PERSONAL PROTECTIVE EQUIPMENT (PPE) IN CONFINED SPACES

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OBJECTIVES

- Identify different types of eye protection and their uses
- Evaluate the different types of face protection
- Understand the uses and limitations of head protection
- The usage characteristics of welding protective gear
- Choosing the right foot protection

OBJECTIVES CONTINUED

- Identifying the usage and limitations of various respirators
- Describe fit testing, medical evaluation, and their importance
- How to clean, care for, and store the respirator

TRAINING

Each employee shall be trained to know at least the following:

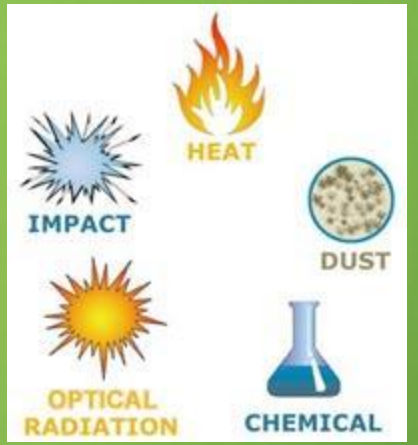
- When PPE is necessary.
- What PPE is necessary.
- How to properly don, doff, adjust, and wear PPE.
- Limitations of the PPE.
- Proper care, maintenance, useful life, and disposal of the PPE

THE FOLLOWING MINIMUM REQUIREMENTS MUST BE MET BY ALL PROTECTIVE DEVICES.

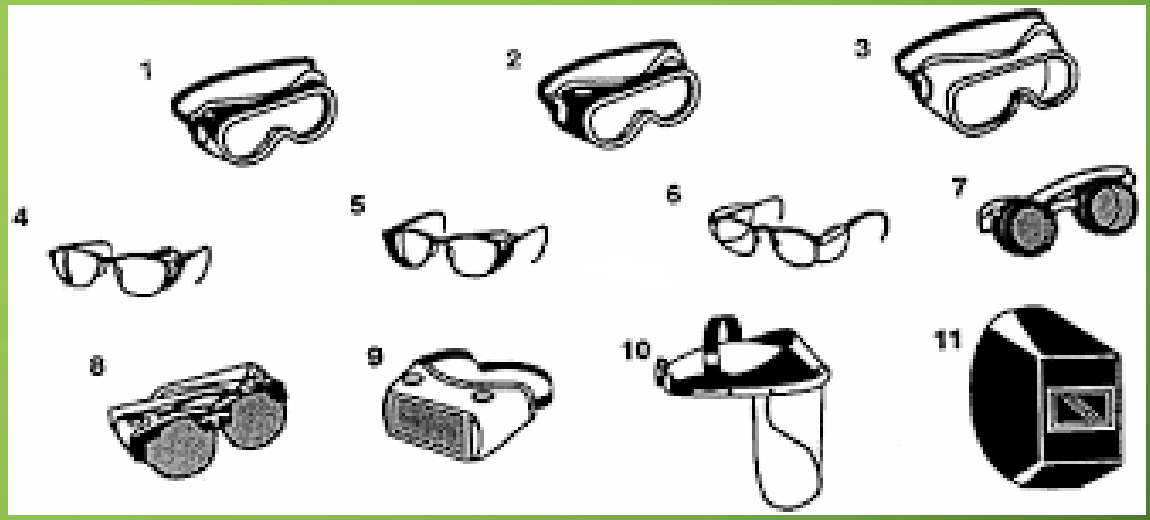
Protectors shall: Provide adequate protection against the particular hazards for which they are designed.

- Be of safe design and construction for the work to be performed.
- Be reasonably comfortable when worn under the designated conditions.
- Fit snugly and not unduly interfere with the movements of the wearer.
- Be durable.
- Be capable of being disinfected and cleaned if reusable.
- Be distinctly marked to facilitate identification only of the manufacturer

HAZARD ASSESSMENT



Hazard Assessment		
Hazard type	**Examples of Hazard**	**Common Related Tasks**
Impact	Flying objects such as large chips, fragments, particles, sand, and dirt	Chipping, grinding, machining, masonry work, wood working, sawing, drilling, chiseling, powered fastening, riveting, and sanding
Heat	Anything emitting extreme heat	Furnace operations, pouring, casting, hot dipping, and welding
Chemicals	Splash, fumes, vapors, and irritating mists	Acid and chemical handling, degreasing, plating, and working with blood
Dust	Harmful dust	Woodworking, buffing, and general dusty conditions
Optical Radiation	Radiant energy, glare, and intense light	Welding, torch-cutting, brazing, soldering, and laser work



EYE PROTECTION

SAFETY SPECTACLES ARE INTENDED TO SHIELD THE WEARER'S EYES FROM IMPACT HAZARDS SUCH AS FLYING FRAGMENTS, OBJECTS, LARGE CHIPS, AND PARTICLES. WORKERS ARE REQUIRED TO USE EYE SAFETY SPECTACLES WITH SIDE SHIELDS WHEN THERE IS A HAZARD FROM FLYING OBJECTS.

SAFETY GLASSES

CHARACTERISTICS

- Z87.1-2010, Z87.1-2003 or Z87.1-1989
- The lenses of safety spectacles are designed to resist moderate impact from flying objects and particles.
- Side shields provide angular protection from impact hazards *in addition* to frontal protection.

SAFETY GOGGLES

CHARACTERISTICS

- Z87.1-2010, Z87.1-2003 or Z87.1-1989
- Safety goggles lenses are designed and tested to resist moderate impact.
- Safety goggle frames must be properly fitted to the worker's face to form a protective seal around the eyes.

- Ventilated goggles allow air circulation while providing protection against airborne particles, dust, liquids, or light.

INCORPORATING PRESCRIPTION INTO THE DESIGN OF PPE

WORKERS WHO WEAR PRESCRIPTION GLASSES MUST ALSO WEAR REQUIRED EYE PROTECTION

- Eye and face protection that fits comfortably over glasses is available.
- Safety goggles and spectacles may incorporate prescription lenses.

DUST AND CHEMICALS PRESENT ADDITIONAL HAZARDS TO CONTACTS WEARERS.

- OSHA recommends that workers have an extra pair of contacts or eyeglasses in case of contact failure or loss.

FACE PROTECTION

FACE SHIELDS ARE INTENDED TO PROTECT THE ENTIRE FACE OR PORTIONS OF IT FROM IMPACT HAZARDS SUCH AS FLYING FRAGMENTS, OBJECTS, LARGE CHIPS, AND PARTICLES. WHEN WORN ALONE, FACE SHIELDS *DO NOT* PROTECT EMPLOYEES FROM IMPACT HAZARDS. USE FACE SHIELDS IN COMBINATION WITH SAFETY SPECTACLES OR GOGGLES, EVEN IN THE ABSENCE OF DUST OR POTENTIAL SPLASHES, FOR ADDITIONAL PROTECTION BEYOND THAT OFFERED BY SPECTACLES OR GOGGLES ALONE.

FACE SHIELD

CHARACTERISTICS

- Face shield windows extend from the brow to below the chin and across the entire width of the face.
- Headgear supports the window shield and secures the device to the head

FACE SHIELD (CONTINUED)

- Face shield windows are made with different transparent materials and in varying degrees or levels of thickness. These levels should correspond with specific tasks

HEAD PROTECTION

PROTECTING EMPLOYEES FROM POTENTIAL HEAD INJURIES IS A KEY ELEMENT OF ANY SAFETY PROGRAM. A HEAD INJURY CAN IMPAIR AN EMPLOYEE FOR LIFE OR IT CAN BE FATAL. WEARING A SAFETY HELMET OR HARD HAT IS ONE OF THE EASIEST WAYS TO PROTECT AN EMPLOYEE'S HEAD FROM INJURY.

HEAD PROTECTION (CONTINUED)

PROTECTIVE HELMETS OR HARD HATS SHOULD DO THE FOLLOWING:

- Resist penetration.
- Absorb the shock of a blow.
- Protect against electrical shock
- Be water-resistant and slow burning.
- Have clear instructions explaining proper adjustment and replacement of the suspension and headband

CHARACTERISTICS

- ANSI Z89.1-2009, 2003 or 1997

HEAD PROTECTION (CONT.)

CLASS A

- Provide impact and penetration resistance along with limited voltage protection (up to 2,200 volts)
- Also known as class G or general purpose

CLASS B

- Provide the highest level of protection against electrical hazards, with high-voltage shock and burn protection (up to 20,000 volts). They also provide protection from impact and penetration hazards by flying/falling objects
- Also known as class E or electrical

HEAD PROTECTION (CONCLUSION)

CLASS C

- Provide lightweight comfort and slight impact protection but offer no protection from electrical hazards.

BUMP HAT

- Use in areas with low head clearance. They are recommended for areas where protection is needed from head bumps and lacerations
- These are not designed to protect against falling or flying objects and are not ANSI approved.

WELDING PROTECTIVE GEAR

HEALTH HAZARDS FROM WELDING, CUTTING, AND BRAZING OPERATIONS INCLUDE EXPOSURES TO METAL FUMES AND TO ULTRAVIOLET (UV) RADIATION. SAFETY HAZARDS FROM THESE OPERATIONS INCLUDE BURNS, EYE DAMAGE, ELECTRICAL SHOCK, CUTS, AND CRUSHED TOES AND FINGERS.

WELDING HELMETS

- Shield the face from sparks and hot debris
- Supports the window and secures the device to the worker's head.
- Welding helmets are heat and electricity insulated and flame resistant

LENSES SHADE SCALE

Table 1

Filter Lenses for Protection Against Radiant Energy

Operations	Electrode size in 1/32" (0.8mm)	Arc current	Minimum* protective shade
Shielded metal arc welding	< 3	< 60	7
	3 - 5	60 - 160	8
	5 - 8	160 - 250	10
	> 8	250 - 550	11
Gas metal arc welding and flux cored arc welding		< 60	7
		60 - 160	10
		160 - 250	10
		250 - 500	10
Gas tungsten arc welding		< 50	8
		50 - 150	8
		150 - 500	10
Air carbon	(light)	< 500	10
Arc cutting	(heavy)	500 - 1,000	11
Plasma arc welding		< 20	6
		20 - 100	8
		100 - 400	10
		400 - 800	11
Plasma arc cutting	(light)**	< 300	8
	(medium)**	300 - 400	9
	(heavy)**	400 - 800	10
Torch brazing			3
Torch soldering			2
Carbon arc welding			14

SHADE SCALE (CONTINUED)

Table 1 (continued)
Filter Lenses for Protection Against Radiant Energy

Operations	Plate thickness inches	Plate thickness mm	Minimum* protective shade
Gas welding: Light	< 1/8	< 3.2	4
Gas welding: Medium	1/8 - 1/2	3.2 - 12.7	5
Gas welding: Heavy	> 1/2	> 12.7	6
Oxygen cutting: Light	< 1	< 25	3
Oxygen cutting: Medium	1 - 6	25 - 150	4
Oxygen cutting: Heavy	> 6	> 150	5

SHADE SCALE (CONCLUSION)

Table 2

Construction Industry Requirements for 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 to 6 inches	4 or 5
Heavy cutting, more than 6 inches	5 or 6
Gas welding (light), up to 1/8-inch	4 or 5
Gas welding (medium), 1/8- to 1/2-inch	5 or 6
Gas welding (heavy), more than 1/2-inch	6 or 8

WELDING PROTECTIVE GEAR (CONTINUED)

GLOVES

- Leather
- Heat resistant
- The hands should be protected with leather gauntlet gloves

WELDING PROTECTIVE GEAR (CONCLUSION)

FOOT PROTECTION

- A pair of high top leather shoes, preferably safety shoes, is good protection for the feet. If low shoes are worn the ankles should be protected by fire resistant leggings
- Metatarsal guards

SLEEVES

- Leather sleeves without cuffs in them are the preferred choice when welding
- The leather is fire resistant

FOOT PROTECTION

EMPLOYEES WHO FACE POSSIBLE FOOT OR LEG INJURIES FROM FALLING OR ROLLING OBJECTS OR FROM CRUSHING OR PENETRATING MATERIALS SHOULD 20 WEAR PROTECTIVE FOOTWEAR. ALSO, EMPLOYEES WHOSE WORK INVOLVES EXPOSURE TO HOT SUBSTANCES OR CORROSIVE OR POISONOUS MATERIALS MUST HAVE PROTECTIVE GEAR TO COVER EXPOSED BODY PARTS, INCLUDING LEGS AND FEET. IF AN EMPLOYEE'S FEET MAY BE EXPOSED TO ELECTRICAL HAZARDS, NON-CONDUCTIVE FOOTWEAR SHOULD BE WORN. ON THE OTHER HAND, WORKPLACE EXPOSURE TO STATIC ELECTRICITY MAY NECESSITATE THE USE OF CONDUCTIVE FOOTWEAR.

FOOT PROTECTION (CONTINUED)

STEEL TOES

- Z41-1999 or 1991

SPECIAL PURPOSE

- Electrically conductive shoes- protect against build up of static electricity
- Electric hazard- nonconductive protect against completing a electrical circuit
- Foundry- insulated from extreme heat

FOOT PROTECTION (CONCLUSION)

Examples of situations in which an employee should wear foot and/or leg protection include:

- When heavy objects such as barrels or tools might roll onto or fall on the employee's feet
- Working with sharp objects such as nails or spikes that could pierce the soles or uppers of ordinary shoes
- Exposure to molten metal that might splash on feet or legs
- Working on or around hot, wet or slippery surfaces
- Working when electrical hazards are present

CARE OF PROTECTIVE FOOTWEAR

- As with all protective equipment, safety footwear should be inspected prior to each use.
- Shoes and leggings should be checked for wear and tear at reasonable intervals. This includes looking for cracks or holes, separation of materials, broken buckles or laces.
- The soles of shoes should be checked for pieces of metal or other embedded items that could present electrical or tripping hazards.
- Employees should follow the manufacturers' recommendations for cleaning and maintenance of protective footwear.

GLOVES

THERE ARE MANY TYPES OF GLOVES AVAILABLE TODAY TO PROTECT AGAINST A WIDE VARIETY OF HAZARDS. THE NATURE OF THE HAZARD AND THE OPERATION INVOLVED WILL AFFECT THE SELECTION OF GLOVES.

GLOVES (CONTINUED)

The following are examples of some factors that may influence the selection of protective gloves for a workplace:

- Type of chemicals handled.
- Nature of contact (total immersion, splash, etc.).
- Duration of contact.
- Area requiring protection (hand only, forearm, arm).
- Grip requirements (dry, wet, oily).
- Thermal protection.
- Size and comfort.
- Abrasion/resistance requirements.

Gloves made from a wide variety of materials are designed for many types of workplace hazards. In general, gloves fall into four groups:

- Gloves made of leather, canvas or metal mesh
- Fabric and coated fabric gloves
- Chemical- and liquid-resistant gloves
- Insulating rubber gloves

CARE OF GLOVES

- Protective gloves should be inspected before each use to ensure that they are not torn, punctured or made ineffective in any way.
- A visual inspection will help detect cuts or tears but a more thorough inspection by filling the gloves with water and tightly rolling the cuff towards the fingers will help reveal any pinhole leaks.
- Gloves that are discolored or stiff may also indicate deficiencies caused by excessive use or degradation from chemical exposure.

BODY PROTECTION

EMPLOYEES WHO FACE POSSIBLE BODILY INJURY OF ANY KIND THAT CANNOT BE ELIMINATED THROUGH ENGINEERING, WORK PRACTICE OR ADMINISTRATIVE CONTROLS, MUST WEAR APPROPRIATE BODY PROTECTION WHILE PERFORMING THEIR JOBS

BODY PROTECTION (CONTINUED)

The following are examples of workplace hazards that could cause bodily injury:

- Temperature extremes
- Hot splashes from molten metals and other hot liquids
- Potential impacts from tools, machinery and materials
- Hazardous chemicals.

PROTECTIVE CLOTHING COMES IN A VARIETY OF MATERIALS, EACH EFFECTIVE AGAINST PARTICULAR HAZARDS, SUCH AS:

- **Paper-like fiber-** used for disposable suits provide protection against dust and splashes.
- **Treated wool and cotton** adapts well to changing temperatures, is comfortable, and fire-resistant and protects against dust, abrasions and rough and irritating surfaces.
- **Duck** is a closely woven cotton fabric that protects against cuts and bruises when handling heavy, sharp or rough materials.

PROTECTIVE CLOTHING COMES IN A VARIETY OF MATERIALS, EACH EFFECTIVE AGAINST PARTICULAR HAZARDS, SUCH AS: CONTINUED

- **Leather** is often used to protect against dry heat and flames.
- **Rubber, rubberized fabrics, neoprene and plastics** protect against certain chemicals and physical hazards.

When chemical or physical hazards are present, check with the clothing manufacturer to ensure that the material selected will provide protection against the specific hazard.

HEARING PROTECTION

HEARING PROTECTION (CONTINUED)

Employee exposure to excessive noise depends upon a number of factors, including:

- The loudness of the noise as measured in decibels (dB).
- The duration of each employee's exposure to the noise.
- Whether employees move between work areas with different noise levels.
- Whether noise is generated from one or multiple sources.

HEARING PROTECTION (CONCLUSION)

Generally, the louder the noise, the shorter the exposure time before hearing protection is required. For instance, employees may be exposed to a noise level of 90 dB for 8 hours per day

TYPES OF HEARING PROTECTION

- **Single-use earplugs** are made of waxed cotton, foam, silicone rubber or fiberglass wool. They are self-forming and, when properly inserted, they work as well as most molded earplugs.
- **Pre-formed or molded earplugs** must be individually fitted by a professional and can be disposable or reusable. Reusable plugs should be cleaned after each use.
- **Earmuffs** require a perfect seal around the ear. Glasses, facial hair, long hair or facial movements such as chewing may reduce the protective value of earmuffs.

PERMISSIBLE NOISE EXPOSURE

Duration per day, in hours	Sound in dB
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
.5	110
.25 or less	115

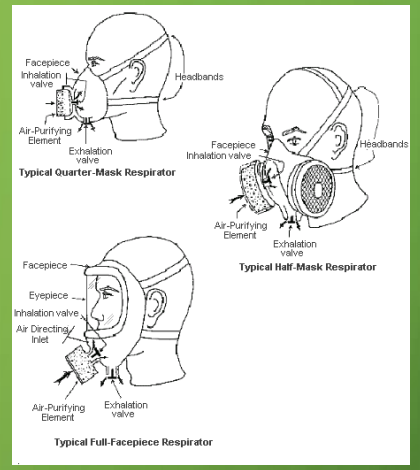
RESPIRATORS

AN ESTIMATED 5 MILLION WORKERS ARE REQUIRED TO WEAR RESPIRATORS IN 1.3 MILLION WORKPLACES THROUGHOUT THE UNITED STATES. RESPIRATORS PROTECT WORKERS AGAINST INSUFFICIENT OXYGEN ENVIRONMENTS, HARMFUL DUSTS, FOGS, SMOKES, MISTS, GASES, VAPORS, AND SPRAYS. THESE HAZARDS MAY CAUSE CANCER, LUNG IMPAIRMENT, DISEASES, OR DEATH.

RESPIRATOR TYPES

View Video: https://youtu.be/u_Dovk_khLw

TWO BASIC TYPES OF RESPIRATORS



AIR SUPPLIED

Protect by supplying clean, breathable air from another source. Respirators that fall into this category include:

- airline respirators, which use compressed air from a remote source
- self-contained breathing apparatus (SCBA), which include their own air supply.

AIR PURIFYING

Removal of contaminants from the air. Respirators of this type include particulate respirators, which filter out airborne particles, and air-purifying respirators with cartridges/canisters which filter out chemicals and gases

- Cannot be used in oxygen deficient atmospheres

TYPES OF RESPIRATORS

PARTICULATE RESPIRATORS

- Filter out dusts, fumes and mists.
- Are usually disposable dust masks or respirators with disposable filters.
- Must be replaced when they become discolored, damaged, or clogged.
- Examples: filtering face piece or elastomeric respirator.
- Intended only for low hazard levels.

CHEMICAL CARTRIDGE/GAS MASK RESPIRATOR

- Uses replaceable chemical cartridges or canisters to remove the contaminant.
- Are color-coded to help you select the right one.
- May require more than one cartridge to protect against multiple hazards

COLOR CODE OF FILTER RESPIRATOR CARTAGES

Contaminant	Color Coding on Cartridge/Canister
Acid gases	White
Hydrocyanic acid gas	White with 1/2 inch green stripe completely around the canister near the bottom.
Chlorine gas	White with 1/2 inch yellow stripe completely around the canister near the bottom.
Organic vapors	Black
Ammonia gas	Green
Acid gases and ammonia gas	Green with 1/2 inch white stripe completely around the canister near the bottom.
Carbon monoxide	Blue
Acid gases & organic vapors	Yellow
Hydrocyanic acid gas and chloropicrin vapor	Yellow with 1/2 inch blue stripe completely around the canister near the bottom.
Acid gases, organic vapors, and ammonia gases	Brown
Radioactive materials, except tritium & noble gases	Purple (magenta)

TYPES OF RESPIRATORS (CONTINUED)

POWERED AIR-PURIFYING RESPIRATOR (PAPR):

- Use a fan to draw air through the filter to the user.

SELF-CONTAINED BREATHING APPARATUS (SCBA)

- Provide clean air from a portable air tank when the air around you is simply too dangerous to breathe
- Weighs 30 lbs. or more
- Half hour breathing time

MAINTENANCE AND CARE OF RESPIRATORS

View Video

- https://www.osha.gov/video/respiratory_protection/maintenance.html
- Source: https://youtu.be/CnF05owDxTI

MEDICAL EVALUATIONS

Employees need to be medically cleared to wear respirators before commencing use. All respirators generally place a burden on the employee.

- Negative pressure respirators restrict breathing, some respirators can cause claustrophobia
- Self-contained breathing apparatuses are heavy

A physician or other licensed health care professional operating within the scope of his/her practice needs to medically evaluate employees to determine under what conditions they can safely wear respirators.

FIT TESTING

All respirators that rely on a mask-to-face seal need to be annually checked with either qualitative or quantitative methods to determine whether the mask provides an acceptable fit to a wearer

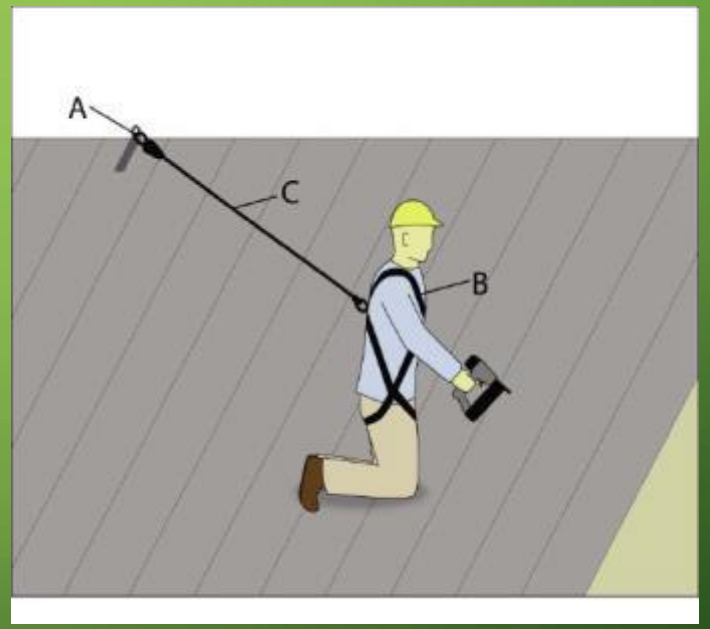
- qualitative fit test procedures rely on a subjective sensation (taste, irritation, smell) of the respirator wearer to a particular test agent
- quantitative fit test uses measuring instruments to measure face seal leakage.

FALL PROTECTION

TO MAINTAIN THEIR SERVICE LIFE AND HIGH PERFORMANCE, ALL BELTS AND HARNESSES SHOULD BE INSPECTED FREQUENTLY. VISUAL INSPECTION BEFORE EACH USE SHOULD BECOME ROUTINE, AND ALSO A ROUTINE INSPECTION BY A COMPETENT PERSON.

PERSONAL FALL ARREST SYSTEMS (PFAS)

- A PFAS consists of the following components:
  - **A**nchorage Point
  - **B**ody Harness
  - **C**onnector

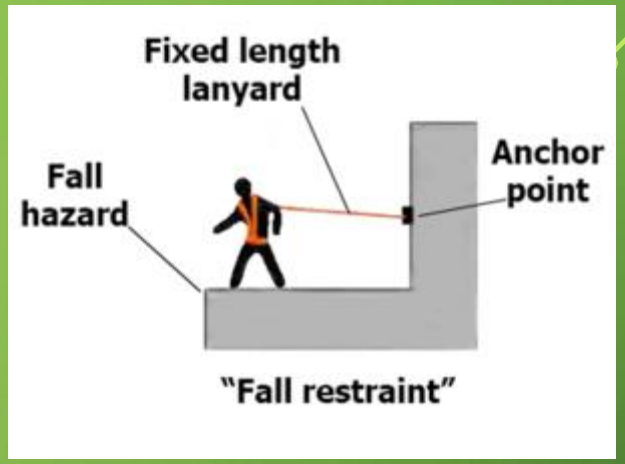


A+B+C=PFAS

ANCHORAGES

Anchorages used for attachment of personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms and capable of supporting at least **5,000** pounds (22.2 kn.) per employee attached

PERSONAL FALL ARREST SYSTEM



FULL BODY HARNESS

- A body harness is defined by OSHA as: "straps which may be secured about the employee in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and shoulders with means for attaching it to other components of a personal fall arrest system

CONNECTING DEVICE

- Carabineers
- Buckles
- Dee-rings
- Snap-hooks
- Lanyards
- Winches

Connects the body harness to the anchor point

RETRIEVAL

- In the event of emergency having a system in place to remove occupant from confined space examples:

Lifeline

- Designed to make non entry rescue possible
  - Difficult to pull person out in vertical confined spaces

Winch

- Designed to assist with the removal of personnel from the confined space
- Makes it possible for single person to pull another out
- Mechanical advantage
  - Dangers are if the incapacitated person becomes tangled on a fixed object can cause damage to the person

VENTILATION

MECHANICAL VENTILATION

- A fan with hose attached to either push a new atmosphere in or pull a hazardous atmosphere out.

IMPROPER VENTILATION DEATH

View Video: https://youtu.be/gMKuzopg5wc

EMPLOYEE RIGHTS AND RESPONSIBILITIES

EMPLOYEE RIGHTS & RESPONSIBILITIES OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

- To assure safe and healthful working conditions for working men and women
- By authorizing enforcement of the standards developed under the Act
- By assisting and encouraging the States in their efforts to assure safe and healthful working conditions
- By providing for research, information, education, and training in the field of occupational safety and health…

EMPLOYEE RIGHTS & RESPONSIBILITIES

- You have the right to:
  - A safe and healthful workplace
  - Know about hazardous chemicals
  - Information about injuries and illnesses in your workplace
  - Complain or request hazard correction from employer

EMPLOYEE RIGHTS & RESPONSIBILITIES
YOU HAVE THE RIGHT TO:

- File a confidential complaint with OSHA to have their workplace inspected.
- Receive information and training about hazards, methods to prevent harm, and the OSHA standards that apply to their workplace. The training must be done in a language and vocabulary workers can understand.
- Get copies of their workplace medical records and exposure records.
- Participate in an OSHA inspection and speak in private with the inspector.

EMPLOYEE RIGHTS & RESPONSIBILITIES CONTINUED:

- File a complaint with OSHA if they have been retaliated or discriminated against by their employer as the result of requesting an inspection or using any of their other rights under the OSH Act.
- File a complaint if punished or discriminated against for acting as a “whistleblower” under the additional 21 federal statutes for which OSHA has jurisdiction.

WHISTLEBLOWER PROTECTION

OSHA's Whistleblower Protection Program enforces the whistleblower provisions of more than twenty whistleblower statutes protecting employees who report violations of various workplace safety and health, airline, commercial motor carrier, consumer product, environmental, financial reform, food safety, health insurance reform, motor vehicle safety, nuclear, pipeline, public transportation agency, railroad, maritime, and securities laws. Rights afforded by these whistleblower protection laws include, but are not limited to, worker participation in safety and health activities, reporting a work-related injury, illness or fatality, or reporting a violation of the statutes herein.

WHISTLEBLOWER PROTECTION (CONTINUED)

EMPLOYEE RIGHTS & RESPONSIBILITIES (CONTINUED)

Workers Rights:

http://www.osha.gov/Publications/osha3021.pdf

- Compliance Assistance Specialists in the area offices
- National Institute for Occupational Safety and Health (NIOSH) – OSHA's sister agency
- OSHA Training Institute Education Centers
- Doctors, nurses, other health care providers
- Other local, community-based resources