



Safe Operating Procedure

(Revised 11/25)

PERSONAL PROTECTIVE EQUIPMENT (PPE) – EYES AND FACE

Introduction

Eye and/or face protection is mandated by federal Occupational Safety and Health Administration (OSHA) standards, as well as state law (Nebraska Revised Statute, Section 85-901), which requires use of American National Standards Institute (ANSI)-approved eye protection by students, faculty, staff, and visitors at UNL who observe or participate in:

1. Vocational, technical, industrial arts, chemical, or chemical-physical courses of instruction involving potential exposure to:
 - Hot molten metals or other molten metals.
 - Milling, sawing, turning, shaping, cutting, grinding, or stamping of any solid materials.
 - Heat treatment, tempering, or kiln firing of any metal or other materials.
 - Gas or electric arc welding or other forms of welding processes.
 - Repair or servicing of any vehicle.
 - Caustic or explosive materials.
2. Chemical, physical, or combined chemical-physical laboratories involving caustic or explosive material, hot liquids or solids, injurious radiation, or other hazards not listed above.

Hazard Assessment

The appropriate ensemble of face and eye protection is determined through a hazard assessment. The hazard assessment must consider multiple and simultaneous hazards that may be present and provide protection against the highest level of each hazard. The tables are provided next that summarize OSHA and ANSI hazard assessment guidance.

**OSHA Eye and Face Protection Selection Chart**

Source	Assessment of Hazard	Protection
IMPACT -- Chipping, grinding machining, masonry work, woodworking, sawing, drilling, chiseling, powered fastening, riveting, and sanding	Flying fragments, objects, large chips, particles, sand, dirt, etc.	Spectacles with side protection, goggles, face shields. See notes (1), (3), (5), (6), (10). For severe exposure, use face shields.
HEAT -- Furnace operations, pouring, casting, hot dipping, and welding	Hot sparks	Face shields, goggles, spectacles with side protection. For severe exposure use face shields. See notes (1), (2), (3).
	Splash from molten metals	Face shields worn over goggles. See notes (1), (2), (3).
	High temperature exposure	Screen face shields, reflective face shields. See notes (1), (2), (3).
CHEMICALS -- Acid and chemical handling, degreasing, plating	Splash	Goggles, eye cup and cover types. For severe exposure, use face shields. See notes (3), (11).
	Irritating mists	Special-purpose goggles.
DUST -- Woodworking, buffing, general dusty conditions	Nuisance dust	Goggles, eye cup and cover types. See note (8).
LIGHT and/or RADIATION --		
Welding: Electric arc	Optical radiation	Welding helmets or welding shields. Typical shades: 10-14. See notes (9), (12).
Welding: Gas	Optical radiation	Welding goggles or welding face shield. Typical shades: gas welding 4-8, cutting 3-6, brazing 3-4. See note (9).
Cutting, Torch brazing, Torch soldering	Optical radiation	Spectacles or welding face shield. Typical shades, 1.5-3. See notes (3), (9).
Glare	Poor vision	Spectacles with shaded or special-purpose lenses, as suitable. See notes (9), (10).

Notes to Eye and Face Protection Selection Chart:

(1) Care should be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards. Adequate protection against the highest level of each of the hazards should be provided. Protective devices do not provide unlimited protection.

- (2) Operations involving heat may also involve light radiation. As required by the standard, protection from both hazards must be provided.
- (3) Face shields should only be worn over primary eye protection (spectacles or goggles).
- (4) As required by the standard, filter lenses must meet the requirements for shade designations in 1910.133(a)(5). Tinted and shaded lenses are not filter lenses unless they are marked or identified as such.
- (5) As required by the standard, people whose vision requires the use of prescription (Rx) lenses must wear either protective devices fitted with prescription (Rx) lenses or protective devices designed to be worn over regular prescription (Rx) eyewear.
- (6) Wearers of contact lenses must also wear appropriate eye and face protection devices in a hazardous environment. It should be recognized that dusty and/or chemical environments may represent an additional hazard to contact lens wearers.
- (7) Caution should be exercised in the use of metal frame protective devices in electrical hazard areas.
- (8) Atmospheric conditions and the restricted ventilation of the protector can cause lenses to fog. Frequent cleansing may be necessary.
- (9) Welding helmets or face shields should be used only over primary eye protection (spectacles or goggles).
- (10) Non-side shield spectacles are available for frontal protection only but are not acceptable eye protection for the sources and operations listed for "impact."
- (11) Ventilation should be adequate but well protected from splash entry. Eye and face protection should be designed and used so that it provides both adequate ventilation and protects the wearer from splash entry.
- (12) Protection from light radiation is directly related to filter lens density. See note (4). Select the darkest shade that allows task performance.

Eye Protection for Lasers (OSHA)

Intensity, CW maximum power density [watts/cm(d)]	Attenuation	
	Optical Density (OD)	Attenuation Factor
10 ⁻²	5	10 ⁵
10 ⁻¹	6	10 ⁶
1.0	7	10 ⁷
10.0	8	10 ⁸

Source: <https://www.osha.gov/eye-face-protection>

ANSI Eye and Face Protection Selection Chart



Hazard	Protectors	Limitations	Markings
IMPACT – Chipping, grinding, machining, masonry work, riveting, 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 Face shield 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>	<p>Impact rated:</p> <p>+ (spectacle lens)</p> <p>Z87+ (all other lenses)</p> <p>Z87+ (plano frame)</p> <p>Z87-2+ (Rx frame)</p>
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 Face shield 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 should be provided.</p>	<p>NOTE: There are currently no marking designations for eye protection to heat or high temperature exposure in the ANSI/ISEA Z87.1-2020 standard.</p>
Splash from molten metal	<ul style="list-style-type: none"> Face shield worn over goggles Full-facepiece respirator Loose-fitting respirator worn over spectacles or goggles 		



High temperature exposure	<ul style="list-style-type: none"> • Screen face shield over spectacles or goggles • Reflective face shield 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) • Face shield 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
Irritating Mist	<ul style="list-style-type: none"> • Goggle with no ventilation (cover type) • Face shield 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 from irritating mists exposure in the ANSI/ISEA Z87.1-2020 standard.
DUST - Woodworking, buffing, general dusty conditions			
Nuisance dust	<ul style="list-style-type: none"> • Goggles with direct or indirect ventilation (eye cup 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 • Face shield worn over spectacles or goggles • Welding helmet worn over spectacles or goggles • Loose-fitting respirator worn over spectacles or goggles • Full-facepiece respirator 	<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 • Face shield worn over spectacles or goggles • Welding helmet worn over spectacles or goggles • Loose-fitting respirator worn over spectacles or goggles • Full-facepiece respirator 	<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 • Face shield worn over spectacles or goggles • Welding helmet worn over spectacles or goggles • Loose-fitting respirator worn over spectacles or goggles • Full-facepiece respirator 	<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 Z136.1-2022 “Safe Use of Lasers” for guidance in choosing the correct protective eyewear		NOTE: There are currently no marking designations for eye protection to



	when working with lasers.		Lasers in the ANSI/ISEA Z87.1-2020 standard.
Electric Arcs	Refer to NFPA 70E for guidance in choosing the correct protective eyewear when working on electrified equipment.	Face shields only provide compliant eye and face protection when worn over top of protective spectacles.	NOTE: there are currently no marking designations for eye protection for electrical arcs in the ANSI/ISEA Z87.1-2020 standard.
Arc Welding: Arc Process Examples: <ul style="list-style-type: none"> 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 Hand shield 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.</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 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</p>	<p>Welding: W shade number</p> <p>UV: U scale number</p> <p>Visible: L scale number</p> <p>IR: R scale number</p> <p>Variable tint: V</p> <p>Special purpose: S</p>



		<p>protection and comfort (reduction in visible glare).</p> <p>Note: Filter lenses shall meet the requirements for shade designations in table 7 of ANSI/ISEA Z87.1-2020.</p>	
<p>Oxyfuel Gas Welding:</p> <p>Process Examples:</p> <ul style="list-style-type: none"> 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 face shield 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>Welding: W shade number</p> <p>UV: U scale number</p> <p>Visible: L scale number</p>
Oxyfuel or Oxygen Cutting	<ul style="list-style-type: none"> Welding goggles Welding helmet over spectacles or goggles Welding face shield over spectacles or goggles Typical filter lens shade: 3-6 	<p>Side shields shall have filtering capability equal to or greater than the front lenses.</p>	<p>IR: R scale number</p> <p>Variable tint: V</p>
Torch brazing	<ul style="list-style-type: none"> Welding goggles Welding helmet over spectacles or goggles Welding face shield over spectacles or goggles Typical filter lens shade: 3-4 	<p>Welding helmets are intended to shield the eyes and face from optical radiation, heat, and impact. Welding helmets should not be used as 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</p>	<p>Special purpose: S</p>



		designations in table 7 of ANSI/ISEA Z87.1-2020.	
Torch soldering	<ul style="list-style-type: none">• Spectacles• Welding face shield over spectacles• Typical filter lens shade: 2	Shade or special purpose lenses, as suitable.	
Glare	<ul style="list-style-type: none">• Spectacles with or without side protection• Face shield over spectacles or goggles	Note: Refer to definition of special purpose lenses in ANSI/ISEA Z87.1-2020	

Sources: <https://blog.ansi.org/ansi/ansi-isea-z87-1-2020-safety-glasses-eye-protection/> and <https://www.osha.gov/eye-face-protection>

Other Considerations

- Face and eye protection is not a substitute for feasible engineering controls and safe work practices.
- Face shields are not a primary protection device for the eyes. They must be used in combination with spectacles or goggles if eye protection is needed.
- Departments have the option of providing eye protection for students, purchasing eye protection and selling it to students at cost; making eye protection available for a moderate rental fee; or requiring students to provide their own.
- Departments are required to provide employees with appropriate eye protection at no cost to the employees. Departments must provide people whose vision requires the use of prescription (Rx) lenses with either protective devices fitted with prescription (Rx) lenses or protective devices designed to be worn over regular prescription (Rx) eyewear. If a department provides protective eyewear fitted with prescription lenses, the department is not responsible for costs associated with eye exams.
- Contact lenses and prescription glasses do not provide eye protection in the industrial sense and must not be worn in a hazardous environment without addition of the appropriate safety eyewear.
- Caution should be exercised in the use of metal frame protective devices in electrical hazard areas.

- Welding helmets should be used in conjunction with safety spectacles (equipped with side shields).
- To ensure adequate protection, ensure goggles fit tightly to the face.
- Use of a respirator is allowed only after the user enrolls in the University of Nebraska-Lincoln's Respiratory Protection Program and has necessary medical qualification, training, and fit testing.
- See the University of Nebraska-Lincoln Bloodborne Pathogen Exposure Control Plan for face and eye protection and other personal protective equipment relative to potential exposures to bloodborne pathogens.

Cleaning

- Goggles may require frequent cleaning to minimize fogging.
- Eyewear marked with an "X" indicates that the lenses have met the required test to show that they are resistant to fogging. However, this applies to the lens only. The complete ensemble of the eyewear is not tested. Fogging may still be a problem.
- Eye and face protection equipment that has been previously used should be cleaned upon obvious contamination, after each work shift, and prior to use by another employee. Soap and water cleaning is generally acceptable, coupled with germicidal cleaning if biological agents are of concern or if PPE is being shared by employees.

Maintenance and Storage

- PPE must be used and maintained in a sanitary and reliable condition.
- The use of equipment with structural or optical defects is prohibited.
- Goggles should be kept in a case when not in use. Spectacles, in particular, should be given the same care as one's own glasses, since the frame, nose pads, and temples can be damaged by rough usage.
- Items should be placed in a clean, dust-proof container, such as a box, bag, or plastic envelope, to protect them while in storage.