



**STREETER**  
ASSOCIATES

**SHARP MINDS. SUPERIOR CONSTRUCTION.**



# PERSONAL PROTECTIVE EQUIPMENT PROGRAM

TAB 7



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## I. Personal Protective Equipment

When engineering and administrative controls are not effective in controlling worker exposure to chemical or physical hazards, personal protective equipment (PPE) must be employed. Prior to using PPE, the worker must receive adequate instruction in:

- When PPE is necessary.
- What PPE is necessary for the specific hazard.
- How to don, doff, adjust and wear PPE.
- The proper care, use, limitations, maintenance, useful life and disposal of PPE.

When selecting PPE:

- Compare the PPE to be used with the potential or known hazards.
- Prior to using, inspect the PPE to ensure it is functioning properly and is in satisfactory condition. Following use, PPE should be re-inspected to determine whether it requires repair, cleaning, adjustment or disposal. PPE considered disposable should be immediately discarded and not reused.

Five types of PPE discussed include eye and face protection, head protection, foot protection, hand protection and protective clothing.



## **II. Eye and Face Protection**

There are a number of workplace hazards which can result in injuries to the eyes and face. These hazards include:

- Chemicals
- Flying objects and sparks
- Optical radiation emitted from welding and lasers; heat from welding, furnaces, induction and radio frequency heating; and ionizing radiation sources such as fluoroscopes.
- Biological hazards resulting from medical treatment of individuals suspected of possessing pathogenic illnesses such as hepatitis B virus (HBV) or Acquired Immune Deficiency Syndrome (AIDS).

Eye protection such as glasses, spectacles and goggles are designed to protect the eyes only. PPE for the eyes and face purchased after July 5, 1994 must meet the requirements of American National Standards Institute (ANSI) Z87.1 – 1989. PPE for the eyes and face which meets these ANSI requirements are identified by a permanent and legible stamp indicating it meets ANSI Z87.1 – 1989.

There are specific types of spectacles and goggles to meet particular hazards. Each type of PPE is discussed below.

### ***Spectacles or Glasses***

- Spectacles are generally designed to shield the eyes from impact. They are worn over the bridge of the nose and are held in place by temple bars which fit over the ears. Head bands may be substituted for temple bars.
- Clear spectacles are designed to shield the eyes from impact of flying objects and biological hazards.
- Lenses of spectacles are made of safety glass or plastic and may or may not be corrected for the workers vision. Workers who require corrective prescription lenses should be periodically evaluated to ensure lenses are at the proper prescription. Lenses may be removable and there may be lift up attachments affixed to the frame, providing additional protection to the worker from glare or optical radiation.
- Depending on materials added to the lens, i.e., tints and attenuators, spectacles can protect the worker from various hazards such as optical or ionizing radiation. In addition, special types of lenses, i.e., photochromic lenses, may present additional hazards by not responding or adjusting fast enough to light level changes in the work environment.





- Lenses should be large enough to cover the entire eye. When peripheral hazards are encountered, spectacles must possess side shields.
- Some spectacles may possess head bands, adjustable temple bars and bridges, and removable side shields. Adjustable features of the spectacle allow it to be properly fitted to the worker.

### *Goggles*

- Goggles are protective devices intended to fit the face immediately surrounding the eyes in order to protect the eyes from a variety of hazards including flying objects, chemical splashes and mists, optical radiation, pathogenic organisms and fumes.
- Depending on its construction, goggles are designed to shield the eyes from chemical splashes, fume and irritating vapors. Tinted goggles are available to protect the worker from optical radiation resulting from laser, cutting and welding operations.
- Two types of goggles are available; eye cup goggles which covers the eye and the cover goggles which covers the eyes and the immediate surrounding area. Cover goggles may be used over spectacles and are constructed of either rigid or flexible frames. Cover goggles may either be directly or indirectly vented. Goggles have an adjustable head band to ensure the goggle maintains contact between the worker's skin and the frame.
- Lenses of goggles are made of safety glass or plastic and may or may not be corrected for the workers vision. Workers who require corrective prescription lenses should be periodically evaluated to ensure lenses are of the proper prescription. Lenses may be removable and there may be lift up attachments affixed to the frame, protecting the worker from additional hazards such as glare or optical radiation.
- Tints are generally used to control optical radiation from cutting and welding activities. Optical radiation includes ultraviolet, visible and infra red light. Depending on materials added to the lens, i.e., tints and attenuators, goggles can protect the worker from various hazards such as optical or ionizing radiation. The darkness of the tint is dependent on the welding activity and equipment used. Refer to the manufacturer's recommendations when selecting the appropriate shade. Due to higher optical radiation intensities, arc welding and cutting requires darker shades (higher shade numbers) than gas welding and cutting. Each shade has a specific number engraved upon it representing a color tint. The darker the shade, the higher the number. In addition, special types of lenses, i.e., photochromic lenses, may present additional hazards by not responding fast enough to light level changes in the work environment.



### ***Faceshields***

- Faceshields are protective devices intended to shield the worker's face from specific hazards. Faceshields do not provide primary eye protection; they must be used with appropriate safety goggle or spectacle to protect the eyes from injury.
- Faceshields are composed of head gear which supports the window or shield. The bottom of the window or shield should drop below the chin to provide adequate protection to the face. Faceshields are designed to protect the face from those hazards listed above. Windows may be constructed entirely of plastic or polyethylene mesh.
- Head gear should sufficiently wrap around the worker's head and support the window. If approved by the manufacturer, faceshields may be attached directly to the hard hat.
- Welding helmets provide protection against optical radiation as well as face protection. Some welding helmets will protect the worker from flying objects through the insertion of safety glass in front of the shade. Contact your equipment manufacturer or representative if you are unable to determine whether the welding helmet provides adequate guarding for flying or impacting objects.

### ***Care and Maintenance of Spectacles, Goggles, and Faceshields***

- If properly maintained, reusable eye and face protection will last for several years. Eye and face protection should be properly stored in a clean sanitary area. Most manufacturers suggest a cleaning procedure for their equipment. If no cleaning procedure is specified, eye and face protection can be soaked in a mild soapy water solution at a temperature not to exceed 120 degrees Fahrenheit for ten minutes. They must be rinsed thoroughly with cool water and allowed to dry before use.
- Eye and face protection identified with scratches, dents and materials obscuring the worker's vision should be removed from service and discarded



### **III. Head Protection**

Safety helmets are rigid headgear made of various types of materials designed to protect the worker's head from impact, penetration or electrical shock. Appropriate head protection should be used whenever there is a possibility of falling objects, objects striking the worker or contact with a specific electrical hazard. Head protection may be divided into two categories, bump caps and hard hats.

#### ***Bump Caps***

Bump caps are designed only to absorb some impact from the worker striking his or her head on a hard surface and not from the impact or penetration of falling objects. Bump caps are generally constructed of a thin shell of plastic or metal and possess a foam insert to fit the worker's head. Bump caps do not meet the requirements of the ANSI Z89.1 – 1989 protective head wear standard. Currently, there are no approved standards for bump caps therefore; the use of bump caps should be strictly limited.

#### ***Hard Hats***

Hard hats which meet the ANSI requirements generally weigh less than one pound and are designed to transmit a maximum force of 850 pounds from the helmet to the suspension system. The suspension must be adjusted to keep the worker's head 1.25 inches away from the shell. The shell may be constructed of metal or plastic and designed with a full or partial brim. Hard hats meeting ANSI Z89.1 standards are designed and constructed into two types and are divided into three classes; Class A, B and C. Hard hats which meet ANSI requirements are appropriately marked as meeting ANSI Z89.1 – 1989 and the appropriate class.

Type 1 – Type 1 hard hat is intended to reduce the force of impact resulting from a blow only to the top of the head.

Type 2 – Type 2 hard hats are intended to reduce the force of lateral impact resulting from a blow which may be received off-center, from the side, or to the top of the head.

#### ***Class G Hard Hats***

Class G hard hats are intended to meet the impact and penetration requirements discussed above and reduce the danger of contact with electrical conductors. Sample shells are usually proof tested to 2,200 volts.

#### ***Class E Hard Hats***

Class E hard hats are intended to meet the impact and penetration requirements discussed above and reduce the danger of contact with exposed high voltage electrical conductors. Representative shells are proof tested to 20,000 volts.



### ***Class C Hard Hats***

Class C hard hats are intended to meet the impact and penetration requirements discussed above and do not offer any electrical protection. Hard hats should be selected based on the hazards anticipated. Never use a Class C or metal hard hat around electrical equipment or within electrical installations. Attachments to hard hats may also decrease the insulating quality of the helmet shell. Contact the manufacturer when determining whether attachments reduce the insulating or dielectric qualities of the hard hat.

Hard hats should be adjusted to fit snugly on the workers head while providing a comfortable fit. Hard hats should be properly worn; even if the suspension is adjusted the practice of wearing the hard hat backwards can injure the neck if the face brim receives the impact. This practice also eliminates the protection afforded to the face by the face brim. Never store tools or materials between the suspension and shell of a hard hat.

Hard hats should be properly stored both in the workplace and while in transit. Hard hats could become a hazardous missile if not secured in transit, striking vehicle occupants. Allowing hard hats to be stored in areas where extreme temperatures occur can adversely affect the degree of protection the hard hat provides.

Hard hats should not be painted. Several commercially available paints contain solvents which can degrade the plastic shell. Hard hats used in areas where there are electrical hazards should never be modified by painting, adding Velcro strips, stickers or labels. Adding stickers, labels and paint may reduce the insulating quality of the hard hat.

### ***Inspection and Care***

The outer shell, suspension and attached accessories should be inspected periodically for cracks, dents or penetrations and if found, should be discarded. Defective parts of hard hats should be replaced immediately. Hard hats should be discarded due to excessive wear and damage. Once a hard hat has absorbed impact from a falling object, it should be discarded.

The shell and suspension should be routinely cleaned with a mild soapy solution at a temperature not to exceed 140 degrees Fahrenheit. Shells should be scrubbed cleaned and rinsed with cool water. After cleaning, they should be inspected for signs of excessive wear and damage.

Some manufacturers recommend the suspension be replaced annually. Check with the helmet's manufacturer for care requirements.





#### IV. Safety Footwear

When workers are performing activities where objects may roll, fall or pierce the sole of the foot; safety footwear meeting the requirements of ANSI Z41 – 1991 should be worn. Other hazards such as chemical splashes and spills, heat and electric current requires specialized footwear. When selecting safety footwear, evaluate its protective requirements to the potential and known hazards of the workplace.

The primary difference between safety footwear and regular footwear is the toe box; constructed of either metal or fiberglass. Additionally, the outer sole of safety footwear is generally pierce resistant; some shoes actually possess a steel shank placed between the insole and outer sole of the shoe. Other safety footwear may possess metatarsal guards which protect the upper foot from impacts. Additionally, the upper foot may be protected by the use of attachable metal foot guards sometimes called Sanke foot guards.

Safety footwear is manufactured in various styles and is classified by ANSI Z41 into three categories. Classifications indicate the shoes ability to meet minimal compression and impact requirements. Both tests are performed within the area of the toe box. Following these tests, at least one half inch of clearance must remain at the point of testing within the toe box. The results of these tests classify safety footwear into:

Based on the hazards, additional approvals may be sought or required. This includes National Fire Protection Association (NFPA) for safety footwear requirements for fire services and American Society of Testing and Materials (ASTM) requirements for chemical permeation and degradation of safety footwear.

Classification	Classification Requirements	
	Compression (Pounds)	Impact (Foot Pounds)
30	1000	30
50	1750	50
75	2500	75

Various types of safety footwear exist for different environments. Where high heat or wet processes are utilized, soles of safety footwear may be constructed of specific materials such as wood which will prevent the transmission of heat or reduce the potential for slipping.

Conductive shoes may be used where static electricity is to be dissipated or where live line electrical maintenance is to be performed. Type I conductive safety footwear is designed for environments where static discharges would result in explosion such as explosive factories and armament plants. Type II conductive safety footwear is utilized by electrical lineman performing bare hand live line maintenance to assure they maintain the same potential as the live circuit.



Non-conductive shoes may be required during electrical work where the worker is attempting to prevent contact with a ground pathway.

In addition to basing footwear selection on the workplace hazard, safety footwear must be designed properly to fit properly and comfortably. Due to the protection afforded by safety footwear, the shoe is generally larger and heavier than standard footwear.

The environment where safety footwear is worn must be evaluated as well. Safety footwear with additional thermal insulation may provide appropriate protection in cold weather however, in hot weather, insulated footwear will cause the feet to sweat. To prevent fungal infections, workers should avoid wearing safety footwear which is wet on the inside. Additionally, foot powders and frequent sock changes will aid in keeping the feet dry. In cold weather, safety footwear wet on the inside may cause trench foot or contribute to hypothermia.

### *Maintenance and Care*

As with all footwear, laces of safety footwear should be free from breaks. Safety footwear should be periodically cleaned. Where applicable, leather polishes, preservatives or waterproofing should be routinely applied. Soles which are worn do not possess sufficient traction and should be either resoled or discarded.

Safety footwear should be periodically inspected for embedded metal and cuts in the leather upper. Safety footwear should be discarded when the leather is worn to the point where the toe box is exposed.



## V. Gloves

Gloves are designed to protect the hands from injury. Gloves are to be selected based on the hazards to the hand. These hazards include:

- Bloodborne pathogens
- Skin absorption of chemicals
- Chemical burns, skin irritation or corrosive activity
- Severe abrasions
- Cuts, lacerations and punctures
- Electrical current
- Temperature extremes such as heat and cold
- Pressure extremes such as blasts, steam or compressed gases
- Ionizing and non ionizing radiation
- Any combination of the above

Selection of gloves must be based on the hazards in the workplace and the performance characteristics of the glove supplied by the manufacturer. Regardless of the hazard, gloves should not be used where they may be caught by rotating machinery or pinch points. Additionally, gloves should fit snugly about the hand.

### ***Chemical Resistant Gloves***

Once the chemical hazards of the workplace have been determined, the length and concentration of chemical exposure must be ascertained in order to determine whether the glove will resist degradation and chemical permeation. Additionally, other conditions such as hot or cold temperatures should be considered when selecting chemical resistant gloves.

Most glove manufacturers who distribute chemical resistant gloves provide permeation guides illustrating a glove's degradation and permeation in accordance with ASTM standards. Always consult the manufacturer's guide when evaluating glove protection to a chemical hazard.



Chemical resistant gloves fit snugly around the hand and may be purchased in various gauntlet lengths from ten to thirty-two inches. Additionally, sleeves may be purchased to protect the arm from chemical exposure. Consult the sleeve manufacturer or guide to determine a sleeves resistance to chemical penetration or degradation. If used, sleeves should be inserted into the gauntlet of the glove. Inserting the sleeve into the glove does not create a liquid barrier therefore workers should not immerse sleeves into chemical liquids. Use gloves with longer gauntlet lengths.

Most chemical resistant gloves are disposable; once used, they should be discarded. When removing chemical resistant gloves, care should be exercised to ensure chemicals on the outside of the gloves do not make contact with the skin. If sleeves are used, they should be rolled or pulled down onto the exterior side of the sleeve; then remove the glove. Reusable chemical resistant gloves should be inspected for deterioration, rips or tears prior to use. In addition, reusable gloves should be air tested. Air testing is a process by which the worker traps air in the glove and squeezed it tightly to determine whether there are any pinhole leaks which could cause leakage.

### ***General Purpose Gloves***

General purpose gloves such as cotton or leather may be used more than once providing the glove is examined for wear, tears and damage prior to use. Gloves with worn palms and ripped stitching should be immediately disposed of. General purpose gloves should not be used for activities where they are not designed for such as metal casting or foundry activities where there is a potential for molten metal exposure.

### ***Electrical Insulating Gloves***

As with general purpose gloves, electrical insulating gloves may be used more than once providing they are examined for wear or damage prior to use. In addition to routing dielectric testing, electrical gloves should be visually examined and air tested prior to use. Air testing is a process by which the worker traps air in the glove and squeezed it tightly to determine whether there are any pinhole leaks which could cause the transmission of electrical current.

There are specific ASTM standards regarding the design and testing of electrical insulating gloves. Additionally, there are insulating sleeves which extend the protective characteristics of the glove to the arm. Both gloves and sleeves are classified by the voltages they are intended to be used for. ASTM standards exist for each specific voltage range. Rubber insulating gloves and sleeves are to be kept free of foreign materials such as solvents, grease and oil. Rubber insulating gloves are to be used in conjunction with leather protectors and cotton liners. When sleeves are used, they are to be tucked into the glove's gauntlet. As with chemical resistant gloves, electrical insulating gloves may be purchased in varying gauntlet lengths from eleven to sixteen inches.

***Special Purpose and Hybrid Gloves***

Special purpose gloves are designed for specific environments such as ionizing radiation, heat, cold and high pressures involving steam or pressurized gases. As with chemical resistant gloves, special purpose gloves protect the worker from a specific hazard. These gloves should be inspected for wear prior to use and disposed of if worn. Some special purpose gloves such as steam guard gloves or leaded gloves can be repaired if minor cuts or abrasions are found. Use the manufacturer's repair kits for proper repair.

Hybrid gloves generally are designed to protect the worker from at least two hazards, generally chemical, temperature and abrasive hazards. As with special purpose gloves, hybrid gloves should be examined prior to use and discarded if worn.





## VI. Protective Clothing

Many forms of protective clothing are available to provide worker protection from workplace hazards. Protective clothing may consist of coveralls, aprons, vests, jackets and leggings. Protective clothing may be reusable or disposable.

Protective clothing should be selected on the recognized and potential hazards of the workplace which may include:

- Bloodborne pathogens
- Skin absorption of chemicals and hazardous materials
- Chemical burns, irritation and corrosive activity of chemicals and hazardous materials
- Temperature extremes such as heat and cold
- Pressure extremes involving blasts, steam and compressed gases
- Ionizing and non-ionizing radiation
- Any combination of the above

Selection of protective clothing is based upon the recognized and potential hazards in the workplace as well as the performance characteristics supplied by the manufacturer.

### **Coveralls**

Coveralls may be disposable or reusable and can protect workers from a wide range of hazards including but not limited to, chemical, pressure, and temperature extremes. Coveralls designed for chemical resistance must be selected on the chemical type, length and concentration of chemical exposure. As with chemical resistant gloves, manufacturers of chemical resistant coveralls provide permeation and gradation guides consistent with ASTM specifications to assist in appropriate selection. Always consult a manufacturer's guide or representative when evaluating a coverall's resistance to a specific chemical or hazardous material.

Coveralls may be designed to protect the worker from temperature and pressure extremes. Consult the coverall manufacturer when selecting a coverall to protect the worker from a specific hazard.

Coveralls are manufactured in various sizes and should comfortably fit the worker without restricting movement. Worn or ripped coveralls are to be immediately replaced. When removing chemical resistant coveralls, care should be exercised to ensure chemical contamination does not reach the worker's skin. Disposable coveralls must be disposed of properly while reusable coveralls can be decontaminated or neutralized and reused.



If reusable coveralls contaminated with hazardous materials are to be laundered; coveralls should be bagged and workers performing the operation are to be informed of the potential for exposure. Some coveralls such as cotton treated flame-retardant coveralls will lose their flame retardancy if washed with bleach or after multiple washings with commercial detergents. Consult the coverall's manufacturer when determining care and laundering instructions.

### ***Aprons***

Aprons are generally used in conjunction with other forms of personal protective equipment to protect the worker from biological and chemical exposure and from physical hazards such as radiation, heat and cold. As with coveralls, aprons may be either disposable or reusable are designed to protect workers from specific hazards. Always consult the manufacturer's literature or representative when determining what hazards the apron will protect against.

Aprons should comfortable fit about without restraining the worker from bending or twisting sideways. Aprons should be inspected prior to use. Strings and suspenders should be free of wear. As with coveralls, care should be exercised to ensure chemical contamination does not contact the worker's skin.

### ***Jackets***

As with coveralls, jackets are designed to protect against a number of hazards. Jackets should provide a comfortable fit over the torso and arms and should be worn over pants. Jackets are to be removed in a fashion as to not contaminate the worker's skin.

Jackets should be inspected prior to use to ensure buttons, seams and snaps are in good working order. Jackets are generally not considered disposable; however if ripped or worn, the jackets should be immediately repaired and disposed of if necessary.

### ***Pants, Leggings, Chaps and Spats***

Coveralls, aprons, and jackets, protect against a wide variety of hazards, i.e., biological, chemical, radiation and heat. Pants, leggings and chaps and spats protect against a variety of hazards as well. Generally worn over employees' clothing and they should fit snugly around the waist. When required, spats and chaps are to fit tightly about the lower leg and not be tucked into the shoe or boot. Since there are many types, the manufacturer should be contacted to determine proper selection and use. As with jackets, aprons and coveralls; pants and leggings should be removed in such a fashion as not to contaminate the workers clothing.

Pants, leggings, chaps and spats are generally not considered disposable. Seams, snaps, buttons, ties and suspenders should be inspected for wear prior to use. They should be inspected for rips or tears, and if worn or un-repairable should be discarded.



## VII. Personal Protective Equipment Highlights

Some highlights to review with workers are:

1. Spectacles and eye glasses are designed to protect the eyes from impacts or injuries from flying objects, sparks or projectiles.
2. Side shields mounted on spectacles or eye glasses are designed to protect the eyes from peripheral (from the side) hazards such as impacts or injuries from flying objects, sparks, or projectiles
3. Spectacles or eye glasses may be corrected to the worker's vision.
4. Goggles are designed to protect the eyes from irritating fumes and vapors, chemicals splashes and impacts and penetrations from flying objects, sparks or projectiles.
5. When welding, cutting or burning, use the right shade number for the right welding activity.
6. Faceshields only protect the face. Use goggles or spectacles to protect the eye from hazards. Use both when protecting the face and eyes.
7. Eye and face protection with scratches, dents, cracks or adhered materials limits the wearer's vision should be removed from service and discarded.
8. Bump caps are not designed to absorb impacts and penetrations from falling objects.
9. Hard hats or helmets are designed to absorb impacts and penetrations from falling objects.
10. Electrical protection afforded by the hard hat is based on its classification. Class B hard hats afford the highest level of electrical protection while Class C hard hats offer no electrical protection.
11. Never place any tools or materials between the hard hat suspension and its shell.
12. Safety shoes are designed with a toe box and a puncture resistant outer sole.
13. Metatarsal and externally mounted foot guards (Sanke foot guards) are designed to protect the upper foot from penetration and impact of falling or striking objects.
14. Chemical resistant footwear (over boots and disposable booties) should be selected using chemical permeation and resistance data supplied by the manufacturer.
15. Gloves should fit snugly about the hand, and are not to be used around operating rotating machinery or where there are operating pinch points.



16. Chemical resistant gloves and sleeves should be selected using chemical permeation and resistance data supplied by the manufacturer.
17. Reusable gloves should be inspected prior to use and discarded if ripped, torn or worn.
18. Coveralls should fit comfortable about the worker without restricting movement.
19. Fiber treated flame retardant coveralls may lose their flame retardancy following multiple washings or when washed with bleach. Always consult the manufacturer for wear and care instructions.
20. Protective pants should be worn under protective jackets.
21. Select the right apron based on the hazards. If in doubt, contact your supervisor or apron manufacturer. Aprons should always fit comfortably.
22. Streeter Associates does not allow employee-owned equipment to be used. Streeter will provide all necessary PPE when required to prevent inadequate equipment from being used on the jobsite. Streeter Associates safety director will check equipment during weekly.