

Basics of Personal Protective Equipment

The objective of the **Personal Protective Equipment (PPE) Program** is to protect employees from the risk of injury by creating a barrier against workplace hazards. Personal protective equipment is not a substitute for good engineering or administrative controls or good work practices, but should be used in conjunction with these controls to ensure the safety and health of employees. Personal protective equipment will be provided, used, and maintained when it has been determined that its use is required and that such use will lessen the likelihood of occupational injury and/or illness.

Head Protection

Head protection (hard hats) will be furnished to, and used by, all employees and contractors engaged in construction and other miscellaneous work. Head protection is also required to be worn by engineers, inspectors, and visitors at construction sites when hazards from falling or fixed objects, or electrical shock are present. Bump caps/skull guards will be issued and worn for protection against scalp lacerations from contact with sharp objects. However, they will not be worn as substitutes for safety caps/hats because they do not afford protection from high impact forces or penetration by falling objects.

Overhead Hazards Include:

- Suspended loads that could fall.
- Overhead beams or loads that could be hit against.
- Energized wires or equipment that could be hit against.
- Employees working at elevated sites who could drop objects on others below.
- Sharp objects or corners at head level.

Head Protection Equipment

Industrial head protective helmets meeting the requirements of the ANSI Z89.1-2009 standard are classified as Type I for top protection or Type II for lateral impact protection. Both types are tested for impact attenuation and penetration resistance. Type II helmet performance requirements include criteria for impact energy attenuation from impacts from the front, back and sides as well as the top; off-center penetration resistance, and chin strap retention.

There are three classes that fall under each type of helmet. The three classes indicate the helmets electrical insulation rating.

Class E (electrical) are tested to withstand 20,000 volts

Class G (general) helmets are tested at 2200 volts

Class C (conductive) provide no electrical protection

Eye and Face Protection

Prevention of eye injuries requires that all persons who may be in eye hazard areas wear protective eyewear. This includes employees, visitors, researchers, contractors, or others passing through an identified eye hazard area. To provide protection for these personnel, supervisors of such areas shall procure a sufficient quantity of goggles and/or plastic eye protectors that afford the maximum amount of protection possible and meet the requirements of ANSI Z287.1-2003. If these personnel wear personal glasses, they shall be provided with a suitable eye protector to wear over them.

Eye and Face Hazards include:

- Chemical splashes
- Dust
- Smoke and fumes
- Welding operations
- Lasers/optical radiation
- Bioaerosols
- Projectiles

Eye and Face Protection Equipment

- Safety glasses with side shields for moderate impact and particles encountered in grinding and scaling etc.
- Single lens goggles with clear or tinted lenses, perforated, port vented, or non-vented frames offer protection similar to safety glasses but may be worn over prescription eyeglasses.
- Welder goggles have impact resistant lenses and provide protection from sparking, scaling, or splashing metals and harmful rays.
- Chipper/grinder goggles provide eye protection from flying particles.
- Face shields protect eyes and face against flying particles, metal sparks, and chemical/biological splash and must be used in conjunction with safety eyewear.
- Welding shields protect laborer's eyes and face from infrared or radiant light burns, flying sparks, metal spatter and slag chips encountered during welding, brazing, soldering, resistance welding, bare or shielded electric arc welding, and oxyacetylene welding and cutting operations.

Emergency Eyewash Facilities

Emergency eyewash facilities meeting the requirements of ANSI Z358.1 will be provided in all areas where the eyes of any employee may be exposed to corrosive materials. All such emergency facilities will be located where they are easily accessible in an emergency.

Hand Protection

Suitable gloves shall be worn when hazards from chemicals, cuts, lacerations, abrasions, punctures, burns, biologicals, and harmful temperature extremes are present. Glove selection shall be based on performance characteristics of the gloves, conditions, duration of use, and hazards present. One type of glove will not work in all situations.

The first consideration in the selection of gloves for use against chemicals is to determine, if possible, the exact nature of the substances to be encountered. Read instructions and warnings on chemical container labels and MSDSs before working with any chemical. Recommended glove types are often listed in the section for personal protective equipment.

Chemicals eventually permeate all glove materials. However, they can be used safely for limited time periods if specific use and other characteristics (i.e., thickness and permeation rate and time) are known. The Office of Health and Safety can assist in determining the specific type of glove material that should be worn for a particular chemical.

Hand Hazards include:

- Chemicals.
- Sharp edges, splinters, etc.
- Temperature extremes.
- Biological agents.
- Exposed electrical wires.
- Sharp tools, machine parts, etc.
- Material handling.

Types of Gloves

- Disposable gloves made of lightweight plastic help guard against mild irritants.
- Fabric gloves made of cotton or blends improve grip and help insulate against mild cold and heat.
- Leather gloves guard against injuries from sparks or scraping against rough surfaces. They are also used with an insulated liner to guard against electrical hazards.
- Metal mesh gloves protect from cuts and scratches when working with cutting tools or sharp instruments.
- Aluminized gloves are designed to insulate hands from intense heat and are commonly used when working with molten materials.
- Chemical resistant gloves made of rubber, neoprene, polyvinyl alcohol or vinyl protect hands from corrosives, oils, and solvents.

Foot Protection

Safety shoes or boots with impact protection are required to be worn in work areas where carrying or handling materials such as packages, objects, parts or heavy tools, which could be dropped; and for other activities where objects might fall onto the feet. Safety shoes or boots with compression protection are required for work activities involving skid trucks (manual materials handling cars) or other activities in which materials or equipment could potentially roll over an employee's feet. Safety shoes or boots with puncture protection are required where sharp objects such as nails, wire, tacks, screws, large staples, scrap metal etc., could be stepped on by employees causing a foot injury.

Foot Hazards include:

- Heavy materials handled by employees.
- Sharp edges or points (puncture risk).
- Exposed electrical wires.
- Unusually slippery conditions.
- Wet conditions.
- Construction/demolition.

Safety Footwear

There are many types and styles of protective footwear and it is important to realize that a particular job may require additional protection other than listed here. Footwear that meets established safety standards will have an American National Standards Institute (ANSI) label inside each shoe.

- **Steel-Reinforced Safety Shoes.** These shoes are designed to protect feet from common machinery hazards such as falling or rolling objects, cuts, and punctures. The entire toe box and insole are reinforced with steel, and the instep is protected by steel, aluminum, or plastic material. Safety shoes are also designed to insulate against temperature extremes and may be equipped with special soles to guard against slip, chemicals, and/or electrical hazards.

- **Safety Boots.** Safety boots offer more protection when splash or spark hazards (chemicals, molten materials) are present:
 - When working with corrosives, caustics, cutting oils, and petroleum products, neoprene or nitrile boots are often required to prevent penetration.
 - Foundry or "Gaiter" style boots feature quick-release fasteners or elasticized insets to allow speedy removal should any hazardous substances get into the boot itself.
 - When working with electricity, special electrical hazard boots are available and are designed with no conductive materials other than the steel toe (which is properly insulated).

Hearing Protection

Wherever it is not feasible to reduce the noise levels or duration of exposures to those specified as Permissible Noise Exposures, in OSHA §1926.52, ear protective devices should be provided and used.

Types of hearing protection devices include:

Insert Type Earplugs

A device designed to provide an airtight seal with the ear canal. There are three types of insert earplugs - premolded, formable, and custom earplugs.

- **Premolded Earplugs—(Reusable)**
Premolded earplugs are pliable devices of fixed proportions. Two standard styles, single flange and triple flange, come in various sizes, and will fit most people. Personnel responsible for fitting and dispensing earplugs will train users on proper insertion, wear, and care. While premolded earplugs are reusable, they may deteriorate and should be replaced periodically.
- **Formable—(Disposable)**
Formable earplugs come in just one size. Some are made of material that, after being compressed and inserted, expands to form a seal in the ear canal. When properly inserted, they provide noise attenuation values that are similar to those from correctly fitted premolded earplugs. Individual units may procure approved formable earplugs. Supervisors must instruct users in the proper use of these earplugs as part of the annual education program. Each earplug must be held in place while it expands enough to remain firmly seated. A set of earplugs with a cord attached is available. These earplugs may be washed and therefore are reusable, but will have to be replaced after two or three weeks or when they no longer form an airtight seal when properly inserted.
- **Custom Molded Earplugs**
A small percentage of the population cannot be fitted with standard premolded or formable earplugs. Custom earplugs can be made to fit the exact size and shape of the individual's ear canal. Individuals needing custom earplugs will be referred to an audiologist.

Earmuffs

Earmuffs are devices worn around the ear to reduce the level of noise that reaches the ear. Their effectiveness depends on an airtight seal between the cushion and the head.

PERSONAL FALL ARREST SYSTEMS, LIFELINES, AND LANYARDS

- Lifelines, personal fall arrest systems (PFAS), and lanyards shall be used only for employee safeguarding. Any lifeline, safety belt, or lanyard actually subjected to in-service loading, as distinguished from static load testing, shall be immediately removed from service and shall not be used again for employee safeguarding.
- Lifelines shall be secured above the point of operation to an anchorage or structural member capable of supporting a minimum dead weight of 5,400 pounds.
- Lifelines used on rock-scaling operations, or in areas where the lifeline may be subjected to cutting or abrasion, shall be a minimum of 1-inch wire core manila rope. For all other lifeline applications, a minimum of ¾-inch manila or equivalent, with a minimum breaking strength of 5,400 pounds, shall be used.
- PFAS lanyard shall be a minimum of ½-inch nylon, or equivalent, with a maximum length to provide for a fall of no greater than 6 feet. The rope shall have a nominal breaking strength of 5,400 pounds.
- All PFAS and lanyard hardware shall be drop forged or pressed steel, cadmium plated in accordance with type 1, Class B plating specified in Federal Specification QQ-P-416. Surface shall be smooth and free of sharp edges.
- All PFAS and lanyard hardware, except rivets, shall be capable of withstanding a tensile loading of 4,000 pounds without cracking, breaking, or taking a permanent deformation.

SAFETY NETS

- Safety nets shall be provided when workplaces are more than 25 feet above the ground or water surface, or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, or safety belts is impractical.
- Where safety net protection is required by this section, operations shall not be undertaken until the net is in place and has been tested.
- Nets shall extend 8 feet beyond the edge of the work surface where employees are exposed and shall be installed as close under the work surface as practical but in no case more than 25 feet below such work surface. Nets shall be hung with sufficient clearance to prevent user's contact with the surfaces or structures below. Such clearances shall be determined by impact load testing.
- It is intended that only one level of nets be required for bridge construction.
- The mesh size of nets shall not exceed 6 inches by 6 inches. All new nets shall meet accepted performance standards of 17,500 foot-pounds minimum impact resistance as determined and certified by the manufacturers, and shall bear a label of proof test. Edge ropes shall provide a minimum breaking strength of 5,000 pounds.
- Forged steel safety hooks or shackles shall be used to fasten the net to its supports.
- Connections between net panels shall develop the full strength of the net.

WORKING OVER OR NEAR WATER

- Employees working over or near water, where the danger of drowning exists, shall be provided with U.S. Coast Guard-approved life jackets or buoyant work vests.
- Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects that would alter their strength or buoyancy. Defective units shall not be used.
- Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations. Distance between ring buoys shall not exceed 200 feet.
- At least one lifesaving skiff shall be immediately available at locations where employees are working over or adjacent to water.

RESPIRATORS

Respirators should be used for protection only when engineering controls have been shown to be infeasible for the control of the hazard or during the interim period when engineering controls are being installed. Engineering and work practice controls are generally regarded as the most effective methods to control exposures to airborne hazardous substances. OSHA considers the use of respirators to be the *least* satisfactory approach to exposure control.

If respirators are necessary to protect the health of the employee or required by the employer:

- The employer must establish and implement a written respirator program with worksite-specific procedures.
- Respirators must be certified by the National Institute for Occupational Safety and Health (NIOSH) and be used in compliance with the conditions of their certification.
- The respirator program must identify and evaluate the respiratory hazards in the workplace, including a reasonable estimate of employee exposures and identification of the contaminant's chemical state and physical form. If exposure cannot be identified or reasonably estimated, the atmosphere shall be considered immediately dangerous to life or health (IDLH).

Respirators for IDLH atmospheres:

- Full face-piece pressure demand self-contained breathing apparatus certified by NIOSH for a minimum service life of thirty minutes.
- Combination full face-piece pressure demand supplied-air respirator with auxiliary self-contained air supply.

Respirators for non-IDLH atmospheres:

- For protection against gases and vapors:
 - Atmosphere-supplying respirator, or
 - Air-purifying respirator.
- For protection against particulates:
 - Atmosphere-supplying respirator, or
 - Air-purifying respirator equipped with high efficiency particulate air (HEPA) filters certified by NIOSH, (see NIOSH regs) or
 - Air-purifying respirator equipped with any filter certified for particulates by NIOSH (see NIOSH regs).

Effective training must be provided to respirator users prior to initial use, unless another employer has provided acceptable training within the last 12 months. Retraining is required annually and when workplace conditions change, new types of respirators are used, or an inadequacy in the employee's knowledge or use indicates need. Additionally, OSHA's basic advisory information shall be provided to employees who wear respirators when respirator use is not required.

Source: U.S. Department of Labor Occupational Safety & Health Administration (OSHA)

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