The ANSI Z87.1-2003 standard designates two levels of protection for safety eyewear: High impact and basic impact

The ANSI standard encourages the reporting of eye injuries to help gather statistics. Article 3 of the new standard addresses Eye Incident Injury/Data History, referencing Annex H, if there is an incident involving eye injury. Annex H is the "Eye Injury Report Form" which states: "The attached form is provided for users of occupational and educational eye and face protection. Completing and returning this form will assist the Z87 Committee on Safety Standards for Eye Protection to improve this standard and develop others, as appropriate.

The Eye Injury Report Form is not subject to copyright and may be reproduced as needed. Click here for a reproducible copy of the Eye Injury Report Form.

The changes are summarized in the following comparison charts. Please review them carefully. However, for the best source of information, we urge you to obtain an actual copy of the standard:

a) Online: http://webstore.ansi.org/ansidocstore/default.asp - then select “ASSE” as the category and choose “Z87.1”

b) To reach ANSI by phone, call: Customer Service or Document Sales 8:30am – 6:00pm EST 1-212-642-4980

Lenses and Frames

The many changes incorporated in the ANSI Z87.1-2003 standard affect the manufacture and testing of both safety frames and safety lenses. Because your industrial business is a valuable asset to your overall operation, you should be familiar with and adopt the practices of the new procedure to ensure compliance and to prevent potential liability issues related to eye injuries. This is particularly true because the use of thinner prescription lenses will be allowed if they meet the new standard.

The changes in test requirements for safety frames ensure a higher level of quality. The standard requires more emphasis on lens retention, which translates to improved eye protection. It is important that you make sure the frames you use meet the standard and are marked Z87-2.

All manufacturers of non-plano (prescription) safety frames are required to test their product using 2.00mm lenses in order to mark the product Z87-2. The test is a critical aspect of this standard because a frame that successfully retains a 3.00mm lens may not be capable of retaining a 2.00mm lens.

All frames must be manufactured and tested to demonstrate they meet the standard. It is important that laboratories make sure the frames they use meet the testing requirements. Uvex Rx ISO Quality Management Procedures call for regularly scheduled re-testing of products throughout their life to guarantee their continuous compliance to the frame test requirement.

Laboratory Responsibility

It is the responsibility of the laboratory to make sure that the complete protector (frame and lenses) delivered to the industrial customer is compliant.

There are two levels of lens performance: Basic Impact and High Impact.
Basic Impact Non-plano Lenses: The test methods for Basic Impact Lenses are unchanged from the 1989 standard and the lenses have a minimum thickness of 3.00mm. Basic Impact Lenses will be tested in the non-mounted state with 100% of glass tested and plastic statistically sampled.

High Impact Non-plano Lenses: The test methods for High Impact Non-plano Lenses are new and require close attention. Unlike Basic Impact, all non-plano lenses considered for use for High Impact will be type-tested in the non-mounted state for high-velocity impact resistance. More detail on this process is covered in the section "Lens Testing Requirements."

Note: Basic Impact plano product is tested in the non-mounted state. High Impact plano product will be tested in the mounted state.

Finished Product
If the finished protector only meets the Basic Impact Standard, it is the responsibility of the laboratory to attach a Warning Label to the frame. This warning is designed to inform the wearer of the impact limitations of the lenses and also states that it is to be removed only by the wearer. These labels will be made available by the OLA.

Lens Requirements
Minimum Thickness

**ANSI Z87.1-1989**
Prescription Lenses
Must be 3.00mm thick except those lenses having a plus power of 3.00D or greater shall have a minimum thickness of 2.5mm.

**ANSI Z87.1-2003**
Prescription Lenses
There are two categories of lenses in the standard: Basic Impact and High Impact. They are called "non-plano."

**Basic Impact Non-plano Lenses**
Shall be 3.00mm thick except those lenses having a plus power of 3.00D or greater shall have a minimum thickness of 2.5mm (no change from the 1989 standard).

**High Impact Non-plano Lenses**
Shall not be less than 2.00mm thick at their thinnest point.

**Removable Plano Lenses**
Shall be 3.00mm thick except those lenses that withstand 45.7mps impact of 1/4-in. steel ball. Such lenses shall not be less than 2.00mm thick.

**Plano Lenses** (also called nonprescription)
Have two impact levels:

**Non-Removable Plano Lenses**
Shall be 3.00mm thick except plastic which can be 2.00mm thick.

**Basic Impact Plano Lenses**
Shall be the same as Basic Impact Non-plano Lenses.

**High Impact Plano Lenses**
Shall not be less than 2.00mm thick when used in a frame marked “Z87-2.” No minimum thickness required if mass production plano protector.
Lens Marking

- Applicable shade designation
- Photochromic lenses - mark V after the manufacturer's logo
- Special purpose lenses mark S
- All marking is permanent

Impact

Prescription Lenses
Lenses shall be capable of resisting impact of a 25.4mm (1 in.) steel ball dropped from a height of 127cm (50 in.). The lens shall not fracture.

Prescription Lenses
(called non-plano in the standard)

Basic Impact Non-plano Lenses
- Shall be capable of resisting impact from a 25.4mm (1 in.) steel ball dropped from a height of 127mm (50 in.). The lens shall not fracture.
- Glass lenses shall be tested 100%.
- Plastic lenses shall be statistically sample tested.

High Impact Non-plano Lenses
Shall be tested to the high velocity impact test. The lenses shall be mounted on a test holder and shall be capable of resisting impact from a 6.35mm (0.25 in.) diameter steel ball traveling at a velocity of 45.7m/s (150ft/s).

Three lenses shall be tested.
- Failure consists of any posterior displacement of the lens completely through the test holder; any fracture of the lens; any detachment of a portion of the lens from its inner surface; or full thickness penetration of a lens.
- If all test lenses pass, then any non-planar lens of the same or greater thickness at its thinnest point, which is made by the same manufacturer, from the same material with the same coatings may bear the "+" mark.

Non-Removable Plano Lenses
Tested as complete devices with High Mass Impact and High Velocity Impact Tests & using an Alderson 50th percentile male head form.

Plano Lenses
(also called nonprescription)

Basic Impact Plano Lenses

- Drop Ball - Shall be capable of resisting impact from a 25.4mm (1 in.) steel ball dropped from a height of 127mm (50 in.). The lens shall not fracture.
- Penetration - Plastic lenses shall be capable of resisting penetration from a weighted projectile weighing 1.56 oz. dropped from a height of 50 in. The lens shall not fracture or be pierced through.
- Tested in the non-mounted state.

High Impact Plano Lenses
Tested with High Mass, High Velocity and Penetration tests. Tested as a complete device.

Warning Label
None required

If the finished protector only meets the Basic Impact Standard, it is the responsibility of the laboratory to attach a Warning Label.

- This warning is designed to inform the wearer of the impact limitations of the lenses and must state that it is to be removed only by the wearer.
- These labels will be made available by the OLA.

Frame Requirements
ANSI Z87.1-1989

Test Requirements

None

ANSI Z87.1-2003

Test Requirements

Spectacle Frame Test

Designed to test the ability of the frame to retain a lens upon impact and to evaluate the strength of the temples and/or side shields.

- Retained is defined as no more than 25% separation of the lens periphery from the frame.

High Mass Impact Test

17.6 oz. pointed projectile dropped from a height of 51.2 in.

- Should not cause any parts or fragments of the protector to be ejected that could contact the eye of the head form.

High Velocity Impact Test

1/4 in. steel ball traveling at 150 ft/s (102mph)

- No contact with the eye of the head form is allowed.
- No parts or fragments of the protector may be ejected that could contact the eye of the head form.

Lens Retention

Safety spectacles available with removable and non-removable lenses must meet High Mass Impact and High Velocity Impact tests.

Test Lens Thickness

- Test lenses for frames designed for Non-plano spectacles shall be 3.00mm thick.
- Plano lenses shall be 3.00mm thick except lenses that can pass the High Velocity Impact Test. These lenses can be 2.00mm thick.

Test Lens Thickness

- The test lens shall be 2.00mm +0.2mm, -0.0mm thick.

Frame Marking
All major spectacle components shall bear a manufacturer’s trademark and shall be marked Z87 to indicate compliance with the standard.

- In addition, fronts shall be marked with the "A" dimension (eye size) and the "DBL" (distance between lenses).
- Temples shall be marked with their overall length.

Spectacle frames intended for non-plano lenses shall be marked with the manufacturer's mark or symbol and "Z87-2."

- In addition, fronts shall be marked with the "A" dimension (eye size) and "DBL" (distance between lenses).
- Temples shall be marked with their overall length.

**Side Shields**

*(if side shields are employed)*

Lateral coverage is checked with a point of rotation at the corneal vertex.

- The side shield shall be impacted 10mm above and 10mm below the plane of the eyes of the head form at the 90º rotated angle.

Lateral protection shall be assessed using a rotation point 10mm behind the corneal vertex.

- The side shield shall be impacted 10mm above and 10mm below the plane of the eyes of the head form at the 90º rotated angle.

**Warning Label**

None required

If the finished protector only meets the Basic Impact Standard, it is the responsibility of the laboratory to attach a Warning Label.

This warning is designed to inform the wearer of the impact limitations of the lenses and must state that it is to be removed only by the wearer. These labels are available from the OLA.

**Flammability**

Enforced standard to Section 15.3. The spectacles shall not continue to burn after exposure to a 50mm (2 in.) flame from a 10mm (.394 in.) Bunsen burner for one second.

The apparatus and procedure as specified in ASTM test method D635-98 shall be used to determine the flammability of plastic components. Alternatively, certification of the material used by the source of supply is acceptable. The material shall not burn at a rate greater than 76mm (3 in.) per minute.

**Corrosion**

Metal parts are boiled in a 10% aqueous solution of sodium chloride for 15 min. then immersed in the same solution at room temperature, removed and allowed to dry for 24 hrs. The metal parts are then rinsed in lukewarm water and allowed to dry. The function of the spectacles shall not be impaired by the corrosion.

No change in the requirements for metal parts.

Lenses and electrical parts are excluded from these requirements.

**Cleanability**

After cleaning, the function of the spectacles shall not be impaired.

All markings shall stay permanently affixed and readable.
ANSI Z87.1-2003 Frame Test Requirements

Testing should be performed by trained personnel using properly calibrated and maintained equipment. Suppliers of frames marked Z87-2 should be able to provide access to test documentation.

This information is provided as a service by Uvex Rx, the OLA (Optical Laboratories Association), and COLTS Laboratories.