RADIANS®

EYE/FACE PROTECTION

FAST FACTS

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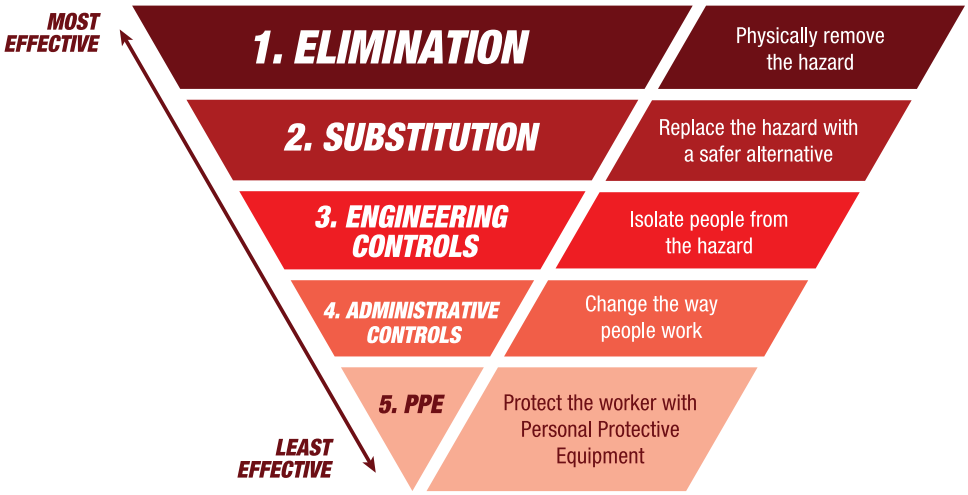
HOW DO INJURIES HAPPEN? HOW CAN WE REDUCE OR PREVENT THEM?

According to OSHA's 29 CFR 1910.132, the General Requirements for Personal Protective Equipment (PPE), employers are required to:

1. **Conduct Hazard Assessments** to identify all potential hazards.
2. **Hierarchy of Controls** to eliminate or reduce the risk of present hazards.
3. **Select & Issue Appropriate PPE** based on hazard assessments.
4. **Provide PPE at no cost**
5. **Provide Training** on the hazard, controls, and PPE

While OSHA 29 CFR 1910.132 establishes general requirements for hazard assessments and PPE, OSHA has additional standards to provide more specific guidance based on the hazard type.

HIERARCHY OF CONTROLS



WHAT ARE SOME COMMON HAZARDS YOU SHOULD BE LOOKING FOR DURING YOUR HAZARD ANALYSIS?

IMPACT (PROJECTILES):
Most eye injuries are from small projectiles ejected by tools, windblown, or falling from above. Wear protective gear rated for high impact (Z87+) and consider size, mass, velocity, and temperature of potential projectiles.

LIQUID SPLASH, DROPLETS, AND SPRAYS:
These can contain harmful chemicals and bacteria, even indirectly. Wear eye and face protection such as safety goggles and face shields, with consideration for eye seal and face coverage. Choose protective devices rated D3 for liquid splash and droplet.

DUST, DEBRIS, AND FINE PARTICLES:
Common in jobs like construction, demolition, woodworking, and manufacturing. Wear safety gear like glasses, goggles, and face shields, adding foam lining for protection. Choosing protective devices rated D4 for dust is recommended.

ACCORDING TO OSHA, EYE AND FACE PROTECTIVE DEVICES MUST COMPLY WITH THE ANSI/ISEA Z87.1 CONSENSUS NATIONAL STANDARD.

This means that all safety glasses must meet the ANSI/ISEA Z87.1 standard, otherwise they are simply just eyeglasses.

OSHA GENERAL INDUSTRY STANDARD – 29 CFR 1910.133
OSHA CONSTRUCTION STANDARD – 29 CFR 1926.102

EYEWEAR STANDARDS AND MARKINGS

ANSI/ISEA Z87.1

The ANSI/ISEA Z87.1 is a national standard that is referenced by OSHA for eye and face protective devices, including safety glasses, goggles, and face shields.

It sets out the necessary requirements and criteria for eye and face protective devices, including:

- Fundamental design requirements such as optical and physical requirements and markings
- Optional characteristics like anti-fog performance (X marking)
- Optional hazard-specific requirements such as impact, liquid splash and droplet, and dust protection.

Additionally, it covers test methods, instructions for use and maintenance, and selection of the appropriate protective device.

FUNDAMENTAL DESIGN REQUIREMENTS FOR ALL DEVICES

Optical Requirements:
Essentially to ensure that the users do not have an obstructed or blurry view while using.

Physical Requirements:

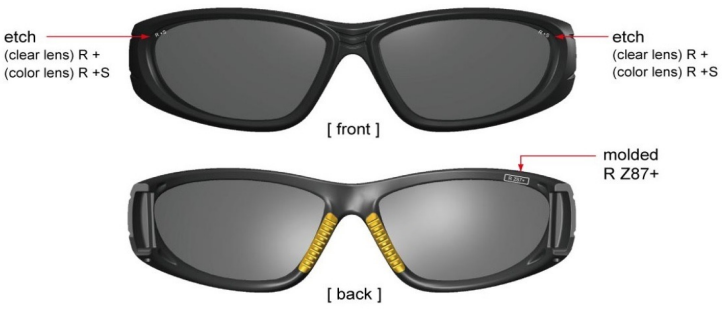
- Devices will not ignite
- Made from non-corrosive materials
- Minimum frontal coverage
- Minimum impact resistance (drop ball impact test)*

**Do not mistake minimum impact resistance for an impact rated device, as the latter has a higher rating and extra specifications.*

Marking & Labeling Requirements:

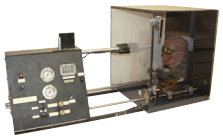
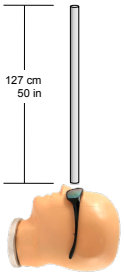
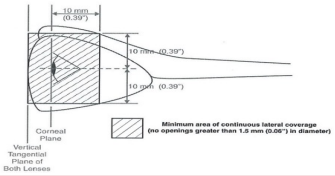
- Ratings
- Placement
- Packaging

MARK TYPE	LENS		FRAME
	GLASSES	GOGGLES/ FACESHIELDS	
MANUFACTURER'S MARK OR LOGO	YES	YES	YES
STANDARD			
PLANO, READERS, MAGNIFIERS		Z87	Z87
RX		Z87	Z87-2
IMPACT RATED			
PLANO, READERS, MAGNIFIERS	+	Z87+	Z87+
RX	+	Z87+	Z87-2+
LENS TYPE			
CLEAR			
WELDING FILTER	W + SHADE	W + SHADE	
UV FILTER	U + SCALE #	U + SCALE #	
IR FILTER	R + SCALE #	R + SCALE #	
VISIBLE LIGHT FILTER	L + SCALE #	L + SCALE #	
SPECIAL PURPOSE LENSES	S	S	
OPTIONAL RATINGS			
ANTI-FOG	X	X	
LIQUID SPLASH & DROPLET			D3
DUST			D4



IMPACT RATED

In order to obtain the Z87+ marking and meet the ANSI Z87.1 standards for eye and face protection against impact, a protective device must pass three major impact tests: high velocity impact, high mass impact, and penetration, as well as offer adequate lateral coverage at a minimum.

TEST		CALIBER	IMPACT	PASS CRITERIA
HIGH VELOCITY	Shall be capabale of resisting an impact from	0.25" Diameter Steel Ball (25 caliber) 	Projectile traveling at a velocity of... • Glasses: 150' / second • Goggles: 250' / second • Faceshields: 300' / second 	No contact with the eye of the head form is permitted as a result of impact. No piece shall be detached from the spectacle and the test lens shall be retained in the frame. In addition, the lens shall not fracture.
HIGH MASS	Shall be capabale of resisting an impact from	17.6 oz (500 g) Projectile 	Projectile dropped from a height of 50" 	No piece shall be detached from the inner surface of any spectacle component and the lens shall be retained in the frame. In addition, the lens shall not fracture.
PENETRATION	Shall be capable of resisting penetration from	Low Mass Weighted Needle (>1.56 oz.) 		The lens shall not be penetrated as a result of this test.
LATERAL (SIDE) COVERAGE	Impact-rated protectors must offer a minimum amount of side coverage.			They need to: 1. extend (>=) 10 mm behind the corneal plane 2. (>=) 10 mm in height above and below the horizontal plane 3. no openings > 1.5 mm in diameter

3 NEW OPTIONAL RATINGS OF THE ANSI Z87.1 STANDARD

LIQUID SPLASH RATED

Devices rated D3 Liquid Splash and Droplet are tested to determine the capability of the protector to prevent liquid splash and droplets from penetrating the protector. When selecting your protective device, you should consider the seal integrity, how it fits and the wearability.

DUST RATED

Devices rated D4 are tested to determine the capability of the protector to prevent dust and debris from penetrating the protector. Swirling particles / Grinding Dust / Environmental Debris.

ANTI-FOG RATED

Devices rated anti-fog “X” are tested to determine the capability and effectiveness of a device to prevent fogging. Users who frequently experience issues with fogging should select a glass with the AF “X” rating.

FACTORS TO CONSIDER WHEN SELECTING THE PROPER PROTECTIVE DEVICE

PROPER FIT

Properly fitting PPE is crucial to avoid potential accidents/injuries, as well as discomfort and distractions that could lead to decreased productivity.

Choose from a variety of features:

- **Comfort:** Added Rubber to Temples, Nose Pieces, and Brows
- **Adjustability:** Adjustable Nose Pieces + Telescoping, Ratcheting, and Wire-Core Temples
- **Size:** Smaller and Larger Frames Available

COVERAGE

A plano safety glass (no foam lining or magnification) offers appropriate protection for more than half of workers.

- Chemical/bio-hazard workers need more than safety glasses for full eye protection
- Goggles/foam-lined glasses may be excessive for dust/liquid-free environments
- Over-protection risks workers removing eyewear, increasing injury vulnerability

VISION IMPAIRMENT

One of the biggest challenges to consider when selecting proper PPE is vision impairment.

Over 150 million Americans wear corrective lenses for vision problems, including:

- Astigmatism (1/3 Americans)
- Farsightedness (14.2 Million Americans)
- Nearsightedness (34 Million Americans)

LIGHT LEVEL

- Match the lens tint to the application
- Choose appropriate tint for lighting conditions
- Glare may warrant polarized lenses

WHY POLYCARBONATE?

Most eye & face protective devices are made from polycarbonate because:

- Highly Impact Resistant
- Lightweight
- Flexible
- Economical
- Naturally Filters 99.9% UV A, B, & C

SCRATCH RESISTANCE

Polycarbonate is naturally soft and prone to scratching, which can reduce the life of safety glasses. To mitigate this issue, a hard coating is often added to the lenses to increase:

- Durability
- Scratch Resistance
- Useful Life

WHEN SHOULD I REPLACE SAFETY GLASSES?

- No universal guidelines for when to replace.
- Depends on usage and exposure to hazards.
- Inspect safety glasses regularly
- Replace as soon as any wear, tear, or damage, such as scratches, cracks, or broken parts, is identified.

FOGGING

Fogging is a major issue to consider when selecting the proper safety eyewear because it can impair vision, causing workers to decide between either working blind or removing the very PPE protecting them.

How does fogging occur?

Fogging occurs when the temperature inside the eyewear is warmer than the temperature outside, causing moisture to condense on the lenses. This can be a common occurrence in high-humidity environments or when workers transition between hot and cold areas.

Solutions for fogging

- Increase Environmental Airflow
- Anti-Fog Treatments
- Anti-Fog Coatings
- Ventilation

Common environments and applications fogging occurs

Fogging can occur in a variety of work environments and applications but some of the most common are:

FOGGING		
ENVIRONMENT	**REASON**	**EXAMPLE APPLICATION**
COLD	*Safety glasses can fog up due to the temperature difference between the warm air inside the glasses and the cold air outside.*	*Food Freezers, Cold Storage, Food Processing, Winter Outdoors*
HOT & HUMID	*Safety glasses can fog up due to the buildup of moisture on the lenses.*	*Forging, Metal Working, Farming, Agriculture, Forestry, Landscaping, DPW's, Manufacturing , Construction, Summer Outdoors*
MOVING BETWEEN DRASTIC TEMP CHANGES	*Workers who move between areas that are kept at very cold temperatures and areas that are at room temperature or higher cause foggy glasses due to the sudden temperature changes.*	*Cold Storage Facilities, Refrigeration, Food Processing*
LOW AIR FLOW / VENTILATION	*Low air flow and/or poor ventilation can create a humid environment that traps moisture and heat, causing safety glasses to fog, which can persist if there is not enough air flow or ventilation to remove the moisture. This can be a problem in situations where safety glasses are needed for extended periods, such as in manufacturing or construction settings.*	*Working in Confined Spaces, Manufacturing, Construction, Maintenance*
FACE COVERINGS / RESPIRATORS	*Wearing a face covering or respirator can cause moisture to condense on safety glasses due to diverted airflow and increased humidity, leading to fogging.*	*Healthcare, Pharmaceutical, Construction, Painters, Welders, Food Processing*

FOGGING SOLUTIONS

AF Coatings
MOST EFFECTIVE

Coatings are the most effective way to combat fog. But not all AF coatings are the same. There are two types of AF Coatings.

HYDROPHOBIC
TRADITIONAL
AF COATINGS
provide an economical, temporary solution to fogging

- Repels water making it bead, run off the lens
- **Temporary:** AF coating easily wipes off after just a few uses.
- **Durability:** Can not apply a hard coat with this coating. Most safety glasses are made of polycarbonate which is inherently soft & scratches easy.

HYDROPHILIC
PREMIUM
AF COATINGS
more effective against fogging, longer-lasting

- Forms a thin coating of water over the lens
- **Long-Lasting:** AF coating lasts for multiple cleanings and extended use.
- **Durability:** Hard coats can be used and these glasses typically have increased resistances to scratches.

Ventilation
EFFECTIVE

Enhanced airflow effectively fights fogging, but for devices guarding against liquid splashes and dust, limited circulation renders it insufficient alone.

AF Treatments
LEAST EFFECTIVE

AF treatments and sprays do temporarily work. However, they must be applied frequently and can decrease the useful life of the device.

EYE/FACE PROTECTION TYPES

EYE/FACE PROTECTION TYPES

GENERAL USE

PLANO

Plano safety glasses are the largest segment of the market.

HAZARD	PROTECTION
Impact "Z87+"	YES Most safety glasses, goggles, & shields are ANSI Z87+ Impact Rated.
Liquid Splash "D3"	NO Provides limited protection against liquid splash
Dust & Debris "D4"	NO Provides limited protection against dust & debris
Anti-Fog "X"	MAYBE It is possible to put AF coatings and treatments on plano safety glasses.

Many feature options:

- Rubber Temples
- Neck Cords
- Full Frame
- One-Piece Design
- Lightweight

MAJOR HAZARDS

FOAM LINED / HYBRID

HAZARD	PROTECTION
Impact "Z87+"	YES Most safety glasses, goggles, & shields are ANSI Z87+ Impact Rated.
Liquid Splash "D3"	NO Provides limited protection against liquid splash
Dust & Debris "D4"	MAYBE Designed to protect against dust & debris. When used w/ head strap it can achieve "D4" rating. "D4" Labeling Requires: "D4" on the frame
Anti-Fog "X"	MAYBE It is possible to put AF coatings and treatments on foam lined safety glasses.

Features:

- Provides additional protection around lens
- NOT recommended for splash protection
- Smaller and typically more comfortable than a goggle
- Strap options

EXTREME HAZARDS

GOGGLES

HAZARD	PROTECTION
Impact "Z87+"	YES Most safety glasses, goggles, & shields are ANSI Z87+ Impact Rated.
Liquid Splash "D3"	YES Designed to protect against liquid splash.
Dust & Debris "D4"	YES Designed to protect against dust & debris.
Anti-Fog "X"	MAYBE It is possible to put AF coatings and treatments on foam lined safety glasses. AF "X" Labeling Requires: "X" on the lens

Features:

- Maximum protection from liquids and dust
- Indirect venting maintains seal while improving comfort
- Wide Range of comfort and value

VISION IMPAIRMENT

CHEATERS, BIFOCALS, MAGNIFIERS	OTG OVER-THE-GLASS	RX SAFETY GLASSES
Cheater safety glasses have built-in magnifying lens for individuals who need to do close-up work but do not require corrective lens.	Designed to fit over prescription glasses, providing eye protection to workers who wear corrective lenses.	Prescription RX safety glasses provide corrective lens.
The magnifying lens is typically located at the bottom of the lens and is available in different magnification strengths, such as +1.5, +2.0, and +2.5.	Also called visitor specs.	When combined with an impact rated side shield, like our 99705 flexible side shield, they can be impact rated (Z87+).
Features: • Convenience • Improved Vision	**Features:** • Cost-Effective • Convenience	**Features:** • Comfort • Customization

FULL FACE COVERAGE

FACE SHIELDS

Disadvantages:

- May not provide same level of impact protection as safety glass or goggle
- May need to use in conjunction with safety glass

Materials:

- **Polycarbonate:**
  Maximum Impact Protection
- **PETG:**
  Most Economical Shield Material – Not Impact
- **Acetate:**
  Best Chemical Resistance
- **Wire Mesh**
  Best Ventilation – Not Impact/Liquid Splash/Dust

FAQ'S

WHEN SHOULD I REPLACE MY EYE / FACE PROTECTIVE DEVICE?

There is no hard and fast rule on how frequently safety glasses should be replaced as this is influenced entirely by usage and the conditions to which the glasses are exposed. The most important issue is to ensure that a proper inspection takes place and that the user changes safety glasses as soon as any deterioration or damage is identified.

I WEAR CONTACTS. THEY SHOULD PROVIDE ENOUGH PROTECTION, RIGHT?

Wrong. Contact lenses can be generally be used in the workplace but ONLY when worn with other appropriate eye protection.

SO HOW DO I KNOW WHICH KIND OF PROTECTIVE DEVICE I NEED AT WORK? ARE SIDE SHIELDS MANDATORY?

The answer to this question is highly reliant on the policies in place by your company and usually depends on the types of hazards you might face in your work environment. Anytime there is a hazard that requires impact protection, side protection is required because side protection is one of the requirements to achieve the ANSI Z87+ impact rating.

DOES PROTECTIVE EYEWEAR THAT HAS SCRATCHES OR PITS NEED TO BE REPLACED? SHOULDN'T THE LENSES BE MADE OF HIGH-GRADE INDUSTRIAL MATERIALS?

Yes "absolutely" for both questions. Protective eyewear with scratched and pitted lenses or damaged frames are less resistant to impact and should be replaced. All protective eyewear should be cleaned, inspected, repaired and, if necessary, replaced on a regular basis. Polycarbonate is the most popular lens material and it is quite strong. In uncoated form, it is soft and prone to scratching. Coating the lens with a hard coat makes it more durable and scratch resistant. Think of your eyewear as your own personal windshields for impact protection and clarity of sight.

MY VISION IS NOT 20-20. DO THEY MAKE PRESCRIPTION PROTECTIVE EYEWEAR?

Yes. Workers who need protective eyewear with corrective lenses must utilize special optical frames that, when fitted with corrective lenses, satisfy applicable ANSI standards for protective eyewear. Some suppliers offer metal and plastic frames fitted with the appropriate prescription lenses or provide heavy-duty "carriers" that can be fitted with Rx lenses. Radians also offers OTG "over the glass" eyewear and safety goggles. These OTG styles fit comfortably over most prescription eyewear.

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