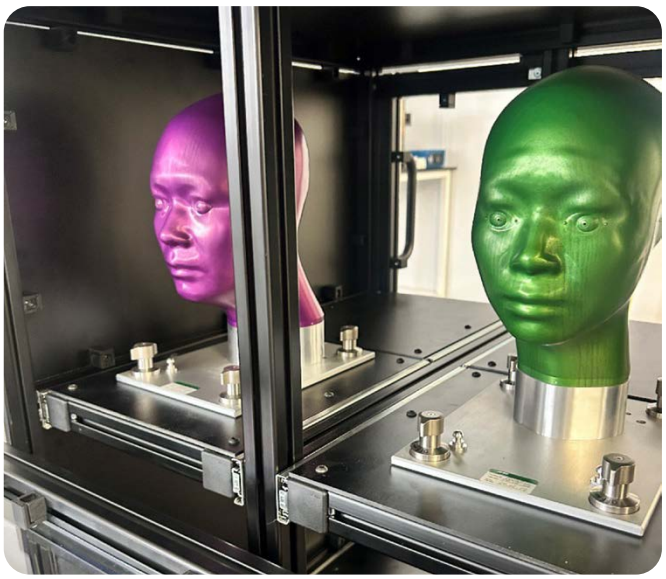
The below table presents and compares the new marking requirements under EN ISO 16321-1 and the withdrawn EN 166 standard.

Code letters EN ISO 16321:1:2022	Code letters EN 166:2001	Description
16321	EN 166	Basic use
1	1/2/3 -Optical class	Enhanced optical performance (marking optional)
3	3	Droplets
4	4	Large dust particles
5	5	Gas and fine dust particles
6	-	Streams of liquids
7	-	Radiant heat
9	9	Molten metals and hot solids
CH	-	Chemical resistance
K	K	Surface damage by fine particles
N	N	Resistance to fogging
-	S	EN 166 Increased robustness
C	F	Impact level C (45m/s)
D	-	Impact level D (80m/s)
E	B	Impact level E (120m/s)
-	A	EN 166 impact level A (190m/s)
HM	-	Impact level HM
CT	FT	Impact level C (45m/s) at extremes of temperature
DT	-	Impact level D (80m/s) at extremes of temperature
ET	BT	Impact level E (120m/s) at extremes of temperature
HMT	-	Impact level HM at extremes of temperature

EN ISO 16321-2:2021

Eye and face protection for occupational use — Part 2: Additional requirements for protectors used during welding and related techniques

In addition to EN ISO 16321-1:2022, this standard specifies material, design, performance and marking requirements for eye and face protectors designed to provide protection against occupational hazards, such as optical radiation, impacts from flying particles and fragments, and hot solids during welding and related techniques.



EN ISO 16321-3:2022

Eye and face protection for occupational use — Part 3: Additional requirements for mesh protectors

This standard shall be used in conjunction with EN ISO 16321-1:2022 to outline the requirements for mesh protectors designed to provide protection for the eyes and face against mechanical hazards such as impacts from flying particles and fragments. It should be noted that one of the main differences between the old and new standards is the aperture count in mesh protectors.

ISO/DIS 16321-4

Eye and face protection for occupational use

Part 4 of the new suite of standards is still in development and has not yet been published. This part will cover the additional requirements for protection against biological hazards.

BS EN ISO 16321-1:2022+A1:2025

As we know, standards and standards development is an ever-evolving world. In March 2025 BSI published the update BS EN ISO 16321-1:2022+A1:2025.It is anticipated this will be added to the PPE Official Journal later in 2025, but in the meantime, BSI has the capability to test and can certify using it as a technical specification.

The key changes in the +A1:2025 version are:

- Field of view for protectors used for driving shall have a minimum unobstructed view in front if each eye of 60˚temporally
- For sun glare filters there is a change in code marking on the lens
- The area to be protected has been changed slightly dimensionally and broken down in the frontal and lateral protection areas
- Molten metal, protection against droplets and protection against streams of liquid have been adjusted due to changes in the areas to be protected
- The protection against droplets has changed from pink or crimson coloration to blue coloration as it is using a new detecting solution (thymol blue sodium salt)
- Changes to the marking requirements

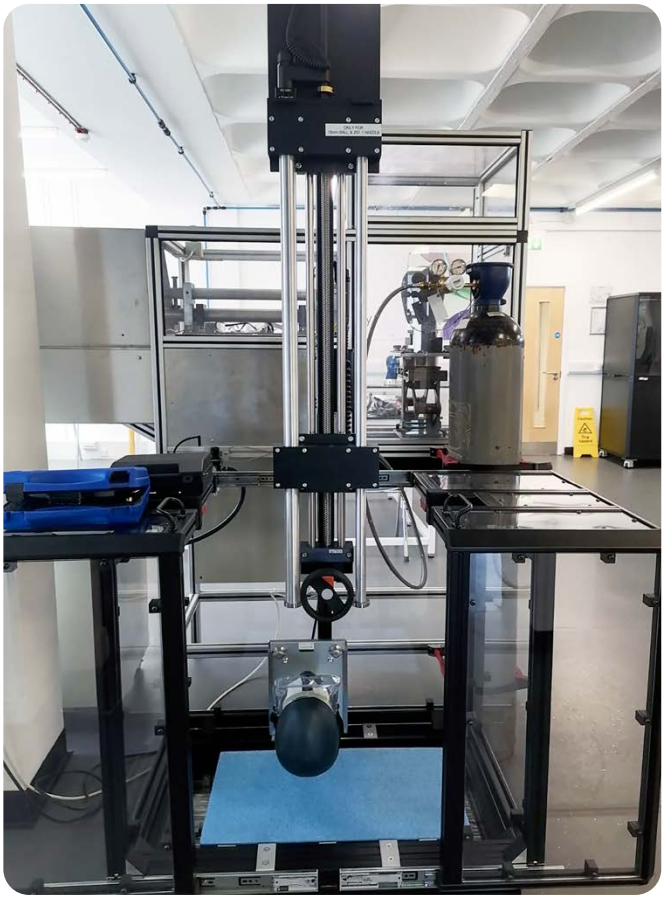
Testing and certification at BSI

BSI's eyewear laboratory is now fully equipped to carry out testing in line with the new requirements introduced by the latest suite of standards including the ISO 16321-1:2022+A1:2025 version. We are ready to provide this service and encourage you to contact us to register your interest, as we anticipate high demand.

At BSI, we are actively helping our clients to get CE and/or UKCA marked eyewear products tested and certified to the latest standards,. We work closely with manufacturers to ensure their products meet the latest regulations to gain market access. To mark products in accordance with the new standard, full testing covering the mandatory clauses as well as relevant optional requirements is necessary.

We work with each manufacturer to establish their claims and work out a bespoke test program covering the full range of products, with the aim of transitioning certification according to the EN ISO 16321 set of standards. Any organization placing protective eyewear onto the market in the EU or UK has a legal requirement to meet the PPE Regulation (EU) 2016/425 and/or Regulation 2016/425 on personal protective equipment, as amended to apply in Great Britain. BSI can offer this in the form of Notified Body/Approved Body services to Module B under the PPE Regulation and Module C2 or Module D if the product falls into category III PPE.

To further differentiate your product in the market, the BSI Kitemark™ offers third party certification and can also be used to meet the requirements of modules B, C2 or D of the PPE Regulation.



Still got questions?

We have the expertise! Contact us to get started:

Find out more

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