



Personal Protective Equipment Basic

This course is an introduction to the various types of personal protective equipment (PPE), including eye and face protection, head protection, arm and hand protection, foot protection, body protection, and respiratory protection. The course is also one of the mandatory courses in OSHA Academy's 10- and 30-Hour Safety Training Programs for General Industry.

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OSHAcademy Course 108 Study Guide

Personal Protective Equipment: Basic

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Contact OSHAcademy to arrange for use as a training document.

This study guide is designed to be reviewed off-line as a tool for preparation to successfully complete OSHAcademy Course 108.

Read each module, answer the quiz questions, and submit the quiz questions online through the course webpage. You can print the post-quiz response screen which will contain the correct answers to the questions.

The final exam will consist of questions developed from the course content and module quizzes.

We hope you enjoy the course and if you have any questions, feel free to email or call:

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Revised: March 28, 2022

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Course Introduction

This course is an introduction to the various types of personal protective equipment (PPE), including eye and face protection, head protection, arm and hand protection, foot protection, body protection, and respiratory protection.

Free Training!

As a registered OSHAcademy student, you gain free access to all training materials, including student dashboard, online courses and study guides, module quizzes, and final course exams. If you decide you would like official documentation of the training including certificates, cards, and transcripts, we charge a small processing fee.

Module 1: General PPE Requirements

OSHA standards require the use of PPE to reduce employee exposure to hazards when engineering and administrative controls are not feasible or effective in reducing these exposures to acceptable levels. Employers are required to determine if PPE should be used to protect their workers and they must also make sure employees use and maintain PPE in a sanitary and reliable condition.

Employer Responsibilities

In general, employers are responsible for:

- performing a "hazard assessment" of the workplace to identify and control physical and health hazards;
- identifying and providing appropriate PPE for employees;
- training employees in the use and care of the PPE;
- maintaining and replacing worn or damaged PPE; and
- periodically reviewing, updating and evaluating the effectiveness of the PPE program

Employee Responsibilities

In general, employees should be:

- properly wearing PPE,
- attending training sessions on PPE,
- properly storing, cleaning, and maintaining PPE, and
- informing a supervisor of the need to repair or replace PPE

Quiz Instructions

After each section, there is a quiz question. Make sure to read the material in each section to discover the correct answer to these questions. Circle the correct answer. When you are

finished go online to take the final exam. This exam is open book, so you can use this study guide.

1. Who is directly responsible for storing, cleaning, and maintaining PPE?

- a. Employers
- b. Employees
- c. Safety Staff
- d. Supervisors

Who Pays for PPE?

With few exceptions, OSHA requires employers to pay for personal protective equipment used to comply with OSHA standards.

Employers cannot require workers to provide their own PPE. Employees who use their own PPE must do so voluntarily. Even if an employee provides his or her own PPE, the employer must still ensure the equipment is adequate to protect the worker from hazards at the workplace.

Employers must pay for the following:

- metatarsal foot protection
- rubber boots with steel toes
- non-prescription eye protection
- prescription eyewear inserts/lenses for full face respirators
- goggles and face shields
- firefighting PPE (helmet, gloves, boots, proximity suits, full gear)
- hard hats
- hearing protection
- welding PPE

Payment Exceptions under the OSHA Rule

Employers are not required to pay for some PPE in certain circumstances:

- **Non-specialty safety-toe protective footwear** (including steel-toe shoes or boots) and non-specialty prescription safety eyewear provided that the employer permits such items to be worn off the job site. OSHA based this decision on the fact that this type of equipment is very personal, is often used outside the workplace, and that it is taken by workers from jobsite to jobsite and employer to employer.
- **Everyday clothing**, such as long-sleeve shirts, long pants, street shoes, and normal work boots.
- **Ordinary clothing**, skin creams, or other items, used solely for protection from weather, such as winter coats, jackets, gloves, parkas, rubber boots, hats, raincoats, ordinary sunglasses, and sunscreen.
- **Items such as hair nets and gloves** worn by food workers for consumer safety.
- **Lifting belts** because their value in protecting the back is questionable.
- When the employee has lost or intentionally damaged the PPE and it must be replaced.

2. Which of the following PPE items must the employer pay for?

- a. Hair nets
- b. Rubber boots and parkas
- c. Goggles and face shields
- d. Normal work boots

What About Safety Belts and Back Belts?

Safety Belts

Safety belts, also called body belts, are worn around the waist to help employees working at heights correctly position themselves in front of a work area or to prevent them from falling over an edge. Safety belts connect to positioning and restraint lanyards that are attached to an anchor point on a building or structure.

Body belts should not be considered personal protective equipment if they do not adequately protect employees from being injured if they fall. OSHA does not allow the use of safety body belts as part of a personal fall arrest system (PFAS). They may only be used for positioning a worker.

Back Belts

Employees may be allowed or even encouraged by the employer to use back belts to provide support for the lower back while lifting heavy objects at work. However, the use of back belts is not recognized by [OSHA](#) as an adequate control measure to prevent back injury when lifting heavy objects. While back belts may be acceptable to workers because they seem to provide additional support, they may restrict the body's range of motion and eventually cause injury due to atrophy of back muscles. [Research by NIOSH](#) indicates that the primary value in back belts is that they "remind" the employee to use proper lifting techniques.

Work Clothing

Clothing must be worn which is appropriate to the work performed and conditions encountered. Loose sleeves, ties, lapels, cuffs, or other loose clothing must not be worn near moving machinery.

Make sure that you immediately remove clothing that becomes saturated or impregnated with flammable liquids, corrosive or toxic substances, irritants, or oxidizing agents. Don't wear it again until it's properly cleaned.

Defective and Damaged Equipment

Of course, defective or damaged personal protective equipment must not be used. It's important to inspect PPE regularly, and before each use, to make sure it's capable of adequately protecting an employee from exposure to hazards. Remember, PPE that is defective is not PPE.

3. Safety belts may NOT be used _____.

- a. as part of a personal fall arrest system (PFAS)
- b. as part of a positioning system
- c. as a reminder to lift properly
- d. to maintain proper posture

PPE Selection - One size does not fit all.

All PPE clothing and equipment should be of safe design and construction, and should be maintained in a clean and reliable fashion. Employers should take the fit and comfort of PPE into consideration when selecting appropriate items for their workplace. PPE that fits well and is comfortable to wear will encourage employee use of PPE. Most protective devices are available in multiple sizes and care should be taken to select the proper size for each employee. If several different types of PPE are worn together, make sure they are compatible. If PPE does not fit properly, it can make the difference between being safely covered or dangerously exposed. It may not provide the level of protection desired and may discourage employee use.

Conduct a Hazard Assessment

To help determine the best PPE for the job, conduct a hazard assessment of each employee's task, the likelihood that the employee would be injured without PPE, and the severity of a potential injury. For example:

The task: A worker uses a plasma cutter to remove the bottom of a 55-gallon drum that contains traces of motor oil. His only PPE is a pair of synthetic gloves. The outcome: The drum explodes and the worker receives severe burns on his face and hands. An effective PPE hazard assessment would produce the following information:

- **Task:** Using a plasma cutter.
- **Hazards:** The plasma-cutting arc produces hot metal and sparks, especially during the initial piercing of the metal. It also heats the work piece and the cutting torch. Never cut closed or pressurized containers such as tanks or drums, which could explode. Do not cut containers that may have held combustibles or toxic or reactive materials unless they have been cleaned, tested, and declared safe by a qualified person.
- **Likelihood of injury without PPE:** High
- **Severity of a potential injury:** Life-threatening burns PPE necessary for the task:
 - **Body:** dry, clean clothing made from tightly woven material such as leather, wool, or heavy denim
 - **Eyes and face:** safety glasses with side shield or face shield; welding helmet with shaded eye protection for welding tasks

- **Feet:** high-top leather shoes or boots
- **Hands:** flame-resistant gloves

4. What should you do to determine the best PPE for the job?

- a. Use good common sense
- b. Ask the employee doing the job
- c. Conduct a hazard assessment
- d. Find out what others have been wearing

PPE Training (Hands-On-How-To)

You are told to mix a certain chemical with water to use as a cleaning agent to wash down your company trucks. You check out the chemical. It looks like water, doesn't feel any different than water... so you assume PPE isn't really necessary. So, you go about washing the trucks. Your hands and arms get pretty wet with the solution you've mixed, but, heck... no pain, no sting... must be safe. No worse than water, right? Wrong, very wrong.

You've been using a mixture of hydrofluoric acid and water. By the time you get home your arms are hurting like crazy. You hurry off to the hospital, but by the time you arrive, it's too late. The hydrofluoric acid has penetrated your skin on both of your arms, clear through to the bone. Fluorine ions have replaced calcium ions in the bone, effectively turning it into a sponge-like consistency. But, you are lucky; only one arm must be amputated. The doctors were able to save the other arm.

This scenario would not have occurred had you been properly trained in using PPE. The PPE standard mandates the employer must provide "hands-on-how-to" (practice) training to each employee who is required to use Personal Protective Equipment. To meet the minimum training requirements, each employee receiving PPE training must be trained to know at least the following:

1. when PPE is necessary;
2. what PPE is necessary;
3. how to properly don, doff, adjust, and wear PPE;
4. the limitations of the PPE; and

5. the proper care, maintenance, useful life, and disposal of the PPE.

So far, we meet minimum OSHA requirements... but one very important element is missing: The PPE standard does not specifically require education on "why" PPE is necessary.

So, why is this element so important? Because study after study tells us the most common reason employees don't follow rules in the workplace is because they don't know why the rules are important.

5. Which PPE training topic is missing from OSHA criteria, but should be a part of every training presentation?

- a. When PPE is necessary
- b. What PPE is necessary
- c. Limitations of the PPE
- d. Why PPE is necessary

Types of PPE

Eye and Face Protection

Protective eye and face devices must comply with ANZI Z87.1, "American National Standard Practice for Occupational and Educational Eye and Face Protection," and [OSHA Standard 1910.133, Eye and Face Protection](#).

Glasses

Protective eyeglasses or spectacles are made with safety frames, tempered glass or plastic lenses, temples and side shields which provide eye protection from moderate impact and particles encountered in job tasks such as carpentry, woodworking, grinding, scaling, etc. Safety glasses are also available in prescription form for those persons who need corrective lenses.

Goggles

- **Vinyl-framed goggles** of soft pliable body design provide adequate eye protection from many hazards. These goggles are available with clear or tinted lenses, perforated, port vented, or non-vented frames.

- **Single-lens goggles** provide similar protection to spectacles and may be worn in combination with spectacles or corrective lenses to ensure protection along with proper vision.
- **Welders goggles** provide protection from sparking, scaling, or splashing metals and harmful light rays. Lenses are impact resistant and are available in graduated shades of filtration.
- **Chipper/Grinder goggles** provide eye protection from flying particles. The dual protective eye cups house impact resistant clear lenses with individual cover plates.

6. Which type of goggles provides protection similar to spectacles and may be worn in combination with spectacles or corrective lenses to ensure protection and proper vision?

- a. Chipper/Grinder goggles
- b. Single-lens goggles
- c. Vinyl-framed goggles
- d. Welders goggles

Face Shields

These normally consist of an adjustable headgear and face shield of tinted/transparent acetate or polycarbonate materials, or wire screen. Face shields are available in various sizes, tensile strength, impact/heat resistance and light ray filtering capacity.

Face shields will be used in operations when the entire face needs protection and should be worn to protect eyes and face against flying particles, metal sparks, and chemical/biological splash.

Welding Shields

These shield assemblies consist of:

- vulcanized fiber or glass fiber body
- a ratchet/button type adjustable headgear or cap attachment
- a filter and cover plate holder

These shields will be provided to protect workers' eyes and face from infrared and ultraviolet light burns to the retina, flying sparks, metal spatter, and slag chips encountered during:

- welding;
- brazing;
- soldering;
- resistance welding;
- bare or shielded electric arc welding;
- oxyacetylene welding; or
- cutting operations.

7. Welding shields protect the welder from which of the following injuries?

- a. Long-term chemical absorption
- b. Fogging of spectacles
- c. Vision fatigue
- d. Burns to the retina

Respiratory Protection

Respiratory Protection is important when employees are exposed to potentially hazardous atmospheres. Respirator use must conform to [ANSI/ASSE Z88.2, Practices for Respiratory Protection](#), and [OSHA Standard 1910.134, Respiratory Protection](#).

Respirator Types

To understand how respirators can be used to protect employees, it is important to understand what a respirator is and what it is not. A respirator protects against respiratory hazards by removing specific air contaminants from the ambient (surrounding) air or by supplying breathable air from a safe source.

- **Air-purifying respirators:** Respirators that remove contaminants from the ambient air are called air-purifying respirators. Particulate respirators are a type of air-purifying

respirator. The part of a respirator that forms a protective barrier between the user's respiratory tract and air contaminants is called an inlet covering. Most inlet coverings are classified as either tight-fitting or loose-fitting.

- **Tight-fitting respirator:** A tight-fitting respirator has an inlet covering, also called a face piece or mask, designed to form a seal with the face of the wearer. It is available in three types: quarter mask, half mask, and full-face piece.
- **Loose-fitting respirator:** A loose-fitting respirator has an inlet covering that typically covers the user's head and may extend over the shoulders. It is designed to form a partial seal with the face. These include loose-fitting face pieces, as well as hoods, helmets, or full suits, all of which cover the head completely.
- **Atmosphere-supplying respirators:** Respirators that supply air from a safe source other than the ambient air are called atmosphere-supplying respirators. There are two types of atmosphere-supplying respirators: Supplied-Air Respirators (SARs) and Self-Contained Breathing Apparatus (SCBA).

8. Which type of respirator removes contaminants from the ambient air?

- a. Air-purifying respirators
- b. Tight-fitting respirator
- c. Loose-fitting respirator
- d. Atmosphere-supplying respirator

Air-Purifying Respirators (APR)

The air-purifying respirator, or "APR," has an air-purifying filter, cartridge, or canister that removes specific air contaminants, such as particulates, gases, and vapors, or both from the air.

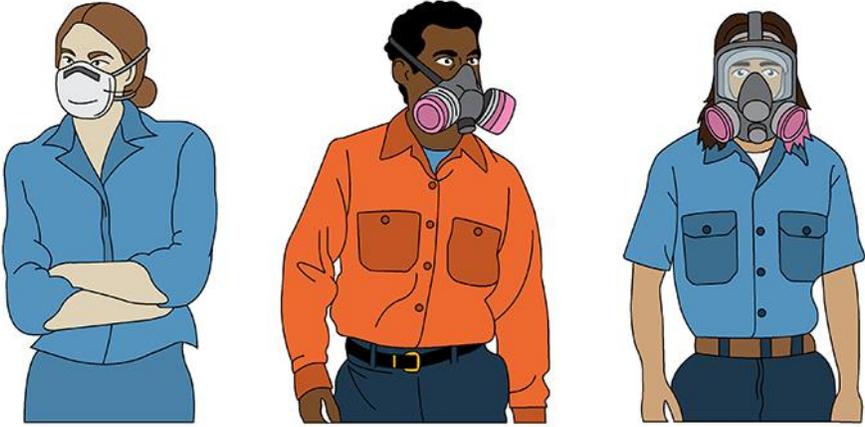
Selecting an appropriate filter, cartridge, or canister can be complicated because there are many types, and none protect against all contaminants. That's why it's necessary to identify each respiratory hazard in your workplace before you select a respirator.

Air-purifying respirators are available in non-powered and powered types:

1. **Non-Powered Air-Purifying Respirators:** When using a non-powered air-purifying respirator, the user operates it simply by breathing. Consequently, the breathing tends to be a little more labored. The three basic types are:

- Half Mask/Dust Mask,
- Half Mask (Elastomeric), and
- Full Facepiece (Elastomeric).

NON-POWERED AIR-PURIFYING RESPIRATORS (APR)



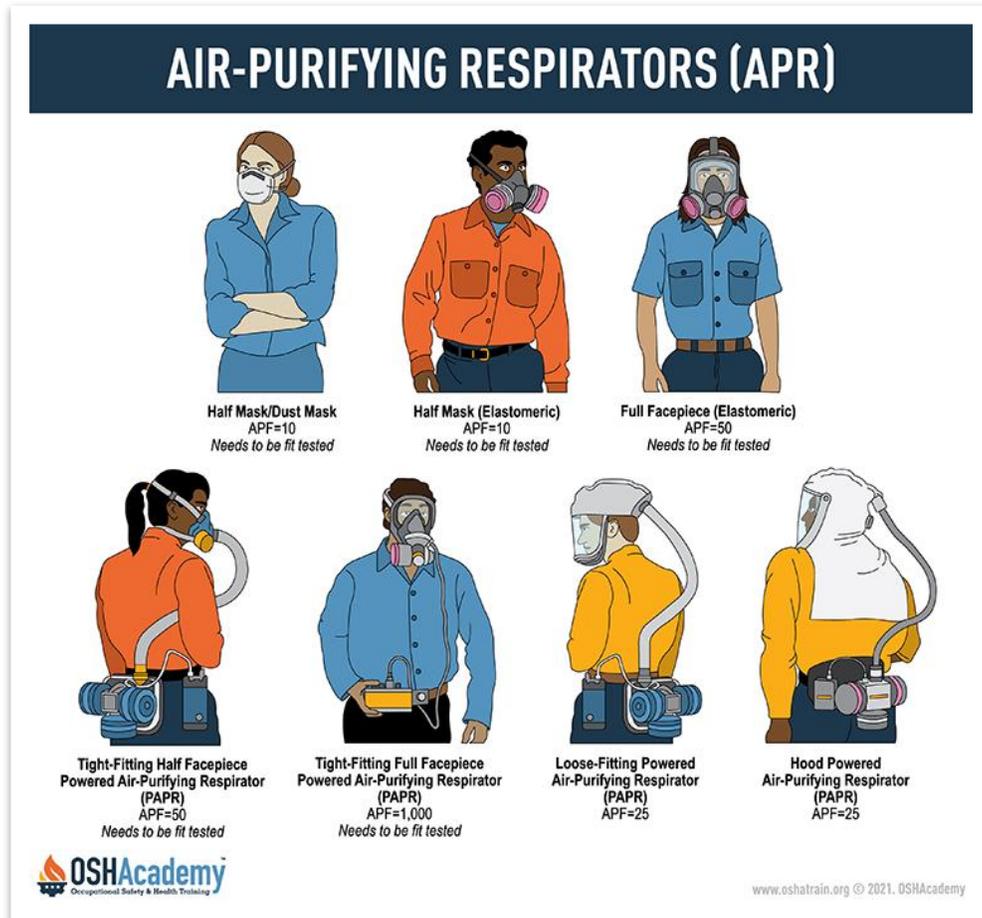
The image shows three illustrations of workers wearing different types of non-powered air-purifying respirators (APR). The first worker on the left is wearing a simple white half mask/dust mask. The second worker in the middle is wearing a more complex elastomeric half mask with two pink filters. The third worker on the right is wearing a full facepiece elastomeric respirator that covers the entire face and has two pink filters.

Half Mask/Dust Mask APF=10 <i>Needs to be fit tested</i>	Half Mask (Elastomeric) APF=10 <i>Needs to be fit tested</i>	Full Facepiece (Elastomeric) APF=50 <i>Needs to be fit tested</i>
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2. **Powered Air-Purifying Respirators:** This type of respirator has a blower that forces ambient air through one or more filters attached to an inlet covering. The powered type is easier to breathe through than the non-powered type but needs a fully charged battery to work properly.



9. Which respirator requires more labored breathing?

- a. Non-powered air-purifying respirator
- b. Powered air-purifying respirator
- c. Supplied-air respirator
- d. Loose-fitting mask

Atmosphere-Supplying Respirators

Atmosphere-supplying respirators are used to provide breathing air from a source independent of the ambient atmosphere. Respirators that supply breathing air are generally used in highly

hazardous work environments. It is critical that such respirator systems provide breathing air of optimal quality and that the equipment operates reliably.

The two types of atmosphere-supplying respirators are:

- **Supplied-air respirators (SARs)** (also known as airline respirators), receive air from a connecting hose. The source of air is either a pressurized cylinder or an air compressor. Because the employee does not carry the air on his or her back when using a SAR, breathing air can be provided over a longer time period than is the case with an SCBA.
- **Self-contained breathing apparatus (SCBA) units:** Air is supplied from a tank (a cylinder of compressed air or oxygen). For this type of respirator, the source of the breathing air is designed to be transported by or with the equipment user.

10. Which respirator will provide a positive pressure air supply over a longer period of time?

- a. Non-powered air-purifying respirator (NPAPR)
- b. Powered air-purifying respirator (PAPR)
- c. Supplied-air respirator (SAR)
- d. Self-contained breathing apparatus (SCBA)

Module 2: Types of PPE

Head Protection

There are primarily two situations when employees must wear protective helmets.

1. Falling Objects

When there is a potential in the workplace for injury to the head from falling objects, the employer must make sure that each affected employee wears a protective helmet.

Some examples of work that might require helmets to protect from falling objects include:

- working below other workers who are using tools and materials which could fall;
- working around or under conveyor belts which are carrying parts or materials; and
- working below machinery or processes which might cause material or objects to fall.

Some examples of occupations for which head protection should be routinely considered are:

- carpenters
- electricians
- linemen
- mechanics and repairers
- plumbers and pipe fitters
- assemblers
- packers
- wrappers
- sawyers
- welders

- laborers
- freight handlers
- timber cutting and logging
- stock handlers
- warehouse laborers

2. Electrical Hazards

The second situation requiring a helmet is to protect the worker from electrical hazards. Whenever an employee works near exposed electrical conductors which could contact the head, the employer must make sure that a protective helmet designed to reduce electrical shock hazard is worn by the employee.

The employer should also furnish and make sure all employees and contractors engaged in construction and other miscellaneous work use proper head protection. Engineers, inspectors, and visitors at construction sites must also wear protective helmets when hazards from falling or fixed objects, or electrical shock are present.

1. When is a protective helmet required to be worn in the workplace?

- a. When there is a potential for falls to a lower level
- b. When there is a hazard from electrical contact or falling objects
- c. When there is a danger of being caught in or between objects
- d. When there is a possibility of being crushed

Criteria for Protective Helmets

1. Protective helmets with [OSHA 1910.135, Head Protection](#), which states that helmets purchased after July 5, 1994, must comply with ANSI Z89.1 or must be demonstrated by the employer to be equally effective. Purchasing helmets that meet these standards ensures that appropriate testing has been conducted and that the quality of the materials (webbing and shell) is adequate.

Selection Guidelines for Head Protection

When selecting head protection, knowledge of potential for falling objects and electrical hazards is important. When it's determined that these hazards exist, choose the most appropriate helmet from the categories listed below.

Impact Type Helmets

- **Type I:** A helmet of Type I is designed to provide protection only to the top of the head. It is not intended to provide impact from side impacts. (This is by far the most commonly used type of hard hat in use.)
- **Type II:** A helmet of Type II is designed to provide protection against both top and side impacts.

Electrical Classes

- **Class G (General):** Class G helmets are intended to reduce the danger of contact exposure to low voltage conductors. Test samples are proof-tested at 2200 volts (phase to ground). However, this voltage is not intended as an indication of the voltage at which the helmet protects the wearer.
- **Class E (Electrical):** Class E helmets are intended to reduce the danger of exposure to high voltage conductors. Test samples are proof-tested at 20,000 volts (phase to ground). However, this voltage is not intended as an indication of the voltage at which the helmet protects the wearer.
- **Class C (Conductive):** Class C helmets are not intended to provide protection against contact with electrical conductors.

Bump Caps

Bump caps/skull guards should be issued and worn for protection against scalp lacerations from contact with sharp objects. However, it's very important to understand that they must not be worn as substitutes for safety caps/hats because they do not provide protection from impact forces or penetration by falling objects.

2. Which class of safety helmet has been proof-tested to 20,000 volts?

- a. Class G (General)
- b. Class E (Electrical)
- c. Class C (Conductive)
- d. Class B (Bump Caps)

Hand Protection

It's important that employers select and require employees to use appropriate hand protection when exposed to any of the hazards listed below:

- hazardous chemicals that can cause burns, rashes, and internal injury;
- cuts or lacerations;
- abrasions;
- punctures;
- thermal burns; and
- harmful temperature extremes.

Glove Guide

Below is a guide to the most common types of protective work gloves and the types of hazards they can guard against:

- **Disposable Gloves:** Disposable gloves, usually made of light-weight plastic, can help guard against mild irritants.
- **Fabric Gloves:** These gloves are made of cotton or fabric blends. They're generally used to improve grip when handling slippery objects. They also help insulate hands from mild heat or cold.
- **Leather Gloves:** These gloves are used to guard against injuries from sparks or scraping against rough surfaces. They are also used in combination with an insulated liner when working with electricity.

- **Metal Mesh Gloves:** These gloves are used to protect hands from accidental cuts and scratches. They are used most commonly by persons working with cutting tools or other sharp instruments.
- **Aluminized Gloves:** These gloves made of aluminized fabric are designed to insulate hands from intense heat. These gloves are most commonly used by persons working with molten materials.
- **Chemical Resistance Gloves:** These gloves may be made of rubber, neoprene, polyvinyl alcohol or vinyl, etc. The gloves protect hands from corrosives, oils, and solvents. When selecting chemical resistance gloves, be sure to consult the manufacturer's recommendations, especially if the gloved hand will be immersed in the chemical.

3. What kind of gloves would you wear if you had to come into contact with very sharp cutting tools?

- a. Aluminized gloves
- b. Disposable gloves
- c. Metal mesh gloves
- d. Leather gloves

Selection of Hand Protection

It's important that employers work closely with their PPE supplier to select appropriate hand protection based on an evaluation of the performance characteristics of the hand protection. The employer needs to look at each of the following:

- specific task(s) being performed;
- environmental conditions present;
- duration of hand protection use while performing the task;
- the actual hazards; and
- potential hazards.

The work activities of the employee should also be studied to determine:

- the degree of dexterity required;
- the duration of the task;
- the frequency of the task;
- degree of exposure of the hazard; and
- the physical stresses that will be applied.

Gloves should be replaced periodically, depending on frequency of use and permeability to the substance(s) handled. Gloves overtly contaminated should be rinsed and then carefully removed after use. With this in mind, there are two important characteristics of gloves to consider.

Permeation rate: The permeation rate measures the length of time it takes a given material (glove) to become saturated by the chemical through absorption.

Breakthrough or Penetration rate: The penetration rate measures the speed with which a given chemical breaks through the layer(s) of the glove to contact the skin.

Gloves should also be worn whenever it is necessary to handle rough or sharp-edged objects, and very hot or very cold materials. The type of glove material to be used in these situations includes leather, welder's gloves, aluminum-backed gloves, and other types of insulated glove materials.

4. What term is used to describe the length of time it takes a glove material to become saturated by the chemical through absorption?

- a. Permeation rate
- b. Breakthrough rate
- c. Penetration rate
- d. Saturation rate

Glove Selection Chart

You can use the chart on the next page to help select the proper gloves for the job. It may serve as a guide to the different types of glove materials and the chemicals they can be used against.

Type	Advantages	Disadvantages	Use Against
Natural rubber	Low cost, good physical properties, dexterity	Poor vs. oils, greases, organics. Frequently imported; may be poor quality	Bases, alcohols, dilute water solutions; fair vs. aldehydes, ketones.
Natural rubber blends	Low cost, dexterity, better chemical resistance than natural rubber vs. some chemicals	Physical properties frequently inferior to natural rubber	Same as natural rubber
Polyvinyl chloride (PVC)	Low cost, very good physical properties, medium cost, medium chemical resistance	Plasticizers can be stripped; frequently imported; may be poor quality	Strong acids and bases, salts, other water solutions, alcohols
Neoprene	Medium cost, medium chemical resistance, medium physical properties	N/A	Oxidizing acids, anilines, phenol, glycol ethers
Nitrile	Low cost, excellent physical properties, dexterity	Poor vs. benzene, methylene chloride, trichloroethylene, many ketones	Oils, greases, aliphatic chemicals, xylene, perchloroethylene, trichloroethane; fair vs. toluene

Butyl	Specialty glove, polar organics	Expensive, poor vs. hydrocarbons, chlorinated solvents	Glycol ethers, ketones, esters
Polyvinyl alcohol (PVA)	Specialty glove, resists a very broad range of organics, good physical properties	Very expensive, water sensitive, poor vs. light alcohols	Aliphatics, aromatics, chlorinated solvents, ketones (except acetone), esters, ethers
Fluoro- elastomer (Viton)	Specialty glove, organic solvents	Extremely expensive, poor physical properties, poor vs. some ketones, esters, amines	Aromatics, chlorinated solvents, also aliphatics and alcohols
Norfoil (Silver Shield)	Excellent chemical resistance	Poor fit, easily punctures, poor grip, stiff	Use for Hazmat work

5. Which type of glove has low cost, excellent physical properties, and dexterity?

- Norfoil
- Butyl
- Neoprene
- Nitrile

Foot Protection

The employer must make sure that each affected employee uses protective footwear when working in areas where there is a danger of foot injuries due to:

- falling or rolling objects;

- objects piercing the sole; and/or
- where feet are exposed to electrical hazards.

Criteria for Protective Footwear

Protective footwear purchased after July 5, 1994 must comply with [ANSI Z41-1991](#), [ANSI Z41-1999](#), or [ASTM F-2413-2005](#), "Standard Specification for Performance Requirements for Protective Footwear" (before July 5, 1994 - ANSI Z41.1-1967) or must be demonstrated by the employer to be equally effective.

Footwear that meets established safety standards will have an American National Standards Institute (ANSI) label inside each shoe.

Types of Footwear

1. 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 materials. Safety shoes are also designed to insulate against temperature extremes and may be equipped with special soles to guard against slips, chemicals, and/or electrical hazards.

2. 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).

6. Affected employees must use protective footwear in areas where there is a danger of foot injuries due to any of the following, EXCEPT _____.

- a. piercing objects
- b. moisture or humidity
- c. falling or rolling objects
- d. exposure to electrical hazards

Electrical Protective Equipment

To prevent injury from exposure to electrical conductors, it's important that all electrical protective equipment be maintained in a safe and reliable condition. Electrical protective equipment includes the following:

- insulating blankets;
- covers;
- line hose;
- gloves; and
- sleeves made of rubber.

All electrical protective equipment made of rubber should meet the established safety standards and specifications discussed below.

Inspecting Equipment

To make sure electrical protective equipment actually performs as designed, it must be inspected for damage before each day's use and immediately following any incident that can reasonably be suspected of having caused damage. Insulating gloves must be given an air test, along with the inspection.

Defects

Insulating equipment must not be used if any of the following defects are detected:

- a hole, tear, puncture, or cut;

- ozone cutting or ozone checking (the cutting action produced by ozone on rubber under mechanical stress into a series of interlacing cracks);
- an embedded foreign object;
- changes in the texture including, swelling, softening, hardening, or becoming sticky or inelastic; or
- any other defect that damages the insulating properties.

Note: For more on this topic, see [Course 715 Electrical Safety Basics](#).

7. Which of the following is a category of insulating protective equipment (IPE)?

- a. Safety shoes
- b. Rubber blankets
- c. Hard hats
- d. Gloves

Electrical Protective Gloves

Protector gloves must be worn over insulating gloves. An exception is when using [Class 0 gloves](#), under limited-use conditions, where small equipment and parts manipulation necessitate unusually high finger dexterity. But, it's important to note that extra care must be taken while visually examining the glove. Also, make sure to avoid handling sharp objects.

Any other class of glove may be used for similar work without protector gloves if the employer can demonstrate that the possibility of physical damage to the gloves is small and if the class of glove is one class higher than that required for the voltage involved. Insulating gloves that have been used without protector gloves may not be used at a higher voltage until they have been tested.

Testing

Electrical protective equipment must be subjected to periodic electrical tests. Maximum intervals between tests must be in accordance with the following table.

Type of Equipment	When to Test
Rubber insulating line hose	Upon indication that insulating value is suspect and after repair.
Rubber insulating covers	Upon indication that insulating value is suspect and after repair.
Rubber insulating blankets	Before first issue and every 12 months thereafter ¹ upon indication that insulating value is suspect; and after repair.
Rubber insulating gloves	Before first issue and every 6 months thereafter ¹ upon indication that insulating value is suspect; after repair; and after use without protectors.
Rubber insulating sleeves	Before first issue and every 12 months thereafter ¹ upon indication that insulating value is suspect; and after repair.

¹ If the insulating equipment has been electrically tested but not issued for service, the insulating equipment may not be placed into service unless it has been electrically tested within the previous 12 months.

You can read more about electrical protective equipment in [OSHA 1910.137, Electrical Protective Equipment](#). Learn more about electrical safety in [OSHAcademy Course 715](#).

8. In addition to inspecting insulating gloves, the inspector must _____.

- a. check the gloves for bubbles with soap and water
- b. ensure the gloves pass a temperature test
- c. send the gloves to a lab within 30 days
- d. give gloves an air test

Hearing Protection

Noise-induced hearing loss is the term for hearing damaged by exposure to excessive noise. The damage to hearing caused by excessive noise at work may not be apparent for years. Hearing loss can't be treated or cured, but it can be prevented.

Sound and Noise

Sound is what you hear. Our sensation of very small, rapid changes in air pressure.

Noise is any sound that you don't want to hear.

Sound is measured in two ways: decibels and frequency.

Decibels indicate the pressure of sound. Sound waves transfer that pressure from place to place and are expressed in units on a logarithmic scale.

Frequency is related to a sound's pitch and is measured in units called hertz (Hz), or cycles per second. The pitch of a sound - how high or low it seems - is how you perceive its frequency.

Human hearing is most sensitive to frequencies between 3,000-4,000 Hz. That's why people with damaged hearing have difficulty understanding higher-pitched voices and other sounds in the 3,000-4,000 Hz range.

Hearing Conservation Program

Your workplace must have a hearing conservation program if employees are exposed to noise levels that are equal to or greater than 85 dBA average over an eight-hour period (called the 8-Hour Time Weighted Average). This is called the "Action Level." Check out course [751 Hearing Conservation Program Management](#) for more in-depth information regarding hearing conservation.

9. When must your employer establish a hearing conservation program?

- a. If employees are subject to sudden impact noise or prolonged noise levels
- b. If employees are exposed to noise levels that are equal to or greater than 85 dBA over 8 hours
- c. If anticipated noise levels exceed reasonably expected or anticipated levels
- d. If noise levels exceed 95 dB over any 15 minute period

Hearing Protectors

As you are probably aware, there are basically four types of hearing protectors.

- molded earplugs
- custom-molded earplugs
- self-molded earplugs
- ear muffs

Molded earplugs are usually made of plastic or silicone rubber. They are available in a variety of shapes and sizes and are usually characterized by one or more ribs or contours. They are considered multiple use; therefore, they must be cleaned and properly stored after each use.

Custom-molded earplugs are generally made of plastic and are designed from a molded wax insert of the wearer's ears. They are considered multiple use but cannot be switched ear to ear.

Self-molded earplugs are generally made of mineral down or plastic foam and are molded or formed by the wearer. Generally, one size fits all and they may be either single or multiple use.

Earmuffs are designed to be multiple use and may be designed to be worn with the harness over or behind the head, or below the chin. They are generally more comfortable, but usually provide less noise reduction, thus less protection, than ear plugs.

[Click here](#) to see how to insert earplugs!

10. Which of the following hearing protection devices are generally more comfortable, but provide less noise reduction?

- a. Self-molded earplugs
- b. Earmuffs
- c. Custom molded earplugs
- d. Earmuffs

Additional Resources

1. [OSHA PPE Standards](#), OSHA
2. [Personal Protective Equipment Compliance Guide](#), Univ. of Alabama
3. [A Guide to Personal Protective Equipment](#), NC Dept. of Labor
4. [Napo's Films](#), Via Storia
5. [Respiratory Protection](#), OSHA
6. [Respiratory Protection ETool](#), OSHA
7. [Respirators](#), NIOSH
8. [A Guide to Respiratory Protection](#), NCDOL