

PPE

What Is PPE?

Personal protective equipment (PPE) is clothing or other equipment workers wear to protect themselves from job hazards.

Hazards can cause injury or impairment of any body part. Hazards can be:

- processes,
- objects, or
- substances.

Hazards cause harm through inhalation, absorption, or physical contact. PPE stands between you and the hazard.

PPE includes:

- hard hats,
- safety glasses,
- goggles,
- face shields,
- ear plugs or muffs,
- steel-toed boots,
- protective clothing,
- gloves,
- respirators,
- life jackets, and
- welding helmets.



OSHA's General Duty Clause requires employers to furnish employees a place of employment that is free from recognized hazards that cause or are likely to cause death or serious physical harm.

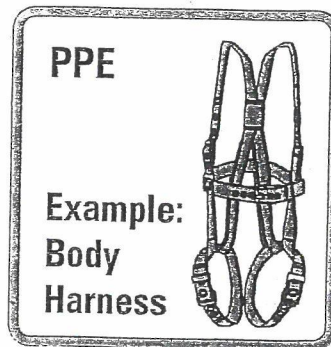
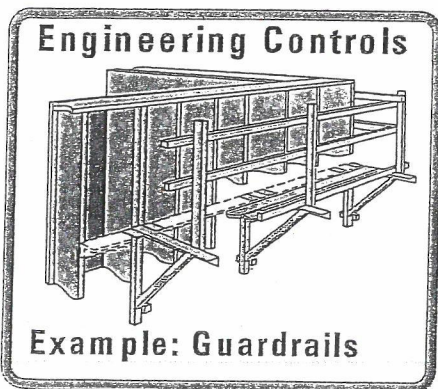
The employer has several choices of hazard control:

- substitution of a safer product or procedure,
- engineering controls,
- administrative controls, and
- PPE.

Engineering controls are the best way to protect against a hazard. Examples of engineering controls include guardrails and ventilation. When effective engineering controls are in place, you may not need PPE.

When engineering controls and administrative controls fail to control the hazard, we need PPE.

PPE is our last defense.



PPE

Why Do We Need PPE?

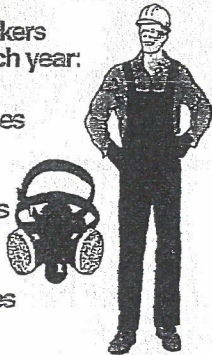
Construction workers need *PPE* because construction sites are hazard-ridden. Other hazard control measures often fail to eliminate or reduce the hazard to acceptable levels. PPE doesn't eliminate the hazard either. But it reduces our chances of injury or illness.

More construction workers lose time from work because of injuries than workers in any other industry. About 15 in 100 full-time construction workers suffer lost-time injuries every year. That's one in 7—about five times more likely than rolling snake eyes with a pair of dice.

PPE reduces our chances of injury.

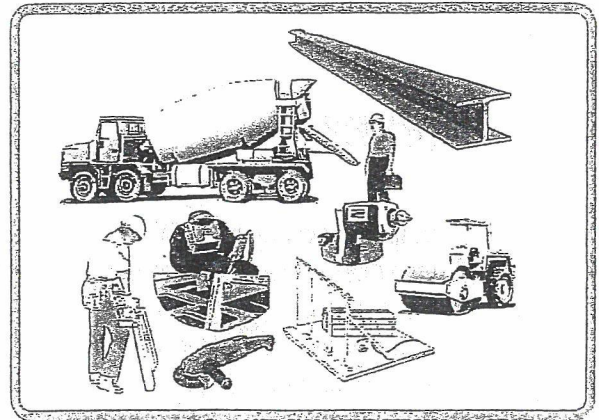
15 in 100 construction workers suffer lost-time injuries each year:

- 6 times more head injuries without hard hats
- 2 times more eye injuries without safety glasses
- 4 times more foot injuries without safety shoes



Most injured workers were not wearing safety gear.

A recent study shows *exposure to harmful substances* causes 18% of all **on-the-job** deaths in construction. This does not even include the large number of construction workers who get diseases from exposure to harmful substances. For example, asbestos, fiber glass, and paint products cause thousands of cases of lung disease among construction workers each year.



On a construction site, we are surrounded by hazards. Construction dangers fall into two categories:

- health hazards
- safety hazards.

Health hazards include:

- carbon monoxide gas,
- wet concrete,
- asbestos dust,
- vapors from solvents and paints,
- gases from welding or soldering,
- fiber glass,
- vibration,
- temperature extremes, and
- noise.

Safety hazards include:

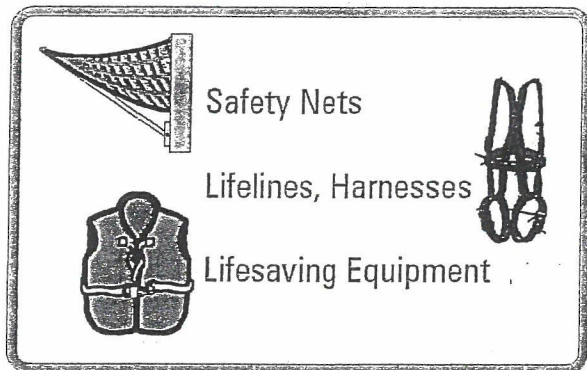
- falls from ladders and scaffolds,
- injuries from falling or flying objects,
- electrocution, and
- lifting and moving tools and materials.

Safety hazards cause immediate harm. Some health hazards also cause immediate harm. Carbon monoxide can knock you out in minutes. But some health hazards cause harm only after repeated or long exposures. This makes it difficult to recognize and guard against health hazards. So limit your exposure to any substance as much as possible.

What PPE Is Available?

PPE is usually named for the body part it protects. The major groups of personal protective equipment are:

- head protection,
- foot and leg protection,
- ear protection,
- eye and face protection,
- respiratory (lung) protection,
- arm and hand protection, and
- torso protection.



Other kinds of PPE include:

- safety nets,
- lifelines, safety harnesses, lanyards, and
- life saving equipment for work near or over water.

PPE

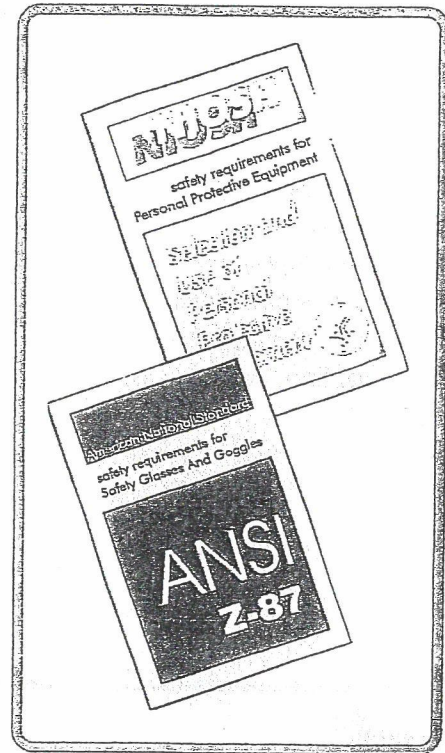
How Do We Know Our PPE Is Acceptable?

To be *acceptable*, PPE should be:

- tested and approved by NIOSH (the National Institute for Occupational Safety and Health) or
- meet standards set by ANSI (the American National Standards Institute).

NIOSH is one of the National Institutes of Health in the U.S. Department of Health and Human Services. NIOSH is part of the Center for Disease Control and Prevention. NIOSH is OSHA's sister agency for research. NIOSH has laboratories which test personal protective equipment. Approved equipment has a NIOSH approval number.

ANSI is a private organization. ANSI publishes a reference book outlining approved standards and specifications for all aspects of construction. OSHA regulations sometimes require PPE to meet ANSI standards.



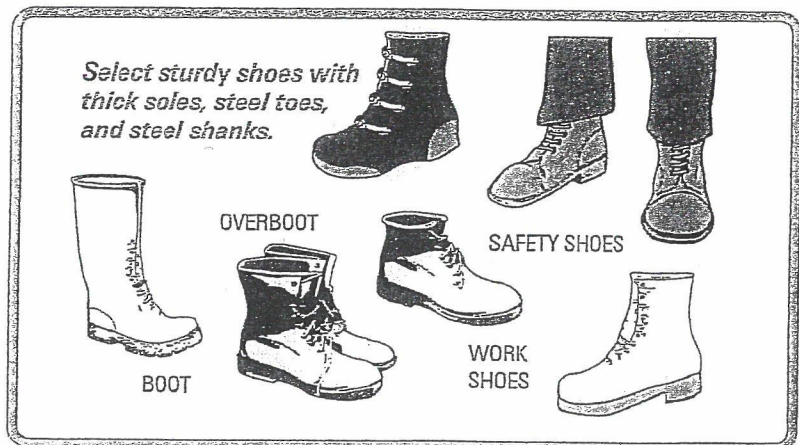
Why Should We Protect Our Feet and Legs?

About 200,000 injuries happen to defenseless toes and feet every year. The correct foot wear would prevent most of these injuries. Some hazards that require foot and leg protection include:

- falling objects,
- rolling objects,
- sharp objects,
- molten metal, and
- hot or wet surfaces,
- hazardous chemicals.

Select sturdy shoes with thick soles, steel toes, and steel shanks. The steel toes protect against falling objects. Steel shanks protect from protruding nails and similar sharp objects.

You can wear Tyvek or leather leggings over your clothes to protect your legs.



Why Should We Protect Our Heads?

We need head protection because thousands of head injuries happen every year in construction. Head injuries are prevented when workers wear head protection.

A hard hat has two parts:

- the shell
- the suspension

The shell should be one seamless piece. The suspension consists of an inside cradle, a headband, and a sweatband.

The suspension absorbs shocks and keeps the hat away from your skull. Adjust the suspension and crown snap so there is a minimum clearance of 1 inch to 1¼ inches between the suspension and outer shell.

Hard hats must meet ANSI requirements. Hard hats come with or without brims in three classifications:

- Class A,
- Class B,
- Class C.



Class A is General Service. Class A is the one most construction workers wear. Electrical workers wear Class B hard hats. These hats are the best protection from

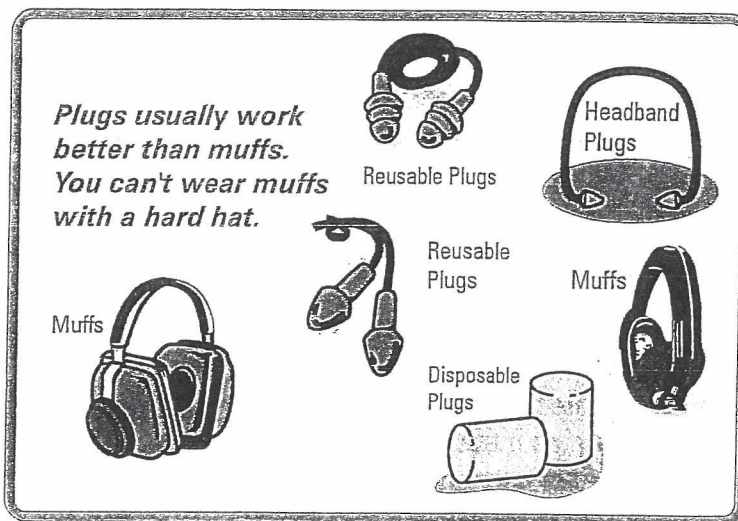
high voltage. Class C hard hats are usually aluminum. They are not acceptable for construction.

Do not alter hard hats. Don't drill vent holes in them or wear them backward. Sunlight, heat, cold, and chemicals can weaken a hard hat. Some products lessen electrical resistance. Don't store a hard hat in the back window or the dash of a vehicle. Don't paint it or clean it with solvents. Replace it immediately, if damaged.

Why Should We Protect Our Ears?

OSHA requires construction workers to wear hearing protection whenever noise is 90 dBA or above for an 8-hour day. Higher noise levels for shorter periods of time also require hearing protection. As a rough gauge: if you have to raise your voice to talk to people standing 3 feet away, you need hearing protection.

Ear plugs usually work best for construction workers because respirators, hard hats, and eyeglasses can prevent a good seal of ear muffs. Ear plugs furnish good hearing protection when properly inserted. Follow manufacturers' directions. Be sure to use plugs



that are the right size. Ask your supervisor if you need help.

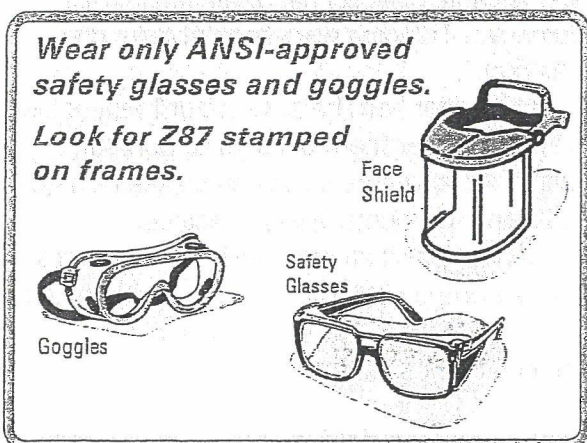
*Forget cotton and wads of tissue.
They offer zero protection.*

PPE

Why Should We Protect Our Eyes and Faces?

About 1,000 workers have eye injuries every day in the United States. Flying objects and sparks cause about 70% of those injuries.

Safety glasses, goggles, and face shields will prevent most eye injuries. Wear eye protection all the time on a construction site. Most construction work requires safety glasses with side shields. But be careful. The wrong eye protection can be more dangerous than none at all. Wear only ANSI-approved safety glasses and goggles.



Eye protection should fit properly and not interfere with movement or vision. It should be reasonably comfortable, durable, easily cleaned or disinfected, and in good repair. Your employer is responsible for selecting the eye protection for your job.

Safety glasses with side shields protect you from hazards in front of you or from the sides. They also protect your eyes from flying particles such as metal, wood, glass, or plastic. Workers use them with power tools that create airborne particles and dusts.

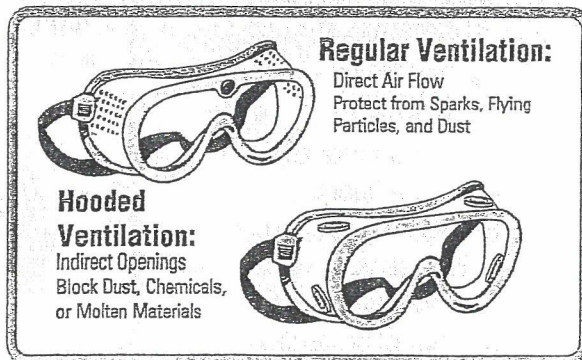
Safety glasses with eye-cups fit close around your eyes. They protect your eyes better than side shields. Use them for lathe work, plumbing, and other work where hazards come from any direction.

Frames that meet NIOSH and ANSI standards have Z87 stamped on them. Acceptable safety glasses meet NIOSH and ANSI standards for both the lenses and the frames. Lenses are impact-resistant glass, plastic, or polycarbonate. They also resist penetration. Manufacturers mark or etch their logo on the lens. Lenses can be prescription or nonprescription. The frames are heat-resistant and stronger than street-wear.

Goggles fit snugly around your eyes. There are two styles.

Goggles with regular ventilation have direct air flow. They protect you from dust, sparks, and flying particles. Use them for sawing, soldering, etching, forging, and riveting.

Goggles with hooded ventilation have indirect openings. These openings block dust and chemicals but allow air flow. Use them with molten materials and other eye splash hazards. If you need corrective lenses, you can wear prescription lenses under goggles. Or you can get prescription lenses to fit behind the goggles' lens. Face shields over safety glasses or goggles protect you from splashes, heat, glare, and flying particles.

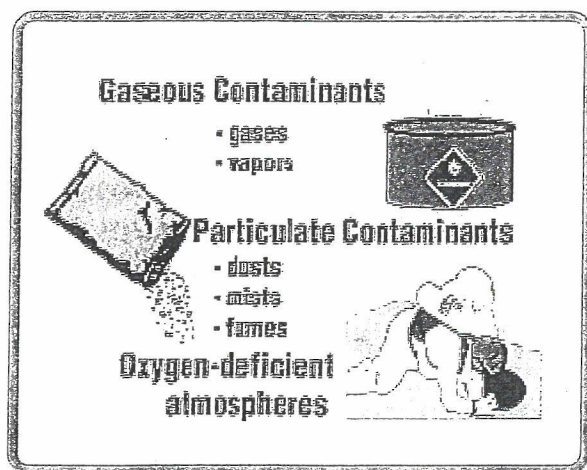


Welders must wear both safety glasses or goggles and a welding helmet. The glasses or goggles protect against sparks and other physical dangers.

The helmet protects from the radiant light. A welding helmet has tinted lenses rated by density from 2 to 14, with 2 being the lowest. Your lenses must be at least as dark as recommended for the task you are doing. You may wear a denser shade (higher number) if you wish.

FILTER LENS SHADE NUMBERS FOR PROTECTION AGAINST RADIANT ENERGY	
Welding operation	Shade number
Shielded metal-arc welding 1/16-, 3/32-, 1/8-, 5/32- inch diameter electrodes	10
Gas-shielded arc welding (nonferrous) 1/16-, 3/32-, 1/8-, 5/32- inch diameter electrodes	11
Gas-shielded arc welding (ferrous) 1/16-, 3/32-, 1/8-, 5/32- inch diameter electrodes	12
Shielded metal-arc welding 3/16-, 7/32-, 1/4- inch diameter electrodes	12
5/16-, 3/8- inch diameter electrodes	14
Atomic hydrogen welding	10 - 14
Carbon-arc welding	14
Soldering	2
Torch brazing	3 or 4
Light cutting, up to 1 inch	3 or 4
Medium cutting, 1 inch to 6 inches	4 or 5
Heavy cutting, over 6 inches	5 or 6
Gas welding (light), up to 1/8-inch	4 or 5
Gas welding (medium), 1/8-inch to 1/2-inch	5 or 6
Gas welding (heavy), over 1/2-inch	6 or 8

Why Should We Protect Our Lungs?



Respiratory hazards cause illness and death for thousands of construction workers each year. Most respiratory hazards are gaseous contaminants—either gases or vapors; particulates; or oxygen deficient atmospheres.

Gases and vapors pass through your airways to your lungs. Once in your lungs, they are absorbed into your bloodstream. From there, they can damage your brain and other internal organs.

Particulate contaminants include dusts, mists, and fumes. Dusts are particles produced by grinding, crushing, and mixing. Mists are tiny liquid droplets given off when a liquid is sprayed, vigorously mixed, or agitated. Fumes are tiny metallic particles given off when metals are heated during soldering, welding, and brazing. Particulates can damage lungs or pass into your blood, affecting the brain and other organs.

Oxygen-deficient atmospheres are usually found in confined spaces with very poor ventilation. Oxygen-deficient atmospheres are classified as Immediately Dangerous to Life or Health (IDLH). Exposure to IDLH atmospheres will cause serious injury or death within minutes—or serious delayed effects. Oxygen starvation can seriously injure your brain or kill you.

PPE

What Is a Respirator?

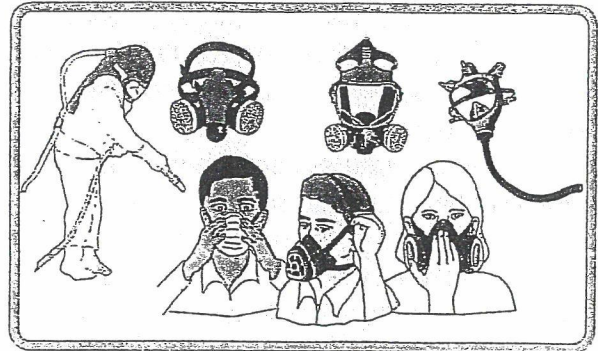
A *respirator* is a device fitting over your nose and mouth that maintains a supply of breathable air. It either filters out contaminants from the air you are in. Or it supplies clean air from another source. Acceptable respirators meet the requirements of the National Institute for Occupational Safety and Health (NIOSH).

To protect your lungs, a respirator must:

- be the correct type for the hazard,
- fit properly, and
- be properly maintained.

Respirators eliminate or reduce specific hazards. No respirator can protect you from all hazards. Your employer chooses the respirator depending on what hazard is present.

OSHA requires your employer to have a



respirator program. The program must include:

- training in respirator wear,
- fit-testing,
- maintenance, and
- medical approval.

Medical approval is very important for air-purifying respirator use. Air-purifying respirators make breathing difficult and can strain the heart of a medically unfit individual.

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How Do Air-Purifying Respirators Work?

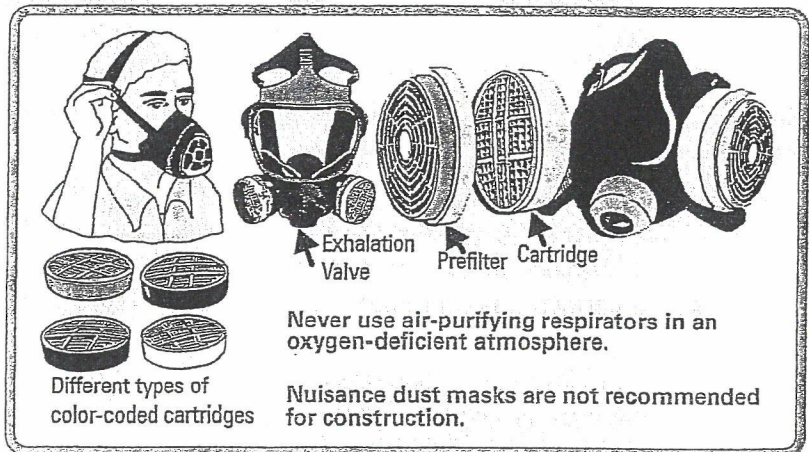
Air-purifying respirators use filters to purify the air. As you inhale, the air from the atmosphere around you flows into the mask.

Disposable masks are the simplest and most common form of respiratory protection. The single use “dust mask” traps particles. Don’t use dust masks to guard against solvent vapors or paint spray mists. Other types of disposable masks filter out gases and vapors.

Reusable air-purifying respirators have a filter, cartridge, or canister to screen out gases and vapors as you breathe in. As you exhale, a valve opens to let air out. Then the valve closes to keep contaminated air from flowing into the mask. A pre-filter may be added to trap particles. Match the filter, cartridge, or canister to the contaminant you are exposed to.

Cartridges and canisters are labeled with the type of contaminant they protect against. The filter elements have a limited life.

Follow the manufacturer’s recommendations and periodically replace the element. If you start having difficulty inhaling, the filter is probably clogged. Go to an area with clean air and replace the filter element.



How Do Supplied-Air Respirators Work?

Supplied-air respirators deliver breathable air from a source free of contaminants. Airline respirators and self-contained respirators are common types.

The clean air in airline respirators comes through a hose attached to a tank of compressed air, or similar device. The connections on the airline must be air-tight. Protect the airline or hose from objects that could cut or puncture it.

Self-contained air respirators supply you with fresh air from a tank on your back. This allows you greater freedom of movement than the airline respirator.

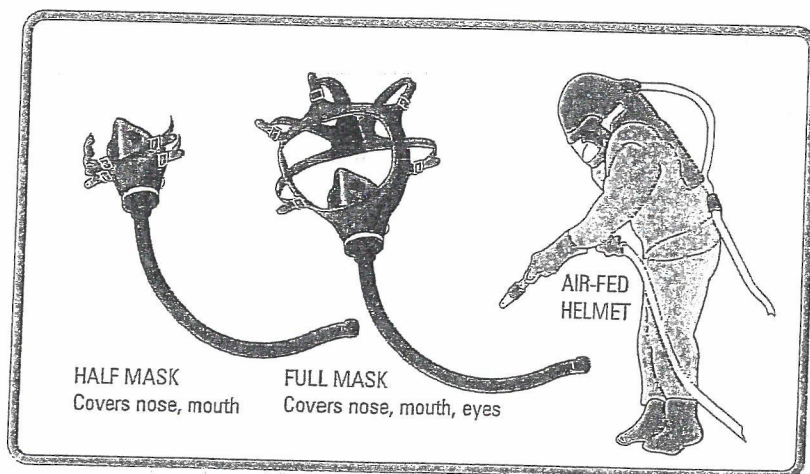
Supplied-air respirators are light-weight and easy to use for long periods of time. They reduce inward leakage of contaminated air around the face mask. Breathing is easier when air is supplied to you.

Supplied-air respirators also have disadvantages. You can only move the length of your hose. A supplied-air respirator has more parts and requires more maintenance than an air-purifying respirator. More parts means more chance of failure. And if the airline or hose is damaged, you are immediately exposed to the hazard's full effect.

Hose-mask and airline are two types of supplied-air respirators. Hose-mask respirators supply air to your mask through a large hose. The hose may be attached to a hand- or motor-operated blower. A blower is better because it creates a positive pressure in the facemask.

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What About Facemasks?



Most respirators have several styles of facemasks. A *half-mask* covers your nose and mouth. It seals below your chin. A *full facemask* covers your nose, mouth, chin, and

eyes. If a hazardous substance causes eye irritation, use a full facemask, hood, or helmet.

Generally, full facemasks are twice as effective as half-masks if both fit properly. But a full facemask, hood, or helmet, costs more and needs more maintenance.

Abrasive blasters use another kind of headpiece, the *air-fed hood or helmet*.

This helmet is made of rigid material that protects the blaster from ricocheting abrasives. Air flows into the helmet and down past your breathing zone.

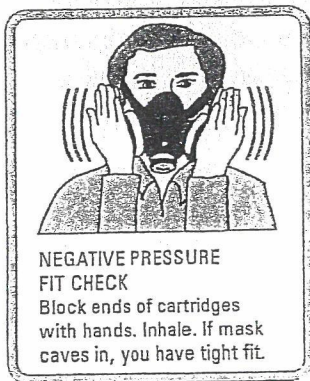
How Do We Know Our Respirators Work?

Your respirator must seal tightly against your face. Several things can prevent a good seal, including:

- the shape of your face,
- beards,
- sideburns, and
- eyeglasses.

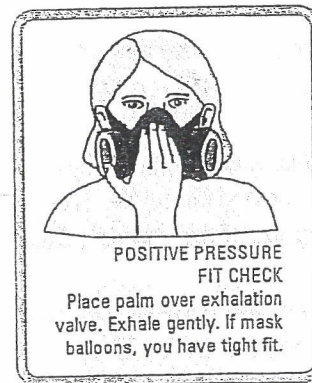
Here are two easy ways you can check your respirator fit:

- a negative fit check, and
- a positive fit check.



For either fit check, strap on the respirator. Adjust it to fit snugly.

For the *negative fit check*: block the end of the cartridge(s) or canister(s) with your palm(s) so that air



For the *positive fit check*: place your palm or thumb over the exhalation valve opening. Exhale gently into the mask. If the mask balloons out, you have a tight fit. If it doesn't, readjust the fit. Repeat until the mask balloons out.

Other fit checks may be required before you use your respirator.

How Do We Care for Our Respirators?

Just like any other piece of equipment, the respirator needs *maintenance*. Proper care means:

- inspecting for damage and defects,
- cleaning and disinfecting,
- repair, and
- storage.

To inspect your respirator:

- Check tightness of the connections and the regulator.
- Check the condition of the facepiece, headbands, valves, connecting tube, filter, cartridge, or canister. Are there cracks, missing parts, or parts that don't fit together?
- Check rubber parts for elasticity and signs of wear. Massage rubber parts to keep them pliable.

Clean and disinfect your respirator after each use.

- Remove all filters, cartridges, or canisters.
- Wash the facepiece and breathing tube in the proper solution.
- Rinse completely in warm water.
- Air dry in a clean area.
- Clean other parts as the manufacturer recommends.
- Install a new filter, cartridge, or canister.

Store your respirator in a clean plastic bag or proper container. Keep away from dust, sunlight, heat, cold, excessive moisture, or harmful chemicals.

What Other PPE Do We Need?

OSHA doesn't have specific requirements for PPE for *hands or torso*. But like other PPE we've looked at, it should be appropriate for the hazard you work with.

Why Should We Protect Our Hands and Arms?

Skin problems are a significant problem among construction workers, especially those who handle:

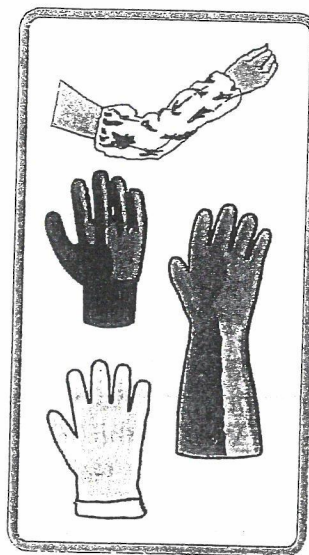
- caustics like wet concrete,
- acids,
- solvents,
- adhesives, and
- other irritating or allergenic materials.

Even if you don't handle such products, construction work can be abrasive to your hands. Abrasive action alone can cause skin problems.

Without hand protection, you are more subject to cuts, scrapes, and other injuries which can lead to infections.

Gloves, sleeves, and wristlets of various materials protect hands, wrists, and arms.

Leather is good protection: for welding, working with rough materials, against cuts, hot sparks, molten metal, and rope burns.



What About Personal Fall Protection?

Most fall protection equipment is covered in other courses. But OSHA's *Subpart E* lists these requirements for safety harnesses, lifelines, and lanyards.

- A harness, lifeline, or lanyard used to stop a worker's fall should never be used again for fall protection.
- Lifelines, lanyards, and anchorages must support 5,400 pounds.
- Lanyards must permit a fall of no more than 6 feet.

When Are Safety Nets Required?

Safety nets are required when workplaces are 30 feet above the ground or water surface. Safety nets also are required where ladders, scaffolds, safety lines, and similar devices are impractical.

Nets must be installed as near the work surface as practical, but no more than 30 feet below. Nets must extend 8 feet beyond the edge of the work surface. Mesh size must be no more than 6 inches by 6 inches.

What Protection Do We Need Over Water?

Some construction sites are over or near *water*. If there is a danger of drowning, you must wear a U.S. Coast Guard-approved life jacket or buoyant work vest. Your employer must provide ring buoys, a throwable safety device, in the work area. Buoys must be no more than 200 feet apart. They must each have at least 90 feet of line. A lifesaving skiff must be kept nearby for emergency rescues.

PPE

Who Is Responsible?

Your employer must:

- furnish proper PPE for the specific job hazard
- train workers for jobsite hazards

If you need a respirator, fall protection, or other PPE, your employer must furnish it. Your employer also must train you to use and care for it. To be effective, PPE must be sanitary and reliable. That's your employer's responsibility. But you must do your part as well. Wear all the PPE your employer requires. Take care of it. Report damaged, ill-fitting, or contaminated PPE to your supervisor immediately.



Remember, most injured construction workers weren't wearing safety gear when they were injured. If you have questions about the safety of a piece of PPE or how to protect yourself from a particular hazard, ask your supervisor or your employer.

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Does PPE Have Limitations?

For all its usefulness, PPE is not perfect. It can be uncomfortable, cumbersome, and hot. It requires inspection, maintenance, and training. In some cases, you need medical clearance to use it. Here are a few examples of the limitations of PPE.

Respirators may make visual and audio communication difficult. Full facepiece respirators restrict vision and can fog-up. Even if your respirator has a speaking diaphragm, your voice is distorted and communication hampered. You need to communicate both to get the work done and to warn others of potential hazards.

To be effective, PPE must be inspected on a daily basis and maintained. If your welding jacket has a hole in it, your skin is exposed to painful burns. If your respirator leaks, your lungs are exposed to the contaminant you are trying to avoid. If your gloves are contaminated, they trap the contaminant against your skin, intensifying your exposure.

Also, you must know how to use the PPE. You may be in more danger because you think you are safe and ignore warning signs that might tell you different.

Are There Hazards of PPE?

PPE can be hazardous. Some PPE can aggravate existing medical conditions. You might be allergic to some gloves, for example.

Bronchitis and other heart and lung problems can make it difficult for you to wear an air-purifying respirator. Filters, cartridges, and canisters restrict air flow to your lungs. That breathing resistance puts additional strain on your heart. You must have a medical examination before wearing an air-purifying respirator. If you have emphysema, bronchitis, fibrosis, or heart problems, you may need a different type of respirator. Positive pressure respirators can decrease breathing difficulties.