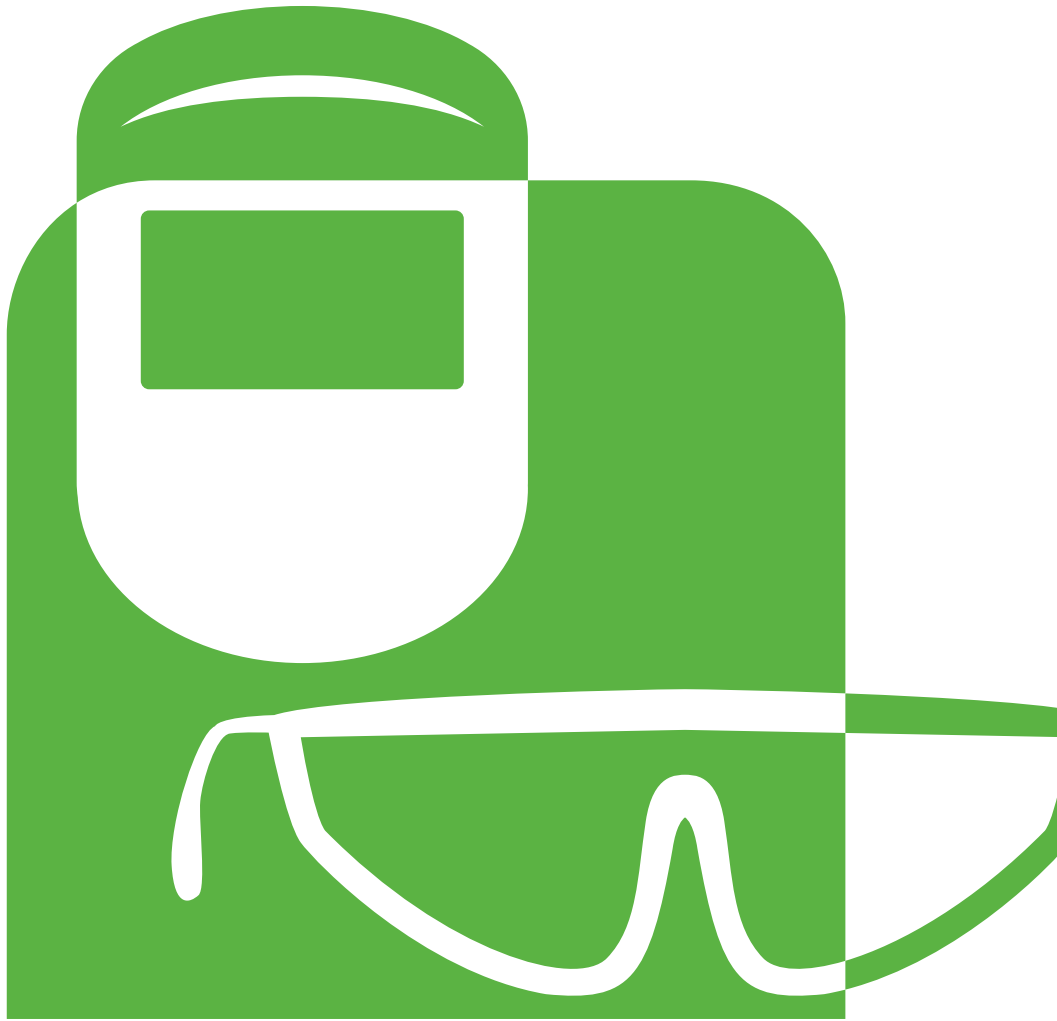


EYE AND FACE PROTECTION

SELECTION AND USE GUIDE



INTERNATIONAL
SAFETY EQUIPMENT
ASSOCIATION



FOREWORD

Workers in almost every industry are subject to hazards that can cause temporary or permanent eye and face injury. The National Institute for Occupational Safety and Health (NIOSH) estimates that there are about 2,000 eye injuries each day in American workplaces. In 2008, injuries to the eyes accounted for 62 percent of all face injuries involving days away from work according to NIOSH. Most injuries are the result of workers not wearing eye protection or wearing the wrong kind of eye protection needed for the job.

The Occupational Safety and Health Administration (OSHA) 1910.133(b)(2) eye protection standard states that OSHA will accept eye and face protective devices that the employer demonstrates are at least as effective as devices that are constructed in accordance with ANSI/ISEA Z87.1, the American National Standard for eye and face protection.

In addition to maximum worker protection, a comprehensive eye and face protection program can reduce business expenses. Consider this: an eye injury can cost up to \$10,000. Add indirect costs such as workers' compensation and other insurance premiums, lost work time and productivity, management time and legal costs, and the total effect of the injury cost can reach up to \$40,000. The high cost of eye injuries can be avoided with a comprehensive eye and face protection program.

Appropriate eye and face protection can take many forms. Spectacles (plano or prescription); goggles; faceshields; welding helmets or hand-held shields, and even full-facepiece respirators are designed to address specific hazards. It is important that workers and supervisors understand the type of protector needed.

The International Safety Equipment Association (ISEA) has prepared this guide to provide practical assistance for eye and face protection users and administrators to select and use eye and face protection equipment. The "ANSI/ISEA Z87.1-2015 Eye and Face Protector Selection Chart" in this document, is intended to aid in identifying and selecting the types of eye and face protectors that are available, and provide information on their capabilities and limitations for the hazards listed.

For additional information on specific eye and face protectors, contact a manufacturer listed in the directory section of the guide.

Edition No. 1
March, 2016

Contents

1. PURPOSE AND SCOPE	3
2. HAZARD ASSESSMENT	3
3. PRODUCT TYPES AND FEATURES	4
Safety Spectacles	4
Goggles	4
Hybrid Eyewear	4
Face Shields (Visors)	5
Full-Facepiece Respirators	5
Loose-Fitting Respirators	5
Welding Helmets	6
Welding Devices	6
Filter Lenses	6
Passive Plates	6
Auto-Darkening Filters (ADFs)	7
4. TRAINING	7
5. EYE PROTECTION MARKINGS	8
6. ANSI/ISEA Z87.1-2015 Eye and Face Protector Selection Chart	9
7. SPECIAL CONSIDERATIONS	13
Working with Chemicals	13
Optical Radiation	13
Lasers and Electrical Safety	14
Working with Molten Metal	15
Working in Humid and/or Abrasive Environments	15
Working Around Electricity	15
8. CARE, MAINTENANCE AND STORAGE	16
9. ISEA EYE AND FACE PROTECTION DIRECTORY	17
10. ADDITIONAL INFORMATION	18

1. PURPOSE AND SCOPE

The purpose of this guide is to assist in the proper selection, care, use and inspection of eye and face protection equipment, and to describe other occupational hazards not covered by the current ANSI/ISEA Z87.1-2015 standard.

NOTE: This document is meant as a guide only and does not replace the ANSI/ISEA Z87.1-2015 standard document. Please review the ANSI/ISEA Z87.1-2015 standard document for specific requirements.

2. HAZARD ASSESSMENT

Please consult with a safety and health professional or a representative from one of the manufacturers listed in this guide for help conducting a hazard assessment.

Some of the considerations, which are also part of a job hazard analysis, include, but are not limited to the following:

- **Impact** – Forcible contact from flying objects, such as large chips, fragments, particles, sand, and dirt from chipping, grinding, machining, masonry work, wood working, sawing, drilling, riveting and/or sanding. As a general rule, it is recommended that an impact protector be used any time when working in an environment that could allow exposure to flying objects.
- **Heat** – Emission of extreme heat from furnace operations, pouring, casting, hot dipping, welding or other similar operations.
- **Chemical** – Liquid splash and droplets, fumes, vapors and irritating mists from acid and chemical handling, degreasing and plating.
- **Dust** – Nuisance or fine dust from woodworking, buffing or general dusty conditions.
- **Optical Radiation** – Ultraviolet (UV) and blue light, infrared (IR), glare and intense light from welding, torch-cutting, -brazing, -soldering, and laser work.
- **Electrical** – Arc flashes and sparks from working around electricity.
- **Environmental Factors** – Working environment and the temperature of area where safety equipment is being used such as high humidity and sources of motion in the area.
- **Human Factors** – Length of work with safety equipment, worker fit and comfort, compatibility with prescription eyewear; employees with corrective lenses should either wear eye protection that incorporates the prescription into the design or wear additional eye protection over their prescription lenses.



3. PRODUCT TYPES AND FEATURES

The information below is based on typical uses, however designs advance quickly, and suitability of a device for a task may change, therefore the marking on the device (see marking section below), should be the final guide to determining the suitability of the product for your hazard. Types of eye and face protectors include, but are not limited to the following:

Safety Spectacles (Plano or prescription)

Protective eyewear has safety frames constructed of metal or plastic and impact-resistant lenses. Side shields are either integrated or removable depending on the models. Safety spectacles should not be used for protection against liquid splashes, mists or vapors unless marked as a splash protector. Only safety spectacles with lateral protection (side shields or integrated to the frame or lens) are impact rated.



Goggles (Direct, indirect ventilation; Enclosed/sealed)



Goggles are fitted eye protection that completely encloses the eyes, eye sockets and the facial area immediately surrounding the eyes, and can provide protection from impact, dust, mists, vapors and splashes. Goggles with direct ventilation typically are used for impact hazards and dusts, not for protection against chemical splashes or vapors (unless so marked). Goggles with indirect ventilation can be used for protection from dusts and splash hazards. Goggles with no ventilation can provide protection from impact, dusts, splashes, mists and vapors. Check the goggle lens and body for specific ANSI/ISEA Z87 marks indicating performance requirements met by the product.

Hybrid Eyewear

Hybrid eyewear, also referred to as "sealed eyewear," is a safety spectacle with additional features, such as foam or rubber linings and a headband for a secure fit, with the intention of providing added protection similar to a goggle. Designs with foam or rubber seal around the eye socket, is intended to reduce the chance of airborne dust particles from reaching the eye. They are required to meet ANSI/ISEA Z87.1 standards for spectacles.

Hybrid eyewear may also have interchangeable or removable parts such as the seal, temples or headband. Common industry applications for hybrid eyewear include oil and gas, construction, material handling and manufacturing. They are worn under face shields when grinding/sanding, and in outdoor windy environments.



Face Shields (Visors)



Face shields are designed to shield the face and eyes from various hazards, and are typically used in conjunction with spectacles or goggles to provide protection from liquid splash and spray hazards. The face shield windows are available in a variety of materials, shapes, thickness, shades and tints, depending on their particular application. Commonly available windows are transparent sheets of plastic or wire screen (wire screens do not provide impact protection). Some are polarized or tinted for glare protection. Face shields may be lifted away from the face and expose the wearer to impact hazards. Therefore, it is recommended that the user wear safety spectacles under the face shield so that eyes remain protected when the face shield is in the raised position.

Full-Facepiece Respirators

Full-facepiece respirators are tight fitting respirators that cover the nose, mouth and eyes from approximately the hairline to below the chin. They protect the wearer's eyes and face against irritating gases, vapors and flying particles.



Loose-Fitting Respirators

Typically worn over spectacles or goggles, a loose-fitting respirator is a respiratory inlet covering that is designed to form a partial seal with the face, or that completely covers the head and neck, and may cover portions of the shoulder.



Welding Helmets

Welding helmets are designed to protect users from the visible and invisible (ultraviolet and infrared) rays a welding arc emits. Workers should protect their eyes from welding light by wearing a welder's helmet fitted with a filter shade that is suitable for the type of welding work they are doing.



Welding Devices

Welding devices also protect the users face and neck to varying degrees. Goggles, for instance, only protect the skin in the immediate area of the eyes and should not be used for welding operations that require darker lens shades (and therefore have higher-intensity radiation). Welding helmets provide coverage to the wearer's face and neck, along with the top of the head and sides of the face and head, given the type of welding and the angle at which he will "view" the weld. However, they may be lifted away from the face, exposing the wearer to impact hazards even though the helmet is in an intended position. Lifting the helmet is inevitable for both direct and peripheral vision, even when the helmet is fitted with an ADF. Therefore, the user should always wear safety spectacles under his helmet so that his eyes remain protected when the helmet is in the raised position.

Filter Lenses

Filter lenses for welding come in various densities, or "shades". The higher the shade number, the more completely the lens filters harmful, intense radiation. The shade of lens used for any particular task depends on the nature of the task and intensity of radiation associated with that operation. Guidance on which shade to select for each operation type is fairly well settled and widely published. OSHA establishes minimum shade recommendations, and other organizations including ANSI and AWS establish recommended shades. A copy of a standard guidance chart can be found here: <https://www.osha.gov/Publications/OSHAfactsheet-eye-protection-during-welding.pdf>

Welding lenses are available in several forms, but passive plates and auto-darkening filters are the most common:

Passive Plates

A passive plate has a single shade that is uniform over the face of the lens. Passive plates are almost always made of polycarbonate, although some glass versions are still available. Passive plates are very inexpensive but require that the user lift the entire helmet away from his face between welds so he can see the workpiece. They are ideal for a welder who will be doing only one type of welding and large, long welds that do not require a frequent need to lift and "head bob" the helmet in front of the face. However, they are usable in any operation



and are often a first choice due to the economy of these lenses.

Auto-Darkening Filters (ADFs)



Auto-darkening filters (ADFs) are the second major type of welding filter. ADFs are lightly shaded for environment and workpiece viewing in normal state but, upon sensing a weld arc, darken to a pre-determined shade in fractions of a second to protect the user's eyes. This means that the welder does not have to raise and "head bob" the helmet up and down for each weld. Some ADF's are available in variable shades and can be adjusted so that the dark, activated state can be any of several shades.

ADFs are particularly good for high-volume operations with short and quick welds that would normally involve hundreds or thousands of helmet lifts and "head bobs" over the course of a shift. With an ADF, the user can keep his focus directly on fixturing the workpiece and staging the weld gun without moving the helmet. Variable-shade ADF's are also well-suited for users who might encounter a variety of different weld types during the life of the unit.

ADFs protect the user's eyes from harmful radiation even if the ADF fails to darken. The filters for IR and UV radiation are permanently built into the ADF unit and are wholly independent of the electronics. The darkening is only for the visible light and for user comfort and ability to remain focused on the weld itself.

4. TRAINING

Providing adequate training for all supervisors and workers who require eye and face protection is crucial to ensuring worker safety. OSHA estimates that 90 percent of eye injuries can be prevented through the use of proper protective eyewear. Those who were injured while not wearing protective eyewear most often said they believed it was not required for the situation, or that they had received no information on where eyewear could be found and what kind of eyewear should be used.

The following is a suggested list of training objectives. Training should be site-specific and may need to cover more topics than are listed below:

- Recognize the hazards, environmental and other workplace factors such as those described in the Hazard Assessment section.
- Proper selection, fit and use of eye and face protectors for each application.
- Inspection and maintenance of eye and face protectors.
- How and where employees can obtain protective eyewear.
- Where to get replacements and what to do if eye protection is missing from a workstation.
- Manufacturer's instructions, warnings, cautions and equipment limitations should be reviewed and understood by the employees.
- Always maintain personal protective equipment according to the manufacturer's requirements.

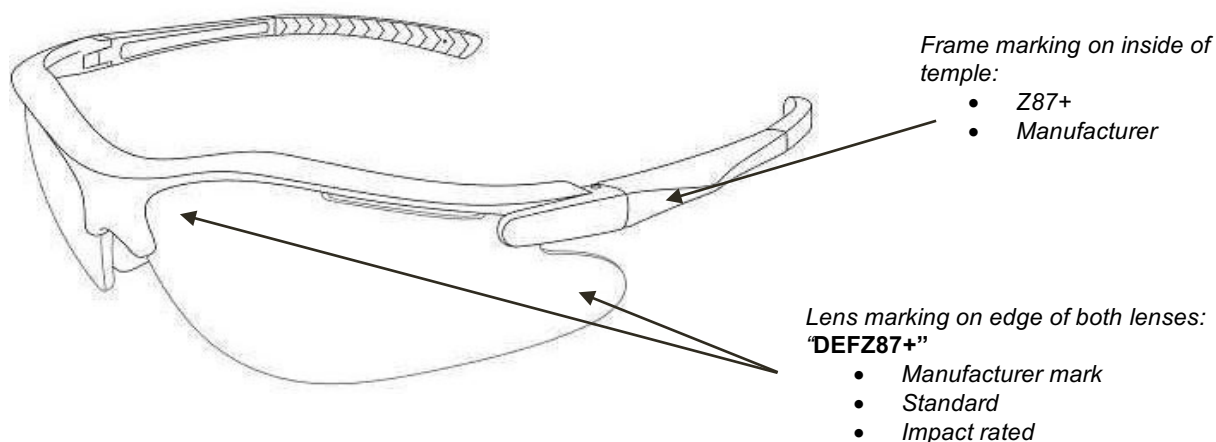
Eye safety policies should be clear. Devices or lenses should be replaced immediately if all or part of the plastic looks cloudy, has lost its gloss, has droops, is crazed or marked by tiny cracks, or seems distorted (product has softened and then re-hardened). Chemical degradation can embrittle plastic and significantly reduce impact protection. Immediate replacement upon failing inspection or after impact is especially important if the protector is also being against impact hazards. See “Working with Chemicals” for more information.

5. EYE PROTECTION MARKINGS

ANSI/ISEA Z87.1-2015 requires markings on eye protection that directly relate to the ability of the eye protection device to defend against specific hazards. If the eye protection is ANSI/ISEA Z87.1-2015 compliant, it will be marked (or etched) with Z87, must clearly indicate the manufacturer, and any additional markings to identify impact, dust, optical radiation, and splash protection. Splash marks are not applied to lenses – they are on frames only. Note: For some devices, markings may appear on the lens or the frames but not both.

Impact	Liquid splash/droplet	Optical Radiation
Spectacle lens: + All other lens: Z87+ Plano frame: Z87+ Rx frame: Z87-2+	Splash/droplet: D3 Dust: D4 Fine dust: D5	IR: R and scale number Visible: L and scale number UV: U and scale number Welding: W shade number Variable tint: V Special purpose: S

Example of Distinct Marking for ANSI Z87.1-2015
(For fictitious manufacturer: DEF)



DEFZ87+W3	Impact rated, Welding (shade 3) Face shield
DEFZ87+	Impact rated Goggle
DEFZ87	Non-impact rated Goggle or Face shield
DEFZ87+	Impact rated Plano Spectacle
DEFZ87-2+	Impact rated prescription Spectacle
DEFZ87+D3	Impact rated, Splash rated, Goggle or Face shield
DEFZ87+D3D4D5	Impact rated, Goggle or Full Face Piece Respirator, splash, dust and fine dust rated
DEFZ87U3	Non-impact rated, UV protective, Goggle or Face shield

6. ANSI/ISEA Z87.1-2015 Eye and Face Protector Selection Chart

This chart is taken from the ANSI/ISEA Z87.1-2015 standard document and is not intended to be the sole reference in selecting the proper eye and face protector. The information in this guide is intended to aid in identifying and selecting the types of eye and face protectors that are available, and their capabilities and limitations for the hazards listed. Please refer to the ANSI/ISEA Z87.1-2015 standard document for specific requirements. For specific applications, please consult manufacturer's guidelines.

Hazard	Protectors	Limitations	Marking ¹
IMPACT - Chipping, grinding, machining, masonry work, riveting, and sanding			
Flying fragments, objects, large chips, particles, sand, dirt, etc.	<ul style="list-style-type: none">• Spectacles with side protection• Goggles with direct or indirect ventilation• Faceshield worn over spectacles or goggles• Welding helmet worn over spectacles or goggles• Loose-fitting respirator worn over spectacles or goggles• Full-facepiece respirators	<p>Caution should be exercised in the use of metal frame protective devices in electrical hazard areas. Metal frame protective devices could potentially cause electrical shock and electrical burn through contact with, or thermal burns from exposure to the hazards of electrical energy, which include radiation from accidental arcs.</p> <p>To provide adequate protection, ensure goggles fit tightly to the face.</p> <p>Atmospheric conditions and the restricted ventilation of a protector can cause lenses to fog. Frequent cleaning may be required.</p>	Impact rated: + (spectacle lens) Z87+ (all other lens) Z87+ (plano frame) Z87-2+ (Rx frame)
HEAT - Furnace operations - pouring, casting, hot dipping, gas cutting, and welding			
Hot sparks	<ul style="list-style-type: none">• Spectacles with side protection• Goggles with direct or indirect ventilation• Faceshield worn over spectacles or goggles• Loose-fitting respirator worn over spectacles• Full-facepiece respirator	<p>Spectacles, cup and cover type goggles do not provide unlimited facial protection.</p> <p>Operations involving heat may also involve optical radiation. Protection from both hazards shall be provided.</p>	NOTE: There are currently no marking designations for eye protection to heat or high-temperature exposure in the ANSI/ISEA Z87.1-2015 standard.
Splash from molten metal	<ul style="list-style-type: none">• Faceshield worn over goggles• Loose-fitting respirator worn over spectacles or goggles• Full-facepiece respirator		
High temperature exposure	<ul style="list-style-type: none">• Screen faceshield over spectacles or goggles• Reflective faceshield over spectacles or goggles		
CHEMICAL – Liquids, acid and chemical handling, degreasing, plating.			
Splash, droplets and sprays	<ul style="list-style-type: none">• Goggles with indirect ventilation (eyecup or cover type)• Faceshield worn over goggles• Loose-fitting respirator worn over spectacles or goggles• Full-facepiece respirator	<p>Atmospheric conditions and the restricted ventilation of a protector can cause lenses to fog. Frequent cleaning may be required.</p> <p>To provide adequate protection, ensure goggles fit tightly to the face.</p>	Splash/droplet: D3

Hazard	Protectors	Limitations	Marking ¹
Irritating Mist	<ul style="list-style-type: none"> Goggle with no ventilation (cover type) Faceshield worn over goggles Loose-fitting respirator worn over spectacles or goggles Full-facepiece respirator 	<p>Atmospheric conditions and the restricted ventilation of a protector can cause lenses to fog. Frequent cleaning may be required.</p> <p>To provide adequate protection, ensure goggles fit tightly to the face.</p>	NOTE: There are currently no marking designations for eye protection to irritating mists exposure in the ANSI/ISEA Z87.1-2015 standard.
DUST - Woodworking, buffing, general dusty conditions			
Nuisance dust	<ul style="list-style-type: none"> Goggles with direct or indirect ventilation (eyecup or cover type) Full-facepiece respirator 	<p>Atmospheric conditions and the restricted ventilation of a protector can cause lenses to fog. Frequent cleaning may be required.</p> <p>To provide adequate protection, ensure goggles fit tightly to the face.</p>	Dust: D4
Fine dust	<ul style="list-style-type: none"> Goggles with indirect ventilation or no ventilation Full-facepiece respirator 	To provide adequate protection, ensure goggles fit tightly to the face.	Fine dust: D5
OPTICAL RADIATION			
Infrared Radiation (IR)	<ul style="list-style-type: none"> Spectacles with side protection Goggles with direct or indirect ventilation Faceshield worn over spectacles or goggles Welding helmet worn over spectacles or goggles Loose-fitting respirator worn over spectacles or goggles Full-facepiece respirators 	<p>For proper fit of protector; there shall be no penetration of direct infrared spectra light in all non-lens areas.</p> <p>Side shields shall have filtering capability equal to or greater than the front lenses.</p>	IR: R and scale number
Visible Light (Glare)	<ul style="list-style-type: none"> Spectacles with side protection Goggles with direct or indirect ventilation Faceshield worn over spectacles or goggles Welding helmet worn over spectacles or goggles Loose-fitting respirator worn over spectacles or goggles Full-facepiece respirators 	<p>For proper fit of protector; there shall be no penetration of direct visible light in all non-lens areas.</p> <p>Side shields shall have filtering capability equal to or greater than the front lenses.</p>	Visible: L and scale number
Ultraviolet Radiation (UV)	<ul style="list-style-type: none"> Spectacles with side protection Goggles with direct or indirect ventilation Faceshield worn over spectacles or goggles Welding helmet worn over spectacles or goggles Loose-fitting respirator worn over spectacles or goggles Full-facepiece respirators 	<p>For proper fit of protector; there shall be no penetration of direct ultraviolet light in all non-lens areas</p> <p>Side shields shall have filtering capability equal to or greater than the front lenses.</p>	UV: U and scale number
Lasers	Refer to ANSI Z136.1-2007 "Safe Use of Lasers", for guidance in choosing the correct protective eyewear when working with lasers.		NOTE: There are currently no marking designations for eye protection to Lasers in the ANSI/ISEA Z87.1-2015 standard.

Hazard	Protectors	Limitations	Marking ¹
Arc Welding: Arc Process Examples: Shielded Metal Arc Welding (SMAW) Gas Metal Arc Welding (GMAW) Gas Tungsten Arc Welding (GTAW) Air Carbon Arc Welding (CAC-A) Carbon Arc Welding (CAW) Plasma Arc Welding (PAW) Plasma Arc Cutting (PAC) Viewing electric arc furnaces and boilers.	<ul style="list-style-type: none"> • Welding helmet over spectacles or goggles • Handshield over spectacles or goggles • Welding Respirator • TYPICAL FILTER LENS SHADE: 10-14 	<p>Protection from optical radiation is directly related to filter lens density. Select the darkest shade that allows adequate task performance.</p> <p>For proper fit of protector; there shall be no penetration of direct visible light in all non-lens areas.</p> <p>Side shields shall have filtering capability equal to or greater than the front lenses. Welding helmets are intended to shield the eyes and face from optical radiation, heat, and impact. Welding helmets should not be used as a stand-alone protective devices and should be worn in conjunction with goggles or spectacles.</p> <p>Filter lens shade selection is to be made based on the welding process, arc current, electrode size and/or plate thickness. Use ANSI Z49.1:2012, Table 1, Guide for Shade Numbers, to select the proper filter lens shade for both protection and comfort (reduction in visible glare).</p> <p>Note: Filter lenses shall meet the requirements for shade designations in table 6 of the ANSI/ISEA Z87.1-2015 standard document.</p>	Welding: W <i>shade number</i> UV: U <i>scale number</i> Visible: L <i>scale number</i> IR: R <i>scale number</i> Variable tint: V Special purpose: S

Hazard	Protectors	Limitations	Marking ¹
Oxyfuel Gas Welding: Process Examples: Oxyfuel Gas Welding (OFW) Viewing gas-fired furnaces and boilers	<ul style="list-style-type: none"> • Welding goggles • Welding helmet over spectacles or goggles • Welding faceshield over spectacles or goggles TYPICAL FILTER LENS SHADE: 6 -8	<p>Protection from optical radiation is directly related to filter lens density. Select the darkest shade that allows adequate task performance.</p> <p>For proper fit of protector; there shall be no penetration of direct visible light in all non-lens areas.</p> <p>Side shields shall have filtering capability equal to or greater than the front lenses.</p> <p>Welding helmets are intended to shield the eyes and face from optical radiation, heat, and impact. Welding helmets should not be used as a stand-alone protective devices and should be worn in conjunction with goggles or spectacles</p> <p>Filter lens shade selection is to be made based on the welding process, arc current, electrode size and/or plate thickness. Use ANSI Z49.1:2012, Table 1, Guide for Shade Numbers, to select the proper filter lens shade for both protection and comfort (reduction in visible glare).</p> <p>Note: Filter lenses shall meet the requirements for shade designations in table 6 of ANSI/ISEA Z87.1-2010.</p>	Welding: W shade number UV: U scale number Visible: L scale number IR: R scale number Variable tint: V Special purpose: S
Oxyfuel or Oxygen Cutting	<ul style="list-style-type: none"> • Welding goggles • Welding helmet over spectacles or goggles • Welding faceshield over spectacles or goggles TYPICAL FILTER LENS SHADE:3-6		Frame marking on inside of left temple: <ul style="list-style-type: none"> • “ANSI Z87 +” • Country of origin • “DEF”
Torch brazing	<ul style="list-style-type: none"> • Welding goggles • Welding helmet over spectacles or goggles • Welding faceshield over spectacles or goggles TYPICAL FILTER LENS SHADE: 3-4		
Torch soldering	<ul style="list-style-type: none"> • Spectacles • Welding faceshield over spectacles TYPICAL FILTER LENS SHADE: 2	Shade, tinted or special purpose lenses, as suitable. Note: Refer to definition of special purpose lenses in ANSI/ISEA Z87.1-2015.	
Glare	<ul style="list-style-type: none"> • Spectacles with or without side protection • Faceshield over spectacles or goggles. 		

1. Refer to ANSI/ISEA Z87.1-2015 table 4a for complete marking requirements.
2. Refer to ANSI Z49.1: 2012: “Safety in Welding, Cutting, and Allied Processes”, Table 1, Guide for Shade Numbers, to select the proper lens filter protective shade based on welding process, arc current (in amperes), Electrode Size (arc welding only) and metal plate thickness (for oxyfuel and oxygen cutting only).
3. Refer to ANSI Z136.1-2007 “Safe Use of Lasers”, for guidance on choosing the correct protective eyewear when working with lasers.

7. SPECIAL CONSIDERATIONS

With the exception of glare, Ultraviolet (UV) and Infrared (IR), the items listed under this section are not addressed directly in ANSI/ISEA Z87.1-2015 through testing requirements and/or markings. The information below is provided as a resource. Please consult with the device manufacturer for additional information.

Working with Chemicals

ANSI/ISEA Z87.1-2015 provides a test methodology and marking for “splash protection” (D3) on eye/face protectors; however, the Standard does not specifically address protector performance against chemicals, including when splashed. Because there are thousands of chemicals and hundreds of complicating environmental factors, the assessment of specific chemicals as part of the Standard would be incomplete, if not nearly impossible.



While a protector marked for splash protection is an important first step in the defense against liquid hazards, chemicals can affect the performance of a product:

- Certain chemicals can cause plastics (from which most eye/face protectors are manufactured) to crack or craze, whereas others have no effect.
- Complicating environmental factors, including but not limited to heat, humidity, and other chemicals, can contribute to the performance of the protector.
- Even stress placed on the protector itself (such as the curvature of a lens, the fit into a frame or headgear, the size of a face), can affect the protector’s performance if under chemical attack.

Optical Radiation



Understanding the dangers of optical hazards and the risks arising from the intensity and length of exposure time to optical radiation is critical when working indoors or outdoors. The most common radiation workplace hazards are:

Glare – Bright, visible light generated from sources such as lamps, welding arcs or furnace operations and outdoors where direct or reflected sunlight is present. High levels of visible glare can cause discomfort and impact visual clarity.

Ultraviolet – Commonly known as UV, is present in welding operations, and is emitted from industrial lamps used for curing and sanitation purposes. UV energy can initiate photo-chemical reactions in the eye, and short term effects can be “sun burn” of the cornea (often referred to as a “sand in the eyes” feeling). Long term UV exposure can accelerate cataract formation beyond a person’s normal aging process, making the use of UV absorbing eyewear and sun glasses highly recommended.

Blue Light – The blue/violet portion of the visible light spectrum adjacent to the UV. It is transmitted through the eye where long term damage can occur with heavy exposures, such as in the presence of welding arcs. The sun emits blue light and workers who spend extended time outdoors can benefit from lenses that reduce the amount transmitted.

Infrared (IR) – Invisible long wavelength radiation that is typically experienced as heat energy from sources such as welding arcs, radiant lamps, ovens & furnaces, or accidental discharges of energy from electrical equipment. Long-term exposures to IR can lead to tissue dehydration and cataract formation. Filtration can be accomplished either by absorption or reflection.

Lasers and Electrical Safety

Other settings and workplaces where optical radiation hazards are present include operations with lasers or servicing of electrical equipment. These applications are outside of the scope of ANSI/ISEA Z87.1-2015, but recommendations for eye and face protection are contained in dedicated standards:

- ANSI Z136.1 Safe Use of Lasers
- NFPA 70E Standard for Electrical Safety in the Workplace

Working with Molten Metal

Molten metal splash, most often created by the addition of wet materials to a molten bath, cause more injuries on a melt deck than any other hazard. Molten metal splash also occurs on a smaller scale during other applications, such as welding. Working around molten metal involves exposure to heat and often (depending on the distance from the source), optical radiation, such as infrared (IR) and UV.



When working near molten metal, the use of face protection, preferably in conjunction with appropriate eye protection, is recommended. Select an impact-rated visor that can withstand heat and resist warping. Additionally, depending on the working distance from the molten metal source, a visor that can reflect heat and its by-products (such as IR) should be worn, such as those with reflective coating (i.e., gold or some metal alloys). Note: While metal mesh visors may dissipate heat when working in hot temperatures, they are not designed to handle splash or optical radiation hazards.

Working in Humid and/or Abrasive Environments



Three important barriers to eyewear PPE usage include: lack of comfort and fit, fogging, and scratching. While comfort and fit are subjective based on facial size, contour, nose bridge, etc., both anti-fog (AF) and anti-scratch (AS) performance is measureable. Fog forms on a surface when water vapor in the air condenses in fine droplets. A good anti-fog coating should prevent the formation of such droplets, but not all anti-fog coatings are the same.

AF coatings can be hydrophilic (attract water), or hydrophobic (repel water):

- Hydrophilic coatings are most effective for moderate moisture, such as the moisture in processing plants.
- Hydrophobic coatings are effective in high moisture environments, including those worksites where users go from warm to cold and back.

- “Superhydro” coatings can help “part” water droplets quickly, clearing fog faster. Superhydro coatings, while offering better performance, do not last as long as their structures are easily damaged in abrasive environments.
- There are also combination products that offer both hydrophilic and hydrophobic properties in the same coating that “switch” between the two methods of clearing fog from the lens, depending on the temperature and humidity.

Working Around Electricity

An arc flash is a complex phenomenon occurring when electricity travels through the air creating ionized gases. The resulting explosion can cause fires and serious harm to the surrounding equipment and people.

Under conditions where an arc flash may occur, PPE categories have been established that indicate the type of PPE needed, as well as what protection level is required (and to which it must perform). Eye and face protector performance against arc flash is specified in NFPA 70E, *Standard for Electrical Safety in the Workplace*.



NFPA 70E requires that all eye and face protectors meet ANSI/ISEA Z87.1. NFPA 70E recommends that eye protection be worn, regardless of the level of energy produced by the electricity, and even when an arc-rated face shield is required.

If the manufacturer claims the eye and face PPE also protects from arc flash, it must also meet the testing criteria in ASTM F2178, *Standard Test Method for Determining the Arc Rating and Standard Specification for Eye or Face Protective Products*. This test method assesses the PPE Category (1, 2, 3 or 4) into which a particular protector falls. NFPA 70E clearly outlines all of the required PPE, based on the results of the risk assessment conducted by qualified personnel.

Arc events almost always include flying particles or objects in addition to the electrical or arc hazard itself. Eye and face protection for arc-hazard environments should always be marked for impact protection according to ANSI/ISEA Z87.1-2015.

8. CARE, MAINTENANCE AND STORAGE

Cleaning

Most manufacturers recommend that eye and face protectors should be cleaned with mild, soapy water and dried in the open air. The use of solvents is not recommended for cleaning and may reduce the strength of the protectors.

Always consult the cleaning directions provided by the manufacturer and consult the manufacturer with questions on cleaning materials or methods not specifically mentioned in the product literature.

Maintenance

Routine maintenance of eye and face protective equipment is generally limited to cleaning and visual inspections for damage. Always maintain personal protective equipment according to the manufacturer's requirements.

Manufacturers recommend that personal eye and face protection equipment be inspected frequently and equipment that has been impacted or shows other signs of damage be removed from service and immediately replaced.



Storage

When not in use, personal protective equipment should be stored in a cool, dry and clean place out of direct sunlight. Avoid areas where heat, oil, chemicals (or their vapors) or other degrading elements may be present.

Prior to using personal protective equipment, which has been stored for long periods of time, an inspection of this equipment should be performed for signs of damage. Products showing signs of damage should be removed from service and replaced.

9. ISEA EYE AND FACE PROTECTION DIRECTORY

3M COMPANY
Occupational Health &
Environmental Safety Division
3M Center Building 0235-02-W-70
St. Paul, MN 55133-1000
800-243-4630
www.mmm.com

ARKANE
18 Boulden Circle
Suite 14
New Castle, DE 19720
www.arkane.com

BOLLÉ
Bushnell Corporation
9200 Cody Street
Overland Park, KS 66214-1734
800-423-3537
www.bolle.com

BULLARD
1898 Safety Way
Cynthiana, KY 41031
800-827-0423
www.bullard.com

EDGE EYEWEAR
P.O. Box 845
Layton, UT
84041
866-953-7325
www.edgeeyewear.com

ENCON SAFETY
PRODUCTS, INC.
6825 W. Sam Houston Parkway N.
Houston, TX 77041
713-466-1449
www.enconsafety.com

ERB INDUSTRIES, INC.
1 Safety Way
P.O. Box 1237
Woodstock, GA 30188
800-800-6522
www.e-erb.com

ERGODYNE
1021 Bandana Blvd, Suite 220
St. Paul, MN 55108
800-225-8238
www.ergodyne.com

GATEWAY SAFETY INC.
11111 Memphis Avenue
Cleveland, OH 44144
800.822.5347
www.gatewayssafety.com

GENTEX CORPORATION
600 North Centennial Street
Zeeland, MI 49464
616-772-1800
www.gentexcorp

GLOBAL GLOVE AND SAFETY
13915 Radium St. NW
Ramsey, MN 55303
763-450-0110
www.globalglove.com

HONEYWELL SAFETY PRODUCTS
900 Douglas Pike
Smithfield, RI 02917
800-430-5490
www.honeywellsafety.com

KIMBERLY-CLARK PROFESSIONAL
1400 Holcomb Bridge Rd.
Roswell, GA 30076
800-241-3146
www.kcprofessional.com

MCR SAFETY
1255 Schilling Blvd. West
Collierville, TN 38017
901-795-5810
www.mcrcsafety.com

MSA SAFETY INC.
1000 Cranberry Woods Drive
Cranberry Township, PA 16066
Phone: 800-MSA-2222
www.MSAsafety.com

PROTECTIVE INDUSTRIAL PRODUCTS
968 Albany Shaker Road
Latham, NY 12110
800/262-5755
www.pipusa.com

RADIANS INC.
5305 Distriplex Farms Drive
Memphis, TN 38141
877-723-4267
www.radians.com

SAFETY OPTICAL SERVICE
PO Box 292397
Lewisville, TX 75029
866-9191-2020
www.sideshield.com

SELLSTROM MANUFACTURING COMPANY
2050 Hammond Drive
Schaumburg, IL 60173
800-323-7402
www.sellstrom.com

10. ADDITIONAL INFORMATION

Occupational Safety and Health Administration (OSHA)
200 Constitution Avenue, NW
Washington, DC 20210
www.osha.gov

Information on standards can be obtained by contacting:

American National Standards Institute (ANSI)
25 West 43rd Street
New York, NY 10036
Phone: 212-242-4900
www.ansi.org

American Society for Testing and Materials (ASTM)
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
Phone: 610-832-9500
www.astm.org

National Fire Protection Association NFPA
1 Batterymarch Park
Quincy, MA 02169-7471
Phone: 617-770-3000
www.nfpa.org

American Welding Society (AWS)
8669 NW 36 Street, # 130
Miami, Florida 33166-6672
Phone: 305-443-9353
www.aws.org

Laser Institute of America (LIA)
13501 Ingenuity Drive, Suite 128
Orlando, FL 32826
Phone: 407-380-1553
www.lia.org

For standard specific questions, please direct any requests for interpretation to the standards developing organization.

ISEA is the trade association for personal protective equipment and technologies:

International Safety Equipment Association (ISEA)
1901 North Moore Street, Suite 808
Arlington, VA 22209
Phone: 703-525-1695
www.safetyequipment.org