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**Current Safety and Health Plan**

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## **INJURY AND ILLNESS PREVENTION**

By following these basic, common-sense rules established in this section, we will effectively keep operating costs down, have fewer work related accidents and injuries, reduce stress, increase productivity, increase profits and enjoy a safer working environment.

As employees, the success of our safety program depends in a large part on you and your actions. A clean, safe workplace is essential to all of us. The following safety rules will call attention to some of the safe practices that must be followed by everyone if accidents and illnesses are to be kept to a minimum.

Do not wear loose clothing that can snag or be caught in machines or other equipment. No shorts, cut-offs, tank tops, etc. You are expected to wear a uniform if required and to dress professionally at all times. Do not wear jewelry (earrings, bracelets, etc.) If doing mechanical work.

Do not engage in horse play on the job.

Hitting, hurting and/or inflicting personal injury on another person is not permitted. If there is a problem, see management.

Theft or possession of customer or company property is grounds for immediate termination and may result in arrest.

Switchblade knives, guns, etc., are not allowed. No dangerous items of any type are allowed.

You are not to threaten anyone, either verbally or physically. You will be fired if you do.

Willful negligence or contributing to damage of company property will result in dismissal.

There will be no gambling or stealing while on company time or property.

No drugs of any kind will be permitted. This company is a "drug free zone". This includes alcohol. Do not drink or do drugs before coming to work or while at work. If you have alcoholic beverages at lunch do not come back to work after lunch. Anyone found to be "under the influence" during working hours will be driven home. You will not be paid for this time. Do not report to work if you have been drinking or are under the influence of drugs. Failure to seek professional help will result in dismissal. Anyone with a substance abuse problem is strongly urged to enroll in a rehabilitation program at their own expense.

Nonprescription drugs and alcohol are not allowed. Drug testing may be required, positive results will result in termination.

Report to work ready to work.

Everyone should know basic first aid. If a serious accident occurs call the posted emergency number. If someone is hurt or has an accident, and it is serious, call posted emergency number. If you have been properly trained and choose to do so, you may begin to administer first aid, CPR, etc. This is a personal choice and not a company policy. If you are hurt on a customer premises, notify your superintendent at once. He will advise you of the action to take. He will follow the accident plan in this book. You will have to fill out an accident report. This can be done immediately or the next day at our office. If you need immediately medical attention, go to the nearest hospital. If you go to emergency or see a doctor, call the office.

Know the location of all fire extinguishers. You should know how to use them.

No smoking in the building except in designated areas.

All employees are to be aware of emergency procedures. These include fire and electrical outages. In these events, contact your supervisor. All personnel will report immediately to the designated area.

You are to never argue with the customer, an employee, your supervisor or anyone else. If you are having a problem, notify your superintendent. You are to be professional and friendly at all times. Be polite and answer with a smile and a friendly response.

Wear your safety glasses, goggles, face shields, etc. When cleaning. Protect your eyesight! All eyewear is to be (ANSI z.87.1). Use your ear protection in noisy areas. Use gloves when required. Hard-hats are required (ANSI z.89.1) in all posted areas.

When lifting heavy objects, employees should bend their knees and use large muscles in the leg instead of smaller muscles of the back. Back injury is the most common, frequent, persistent and painful type of workplace injury. **If it is heavy, get help!**

Take care of your equipment at all times. All equipment should be cleaned and in working condition at all times.

Report any broken or defective equipment to your supervisor at once.

Drug testing may be required due to insurance company regulations and certain requirements.

Any accident, no matter how minor must be reported to safety.

### **FIRST AID KITS**

First-aid kits and required contents are maintained in a serviceable condition. Unit-type kits have all items in the first-aid kit individually wrapped, sealed, and packaged in comparable sized packages. The commercial or cabinet-type kits do not require all items to be individually wrapped and sealed, but only those which must be kept sterile. Items such as scissors, tweezers, tubes of ointments with caps, or rolls of adhesive tape, need not be individually wrapped, sealed, or disposed of after a single use or application. Individual packaging and sealing shall be required only for those items which must be kept sterile in a first-aid kit.

#### **10 package kit:**

- 1 pkg. Adhesive bandages, 1" (16 per pkg.)
- 1 pkg. Bandage compress, 4" (1 per pkg.)
- 1 pkg. Scissors and tweezers (1 each per pkg.)
- 1 pkg. Triangular bandage, 40" (1 per pkg.)
- 1 pkg. Antiseptic soap or pads (3 per pkg.)
- 5 pkgs. Of consulting physician's choice

#### **16 package kit:**

- 1 pkg. Absorbent gauze, 24" x 72" (1 per pkg.)
- 1 pkg. Adhesive bandages, 1" (16 per pkg.)
- 2 pkgs. Bandage compresses, 4" (1 per pkg.)
- 1 pkg. Eye dressing (1 per pkg.)
- 1 pkg. Scissors and tweezers (1 each per pkg.)
- 2 pkgs. Triangular bandages, 40" (1 per pkg.)
- 1 pkg. Antiseptic soap or pads (3 per pkg.)
- 7 pkgs. Of consulting physician's choice

#### **24 package kit:**

- 2 pkgs. Absorbent gauze, 24" x 72" (1 per pkg.)
- 2 pkgs. Adhesive bandages, 1" (16 per pkg.)
- 2 pkgs. Bandage compresses, 4" (1 per pkg.)
- 1 pkg. Eye dressing (1 per pkg.)
- 1 pkg. Scissors and tweezers (1 each per pkg.)
- 6 pkgs. Triangular bandages (1 per pkg.)
- 1 pkg. Antiseptic soap or pads (3 per pkg.)
- 9 pkgs. Of consulting physician's choice **36 package kit:**
- 4 pkgs. Absorbent gauze, 24" x 72" (1 per pkg.)
- 2 pkgs. Adhesive bandages, 1" (16 per pkg.)
- 5 pkgs. Bandage compresses, 4" (1 per pkg.)

2 pkgs. Eye dressing (1 per pkg.)  
1 pkg. Scissors and tweezers (1 each per pkg.)  
8 pkgs. Triangular bandages, 40" (1 per pkg.)  
1 pkg. Antiseptic soap or pads (3 per pkg.)  
13 pkgs. Of consulting physician's choice

Scissors shall be capable of cutting 2 layers of 15 oz. Cotton cloth or its equivalent. The first-aid kits are maintained at the ten, sixteen, twenty-four or thirty-six package level.

Where the eyes or body of any person may be exposed to injurious chemicals and/or materials, suitable facilities for quick drenching or flushing of the eyes and body are provided, within the work area, for immediate emergency use. A poster shall be fastened and maintained either on or in the cover of each first-aid kit and at or near all phones plainly stating, the phone numbers of available doctors, hospitals, and ambulance services within the district of the work site.

### **DRUG & ALCOHOL POLICY**

The presence of alcohol or the presence of any other intoxicants or mind-altering substances in the body is a violation of this policy. Refusal of an employee to undergo testing or to cooperate fully with any of these tests is also a violation of this policy.

Our employees are also prohibited from possessing, using, selling, or purchasing any alcoholic beverages or mind altering substances on company property, job sites or in company vehicles.

This policy does not prohibit the proper use of medication under the direction of a physician. However, the misuse or abuse of such drugs is prohibited. Employees who are taking prescription or nonprescription drugs, which could affect the ability to perform their job in a safe and efficient manner, must notify their immediate supervisor of this fact when they report to work.

Violation of any aspect of this company's drug and alcohol policy will result in discipline up to and including, immediate termination.

### **HOUSEKEEPING**

Poor housekeeping is the main contributor to accidents both major and minor. Keep your work area clean. Help your fellow workers keep theirs clean also. Get rid of all rubbish by putting it in the proper containers. Keep exits open, free of debris. Make sure flammables are properly stored. In the event of an emergency know where the exits are.

- A. Be sure your work area is properly lit. If you can't see, you could get hurt. Replace any lights that are not working.
- B. Keep the restrooms clean and sanitary, (toilets, sinks and floors).
- C. Keep all work areas clean and neat. There is no one to pick up after you except yourself.
- D. Work surfaces must be kept dry and slip-resistant.
- E. Spills must be cleaned up at once. Do not wait for someone else to do it.
- F. Keep combustible scrap, debris and waste stored away from worksite.
- G. Keep oil and paint-soaked waste in metal waste cans with covers. Keep the covers on containers.
- H. Keep aisles and passageways clear at all times.
- I. Be sure there is safe clearance for walking in aisles where motorized or mechanical handling equipment is operated.
- J. Be sure no sharp projections are in walkways.
- K. Make sure there is adequate headroom provided wherever people have to walk.
- L. Never walk behind a vehicle that is running. The driver may not see you. You could be run over.
- M. All oil, water, etc. Will be immediately cleaned up with absorbents or other materials to prevent slips, trips or falls.
- N. Any and all containers will be labeled as to their contents and purpose.
- O. Combustible scrap and debris shall be removed at regular intervals.
- P. Covers shall be provided for containers used for flammable or harmful substances.
- Q. All aisles, passageways and stairways will be kept clear! No exceptions! Working and walking areas will be marked with yellow tape or paint.
- R. Good work habits and a neat worksite are essential for job safety and

- S. Efficiency - You are expected to keep your workplace well organized.
- T. Materials are to be in good order at all times. Employees shall report to the foreman any unsafe condition. If an employee should find an Unsafe situation which would cause an accident, the employee should correct it himself/herself if possible.

#### **HAZCOM PLAN – 29CFr 1910.1200**

Components of this program include labeling, preparing a material safety data sheet (MSDS), and training. Companies are required to maintain only those sheets that are received with incoming shipments for the following reasons: commonly uses small quantities of many different hazardous materials for short periods of time; that the hazards change, often unpredictably; many materials are of unknown composition and most workers are highly trained.

- Identify hazards for respective work areas.
- Ensure hazards are properly labeled.
- Obtain/maintain copies of material safety data sheets, as required, of each hazardous material used in the work area and make them accessible to employees.
- Have the written hazard communication program available to all employees.
- Provide hazard-specific training for employees.
- Identify hazardous materials in the hazard review section of the purchase requisition form.
- Attend safety-training meetings.
- Perform operations in safe manner.
- Notify management immediately of any safety hazards or injuries.
- Maintain a central file of material safety data sheets.
- Review and update stock safety labels.
- Alert on-site contractors to hazardous materials in work areas.

#### **The following general safety precautions should be observed when working with chemicals:**

- Keep the work area clean and orderly.
- Use the necessary safety equipment.
- Carefully label every container with the identity of its contents and appropriate hazard warnings.
- Store incompatible chemicals in separate areas.
- Substitute less toxic materials whenever possible.
- Limit the volume of volatile or flammable material to the minimum needed for short operation periods.
- Provide means of containing the material if equipment or containers should break or spill their contents.
- Follow the requirements of this manual, if systems that can generate pressure or are operated under pressure are involved.
- provide a back-up method of shutting off power to a heat source if any hazard is involved
- Obtain and read the material safety data sheets.

#### **PERSONAL PROTECTIVE EQUIPMENT - §1926.95**

Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact. All personal protective equipment shall be of safe design and construction for the work to be performed.

#### **FOOT PROTECTION - §1926.96**

Safety-toe footwear for employees shall meet the requirements and specifications in *American National Standard for Men's Safety-Toe Footwear*, ANSI Z41.1-1967.

#### **HEAD PROTECTION - §1926.100**

Employees working in areas where there is a possible danger of head injury from impact, or from falling or flying objects, or from electrical shock and burns shall be protected by protective helmets. Helmets for the protection of employees against impact and penetration of falling and flying objects shall meet the specifications contained in American National Standards Institute, ANSI Z89.1-1969. Helmets for the head protection of employees exposed to high voltage electrical shock and burns shall meet the specifications contained in American National Standards Institute, ANSI Z89.2-1971.

#### **HEARING PROTECTION - §1926.101**

Wherever it is not feasible to reduce the noise levels or duration of exposures ear protective devices shall be provided and used. Hearing protective devices inserted in the ear shall be fitted or determined individually by competent persons. Plain cotton is not an acceptable protective device.

#### **RESPIRATORY SAFETY PROGRAM**

Any worker that uses a respirator to protect their health, or must comply with another company's respiratory policy must follow the following items to comply with the standard:

- Each worker must have had a medical evaluation completed to determine if they are physically able to use a respirator.
- Any worker that uses a respirator must be fit tested by a competent, qualified person.
- Each respirator must be equipped with an end of life indicator if used to protect against fumes and vapors, and particulates.
- Any respirator used on the job must meet each jobsite specific requirements. Cartridges must be correct for type of exposure present at the job site.
- Beards are prohibited with the use of a respirator.

#### **EYE AND FACE PROTECTION - §1926.102**

Employees must use eye and face protection equipment when machines or operations present potential eye or face injury from physical, chemical, or radiation agents. Eye and face protection equipment required by this section shall meet the requirements specified in American National Standards Institute, ANSI Z87.1-1968, *Practice for Occupational and Educational Eye and Face Protection*.

Employees, whose vision requires the use of corrective lenses in spectacles, when required by this regulation to wear eye protection, shall be protected by goggles or spectacles of one of the following types:

- Spectacles whose protective lenses provide optical correction;
- Goggles that can be worn over corrective spectacles without disturbing the adjustment of the spectacles; or
- Goggles that incorporate corrective lenses mounted behind the protective lenses.

Protectors shall meet the following minimum requirements:

- Provide adequate protection against the particular hazards for which they are designed
- 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
- Be easily cleanable

#### **SAFETY BELTS, LIFELINES, AND LANYARDS - §1926.104**

Lifelines, safety belts, and lanyards shall be used only for employee safeguarding. Any lifeline, safety belt, or lanyard actually subjected to in-service loading, as distinguished from static load testing, shall be immediately removed from service and shall not be used again for employee safeguarding. Lifelines shall be secured above the point of operation to an anchorage or structural member capable of supporting a minimum dead weight of 5,400 pounds. Lifelines used on rock-scaling operations, or in areas where the lifeline may be subjected to cutting or abrasion, shall be a minimum of 1/2-inch wire core manila rope. For all other lifeline applications, a minimum of 3/4-inch manila or equivalent, with a minimum breaking strength of 5,400 pounds, shall be used.

Safety belt lanyard shall be a minimum of 1/2-inch nylon, or equivalent, with a maximum length to provide for a fall of no greater than 6 feet. The rope shall have a nominal breaking strength of 5,400 pounds. All safety belt and lanyard hardware shall be drop forged or pressed steel, cadmium plated in accordance with type 1, Class B plating specified in Federal Specification QQ-P-416. Surface shall be smooth and free of sharp edges. All safety belt and lanyard hardware, except rivets, shall be capable of withstanding a tensile loading of 4,000 pounds without cracking, breaking, or taking a permanent deformation.

#### **SAFETY NETS - §1926.105**

Safety nets shall be provided when workplaces are more than 25 feet above the ground or water surface, or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, or safety belts is impractical. Where safety net protection is required by this section, operations shall not be undertaken until the net is in place and has been tested.

Nets shall extend 8 feet beyond the edge of the work surface where employees are exposed and shall be installed as close under the work surface as practical but in no case more than 25 feet below such work surface. Nets shall be hung with sufficient clearance to prevent user's contact with the surfaces or structures below. Such clearances shall be determined by impact load testing. It is intended that only one level of nets be required for bridge construction. The mesh size of nets shall not exceed 6 inches by 6 inches. All new nets shall meet accepted performance standards of 17,500 foot-pounds minimum impact resistance as determined and certified by the manufacturers, and shall bear a label of proof test. Edge ropes shall provide a minimum breaking strength of 5,000 pounds. Forged steel safety hooks or shackles shall be used to fasten the net to its supports. Connections between net panels shall develop the full strength of the net.

#### **WORKING OVER OR NEAR WATER - §1926.106**

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

#### **FIRE PROTECTION - §1926.150**

Access to all available firefighting equipment shall be maintained at all times. All firefighting equipment, provided by the employer, shall be conspicuously located. All firefighting equipment shall be periodically inspected and maintained in operating condition. Defective equipment shall be immediately replaced.

**Water Supply** - A temporary or permanent water supply, of sufficient volume, duration, and pressure, required to properly operate the firefighting equipment shall be made available as soon as combustible materials accumulate.

Where underground water mains are to be provided, they shall be installed, completed, and made available for use as soon as practicable.

**Fire Extinguishers and Small Hose Lines** - A fire extinguisher, rated not less than 2A, shall be provided for each 3,000 square feet of the protected building area, or major fraction thereof. Travel distance from any point of the protected area to the nearest fire extinguisher shall not exceed 100 feet. One 55-gallon open drum of water with two fire pails may be substituted for



a fire extinguisher having a 2A rating. A ½-inch diameter garden-type hose line, not to exceed 100 feet in length and equipped with a nozzle, may be substituted for a 2A-rated fire extinguisher, providing it is capable of discharging a minimum of 5 gallons per minute with a minimum hose stream range of 30 feet horizontally. The garden-type hose lines shall be mounted on conventional racks or reels. The number and location of hose racks or reels shall be such that at least one hose stream can be applied to all points in the area. One or more fire extinguishers, rated not less than 2A, shall be provided on each floor. In multistory buildings, at least one fire extinguisher shall be located adjacent to stairway. Extinguishers and water drums, subject to freezing, shall be protected from freezing. A fire extinguisher, rated not less than 10B, shall be provided within 50 feet of wherever more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are being used on the jobsite. This requirement does not apply to the integral fuel tanks of motor vehicles. Carbon tetrachloride and other toxic vaporizing liquid fire extinguishers are prohibited. Portable fire extinguishers shall be inspected periodically and maintained in accordance with *Maintenance and Use of Portable Fire Extinguishers*, NFPA No. 10A-1970. Fire extinguishers which have been listed or approved by a nationally recognized testing laboratory shall be used to meet the requirements of this subpart.

**Fire Hose and Connections** - One hundred feet, or less, of 1½-inch hose, with a nozzle capable of discharging water at 25 gallons or more per minute, may be substituted for a fire extinguisher rated not more than 2A in the designated area provided that the hose line can reach all points in the area. If fire hose connections are not compatible with local firefighting equipment, the contractor shall provide adapters, or equivalent, to permit connections. During demolition involving combustible materials, charged hose lines, supplied by hydrants, water tank trucks with pumps, or equivalent, shall be made available.

**Fixed Firefighting Equipment - Sprinkler Protection** - If the facility being constructed includes the installation of automatic sprinkler protection, the installation shall closely follow the construction and be placed in service as soon as applicable laws permit following completion of each story. During demolition or alterations, existing automatic sprinkler installations shall be retained in service as long as reasonable. The operation of sprinkler control valves shall be permitted only by properly authorized persons. Modification of sprinkler systems to permit alterations or additional demolition should be expedited so that the automatic protection may be returned to service as quickly as possible. Sprinkler control valves shall be checked daily at close of work to ascertain that the protection is in service.

**Standpipes** - In all structures in which standpipes are required, or where standpipes exist in structures being altered, they shall be brought up as soon as applicable laws permit, and shall be maintained as construction progresses in such a manner that they are always ready for fire protection use. The standpipes shall be provided with Siamese fire department connections on the outside of the structure, at the street level, which shall be conspicuously marked. There shall be at least one standard hose outlet at each floor.

**Fire Alarm Devices** - An alarm system, e.g., telephone system, siren, etc., shall be established by the employer whereby employees on the site and the local fire department can be alerted for an emergency. The alarm code and reporting instructions shall be conspicuously posted at phones and at employee entrances.

**Fire Cutoffs** - Fire walls and exit stairways, required for the completed buildings, shall be given construction priority. Fire doors, with automatic closing devices, shall be hung on openings as soon as practicable. Fire cutoffs shall be retained in buildings undergoing alterations or demolition until operations necessitate their removal.

## **FIRE PREVENTION - §1926.151**

Electrical wiring and equipment for light, heat, or power purposes shall be installed in compliance with the requirements of Subpart K, *Electrical*. Internal combustion engine powered equipment shall be so located that the exhausts are well away from combustible materials. When the exhausts are piped to outside the building under construction, a clearance of at least 6 inches shall be maintained between such piping and combustible material. Smoking shall be prohibited at or in the vicinity of operations which constitute a fire hazard, and shall be conspicuously posted: "No Smoking or Open Flame." Portable battery powered lighting equipment, used in connection with the storage, handling, or use of flammable gases or liquids shall be of the type approved for the hazardous locations. The nozzle of air, inert gas, and steam lines or hoses, when used in the cleaning or ventilation of tanks and vessels that contain hazardous concentrations of flammable gases or vapors shall be bonded to the tank or vessel shell. Bonding devices shall not be attached or detached in hazardous concentrations of flammable gases or vapors.

## **FLAMMABLE AND COMBUSTIBLE LIQUIDS - §1926.152**

Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids. Approved metal safety cans shall be used for the handling and use of flammable liquids in quantities greater than one gallon, except that this shall not apply to those flammable liquid materials which are highly viscid (extremely hard to pour), which may be used and handled in original shipping containers. For quantities of one gallon or less, only the original container or approved metal safety cans shall be used for storage, use, and handling of flammable liquids. Flammable or combustible liquids shall not be stored in areas used for exits, stairways, or normally used for the safe passage of people.

**Indoor Storage of Flammable and Combustible Liquids** - No more than 25 gallons of flammable or combustible liquids shall be stored in a room outside of an approved storage cabinet. For storage of liquefied petroleum gas, see §1926.153. Quantities of flammable and combustible liquid in excess of 25 gallons shall be stored in an acceptable or approved cabinet meeting the following requirements:

- i. Acceptable wooden storage cabinets shall be constructed in the following manner, or equivalent: The bottom, sides, and top shall be constructed of an exterior grade of plywood at least 1 inch in thickness, which shall not break down or delaminate under standard fire test conditions. All joints shall be rabbeted and shall be fastened in two directions with flathead wood screws. When more than one door is used, there shall be a rabbeted overlap of not less than 1 inch. Steel hinges shall be mounted in such a manner as to not lose their holding capacity due to loosening or burning out of the screws when subjected to fire. Such cabinets shall be painted inside and out with fire retardant paint.
- ii. Approved metal storage cabinets will be acceptable.
- iii. Cabinets shall be labeled in conspicuous lettering, "Flammable-Keep Fire Away."

Not more than 60 gallons of flammable or 120 gallons of combustible liquids shall be stored in any one storage cabinet. Not more than three such cabinets may be located in a single storage area. Quantities in excess of this shall be stored in an inside storage room. Inside storage rooms shall be constructed to meet the required fire-resistive rating for their use. Such construction shall comply with the test specifications set forth in *Standard Methods of Fire Test of Building Construction and Material*, NFPA 251-1969. Where an automatic extinguishing system is provided, the system shall be designed and installed in an approved manner. Openings to other rooms or buildings shall be provided with noncombustible liquid-tight raised sills or ramps at least 4 inches in height or the floor in the storage area shall be at least 4 inches below the surrounding floor. Openings shall be provided with approved self-closing fire doors. The room shall be liquid-tight where the walls join the floor. A permissible alternate to the sill or ramp is an open-grated trench, inside of the room, which drains to a safe location. Where other portions of the building or other buildings are exposed, windows shall be protected as set forth in the *Standard for Fire Doors and Windows*, NFPA No. 80-1970, for Class E or F openings. Wood of at least 1-inch nominal thickness may be used for shelving, racks, dunnage, scuff boards, floor overlay, and similar installations. Materials which will react with water and create a fire hazard shall not be stored in the same room with flammable or combustible liquids.

The quantity of flammable or combustible liquids kept in the vicinity of spraying operations shall be the minimum required for operations and should ordinarily not exceed a supply for 1 day or one shift. Bulk storage of portable containers of flammable or combustible liquids shall be in a separate, constructed building detached from other important buildings or cut off in a standard manner.

**Dispensing Liquids** - Areas in which flammable or combustible liquids are transferred at one time, in quantities greater than 5 gallons from one tank or container to another tank or container shall be separated from other operations by 25-foot distance or by construction having a fire resistance of at least 1 hour. Drainage or other means shall be provided to control spills. Adequate natural or mechanical ventilation shall be provided to maintain the concentration of flammable vapor at or below 10 percent of the lower flammable limit. Transfer of flammable liquids from one container to another shall be done only when containers are electrically interconnected (bonded). Flammable or combustible liquids shall be drawn from or transferred into vessels, containers, or tanks within a building or outside only through a closed piping system, from safety cans, by means of a device drawing through the top, or from a container, or portable tanks, by gravity or pump, through an approved self-closing valve. Transferring by means of air pressure on the container or portable tanks is prohibited. The dispensing units shall be protected against collision damage. Dispensing devices and nozzles for flammable liquids shall be of an approved type.

**Handling Liquids at Point of Final Use** - Flammable liquids shall be kept in closed containers when not actually in use. Leakage or spillage of flammable or combustible liquids shall be disposed of promptly and safely. Flammable liquids may be used only where there are no open flames or other sources of ignition within 50 feet of the operation, unless conditions warrant greater clearance.

**Service and Refueling Areas** - Flammable or combustible liquids shall be stored in approved closed containers, in tanks located underground, or in aboveground portable tanks. The tank trucks shall comply with the requirements covered in the *Standard*

*for Tank Vehicles for Flammable and Combustible Liquids*, NFPA No. 385-1966. The dispensing hose shall be an approved type, and the dispensing nozzle shall be an approved automatic-closing type without a latch-open device. Underground tanks shall not be abandoned. Clearly identified and easily accessible switches shall be provided at a location remote from dispensing devices to shut off the power to all dispensing devices in the event of an emergency. Heating equipment of an approved type may be installed in the lubrication or service area where there is no dispensing or transferring of flammable liquids, provided the bottom of the heating unit is at least 18 inches above the floor and is protected from physical damage. Heating equipment installed in lubrication or service areas, where flammable liquids are dispensed, shall be of an approved type for garages, and shall be installed at least 8 feet above the floor. There shall be no smoking or open flames in the areas used for fueling, servicing fuel systems for internal combustion engines, receiving or dispensing of flammable or combustible liquids. Conspicuous and legible signs prohibiting smoking shall be posted. The motors of all equipment being fueled shall be shut off during the fueling operation.

Each service or fueling area shall be provided with at least one fire extinguisher having a rating of not less than 20-B:C located so that an extinguisher will be within 75 feet of each pump, dispenser, underground fill pipe opening, and lubrication or service area.

**Tank Storage** - follow §1926.152(i) for design, construction, and installation requirements for flammable or combustible liquid storage tanks.

**Piping, Valves, and Fittings** - follow §1926.152(i) for design, fabrication, assembly, test, and inspection requirements for piping systems containing flammable or combustible liquids.

**Marine Service Stations** – follow §1926.152(k) for dispensing, tanks and pumps, and piping service stations where flammable or combustible liquids used as fuels are stored and dispensed.

#### **LIQUEFIED PETROLEUM GAS (LP-GAS) - §1926.153**

Each system shall have containers, valves, connectors, manifold valve assemblies, and regulators of an approved type. All cylinders shall meet the Department of Transportation specification identification requirements published in 49 CFR Part 178, *Shipping Container Specifications*. As used in this section, "Containers" are defined as all vessels, such as tanks, cylinders, or drums, used for transportation or storing liquefied petroleum gases.

**Welding on LP-Gas Containers** - Welding is prohibited on containers.

**Container Valves and Container Accessories** - Valves, fittings, and accessories connected directly to the container, including primary shut off valves, shall have a rated working pressure of at least 250 p.s.i.g. and shall be of material and design suitable for LP-Gas service.

Connections to containers, except safety relief connections, liquid level gauging devices, and plugged openings, shall have shutoff valves located as close to the container as practicable.

**Safety Devices** - Every container and every vaporizer shall be provided with one or more approved safety relief valves or devices. These valves shall be arranged to afford free vent to the outer air with discharge not less than 5 feet horizontally away from any opening into a building which is below such discharge. Shutoff valves shall not be installed between the safety relief device and the container, or the equipment or piping to which the safety relief device is connected, except that a shutoff valve may be used where the arrangement of this valve is such that full required capacity flow through the safety relief device is always afforded. Container safety relief devices and regulatory relief vents shall be located not less than 5 feet in any direction from air openings into sealed combustion system appliances or mechanical ventilation air intakes.

**Dispensing** - Filling of fuel containers for trucks or motor vehicles from bulk storage containers shall be performed not less than 10 feet from the nearest masonry-walled building, or not less than 25 feet from the nearest building or other construction and, in any event, not less than 25 feet from any building opening. Filling of portable containers or containers mounted on skids from storage containers shall be performed not less than 50 feet from the nearest building.

**Requirements for Appliances** - Any appliance that was originally manufactured for operation with a gaseous fuel other than LP-Gas, and is in good condition, may be used with LP-Gas only after it is properly converted, adapted, and tested for performance with LP-Gas before the appliance is placed in use. Containers shall be upright upon firm foundations or otherwise firmly secured. The possible effect on the outlet piping of settling shall be guarded against by a flexible connection or special fitting.

**Containers and Equipment Used Inside of Buildings or Structures** - When operational requirements make portable use of

containers necessary, and their location outside of buildings or structures is impracticable, containers and equipment shall be permitted to be used inside of buildings or structures in accordance with paragraphs (h)(2) through (11) of this section.

"Containers in use" means connected for use.

Systems utilizing containers having a water capacity greater than 2½ pounds (nominal 1 pound LP-Gas capacity) shall be equipped with excess flow valves. Such excess flow valves shall be either integral with the container valves or in the connections to the container valve outlets. Regulators shall be either directly connected to the container valves or to manifolds connected to the container valves. The regulator shall be suitable for use with LP-Gas. Manifolds and fittings connecting containers to pressure regulator inlets shall be designed for at least 250 p.s.i.g. service pressure. Valves on containers having water capacity greater than 50 pounds (nominal 20 pounds LP-Gas capacity) shall be protected from damage while in use or storage. Aluminum piping or tubing shall not be used. Hose shall be designed for a working pressure of at least 250 p.s.i.g. Design, construction, and performance of hose, and hose connections shall have their suitability determined by listing by a nationally recognized testing agency. The hose length shall be as short as practicable. Hoses shall be long enough to permit compliance with spacing provisions of paragraphs (h)(1) through (13) of this section, without kinking or straining, or causing hose to be so close to a burner as to be damaged by heat.

Portable heaters, including salamanders, shall be equipped with an approved automatic device to shut off the flow of gas to the main burner, and pilot if used, in the event of flame failure. Such heaters, having inputs above 50,000 B.t.u. per hour, shall be equipped with either a pilot, which must be lighted and proved before the main burner can be turned on, or an electrical ignition system. NOTE: The provisions of this subparagraph do not apply to portable heaters under 7,500 B.t.u. per hour input when used with containers having a maximum water capacity of 2½ pounds. Container valves, connectors, regulators, manifolds, piping, and tubing shall not be used as structural supports for heaters.

Containers, regulating equipment, manifolds, pipe, tubing, and hose shall be located to minimize exposure to high temperatures or physical damage. Containers having a water capacity greater than 2½ pounds (nominal 1 pound LP-Gas capacity) connected for use shall stand on a firm and substantially level surface and, when necessary, shall be secured in an upright position. The maximum water capacity of individual containers shall be 245 pounds (nominal 100 pounds LP-Gas capacity). For temporary heating, heaters (other than integral heater-container units) shall be located at least 6 feet from any LP-Gas container. This shall not prohibit the use of heaters specifically designed for attachment to the container or to a supporting standard, provided they are designed and installed so as to prevent direct or radiant heat application from the heater onto the containers. Blower and radiant type heaters shall not be directed toward any LP-Gas container within 20 feet. If two or more heater-container units, of either the integral or non-integral type, are located in an unpartitioned area on the same floor, the container or containers of each unit shall be separated from the container or containers of any other unit by at least 20 feet. When heaters are connected to containers for use in an unpartitioned area on the same floor, the total water capacity of containers, manifolded together for connection to a heater or heaters, shall not be greater than 735 pounds (nominal 300 pounds LP-Gas capacity). Such manifolds shall be separated by at least 20 feet. Storage of containers awaiting use shall be in accordance with paragraphs (j) and (k) of this section.

**Multiple Container Systems** - Valves in the assembly of multiple container systems shall be arranged so that replacement of containers can be made without shutting off the flow of gas in the system. This provision is not to be construed as requiring an automatic changeover device.

Heaters shall be equipped with an approved regulator in the supply line between the fuel cylinder and the heater unit. Cylinder connectors shall be provided with an excess flow valve to minimize the flow of gas in the event the fuel line becomes ruptured. Regulators and low-pressure relief devices shall be rigidly attached to the cylinder valves, cylinders, supporting standards, the building walls, or otherwise rigidly secured, and shall be so installed or protected from the elements. Storage of LPG within buildings is prohibited.

**Fire Protection** - Storage locations shall be provided with at least one approved portable fire extinguisher having a rating of not less than 20-B:C.

**Marking of Gas Cylinders** - When LP-Gas and one or more other gases are stored or used in the same area, the containers shall be marked to identify their content. Marking shall be in compliance with American National Standard Z48.1-1954, *Method of Marking Portable Compressed Gas Containers to Identify the Material Contained*.

**Damage From Vehicles** - When damage to LP-Gas systems from vehicular traffic is a possibility, precautions against such damage shall be taken.

#### **TEMPORARY HEATING DEVICES - §1926.154**

**Ventilation** - Fresh air shall be supplied in sufficient quantities to maintain the health and safety of workers. Where natural means of fresh air supply is inadequate, mechanical ventilation shall be provided. When heaters are used in confined spaces, special care shall be taken to provide sufficient ventilation in order to ensure proper combustion, maintain the health and safety of workers, and limit temperature rise in the area.

**Clearance and Mounting** - Temporary heating devices shall be installed to provide clearance to combustible material not less than the amount shown in Table F-4 in §1926.154(b)(1). Temporary heating devices, which are listed for installation with lesser clearances than specified in Table F-4, may be installed in accordance with their approval. Heaters not suitable for use on wood floors shall not be set directly upon them or other combustible materials. When such heaters are used, they shall rest on suitable heat insulating material or at least 1-inch concrete, or equivalent. The insulating material shall extend beyond the heater 2 feet or more in all directions. Heaters used in the vicinity of combustible tarpaulins, canvas, or similar coverings shall be located at least 10 feet from the coverings. The coverings shall be securely fastened to prevent ignition or upsetting of the heater due to wind action on the covering or other material.

**Stability** - Heaters, when in use, shall be set horizontally level, unless otherwise permitted by the manufacturer's markings.

**Solid Fuel Salamanders** - Solid fuel salamanders are prohibited in buildings and on scaffolds.

**Oil-Fired Heaters** - Flammable liquid-fired heaters shall be equipped with a primary safety control to stop the flow of fuel in the event of flame failure. Barometric or gravity oil feed shall not be considered a primary safety control. Heaters designed for barometric or gravity oil feed shall be used only with the integral tanks. Heaters specifically designed and approved for use with separate supply tanks may be directly connected for gravity feed, or an automatic pump, from a supply tank.

#### **PORTABLE FIRE EXTINGUISHERS**

Portable fire extinguishers are classified to indicate their ability to handle specific classes and sizes of fires. Labels on extinguishers indicate the class and relative size of fire that they can be expected to handle. Class A extinguishers are used on fires involving ordinary combustibles, such as wood, cloth, and paper. Class B extinguishers are used on fires involving liquids, greases, and gases. Class C extinguishers are used on fires involving energized electrical equipment. Class D extinguishers are used on fires involving metals such as magnesium, titanium, zirconium, sodium, and potassium.

#### **SIGNS, SIGNALS, BARRICADES – 1926.200 thru 1926.203**

- Signs and symbols required shall be visible at all times when work is being performed, and shall be removed or covered promptly when the hazards no longer exist.
- **Danger Signs** - Danger signs shall be used only where an immediate hazard exists. Danger signs shall have red as the predominating color for the upper panel; black outline on the borders; and a white lower panel for additional sign wording (see accompanying figure).
- **Caution Signs** - Caution signs shall be used only to warn against potential hazards or to caution against unsafe practices.
- Caution signs shall have yellow as the predominating color; black upper panel and borders; yellow lettering of "caution" on the black panel; and the lower yellow panel for additional sign wording. Black lettering shall be used for additional wording.
- **Exit Signs** - Exit signs, when required, shall be lettered in legible red letters, not less than 6 inches high, on a white field and the principal stroke of the letters shall be at least three-fourths inch in width.
- **Safety Instruction Signs** - Safety instruction signs, when used, shall be white with green upper panel with white letters to convey the principal message. Any additional wording on the sign shall be black letters on the white background (see accompanying figure).
- **Directional Signs** - Directional signs, other than automotive traffic signs specified in the paragraph below, shall be white with a black panel and a white directional symbol. Any additional wording on the sign shall be black letters on the white background.

- Traffic Signs - Construction areas shall be posted with legible traffic signs at points of hazard. - All traffic control signs or devices used for protection of construction workers shall conform to American National Standards Institute ANSI D6.1-1971, *Manual on Uniform Traffic Control Devices for Streets and Highways*.
- Accident Prevention Tags - Accident prevention tags shall be used as a temporary means of warning employees of an existing hazard, such as defective tools, equipment, etc. They shall not be used in place of, or as a substitute for, accident prevention signs.
- Accident prevention tags - American National Standards Institute ANSI Z35.1-1968, *Specifications for Accident Prevention Signs*, and ANSI Z35.2-1968, *Specifications for Accident Prevention Tags*, contain rules which are additional to the rules prescribed in this section. The employer shall comply with these ANSI standards with respect to rules not specifically prescribed in this subpart.
- SIGNALING - **§1926.201** – Flagmen - When operations are such that signs, signals, and barricades do not provide the necessary protection on or adjacent to a highway or street, flagmen or other appropriate traffic controls shall be provided. Signaling directions by flagmen shall conform to the American National Standards Institute ANSI D6.1-1971, *Manual on Uniform Traffic Control Devices for Streets and Highways*. Hand signaling by flagmen shall be by use of red flags at least 18 inches square or sign paddles, and in periods of darkness, red lights. Flagmen shall be provided with and shall wear a red or orange warning garment while flagging. Warning garments worn at night shall be of reflectorized material.
- Crane and Hoist Signals - Regulations for crane and hoist signaling will be found in applicable American National Standards Institute standards.
- BARRICADES - **§1926.202** - Barricades for protection of employees shall conform to the portions of the American National Standards Institute ANSI D6.1-1971, *Manual on Uniform Traffic Control Devices for Streets and Highways*, relating to barricades.

## **MATERIALS HANDLING AND STORAGE**

When manually moving materials, employees should seek help when a load is so bulky it cannot be properly grasped or lifted, when they cannot see around or over it, or when a load cannot be safely handled. When an employee is placing blocks under raised loads, the employee should ensure that the load is not released until his or her hands are clearly removed from the load. Blocking materials and timbers should be large and strong enough to support the load safely. Materials with evidence of cracks, rounded corners, splintered pieces, or dry rot should not be used for blocking. Handles and holders should be attached to loads to reduce the chances of getting fingers pinched or smashed. Workers also should use appropriate protective equipment. For loads with sharp or rough edges, wear gloves or other hand and forearm protection. To avoid injuries to the hands and eyes, use gloves and eye protection. When the loads are heavy or bulky, the mover should also wear steel-toed safety shoes or boots to prevent foot injuries if the worker slips or accidentally drops a load.

When mechanically moving materials, avoid overloading the equipment by letting the weight, size, and shape of the material being moved dictate the type of equipment used for transporting it. All materials handling equipment has rated capacities that determine the maximum weight the equipment can safely handle and the conditions under which it can handle those weights. The equipment-rated capacities must be displayed on each piece of equipment and must not be exceeded except for load testing. When picking up items with a powered industrial truck, the load must be centered on the forks and as close to the mast as possible to minimize the potential for the truck tipping or the load falling. A lift truck must never be overloaded because it would be hard to control and could easily tip over. Extra weight must not be placed on the rear of a counterbalanced forklift to offset an overload. The load must be at the lowest position for traveling, and the truck manufacturer's operational requirements must be followed. All stacked loads must be correctly piled and cross-tiered, where possible. Precautions also should be taken when stacking and storing material.

Stored materials must not create a hazard. Storage areas must be kept free from accumulated materials that may cause tripping, fires, or explosions, or that may contribute to the harboring of rats and other pests. When stacking and piling materials, it is important to be aware of such factors as the materials' height and weight, how accessible the stored materials are to the user, and the condition of the containers where the materials are being stored. All bound material should be stacked, placed on racks, blocked, interlocked, or otherwise secured to prevent it from sliding, falling, or collapsing. A load greater than that approved by a building official may not be placed on any floor of a building or other structure. Where applicable, load limits approved by the building inspector should be conspicuously posted in all storage areas.

When stacking materials, height limitations should be observed. For example, lumber must be stacked no more than 16 feet high if it is handled manually; 20 feet is the maximum stacking height if a forklift is used. For quick reference, walls or posts may be painted with stripes to indicate maximum stacking heights. Used lumber must have all nails removed before stacking.

Lumber must be stacked and leveled on solidly supported bracing. The stacks must be stable and self-supporting. Stacks of loose bricks should not be more than 7 feet in height. When these stacks reach a height of 4 feet, they should be tapered back 2 inches for every foot of height above the 4-foot level. When masonry blocks are stacked higher than 6 feet, the stacks should be tapered back one-half block for each tier above the 6-foot level.

Bags and bundles must be stacked in interlocking rows to remain secure. Bagged material must be stacked by stepping back the layers and cross-keying the bags at least every ten layers. To remove bags from the stack, start from the top row first. Baled paper and rags stored inside a building must not be closer than 18 inches to the walls, partitions, or sprinkler heads. Boxed materials must be banded or held in place using cross-ties or shrink plastic fiber. Drums, barrels, and kegs must be stacked symmetrically. If stored on their sides, the bottom tiers must be blocked to keep them from rolling. When stacked on end, put planks, sheets of plywood dunnage, or pallets between each tier to make a firm, flat, stacking surface. When stacking materials two or more tiers high, the bottom tier must be chocked on each side to prevent shifting in either direction. When stacking, consider the need for availability of the material. Material that cannot be stacked due to size, shape, or fragility can be safely stored on shelves or in bins. Structural steel, bar stock, poles, and other cylindrical materials, unless in racks, must be stacked and blocked to prevent spreading or tilting. Pipes and bars should not be stored in racks that face main aisles; this could create a hazard to passers-by when supplies are being removed.

### **Using Materials Handling Equipment –**

**Conveyors** - When using conveyors, workers' hands may be caught in nip points where the conveyor runs over support members or rollers; workers may be struck by material falling off the conveyor; or they may become caught on or in the conveyor, thereby being drawn into the conveyor path. To reduce the severity of an injury, an emergency button or pull cord designed to stop the conveyor must be installed at the employee's work station. Continuously accessible conveyor belts should have an emergency stop cable that extends the entire length of the conveyor belt so that the cable can be accessed from any location along the belt. The emergency stop switch must be designed to be reset before the conveyor can be restarted. Before restarting a conveyor that has stopped due to an overload, appropriate personnel must inspect the conveyor and clear the stoppage before restarting. Employees must never ride on a materials handling conveyor. Where a conveyor passes over work areas or aisles, guards must be provided to keep employees from being struck by falling material. If the crossover is low enough for workers to run into, it must be guarded to protect employees and either marked with a warning sign or painted a bright color. Screw conveyors must be completely covered except at loading and discharging points. At those points, guards must protect employees against contacting the moving screw; the guards are movable, and they must be interlocked to prevent conveyor movement when not in place.

**Cranes** - Only thoroughly trained and competent persons are permitted to operate cranes. Operators should know what they are lifting and what it weighs. The rated capacity of mobile cranes varies with the length of the boom and the boom radius. When a crane has a telescoping boom, a load may be safe to lift at a short boom length and/or a short boom radius, but may overload the crane when the boom is extended and the radius increases. All movable cranes must be equipped with a boom angle indicator; those cranes with telescoping booms must be equipped with some means to determine the boom length, unless the load rating is independent of the boom length. Load rating charts must be posted in the cab of cab-operated cranes. All mobile cranes do not have uniform capacities for the same boom length and radius in all directions around the chassis of the vehicle. Always check the crane's load chart to ensure that the crane is not going to be overloaded for the conditions under which it will operate. Plan lifts before starting them to ensure that they are safe. Take additional precautions and exercise extra care when operating around power lines.

**Slings** - When working with slings, employers must ensure that they are visually inspected before use and during operation, especially if used under heavy stress. Riggers or other knowledgeable employees should conduct or assist in the inspection because they are aware of how the sling is used and what makes a sling unserviceable. A damaged or defective sling must be removed from service. Slings must not be shortened with knots or bolts or other makeshift devices, sling legs that have been kinked must not be used. Slings must not be loaded beyond their rated capacity, according to the manufacturer's instructions. Suspended loads must be kept clear of all obstructions, and crane operators should avoid sudden starts and stops when moving suspended loads. Employees also must remain clear of loads about to be lifted and suspended. All shock loading is prohibited.

**Powered Industrial Trucks** - Workers who must handle and store materials often use fork trucks, platform lift trucks, motorized hand trucks, and other specialized industrial trucks powered by electrical motors or internal combustion engines. Affected workers, therefore, should be aware of the safety requirements pertaining to fire protection, and the design, maintenance, and use of these trucks.

All new powered industrial trucks, except vehicles intended primarily for earth moving or over-the-road hauling, shall meet the

design and construction requirements for powered industrial trucks established in the American National Standard for Powered Industrial Trucks, Part II, ANSI B56.1-1969. Approved trucks shall also bear a label or some other identifying mark indicating acceptance by a nationally recognized testing laboratory. Modifications and additions that affect capacity and safe operation of the trucks shall not be performed by an owner or user without the manufacturer's prior written approval. In these cases, capacity, operation, and maintenance instruction plates and tags or decals must be changed to reflect the new information. If the truck is equipped with front-end attachments that are not factory installed, the user should request that the truck be marked to identify these attachments and show the truck's approximate weight, including the installed attachment, when it is at maximum elevation with its load laterally centered.

### **ASBESTOS – CFR 1926.1101**

This discussion is designed to acquaint interested persons with significant changes to OSHA's new Asbestos Standard for Construction, 29 CFR 1926.1101. It is not intended to be a comprehensive review of the entire standard. Persons who wish to learn more about the specific provisions of the standard should consult the preamble and regulatory text of the standard as published in the *Federal Register*.

Before work is begun, building/facility owners must identify the presence, location, and quantity of ACM/PACM and notify the following persons:

- Prospective employers applying for or bidding for work whose employees reasonably can be expected to work in or adjacent to areas containing such material
- Employees of the owner who will work in or adjacent to areas containing such material
- On multi-employer worksites, all employers of employees who will be performing work within or adjacent to areas containing such materials
- Tenants who will occupy areas containing such materials

Notification may be in writing or by personal communication to the affected person(s) or their authorized representatives.

NOTE: When materials labeled as containing asbestos according to the requirements of this standard are installed on non-residential roofs, the contractor must notify the building owner of the presence and location of such asbestos-containing materials. This facilitates the owner's future notification requirements.

**Signs and Labels** - Building/facility owners must post signs at the entrance to mechanical rooms/areas in which employees reasonably can be expected to enter and which contain TSI and surfacing ACM/PACM. The signs must identify the material which is present, its location, and appropriate work practices that will ensure ACM/PACM will not be disturbed. Labels must also contain a warning statement against breathing asbestos fibers.

**Records Retention** - Where a building/facility owner has communicated and/or received notification concerning the identification, location, and quantity of ACM/PACM, written records of such notifications and their content must be maintained by the building owner for the duration of ownership and transferred to successive owners. Where a building/facility owner has relied on data to demonstrate that PACM is not asbestos-containing, such data must be maintained for as long as they are relied upon to rebut the presumption.

**Competent Person** - A competent person must be designated for *all* worksites covered by the standard. The competent person must have the qualifications and authority required by 29 CFR 1926.20-32, the basic construction requirements. **Duties** - The competent person must make frequent and regular inspections of the job site, materials, and equipment. On jobsites where Class I or II work is being performed, the competent person must perform or supervise the following duties:

- Set-up the regulated area, enclosure, or other containment
- Ensure (by on-site inspection) the integrity of the enclosure or containment
- Set up procedures to control entry to and exit from the enclosure and/or area
- Supervise all employee exposure monitoring
- Ensure that employees working within the enclosure and/or using glove bags wear protective clothing and respirators



- Ensure through on-site supervision, that employees set up and remove engineering controls, use work practices and personal protective equipment in compliance with all requirements
- Ensure that employees use the hygiene facilities and observe the decontamination procedures
- Ensure through on-site inspection that engineering controls are functioning properly and employers are using proper work practices
- Ensure that notification requirements are met

For Class I jobs, on-site inspections must be made at least once during each work shift, and at any time at employee request. For Class II and III jobs, on-site inspections must be made frequently enough to assess whether conditions have changed, as well as at any reasonable time at employee request.

**Training** - For Class I and II asbestos work, training of the competent person must include all aspects of asbestos removal and handling, including

- abatement, installation, removal, and handling
- contents of the standard
- identification of asbestos
- other practices for reducing the hazard

This training will be obtained in a comprehensive course for supervisors that meets the criteria of EPA's Model Accreditation Plan (40 CFR Part 763), or a course equivalent in stringency, content, and length. For Class III and IV, training of the competent person must include aspects of asbestos handling appropriate to the work, including

- procedures for setting up glove bags and mini-enclosures
- use of wet methods
- contents of the standard
- identification of asbestos

Training must include successful completion of a course meeting EPA requirements for training local education agency maintenance and custodial staff [40 CFR 763.92(a)(2)], or its equivalent in stringency, content, and length. Training required for Class I and II competent persons also satisfies the requirements for Class III and IV.

**Exposure Monitoring** - A competent person must make an "initial exposure assessment" before or at the initiation of all covered operations to determine expected exposures. An initial exposure assessment is not the same as initial exposure monitoring. Initial employee exposure monitoring cannot adequately predict all future exposures on construction jobs. First-day exposures may reflect set-up activities and thus be lower than later exposures. In addition, results of monitoring are not instantaneously available. Therefore, the initial exposure assessment will identify jobs likely to exceed the PEL in time for employers to install and implement the extra controls required to reduce exposures.

**Periodic Monitoring** - Daily monitoring is required for Class I and II operations unless the employer has made a negative exposure assessment for the entire operation. For Class I work, daily monitoring may be dispensed with only if all employees are equipped with supplied-air respirators operated in the pressure demand mode (or other positive pressure mode respirator) *and* only control methods listed in the standard are used. For Class II work, daily monitoring may be dispensed with if all employees are equipped with supplied-air respirators operated in the positive-pressure mode. All work operations, other than Class I and II work, where exposures are expected to exceed a PEL, must be monitored at intervals sufficient to document the validity of the exposure prediction.

### **Requirements Applying to All Jobs**

Controls and practices that must *always* be used, *regardless of the level of exposure*, are:

- 1) Vacuum cleaners with HEPA filters to collect asbestos-containing debris and dust
- 2) Wet methods or wetting agents during handling, mixing, removal, cutting, application, and clean-up (unless infeasible or creates a greater hazard)
- 3) Prompt clean-up and disposal of wastes and debris contaminated with asbestos in leak-tight containers

Controls and work practices that may *never* be used, *regardless of the level of exposure*, are:

- 1) High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air
- 2) Compressed air to remove asbestos-containing materials, unless used in conjunction with an enclosed ventilation system to capture the dust cloud
- 3) Dry sweeping, shoveling or other dry clean-up of dust and debris containing ACM and PACM
- 4) Employee rotation to reduce employee exposure

## **HAND TOOLS**

Hand tools are non-powered. They include anything from axes to wrenches. The greatest hazards posed by hand tools result from misuse and improper maintenance. The employer is responsible for the safe condition of tools and equipment used by employees but the employees have the responsibility for properly using and maintaining tools. Employers should caution employees that saw blades, knives, or other tools be directed away from aisle areas and other employees working in close proximity. Knives and scissors must be sharp. Dull tools can be more hazardous than sharp ones. Appropriate personal protective equipment, e.g., safety goggles, gloves, etc., should be worn due to hazards that may be encountered while using portable power tools and hand tools. Safety requires that floors be kept as clean and dry as possible to prevent accidental slips with or around dangerous hand tools. Around flammable substances, sparks produced by iron and steel hand tools can be a dangerous ignition source. Where this hazard exists, spark-resistant tools made from brass, plastic, aluminum, or wood will provide for safety.

## **POWER TOOL PRECAUTIONS**

Power tools can be hazardous when improperly used. There are several types of power tools, based on the power source they use: electric, pneumatic, liquid fuel, hydraulic, and powder-actuated. Employees should be trained in the use of all tools - not just power tools. They should understand the potential hazards as well as the safety precautions to prevent those hazards from occurring.

The following general precautions should be observed by power tool users:

- Never carry a tool by the cord or hose.
- Never yank the cord or the hose to disconnect it from the receptacle.
- Keep cords and hoses away from heat, oil, and sharp edges.
- Disconnect tools when not in use, before servicing, and when changing accessories such as blades, bits and cutters.
- All observers should be kept at a safe distance away from the work area.
- Secure work with clamps or a vise, freeing both hands to operate the tool.
- Avoid accidental starting. The worker should not hold a finger on the switch button while carrying a plugged-in tool.
- Tools should be maintained with care. They should be kept sharp and clean for the best performance. Follow instructions in the user's manual for lubricating and changing accessories.
- Be sure to keep good footing and maintain good balance.
- The proper apparel should be worn. Loose clothing, ties, or jewelry can become caught in moving parts.
- All portable electric tools that are damaged shall be removed from use and tagged "Do Not Use."

**Guards** - Hazardous moving parts of a power tool need to be safeguarded. For example, belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or moving parts of equipment must be guarded if such parts are exposed to contact by employees. Safety guards must never be removed when a tool is being used. For example, portable circular saws must be equipped with guards. An upper guard must cover the entire blade of the saw. A retractable lower guard must cover the teeth of the saw, except when it makes contact with the work material. The lower guard must automatically return to the covering position when the tool is withdrawn from the work.

**Safety Switches** - The following hand-held powered tools must be equipped with a momentary contact "on-off" control switch: drills, tappers, fastener drivers, horizontal, vertical and angle grinders with wheels larger than 2 inches in diameter, disc and belt sanders, reciprocating saws, saber saws, and other similar tools. These tools also may be equipped with a lock-on control

provided that turnoff can be accomplished by a single motion of the same finger or fingers that turn it on.

The following hand-held powered tools may be equipped with only a positive "on-off" control switch: platen sanders, disc sanders with discs 2 inches or less in diameter; grinders with wheels 2 inches or less in diameter; routers, planers, laminate trimmers, nibblers, shears, scroll saws and jigsaws with blade shanks one-fourth of an inch wide or less.

Other hand-held powered tools such as circular saws having a blade diameter greater than 2 inches, chain saws, and percussion tools without positive accessory holding means must be equipped with a constant pressure switch that will shut off the power when the pressure is released.

**Electric Tools** - Employees using electric tools must be aware of several dangers; the most serious is the possibility of electrocution.

Among the chief hazards of electric-powered tools are burns and slight shocks which can lead to injuries or even heart failure. Under certain conditions, even a small amount of current can result in fibrillation of the heart and eventual death. A shock also can cause the user to fall off a ladder or other elevated work surface. To protect the user from shock, tools must either have a three-wire cord with ground and be grounded, be double insulated, or be powered by a low-voltage isolation transformer. Three-wire cords contain two current-carrying conductors and a grounding conductor. One end of the grounding conductor connects to the tool's metal housing. The other end is grounded through a prong on the plug. Anytime an adapter is used to accommodate a two-hole receptacle, the adapter wire must be attached to a known ground. The third prong should never be removed from the plug. Double insulation is more convenient. The user and the tools are protected in two ways: by normal insulation on the wires inside, and by a housing that cannot conduct electricity to the operator in the event of a malfunction. These general practices should be followed when using electric tools:

- Electric tools should be operated within their design limitations.
- Gloves and safety footwear are recommended during use of electric tools.
- When not in use, tools should be stored in a dry place.
- Electric tools should not be used in damp or wet locations.
- Work areas should be well lighted.

**Powered Abrasive Wheel Tools** - Powered abrasive grinding, cutting, polishing, and wire buffing wheels create special safety problems because they may throw off flying fragments. Before an abrasive wheel is mounted, it should be inspected closely and sound- or ring-tested to be sure that it is free from cracks or defects. To test, wheels should be tapped gently with a light non-metallic instrument. If they sound cracked or dead, they could fly apart in operation and so must not be used. A sound and undamaged wheel will give a clear metallic tone or "ring." To prevent the wheel from cracking, the user should be sure it fits freely on the spindle. The spindle nut must be tightened enough to hold the wheel in place, without distorting the flange. Follow the manufacturer's recommendations. Care must be taken to assure that the spindle wheel will not exceed the abrasive wheel specifications. Due to the possibility of a wheel disintegrating (exploding) during start-up, the employee should never stand directly in front of the wheel as it accelerates to full operating speed. Portable grinding tools need to be equipped with safety guards to protect workers not only from the moving wheel surface, but also from flying fragments in case of breakage. In addition, when using a powered grinder - Always use eye protection - Turn off the power when not in use - Never clamp a hand-held grinder in a vise.

**Pneumatic Tools** - Pneumatic tools are powered by compressed air and include chippers, drills, hammers, and sanders. There are several dangers encountered in the use of pneumatic tools. The main one is the danger of getting hit by one of the tool's attachments or by some kind of fastener the worker is using with the tool. Eye protection is required and face protection is recommended for employees working with pneumatic tools. Noise is another hazard. Working with noisy tools such as jackhammers requires proper, effective use of hearing protection.

When using pneumatic tools, employees must check to see that they are fastened securely to the hose to prevent them from becoming disconnected. A short wire or positive locking device attaching the air hose to the tool will serve as an added safeguard. A safety clip or retainer must be installed to prevent attachments, such as chisels on a chipping hammer, from being unintentionally shot from the barrel.

Screens must be set up to protect nearby workers from being struck by flying fragments around chippers, riveting guns, staplers, or air drills.

Compressed air guns should never be pointed toward anyone. Users should never "dead-end" it against themselves or anyone else.

**Powder-Actuated Tools** - Powder-actuated tools operate like a loaded gun and should be treated with the same respect and precautions. In fact, they are so dangerous that they must be operated only by specially trained employees. Safety precautions to remember include the following:

Before using the tool, the worker should inspect it to determine that it is clean, that all moving parts operate freely, and that the barrel is free from obstructions.

- The tool should never be pointed at anybody.
- The tool should not be loaded unless it is to be used immediately. A loaded tool should not be left unattended, especially where it would be available to unauthorized persons.
- Hands should be kept clear of the barrel end. To prevent the tool from firing accidentally, two separate motions are required for firing: one to bring the tool into position, and another to pull the trigger. The tools must not be able to operate until they are pressed against the work surface with a force of at least 5 pounds greater than the total weight of the tool.

If a powder-actuated tool misfires, the employee should wait at least 30 seconds, then try firing it again. If it still will not fire, the user should wait another 30 seconds so that the faulty cartridge is less likely to explode, then carefully remove the load. The bad cartridge should be put in water. Suitable eye and face protection are essential when using a powder-actuated tool. The muzzle end of the tool must have a protective shield or guard centered perpendicularly on the barrel to confine any flying fragments or particles that might otherwise create a hazard when the tool is fired. The tool must be designed so that it will not fire unless it has this kind of safety device. All powder-actuated tools must be designed for varying powder charges so that the user can select a powder level necessary to do the work without excessive force.

If the tool develops a defect during use it should be tagged and taken out of service immediately until it is properly repaired.

**Fasteners** - When using powder-actuated tools to apply fasteners, there are some precautions to consider. Fasteners must not be fired into material that would let them pass through to the other side. The fastener must not be driven into materials like brick or concrete any closer than 3 inches to an edge or corner. In steel, the fastener must not come any closer than one-half inch from a corner or edge. Fasteners must not be driven into very hard or brittle materials which might chip or splatter, or make the fastener ricochet. An alignment guide must be used when shooting a fastener into an existing hole. A fastener must not be driven into a spalled area caused by an unsatisfactory fastening.

**Hydraulic Power Tools** - The fluid used in hydraulic power tools must be an approved fire-resistant fluid and must retain its operating characteristics at the most extreme temperatures to which it will be exposed. The manufacturer's recommended safe operating pressure for hoses, valves, pipes, filters, and other fittings must not be exceeded.

**Jacks** - All jacks - lever and ratchet jacks, screw jacks, and hydraulic jacks - must have a device that stops them from jacking up too high. Also, the manufacturer's load limit must be permanently marked in a prominent place on the jack and should not be exceeded. A jack should never be used to support a lifted load. Once the load has been lifted, it must immediately be blocked up. Use wooden blocking under the base if necessary to make the jack level and secure. If the lift surface is metal, place a 1-inch-thick hardwood block or equivalent between it and the metal jack head to reduce the danger of slippage.

Proper maintenance of jacks is essential for safety. All jacks must be inspected before each use and lubricated regularly. If a jack is subjected to an abnormal load or shock, it should be thoroughly examined to make sure it has not been damaged. Hydraulic jacks exposed to freezing temperatures must be filled with an adequate antifreeze liquid.

## **GAS WELDING AND CUTTING - §1926.350**

### **Transporting, Moving, and Storing Compressed Gas Cylinders**

- Valve protection caps shall be in place and secured.
- When cylinders are hoisted, they shall be secured on a cradle, sling board, or pallet. They shall not be hoisted or transported by means of magnets or choker slings.
- Cylinders shall be moved by tilting and rolling them on their bottom edges. They shall not be intentionally dropped, struck, or permitted to strike each other violently.
- When cylinders are transported by powered vehicles, they shall be secured in a vertical position.

- Valve protection caps shall not be used for lifting cylinders from one vertical position to another. Bars shall not be used under valves or valve protection caps to pry cylinders loose when frozen. Warm, not boiling, water shall be used to thaw cylinders loose.
- Unless cylinders are firmly secured on a special carrier intended for this purpose, regulators shall be removed and valve protection caps put in place before cylinders are moved.
- A suitable cylinder truck, chain, or other steadying device shall be used to keep cylinders from being knocked over while in use.
- When work is finished, when cylinders are empty, or when cylinders are moved at any time, the cylinder valve shall be closed.
- Compressed gas cylinders shall be secured in an upright position at all times, if necessary, for short periods of time while cylinders are actually being hoisted or carried.
- Oxygen cylinders in storage shall be separated from fuel-gas cylinders or combustible materials (especially oil or grease), a minimum distance of 20 feet (6.1 m) or by a noncombustible barrier at least 5 feet (1.5 m) high having a fire-resistance rating of at least one-half hour.
- Inside of buildings, cylinders shall be stored in a well-protected, well-ventilated, dry location, at least 20 feet (6.1 m) from highly combustible materials such as oil or excelsior. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage places shall be located where cylinders will not be knocked over or damaged by passing or falling objects, or subject to tampering.
- The in-plant handling, storage, and utilization of all compressed gases in cylinders, portable tanks, rail tank cars, or motor vehicle cargo tanks shall be in accordance with Compressed Gas Association Pamphlet P-1-1965.

### Placing Cylinders

- Cylinders shall be kept far enough away from the actual welding or cutting operation so that sparks, hot slag, or flame will not reach them. When this is impractical, fire resistant shields shall be provided.
- Cylinders shall be placed where they cannot become part of an electrical circuit. Electrodes shall not be struck against a cylinder to strike an arc.
- Fuel gas cylinders shall be placed with **valve end up** whenever they are in use. They shall not be placed in a location where they would not be subject to open flame, hot metal, or other sources of artificial heat.
- Cylinders containing oxygen or acetylene or other fuel gas shall not be taken into confined spaces.

### Treatment of Cylinders

- Cylinders, whether full or empty, shall not be used as rollers or supports.
- No person other than the gas supplier shall attempt to mix gases in a cylinder. No one except the owner of the cylinder or person authorized by him shall refill a cylinder. No one shall use a cylinder's contents for purposes than those intended by the supplier. All cylinders used shall meet the Department of Transportation requirements published in 49 CFR Part 178, Subpart C, **Specification for Cylinders**.
- No damaged or defective cylinder shall be used.

### Use of Fuel Gas

The employer shall thoroughly instruct employees in the safe use of fuel gas, as follows:

- Fuel gas shall not be used from cylinders through torches or other devices which are equipped with shutoff valves without reducing the pressure through a suitable regulator attached to the cylinder valve or manifold.
- Before a regulator to a cylinder valve is connected, the valve shall be opened slightly and closed immediately. (This action is generally termed "cracking" and is intended to clear the valve of dust or dirt that might otherwise enter the regulator.) The person cracking the valve shall stand to one side of the outlet, not in front of it. The valve of a fuel gas cylinder shall not be cracked where the gas would reach welding work, sparks, flame, or other possible sources of ignition.
- The cylinder valve shall always be opened slowly to prevent damage to the regulator. For quick closing, valves of fuel gas cylinders shall not be opened more than 1½ turns. When a special wrench is required, it shall be left in position on the stem of the valve while the cylinder is in use so that the fuel gas flow can be shut off quickly in case of an

emergency. In the case of manifolded or coupled cylinders, at least one such wrench shall always be available for immediate use. Nothing shall be placed on top of a fuel gas cylinder, when in use, which may damage the safety device or interfere with the quick closing of the valve.

- Before a regulator is removed from a cylinder valve, the cylinder valve shall always be closed and the gas released from the regulator.
- If, when the valve on a fuel gas cylinder is opened, there is found to be a leak around the valve stem, the valve shall be closed and the gland nut tightened. If this action does not stop the leak, the use of the cylinder shall be discontinued, and it shall be properly tagged and removed from the work area. In the event that fuel gas should leak from the cylinder valve, rather than from the valve stem, and the gas cannot be shut off, the cylinder shall be properly tagged and removed from the work area. If a regulator attached to a cylinder valve will effectively stop a leak through the valve seat, the cylinder need not be removed from the work area.
- If a leak should develop at a fuse plug or other safety device, the cylinder shall be removed from the work area.

**Fuel Gas and Oxygen Manifolds** - Fuel gas and oxygen manifolds shall bear the name of the substance they contain in letters at least 1-inch high which shall be either painted on the manifold or on a sign permanently attached to it. These manifolds shall be placed in safe, well ventilated, and accessible locations and not be located within enclosed spaces. Manifold hose connections, including both ends of the supply hose that lead to the manifold, shall be such that the hose cannot be interchanged between fuel gas and oxygen manifolds and supply header connections. Adapters shall not be used to permit the interchange of hose. Hose connections shall be kept free of grease and oil. When not in use, manifold and header hose connections shall be capped. Nothing shall be placed on top of a manifold, when in use, which will damage the manifold or interfere with the quick closing of the valves.

**Hose** - Fuel gas and oxygen hose shall be easily distinguishable from each other. The contrast may be made by different colors or by surface characteristics readily distinguishable by the sense of touch. Oxygen and fuel gas hoses shall not be interchangeable. A single hose having more than one gas passage shall not be used. When parallel sections of oxygen and fuel gas hose are taped together, not more than 4 inches out of 12 inches shall be covered by tape. All hose in use, carrying acetylene, oxygen, natural or manufactured fuel gas, or any gas or substance which may ignite or enter into combustion, or be in any way harmful to employees, shall be inspected at the beginning of each working shift. Defective hose shall be removed from service. Hose which has been subject to flashback, or which shows evidence of severe wear or damage, shall be tested to twice the normal pressure to which it is subject, but in no case less than 300 p.s.i. Defective hose, or hose in doubtful condition, shall not be used. Hose couplings shall be of the type that cannot be unlocked or disconnected by means of a straight pull without rotary motion. Boxes used for the storage of gas hose shall be ventilated. Hoses, cables, and other equipment shall be kept clear of passageways, ladders, and stairs.

**Torches** - Clogged torch tip openings shall be cleaned with suitable cleaning wires, drills, or other devices designed for such purpose.

Torches in use shall be inspected at the beginning of each working shift for leaking shutoff valves, hose couplings, and tip connections. Defective torches shall not be used. Torches shall be lighted by friction lighters or other approved devices, and not by matches or from hot work.

**Regulators and Gauges** - Oxygen and fuel gas pressure regulators, including their related gauges, shall be in proper working order while in use.

**Oil and Grease Hazards** - Oxygen cylinders and fittings shall be kept away from oil or grease. Cylinders, cylinder caps and valves, couplings, regulators, hose, and apparatus shall be kept free from oil or greasy substances and shall not be handled with oily hands or gloves. Oxygen shall not be directed at oily surfaces, greasy clothes, or within a fuel oil or other storage tank or vessel.

### **ARC WELDING AND CUTTING - §1926.351**

**Manual Electrode Holders** - Only manual electrode holders which are specifically designed for arc welding and cutting, and are of a capacity capable of safely handling the maximum rated current required by the electrodes, shall be used. Any current-carrying parts passing through the portion of the holder which the arc welder or cutter grips in his hand, and the outer surfaces of the jaws of the holder, shall be fully insulated against the maximum voltage encountered to ground.

**Welding Cables and Connectors** - All arc welding and cutting cables shall be of the completely, insulated, flexible type, capable of handling the maximum current requirements of the work in progress, taking into account the duty cycle under which the arc welder or cutter is working.

Only cable free from repair or splices for a minimum distance of 10 feet from the cable end to which the electrode holder is connected shall be used, except that cables with standard insulated connectors or with splices whose insulating quality is equal to that of the cable are permitted.

Cables in need of repair shall not be used. When a cable, other than the cable lead referred to above, becomes worn to the extent of exposing bare conductors, the portion thus exposed shall be protected by means of rubber and friction tape or other equivalent insulation.

When it becomes necessary to connect or splice lengths of cable one to another, substantial insulated connectors of a capacity at least equivalent to that of the cable shall be used. If connections are effected by means of cable lugs, they shall be securely fastened together to give good electrical contact, and the exposed metal parts of the lugs shall be completely insulated.

**Ground Returns and Machine Grounding** - A ground return cable shall have a safe current-carrying capacity equal to or exceeding the specified maximum output capacity of the arc welding or cutting unit which it services. When a single ground return cable services more than one unit, its safe current-carrying shall exceed the total specified maximum output capacities of all the units which it services. Pipelines containing gases or flammable liquids, or conduits containing electrical circuits, shall not be used as a ground return. When a structure or pipeline is employed as a ground return circuit, it shall be determined that the required electrical contact exists at all joints. The generation of an arc, sparks, or heat at any point shall cause rejection of the structures as a ground circuit. When a structure or pipeline is continuously employed as a ground return circuit, all joints shall be bonded, and periodic inspections shall be conducted to ensure that no condition of electrolysis or fire hazard exists by virtue of such use. The frames of all arc welding and cutting machines shall be grounded either through a third wire in the cable containing the circuit conductor or through a separate wire which is grounded at the source of the current. Grounding circuits, other than by means of the structure, shall be checked to ensure that the circuit between the ground and the grounded power conductor has resistance low enough to permit sufficient current to flow to cause the fuse or circuit breaker to interrupt the current.

All ground connections shall be inspected to ensure that they are mechanically strong and electrically adequate for the required current.

### **Operating Instructions**

- When electrode holders are to be left unattended, the electrodes shall be removed and the holders shall be so placed or protected that they cannot make electrical contact with employees or conducting objects.
- Hot electrode holders shall not be dipped in water; to do so may expose the arc welder or cutter to electric shock.
- When the arc welder or cutter has occasion to leave his work or to stop work for any appreciable length of time, or when the arc welding or cutting machine is to be moved, the power supply switch to the equipment shall be opened.
- Any faulty or defective equipment shall be reported to the supervisor.
- A disconnecting means shall be provided in the supply circuit for each motor generated arc welder, and for each AC transformer and DC rectifier arc welder which is not equipped with a disconnect mounted as an integral part of the welder.
- A switch or circuit breaker shall be provided by which each resistance welder and its control equipment can be isolated from the supply circuit. The ampere rating of this disconnecting means shall not be less than the supply conductor ampacity.

**Shielding** - Whenever practicable, all arc welding and cutting operations shall be shielded by noncombustible or flameproof screen which will protect employees and other persons working in the vicinity from the direct rays of the arc.

**Fire Prevention** - When practical, objects to be welded, cut, or heated shall be moved to a designated safe location or, if these objects cannot be readily moved, all movable fire hazards in the vicinity shall be taken to a safe place, or otherwise protected. If these objects cannot be moved and if all the fire hazards cannot be removed, positive means shall be taken to confine the heat, sparks, and slag, and to protect the immovable fire hazards from them. No welding, cutting or heating shall be done where the application of flammable paints, or the presence of other flammable compounds, or heavy dust concentrations creates a hazard. Suitable fire extinguishing equipment shall be immediately available in the work area and shall be maintained in a state of readiness for instant use. When the welding, cutting, or heating operation is such that normal fire prevention precautions are not sufficient, additional personnel shall be assigned to guard against fire while the actual welding, cutting, or heating operation is being performed, and for a sufficient period of time after completion of the work to ensure that no possibility of fire exists. Such personnel shall be instructed as to the specific anticipated fire hazards and how the firefighting equipment provided is to be used. When welding, cutting, or heating is performed on walls, floors, and ceilings, since direct penetration of sparks or heat transfer may introduce a fire hazard to an adjacent area, the same precautions shall be taken on the opposite side as are taken on the side on which the welding is being performed. For the elimination of possible fire in enclosed spaces as

a result of gas escaping through leaking or improperly closed torch valves, the gas supply to the torch shall be positively shut off at some point outside the enclosed space whenever the torch is not to be used or whenever the torch is left unattended for a substantial period of time, such as during the lunch period. Overnight and at the change of shifts, the torch and hose shall be removed from the confined space. Open end fuel gas and oxygen hoses shall be immediately removed from enclosed spaces when they are disconnected from the torch or other gas-consuming device. Except when the contents are being removed or transferred, drums, pails, and other containers which contain or have contained flammable liquids shall be kept closed. Empty containers shall be removed to a safe area apart from hot work operations or open flames. Drums, containers, or hollow structures which have contained toxic or flammable substances shall, before welding, cutting, or heating is undertaken on them, either be filled with water or thoroughly cleaned of such substances and ventilated and tested. Before heat is applied to a drum, container, or hollow structure, a vent or opening shall be provided for the release of any built-up pressure during the application of heat.

**Ventilation And Protection In Welding, Cutting, And Heating** - Mechanical Ventilation - Mechanical ventilation shall consist of either general mechanical ventilation systems or local exhaust systems. Ventilation shall be deemed adequate if it is of sufficient capacity and so arranged as to remove fumes and smoke at the source and keep their concentration in the breathing zone within safe limits as defined in Subpart D of Part 1926, Occupational Health and Environmental Controls. Contaminated air exhausted from a working space shall be discharged clear of the source of intake air. All air replacing that withdrawn shall be clean and respirable. Oxygen shall not be used for ventilation purposes, comfort cooling, blowing dust from clothing, or for cleaning the work area.

**Welding, Cutting, and Heating in Confined Spaces** - Except where air line respirators are required or allowed as described below, adequate mechanical ventilation meeting the requirements described above shall be provided whenever welding, cutting, or heating is performed in a confined space. When sufficient ventilation cannot be obtained without blocking the means of access, employees in the confined space shall be protected by air line respirators in accordance with the requirements of Subpart E of Part 1926, Personal Protective and Life Saving Equipment. An employee on the outside of the confined space shall be assigned to maintain communication with those working within it and to aid them in an emergency. Where a welder must enter a confined space through a small opening, means shall be provided for quickly removing him in case of emergency. When safety belts and lifelines are used for this purpose they shall be so attached to the welder's body that his body cannot be jammed in a small exit opening. An attendant with a pre-planned rescue procedure shall be stationed outside to observe the welder at all times and be capable of putting rescue operations into effect.

**Welding, Cutting, or Heating of Metals of Toxic Significance** - Welding, cutting, or heating in any enclosed spaces involving the following metals shall be performed with adequate mechanical ventilation as described above:

- Zinc-bearing base or filler metals or metals coated with zinc-bearing materials;
- Lead base metals;
- Cadmium-bearing filler materials;
- Chromium-bearing metals or metals coated with chromium-bearing materials.

Welding, cutting, or heating in any enclosed spaces involving the following metals shall be performed with adequate local exhaust ventilation as described above or employees shall be protected by air line respirators in accordance with the requirements of Subpart E:

- Metals containing lead, other than as an impurity, or metals coated with lead-bearing materials;
- Cadmium-bearing or cadmium-coated base metals;
- Metal coated with mercury-bearing metals;

Beryllium-containing base or filler metals. Because of its high toxicity, work involving beryllium shall be done with both local exhaust ventilation and air line respirators. Employees performing such operations in the open air shall be protected by filter-type respirators in accordance with the requirements of Subpart E, except that employees performing such operations on beryllium-containing base or filler metals shall be protected by air line respirators in accordance with the requirements of Subpart E. Other employees exposed to the same atmosphere as the welders or burners shall be protected in the same manner as the welder or burner.

**Inert-Gas Metal-Arc Welding** - Since the inert-gas metal-arc welding process involves the production of ultra-violet radiation of intensities of 5 to 30 times that produced during shielded metal-arc welding, the decomposition of chlorinated solvents by



ultraviolet rays, and the liberation of toxic fumes and gases, employees shall not be permitted to engage in, or be exposed to the process until the following special precautions have been taken:

- The use of chlorinated solvents shall be kept at least 200 feet, unless shielded, from the exposed arc, and surfaces prepared with chlorinated solvents shall be thoroughly dry before welding is permitted on such surfaces.
- Employees in the area not protected from the arc by screening shall be protected by filter lenses meeting the requirements of Subpart E. When two or more welders are exposed to each other's arc, filter lens goggles of a suitable type, meeting the requirements of Subpart E, shall be worn under welding helmets. Hand shields to protect the welder against flashes and radiant energy shall be used when either the helmet is lifted or the shield is removed.
- Welders and other employees who are exposed to radiation shall be suitably protected so that the skin is covered completely to prevent burns and other damage by ultraviolet rays. Welding helmets and hand shields shall be free of leaks and openings, and highly reflective surfaces.
- When inert-gas metal-arc welding is being performed on stainless steel, adequate local exhaust ventilation as described above or air line respirators in accordance with the requirements of Subpart E shall be used to protect against dangerous concentrations of nitrogen dioxide.

#### **ELECTRICAL STANDARDS FOR CONSTRUCTION - 29 CFR 1926.402 through 1926.408**

Safety of equipment must be determined by the following:

- Suitability for installation and use in conformity with the provisions of the standard. Suitability of equipment for an identified purpose may be evidenced by a listing, by labeling, or by certification for that identified purpose.
- Mechanical strength and durability. For parts designed to enclose and protect other equipment, this includes the adequacy of the protection thus provided.
- Electrical insulation.
- Heating effects under conditions of use.
- Arcing effects.
- Classification by type, size, voltage, current capacity, and specific use.
- Other factors that contribute to the practical safeguarding of employees who use or are likely to come in contact with the equipment.

#### **Guarding**

Live parts of electric equipment operating at 50 volts or more must be guarded against accidental contact. Guarding of live parts must be accomplished as follows:

- Location in a cabinet, room, vault, or similar enclosure accessible only to qualified persons.
- Use of permanent, substantial partitions or screens to exclude unqualified persons.
- Location on a suitable balcony, gallery, or platform elevated and arranged to exclude unqualified persons.
- Elevation of eight feet or more above the floor.

Entrance to rooms and other guarded locations containing exposed live parts must be marked with conspicuous warning signs forbidding unqualified persons to enter.

Electric installations that are over 600 volts and that are open to unqualified persons must be made with metal-enclosed equipment or enclosed in a vault or area controlled by a lock. In addition, equipment must be marked with appropriate caution signs.

#### **Overcurrent Protection**

The following requirements apply to overcurrent protection of circuits rated 600 volts, nominal, or less.

- Conductors and equipment must be protected from overcurrent in accordance with their ability to safely conduct current and the conductors must have sufficient current-carrying capacity to carry the load.

- Overcurrent devices must not interrupt the continuity of the grounded conductor unless all conductors of the circuit are opened simultaneously, except for motor-running overload protection.
- Overcurrent devices must be readily accessible and not located where they could create an employee safety hazard by being exposed to physical damage or located in the vicinity of easily ignitable material.
- Fuses and circuit breakers must be so located or shielded that employees will not be burned or otherwise injured by their operation, e.g., arcing.

#### **Grounding of Equipment Connected by Cord and Plug**

Exposed noncurrent-carrying metal parts of cord- and plug-connected equipment that may become energized must be grounded in the following situations:

- When in a hazardous (classified) location.
- When operated at over 150 volts to ground, except for guarded motors and metal frames of electrically heated appliances if the appliance frames are permanently and effectively insulated from ground.
- When one of the types of equipment listed below. But see Item 6 for exemption.

Hand held motor-operated tools. Cord- and plug-connected equipment used in damp or wet locations or by employees standing on the ground or on metal floors or working inside metal tanks or boilers. Portable and mobile X-ray and associated equipment. Tools likely to be used in wet and/or conductive locations. Portable hand lamps. [Exemption] Tools likely to be used in wet and/or conductive locations need not be grounded if supplied through an isolating transformer with an ungrounded secondary of not over 50 volts. Listed or labeled portable tools and appliances protected by a system of double insulation, or its equivalent, need not be grounded. If such a system is employed, the equipment must be distinctively marked to indicate that the tool or appliance uses a system of double insulation.

**Protection of Employees** - The employer must not permit an employee to work near any part of an electric power circuit that the employee could contact in the course of work, unless the employee is protected against shock by de-energizing the circuit and grounding it or by guarding it effectively by insulation or other means. Where the exact location of underground electric power lines is unknown, employees using jack hammers or hand tools that may contact a Even before work is begun, the employer must determine by inquiry, observation, or instruments where any part of an exposed or concealed energized electric power circuit is located. This is necessary because a person, tool or machine could come into physical or electrical contact with the electric power circuit. The employer is required to advise employees of the location of such lines, the hazards involved, and protective measures to be taken as well as to post and maintain proper warning signs.

**Passageways and Open Spaces** - The employer must provide barriers or other means of guarding to ensure that workspace for electrical equipment will not be used as a passageway during the time when energized parts of electrical equipment are exposed. Walkways and similar working spaces must be kept clear of electric cords. Other standards cover load ratings, fuses, cords, and cables.

**Lockout and Tagging of Circuits** - Tags must be placed on controls that are to be deactivated during the course of work on energized or de-energized equipment or circuits. Equipment or circuits that are de-energized must be rendered inoperative and have tags attached at all points where such equipment or circuits can be energized.

**Maintenance of Equipment** - Ensure that all wiring components and utilization equipment in hazardous locations are maintained in a dust-tight, dust-ignition-proof, or explosion-proof condition without loose or missing screws, gaskets, threaded connections, seals, or other impairments to a tight condition.

**Environmental Deterioration of Equipment** - Unless identified for use in the operating environment, no conductors or equipment can be located: In damp or wet locations - Where exposed to gases, fumes, vapors, liquids, or other agents having a deteriorating effect on the conductors or equipment - Where exposed to excessive temperatures.

Control equipment, utilization equipment, and bus ways approved for use in dry locations only must be protected against damage from the weather during building construction. For protection against corrosion, metal raceways, cable armor, boxes, cable sheathing, cabinets, elbows, couplings, fittings, supports, and support hardware must be of materials appropriate for the environment in which they are installed.

**Batteries** - Batteries of the unsealed type must be located in enclosures with outside vents or in well-ventilated rooms arranged to prevent the escape of fumes, gases, or electrolyte spray into other areas. Other provisions include the following:

Ventilation-to ensure diffusion of the gases from the battery and to prevent the accumulation of an explosive mixture.  
Racks and trays-treated to make them resistant to the electrolyte.  
Floors-acid-resistant construction unless protected from acid accumulations.  
Face shields, aprons, and rubber gloves-for workers handling acids or batteries.  
Facilities for quick drenching of the eyes and body-within 25 feet (7.62m) of battery handling areas.  
Facilities-for flushing and neutralizing spilled electrolytes and for fire protection.

**Battery Charging** - Battery charging installations must be located in areas designated for that purpose. When batteries are being charged, vent caps must be maintained in functioning condition and kept in place to avoid electrolyte spray. Also, charging apparatus must be protected from damage by trucks.

**Insulation And Grounding** - Insulation and grounding are two recognized means of preventing injury during electrical equipment operation. Conductor insulation may be provided by placing nonconductive material such as plastic around the conductor. Grounding may be achieved through the use of a direct connection to a known ground such as a metal cold water pipe. Consider, for example, the metal housing or enclosure around a motor or the metal box in which electrical switches, circuit breakers, and controls are placed. Such enclosures protect the equipment from dirt and moisture and prevent accidental contact with exposed wiring. However, there is a hazard associated with housings and enclosures. A malfunction within the equipment—such as deteriorated insulation—may create an electrical shock hazard. Many metal enclosures are connected to a ground to eliminate the hazard. If a "hot" wire contacts a grounded enclosure, a ground fault results which normally will trip a circuit breaker or blow a fuse. Metal enclosures and containers are usually grounded by connecting them with a wire going to ground. This wire is called an equipment grounding conductor. Most portable electric tools and appliances are grounded by this means. There is one disadvantage to grounding: a break in the grounding system may occur without the user's knowledge. Insulation may be damaged by hard usage on the job or simply by aging. If this damage causes the conductors to become exposed, the hazards of shocks, burns, and fire will exist. Double insulation may be used as additional protection on the live parts of a tool, but double insulation does not provide protection against defective cords and plugs or against heavy moisture conditions. The use of a ground-fault circuit interrupter (GFCI) is one method used to overcome grounding and insulation deficiencies.

**GFCI** - The ground-fault circuit interrupter (GFCI) is a fast-acting circuit breaker which senses small imbalances in the circuit caused by current leakage to ground and, in a fraction of a second, shuts off the electricity. The GFCI continually matches the amount of current going to an electrical device against the amount of current returning from the device along the electrical path. Whenever the amount "going" differs from the amount "returning" by approximately 5 milliamps, the GFCI interrupts the electric power within as little as 1/40 of a second. However, the GFCI will not protect the employee from line-to-line contact hazards (such as a person holding two "hot" wires or a hot and a neutral wire in each hand). It does provide protection against the most common form of electrical shock hazard--the ground fault. It also provides protection against fires, overheating, and destruction of insulation on wiring. GFCIs can be used successfully to reduce electrical hazards on construction sites. Tripping of GFCIs—interruption of current flow—is sometimes caused by wet connectors and tools. It is good practice to limit exposure of connectors and tools to excessive moisture by using watertight or sealable connectors. Providing more GFCIs or shorter circuits can prevent

#### **SCAFFOLDING - §1926.451**

The footing or anchorage for scaffolds shall be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Unstable objects such as barrels, boxes, loose brick, or concrete blocks, shall not be used to support scaffolds or planks.

No scaffold shall be erected, moved, dismantled, or altered except under the supervision of competent persons.

Guardrails and toe boards shall be installed on all open sides and ends of platforms more than 10 feet above the ground or floor, except needle beam scaffolds and floats [see paragraphs (p) and (w) of this section]. Scaffolds 4 feet to 10 feet in height, having a minimum horizontal dimension in either direction of less than 45 inches, shall have standard guardrails installed on all open sides and ends of the platform.

Guardrails shall be 2 x 4 inches, or the equivalent, approximately 42 inches high, with a mid-rail, when required. Supports shall

be at intervals not to exceed 8 feet. Toe boards shall be a minimum of 4 inches in height.

Where persons are required to work or pass under the scaffold, scaffolds shall be provided with a screen between the toeboard and the guardrail, extending along the entire opening, consisting of No. 18 gauge U.S. Standard wire = - inch mesh, or the equivalent.

Scaffolds and their components shall be capable of supporting without failure at least 4 times the maximum intended load.

Any scaffold including accessories such as braces, brackets, trusses, screw legs, ladders, etc. damaged or weakened from any cause shall be immediately repaired or replaced.

All load-carrying timber members of scaffold framing shall be a minimum of 1,500 fiber (Stress Grade) construction grade lumber. All dimensions are nominal sizes as provided in the American Lumber Standards, except that where rough sizes are noted, only rough or undressed lumber of the size specified will satisfy minimum requirements.

All planking shall be Scaffold Grades, or equivalent, as recognized by approved grading rules for the species of wood used. The maximum permissible spans for 2- x 10-inch or wider planks shall be as shown in Table L-3.

The maximum permissible span for 1 < - x 9-inch or wider plank of full thickness shall be 4 feet with medium duty loading of 50 p.s.f.

All planking of platforms shall be overlapped (minimum 12 inches), or secured from movement.

An access ladder or equivalent safe access shall be provided.

Scaffold planks shall extend over their end supports not less than 6 inches nor more than 12 inches.

The poles, legs, or uprights of scaffolds shall be plumb, and securely and rigidly braced to prevent swaying and displacement.

Overhead protection shall be provided for employees on a scaffold exposed to overhead hazards.

Slippery conditions on scaffolds shall be eliminated as soon as possible after they occur.

No welding, burning, riveting, or open flame work shall be performed on any staging suspended by means of fiber or synthetic rope. Only treated or protected fiber or synthetic ropes shall be used for or near any work involving the use of corrosive substances or chemicals. Specific requirements for boatswain's chairs and float or ship scaffolds are contained in paragraphs (l) and (w) of this section.

Wire, synthetic, or fiber rope used for scaffold suspension shall be capable of supporting at least 6 times the rated load.

The use of shore or lean-to scaffolds is prohibited.

Lumber sizes, when used in this subpart, refer to nominal sizes except where otherwise stated.

Materials being hoisted onto a scaffold shall have a tag line.

Employees shall not work on scaffolds during storms or high winds.

Tools, materials, and debris shall not be allowed to accumulate in quantities to cause a hazard.

#### **FALL PROTECTION - OSHA 1926.500, 1926.501, 1926.502, and 1926.503**

**Controlled Access Zones** - A Controlled access zone is a work area designated and clearly marked in which certain types of work (such as overhand bricklaying) may take place without the use of conventional fall protection systems—guardrail, personal arrest or safety net—to protect the employees working in the zone. Controlled access zones are used to keep out workers other than those authorized to enter work areas from which guardrails have been removed. Where there are no guardrails, masons are the only workers allowed in controlled access zones. Controlled access zones, when created to limit entrance to areas where leading edge work and other operations are taking place, must be defined by a control line or by any other means

that restrict access. Control lines shall consist of ropes, wires, tapes or equivalent materials, and supporting stanchions, and each must be:

- Flagged or otherwise clearly marked at not more than 6-foot (1.8 meters) intervals with high-visibility material;
- Rigged and supported in such a way that the lowest point (including sag) is not less than 39 inches (1 meter) from the walking/working surface and the highest point is not more than 45 inches (1.3 meters)—nor more than 50 inches (1.3 meters) when overhand bricklaying operations are being performed—from the walking/working surface;
- Strong enough to sustain stress of not less than 200 pounds (0.88 kilonewtons). Control lines shall extend along the entire length of the unprotected or leading edge and shall be approximately parallel to the unprotected or leading edge.
- Control lines also must be connected on each side to a guardrail system or wall.

When control lines are used, they shall be erected not less than 6 feet (1.8 meters) nor more than 25 feet (7.6 meters) from the unprotected or leading edge, except when precast concrete members are being erected. In the latter case, the control line is to be erected not less than 6 feet (1.8 meters) nor more than 60 feet (18 meters) or half the length of the member being erected, whichever is less, from the leading edge.

Controlled access zones when used to determine access to areas where **overhand bricklaying and related work** are taking place are to be defined by a control line erected not less than 10 feet (3 meters) nor more than 15 feet (4.6 meters) from the working edge. Additional control lines must be erected at each end to enclose the controlled access zone. Only employees engaged in overhand bricklaying or related work are permitted in the controlled access zones. On floors and roofs where guardrail systems are not in place prior to the beginning of overhand bricklaying operations, controlled access zones will be enlarged as necessary to enclose all points of access, material handling areas, and storage areas. On floors and roofs where guardrail systems are in place, but need to be removed to allow overhand bricklaying work or leading edge work to take place, only that portion of the guardrail necessary to accomplish that day's work shall be removed.

**Excavations** - Each employee at the edge of an excavation 6 feet (1.8 meters) or more deep shall be protected from falling by guardrail systems, fences, barricades, or covers. Where walkways are provided to permit employees to cross over excavations, guardrails are required on the walkway if it is 6 feet (1.8 meters) or more above the excavation.

**Formwork and Reinforcing Steel** - For employees, while moving vertically and/or horizontally on the vertical face of rebar assemblies built in place, fall protection is not required when employees are moving. OSHA considers the multiple hand holds and foot holds on rebar assemblies as providing similar protection as that provided by a fixed ladder; consequently, no fall protection is necessary while moving point to point for heights below 24 feet (7.3 meters). An employee must be provided with fall protection when climbing or otherwise moving at a height more than 24 feet (7.3 meters), the same as for fixed ladders.

**Hoist Areas** - Each employee in a hoist area shall be protected from falling 6 feet (1.8 meters) or more by guardrail systems or personal fall arrest systems. If guardrail systems (or chain gate or guardrail) or portions thereof must be removed to facilitate hoisting operations, as during the landing of materials, and a worker must lean through the access opening or out over the edge of the access opening to receive or guide equipment and materials, that employee must be protected by a personal fall arrest system.

**Holes** - Personal fall arrest systems, covers, or guardrail systems shall be erected around holes (including skylights) that are more than 6 feet (1.8 meters) above lower levels.

**Leading Edges** - Each employee who is constructing a leading edge 6 feet (1.8 meters) or more above lower levels shall be protected by guardrail systems, safety net systems, or personal fall arrest systems. If the employer can demonstrate that it is infeasible or creates a greater hazard to implement these systems, he or she must develop and implement a fall protection plan that meets the requirements of [29 CFR 1926.502\(k\)](#).

**Overhand Bricklaying and Related Work** - Each employee performing overhand bricklaying and related work 6 feet (1.8 meters) or more above lower levels shall be protected by guardrail systems, safety net systems, or personal fall arrest systems, or shall work in a controlled access zone. All employees reaching more than 10 inches (25 cm) below the level of a walking/working surface on which they are working shall be protected by a guardrail system, safety net system, or personal fall arrest system.

**Precast Concrete Erection and Residential Construction** - Each employee who is 6 feet (1.8 meters) or more above lower levels while erecting precast concrete members and related operations such as grouting of precast concrete members and each employee engaged in residential construction, shall be protected by guardrail systems, safety net systems, or personal fall

arrest systems. Where the employer can demonstrate, however, that it is infeasible or creates a greater hazard to use those systems, the employer must develop and implement a fall protection plan that meets the requirements of 29 CFR 1926.502(k).

**Ramps, Runways, and Other Walkways** - Each employee using ramps, runways, and other walkways shall be protected from falling 6 feet (1.8 meters) or more by guardrail systems.

**Low-slope Roofs** - Each employee engaged in roofing activities on low-slope roofs with unprotected sides and edges 6 feet (1.8 meters) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, personal fall arrest systems or a combination of a warning line system and guardrail system, warning line system and safety net system, warning line system and personal fall arrest system, or warning line system and safety monitoring system. On roofs 50 feet (15.24 meters) or less in width, the use of a safety monitoring system without a warning line system is permitted.

**Steep Roofs** - Each employee on a steep roof with unprotected sides and edges 6 feet (1.8 meters) or more above lower levels shall be protected by guardrail systems with toe boards, safety net systems, or personal fall arrest systems.

**Wall Openings** - Each employee working on, at, above, or near wall openings (including those with chutes attached) where the outside bottom edge of the wall opening is 6 feet (1.8 meters) or more above lower levels and the inside bottom edge of the wall opening is less than 39 inches (1.0 meter) above the walking/working surface must be protected from falling by the use of a guardrail system, a safety net system, or a personal fall arrest system.

**Guardrail Systems** - If the employer chooses to use guardrail systems to protect workers from falls, the systems must meet the following criteria. Top rails and mid-rails of guardrail systems must be at least one-quarter inch (0.6 centimeters) nominal diameter or thickness to prevent cuts and lacerations. If wire rope is used for top rails, it must be flagged at not more than 6 feet intervals (1.8 meters) with high-visibility material. Steel and plastic banding cannot be used as top rails or mid-rails. Manila, plastic, or synthetic rope used for top rails or mid-rails must be inspected as frequently as necessary to ensure strength and stability. The top edge height of top rails, or (equivalent) guardrails must be 42 inches (1.1 meters) plus or minus 3 inches (8 centimeters), above the walking/working level. When workers are using stilts, the top edge height of the top rail, or equivalent member, must be increased an amount equal to the height of the stilts. Screens, mid-rails, mesh, intermediate vertical members, or equivalent intermediate structural members must be installed between the top edge of the guardrail system and the walking/working surface when there are no walls or parapet walls at least 21 inches (53 centimeters) high. When mid-rails are used, they must be installed at a height midway between the top edge of the guardrail system and the walking/working level. When screens and mesh are used, they must extend from the top rail to the walking/working level and along the entire opening between top rail supports. Intermediate members, such as balusters, when used between posts, shall not be more than 19 inches (48 centimeters) apart. Other structural members, such as additional mid-rails and architectural panels, shall be installed so that there are no openings in the guardrail system more than 19 inches (48 centimeters). The guardrail system must be capable of withstanding a force of at least 200 pounds (890 newton's) applied within 2 inches of the top edge in any outward or downward direction. When the 200 pound (890 newton's) test is applied in a downward direction, the top edge of the guardrail must not deflect to a height less than 39 inches (1 meter) above the walking/working level. Mid-rails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members shall be capable of withstanding a force of at least 150 pounds (667 newton's) applied in any downward or outward direction at any point along the mid-rail or other member. Guardrail systems shall be surfaced to protect workers from punctures or lacerations and to prevent clothing from snagging. The ends of top rails and mid-rails must not overhang terminal posts, except where such overhang does not constitute a projection hazard. When guardrail systems are used at hoisting areas, a chain, gate, or removable guardrail section must be placed across the access opening between guardrail sections when hoisting operations are not taking place. At holes, guardrail systems must be set up on all unprotected sides or edges. When holes are used for the passage of materials, the hole shall have not more than two sides with removable guardrail sections. When the hole is not in use, it must be covered or provided with guardrails along all unprotected sides or edges. If guardrail systems are used around holes that are used as access points (such as ladder ways), gates must be used or the point of access must be offset to prevent accidental walking into the hole. If guardrails are used at unprotected sides or edges of ramps and runways, they must be erected on each unprotected side or edge.

**Personal Fall Arrest Systems** - These consist of an anchorage, connectors, and a body belt or body harness and may include a deceleration device, lifeline, or suitable combinations. If a personal fall arrest system is used for fall protection, it must do the following:

- Limit maximum arresting force on an employee to 900 pounds (4 kilonewtons) when used with a body belt;
- Limit maximum arresting force on an employee to 1,800 pounds (8 kilonewtons) when used with a body harness;
- Be rigged so that an employee can neither free fall more than 6 feet (1.8 meters) nor contact any lower level;

- Bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet (1.07 meters); and
- Have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet (1.8 meters) or the free fall distance permitted by the system, whichever is less.

As of January 1, 1998, the use of a body belt for fall arrest is prohibited. - Personal fall arrest systems must be inspected prior to each use for wear damage, and other deterioration. Defective components must be removed from service. Dee-rings and snap hooks must have a minimum tensile strength of 5,000 pounds (22.2 kilonewtons). Dee-rings and snap hooks shall be proof-tested to a minimum tensile load of 3,600 pounds (16 kilonewtons) without cracking, breaking, or suffering permanent deformation. Snap hooks shall be sized to be compatible with the member to whom they will be connected, or shall be of a locking configuration. Unless the snap hook is a locking type and designed for the following connections, they shall not be engaged (a) directly to webbing, rope or wire rope; (b) to each other; (c) to a dee-ring to which another snap hook or other connector is attached; (d) to a horizontal lifeline; or (e) to any object incompatible in shape or dimension relative to the snap hook, thereby causing the connected object to depress the snap hook keeper and release unintentionally. OSHA considers a hook to be compatible when the diameter of the dee-ring to which the snap hook is attached is greater than the inside length of the snap hook when measured from the bottom (hinged end) of the snap hook keeper to the inside curve of the top of the snap hook. Thus, no matter how the dee-ring is positioned or moved (rolls) with the snap hook attached, the dee-ring cannot touch the outside of the keeper, thus depressing it open. As of January 1, 1998, the use of non-locking snap hooks is prohibited. On suspended scaffolds or similar work platforms with horizontal lifelines that may become vertical lifelines, the devices used to connect to a horizontal lifeline shall be capable of locking in both directions on the lifeline. Horizontal lifelines shall be designed, installed, and used under the supervision of a qualified person, as part of a complete personal fall arrest system that maintains a safety factor of at least two. Lifelines shall be protected against being cut or abraded. Self-retracting lifelines and lanyards that automatically limit free fall distance to 2 feet (0.61 meters) or less shall be capable of sustaining a minimum tensile load of 3,000 pounds (13.3 kilonewtons) applied to the device with the lifeline or lanyard in the fully extended position. Self-retracting lifelines and lanyards that do not limit free fall distance to 2 feet (0.61 meters) or less, rip stitch lanyards, and tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,000 pounds (22.2 kilonewtons) applied to the device with the lifeline or lanyard in the fully extended position. Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses shall be made of synthetic fibers. Anchorages shall be designed, installed, and used under the supervision of a qualified person, as part of a complete personal fall arrest system that maintains a safety factor of at least two, i.e., capable of supporting at least twice the weight expected to be imposed upon it. Anchorages used to attach personal fall arrest systems shall be independent of any anchorage being used to support or suspend platforms and must be capable of supporting at least 5,000 pounds (22.2 kilonewtons) per person attached. Lanyards and vertical lifelines must have a minimum breaking strength of 5,000 pounds (22.2 kilonewtons).

**Positioning Device Systems** - These body belt or body harness systems are to be set up so that a worker can free fall no farther than 2 feet (0.6 meters). They shall be secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds (13.3 kilonewtons), whichever is greater. Requirements for snap hooks, dee-rings, and other connectors used with positioning device systems must meet the same criteria as those for personal fall arrest systems.

**Safety Monitoring Systems** - When no other alternative fall protection has been implemented, the employer shall implement a safety monitoring system. Employers must appoint a competent person to monitor the safety of workers and the employer shall ensure that the safety monitor:

- Is competent in the recognition of fall hazards;
- Is capable of warning workers of fall hazard dangers and in detecting unsafe work practices;
- Is operating on the same walking/working surfaces of the workers and can see them;
- Is close enough to work operations to communicate orally with workers and has no other duties to distract from the monitoring function.

Mechanical equipment shall not be used or stored in areas where safety monitoring systems are being used to monitor employees engaged in roofing operations on low-sloped roofs. No worker, other than one engaged in roofing work (on low-sloped roofs) or one covered by a fall protection plan, shall be allowed in an area where an employee is being protected by a safety monitoring system. All workers in a controlled access zone shall be instructed to promptly comply with fall hazard warnings issued by safety monitors.

**Safety Net Systems** - Safety nets must be installed as close as practicable under the walking/working surface on which employees are working and never more than 30 feet (9.1 meters) below such levels. Defective nets shall not be used. Safety

nets shall be inspected at least once a week for wear, damage, and other deterioration. The maximum size of each safety net mesh opening shall not exceed 36 square inches (230 square centimeters) nor be longer than 6 inches (15 centimeters) on any side, and the openings, measured center-to-center, of mesh ropes or webbing, shall not exceed 6 inches (15 centimeters). All mesh crossings shall be secured to prevent enlargement of the mesh opening. Each safety net or section shall have a border rope for webbing with a minimum breaking strength of 5,000 pounds (22.2 kilonewtons). Connections between safety net panels shall be as strong as integral net components and be spaced no more than 6 inches (15 centimeters) apart. Safety nets shall be installed with sufficient clearance underneath to prevent contact with the surface or structure below.

When nets are used on bridges, the potential fall area from the walking/working surface to the net shall be unobstructed.

Safety nets shall be capable of absorbing an impact force of a drop test consisting of a 400-pound (180 kilogram) bag of sand 30 inches (76 centimeters) in diameter dropped from the highest walking/working surface at which workers are exposed, but not from less than 42 inches (1.1 meters) above that level. Items that have fallen into safety nets including—but not restricted to, materials, scrap, equipment, and tools—must be removed as soon as possible and at least before the next work shift.

**Warning Line Systems** - Warning line systems consist of ropes, wires, or chains, and supporting stanchions and are set up as follows:

- Flagged at not more than 6-foot (1.8 meters) intervals with high-visibility material;
- Rigged and supported so that the lowest point (including sag) is no less than 34 inches (0.9 meters) from the walking/working surface and its highest point is no more than 39 inches (1 meter) from the walking/working surface.
- Stanchions, after being rigged with warning lines, shall be capable of resisting, without tipping over, a force of at least 16 pounds (71 newton's) applied horizontally against the stanchion, 30 inches (0.8 meters) above the walking/working surface, perpendicular to the warning line and in the direction of the floor, roof, or platform edge;
- The rope, wire, or chain shall have a minimum tensile strength of 500 pounds (2.22 kilonewtons) and after being attached to the stanchions, must support without breaking, the load applied to the stanchions as prescribed above.
- Shall be attached to each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in the adjacent section before the stanchion tips over.

Warning lines shall be erected around all sides of roof work areas. When mechanical equipment is being used, the warning line shall be erected not less than 6 feet (1.8 meters) from the roof edge parallel to the direction of mechanical equipment operation, and not less than 10 feet (3 meters) from the roof edge perpendicular to the direction of mechanical equipment operation. When mechanical equipment is not being used, the warning line must be erected not less than 6 feet (1.8 meters) from the roof edge.

**Covers** - Covers located in roadways and vehicular aisles must be able to support at least twice the maximum axle load of the largest vehicle to which the cover might be subjected. All other covers must be able to support at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time. To prevent accidental displacement resulting from wind, equipment, or workers' activities, all covers must be secured. All covers shall be color coded or bear the markings "HOLE" or "COVER."

## **CRANES AND DERRICKS - §1926.550**

Comply with the manufacturer's specifications and limitations applicable to the operation of any and all cranes and derricks. Where manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a qualified engineer competent in this field and such determinations will be appropriately documented and recorded. Attachments used with cranes shall not exceed the capacity, rating, or scope recommended by the manufacturer.

Rated load capacities, and recommended operating speeds, special hazard warnings, or instruction, shall be conspicuously posted on all equipment. Instructions or warnings shall be visible to operators while they are at their control stations. Hand signals to crane and derrick operators shall be those prescribed by the applicable ANSI standard for the type of crane in use. Illustration of the signals shall be posted at the job site. A competent person should be appointed who shall inspect all machinery and equipment prior to each use, and during use, to make sure it is in safe operating condition. Any deficiencies shall be repaired, or defective parts replaced, before continued use.

A thorough, annual inspection of the hoisting machinery shall be made by a competent person, or by a government or private



agency recognized by the U.S. Department of Labor. Maintain records of the dates and results of inspections for each hoisting machine and piece of equipment.

Accessible areas within the swing radius of the rear of the rotating superstructure of the crane, either permanently or temporarily mounted, shall be barricaded in such a manner as to prevent an employee from being struck or crushed by the crane.

All exhaust pipes shall be guarded or insulated in areas where contact by employees is possible in the performance of normal duties.

Whenever internal combustion engine powered equipment exhausts in enclosed spaces, tests shall be made and recorded to see that employees are not exposed to unsafe concentrations of toxic gases or oxygen deficient atmospheres.

All windows in cabs shall be of safety glass, or equivalent, that introduces no visible distortion that will interfere with the safe operation of the machine.

Where necessary for rigging or service requirements, a ladder, or steps, shall be provided to give access to a cab roof. Guardrails, handholds, and steps shall be provided on cranes for easy access to the car and cab, conforming to American National Standards Institute B30.5.

Platforms and walkways shall have anti-skid surfaces.

Fuel tank filler pipe shall be located in such a position, or protected in such manner, as to not allow spill or overflow to run onto the engine, exhaust, or electrical equipment of any machine being fueled.

An accessible fire extinguisher of 5BC rating, or higher, shall be available at all operator stations or cabs of equipment.

When fuel is transported by vehicles on public highways, Department of Transportation rules contained in 49 CFR Parts 177 and 393 concerning such vehicular transportation are considered applicable.

Side boom cranes mounted on wheel or crawler tractors shall meet the requirements of SAE J743a-1964.

#### **MATERIAL HOISTS, PERSONNEL HOISTS, AND ELEVATORS - §1926.552**

Where manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a professional engineer competent in the field. Rated load capacities, recommended operating speeds, and special hazard warnings or instructions shall be posted on cars and platforms. Wire rope shall be removed from service when any of the following conditions exists:

- In hoisting ropes, six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay;
- Abrasion, scrubbing, flattening, or peening, causing loss of more than one-third of the original diameter of the outside wires;
- Evidence of any heat damage resulting from a torch or any damage caused by contact with electrical wires;
- Reduction from nominal diameter of more than three sixty-fourths inch for diameters up to and including three-fourths inch; one-sixteenth inch for diameters seven-eighths to 1 inches; and three thirty-seconds inch for diameters 1¼ to 1½ inches.

Hoisting ropes shall be installed in accordance with the wire rope manufacturers' recommendations. The installation of live booms on hoists is prohibited. The use of endless belt-type man lifts on construction shall be prohibited.

**Material Hoists** - Operating rules shall be established and posted at the operator's station of the hoist. Such rules shall include signal system and allowable line speed for various loads. Rules and notices shall be posted on the car frame or crosshead in a conspicuous location, including the statement "No Riders Allowed." No person shall be allowed to ride on material hoists except for the purposes of inspection and maintenance. All entrances of the hoist ways shall be protected by substantial gates or bars which shall guard the full width of the landing entrance. All hoist way entrance bars and gates shall be painted with diagonal contrasting colors, such as black and yellow stripes.

Bars shall be not less than 2- by 4-inch wooden bars or the equivalent, located 2 feet from the hoist way line. Bars shall be located not less than 36 inches nor more than 42 inches above the floor. Gates or bars protecting the entrances to hoist ways shall be equipped with a latching device. Overhead protective covering of 2-inch planking, ¾-inch plywood, or other solid material of equivalent strength, shall be provided on the top of every material hoist cage or platform. The operator's station of a hoisting machine shall be provided with overhead protection equivalent to tight planking not less than 2 inches thick. The support for the overhead protection shall be of equal strength. Hoist towers may be used with or without an enclosure on all sides. However, whichever alternative is chosen, the following applicable conditions shall be met:

When a hoist tower is enclosed, it shall be enclosed on all sides for its entire height with a screen enclosure of ½-inch mesh, No. 18 U.S. gauge wire or equivalent, except for landing access. When a hoist tower is not enclosed, the hoist platform or car shall be totally enclosed (caged) on all sides for the full height between the floor and the overhead protective covering with ½-inch mesh of No. 14 U.S. gauge wire or equivalent. The hoist platform enclosure shall include the required gates for loading and unloading. A 6-foot high enclosure shall be provided on the unused sides of the hoist tower at ground level. Car arresting devices shall be installed to function in case of rope failure.

All material hoist towers shall be designed by a licensed professional engineer. All material hoists shall conform to the requirements of ANSI A10.5-1969, *Safety Requirements for Material Hoists*.

**Personnel Hoists** - Hoist towers outside the structure shall be enclosed for the full height on the side or sides used for entrance and exit to the structure. At the lowest landing, the enclosure on the sides not used for exit or entrance to the structure shall be enclosed to a height of at least 10 feet. Other sides of the tower adjacent to floors or scaffold platforms shall be enclosed to a height of 10 feet above the level of such floors or scaffolds. Towers inside of structures shall be enclosed on all four sides throughout the full height. Towers shall be anchored to the structure at intervals not exceeding 25 feet. In addition to tie-ins, a series of guys shall be installed. Where tie-ins are not practical the tower shall be anchored by means of guys made of wire rope at least one-half inch in diameter, securely fastened to anchorage to ensure stability.

Hoist way doors or gates shall be not less than 6 feet 6 inches high and shall be provided with mechanical locks which cannot be operated from the landing side, and shall be accessible only to persons on the car. Cars shall be permanently enclosed on all sides and the top, except sides used for entrance and exit which have car gates or doors. A door or gate shall be provided at each entrance to the car which shall protect the full width and height of the car entrance opening.

Overhead protective covering of 2-inch planking, ¾-inch plywood or other solid material or equivalent strength shall be provided on the top of every personnel hoist. Doors or gates shall be provided with electric contacts which do not allow movement of the hoist when door or gate is open. Safeties shall be capable of stopping and holding the car and rated load when traveling at governor tripping speed. Cars shall be provided with a capacity and data plate secured in a conspicuous place on the car or crosshead. Internal combustion engines shall not be permitted for direct drive. Normal and final terminal stopping devices shall be provided. An emergency stop switch shall be provided in the car and marked "Stop." The minimum number of hoisting ropes used shall be three for traction hoists and two for drum-type hoists. The minimum diameter of hoisting and counterweight wire ropes shall be ½-inch. Minimum factors of safety for suspension wire ropes are shown in §1926.552(c)(14)(iii). Following assembly and erection of hoists, and before being put in service, an inspection and test of all functions and safety devices shall be made under the supervision of a competent person. A similar inspection and test is required following major alteration of an existing installation. All hoists shall be inspected and tested at not more than 3-month intervals. The employer shall prepare a certification record which includes the date the inspection and test of all functions and safety devices was performed; the signature of the person who performed the inspection and test; and a serial number, or other identifier, for the hoist that was inspected and tested. The most recent certification record shall be maintained on file.

All personnel hoists used by employees shall be constructed of materials and components which meet the specifications for materials, construction, safety devices, assembly, and structural integrity as stated in the American National Standard A10.4-1963, *Safety Requirements for Workmen's Hoists*. The requirements of this paragraph §1926.552(c)(16) do not apply to cantilever type personnel hoists. Personnel hoists used in bridge tower construction shall be approved by a registered professional engineer and erected under the supervision of a qualified engineer competent in this field. When a hoist tower is not enclosed, the hoist platform or car shall be totally enclosed (caged) on all sides for the full height between the floor and the overhead protective covering with ¾-inch mesh of No. 14 U.S. gauge wire or equivalent. The hoist platform enclosure shall include the required gates for loading and unloading. These hoists shall be inspected and maintained on a weekly basis. Whenever the hoisting equipment is exposed to winds exceeding 35 miles per hour it shall be inspected and put in operable condition before reuse. Wire rope shall be taken out of service when any of the following conditions exist:

- In running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay;
- Wear of one-third the original diameter of outside individual wires. Kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure;
- Evidence of any heat damage from any cause;

- Reductions from nominal diameter of more than three-sixty-fourths inch for diameters to and including three-fourths inch, one-sixteenth inch for diameters seven-eighths inch to 1 inches inclusive, three-thirty-seconds inch for diameters 1¼ to 1½ inches inclusive;

#### **CONVEYORS - §1926.555**

- Means for stopping the motor or engine shall be provided at the operator's station. Conveyor systems shall be equipped with an audible warning signal to be sounded immediately before starting up the conveyor.
- If the operator's station is at a remote point, similar provisions for stopping the motor or engine shall be provided at the motor or engine location.
- Emergency stop switches shall be arranged so that the conveyor cannot be started again until the actuating stop switch has been reset to running or "on" position.
- Screw conveyors shall be guarded to prevent employee contact with turning flights.
- Where a conveyor passes over work areas, aisles, or thoroughfares, suitable guards shall be provided to protect employees required to work below the conveyors.
- All crossovers, aisles, and passageways shall be conspicuously marked by suitable signs, as required by Subpart G, Signs, Signals, and Barricades.
- Conveyors shall be locked out or otherwise rendered inoperable, and tagged out with a "Do Not Operate" tag during repairs and when operation is hazardous to employees performing maintenance work.
- All conveyors in use shall meet the applicable requirements for design, construction, inspection, testing, maintenance, and operation, as prescribed in the ANSI B20.1-1957, *Safety Code for Conveyors, Cableways, and Related Equipment*.

#### **AERIAL LIFTS - §1926.556**

***Ladder Trucks and Tower Trucks*** - Aerial ladders shall be secured in the lower traveling position by the locking device on top of the truck cab, and the manually operated device at the base of the ladder before the truck is moved for highway travel.

***Extensible and Articulating Boom Platforms*** - Lift controls shall be tested each day prior to use to determine that such controls are in safe working condition. Only authorized persons shall operate an aerial lift. Belting off to an adjacent pole, structure, or equipment while working from an aerial lift shall not be permitted. Employees shall always stand firmly on the floor of the basket, and shall not sit or climb on the edge of the basket or use planks, ladders, or other devices for a work position. A body belt shall be worn and a lanyard attached to the boom or basket when working from an aerial lift. Boom and basket load limits specified by the manufacturer shall not be exceeded. The brakes shall be set and when outriggers are used, they shall be positioned on pads or a solid surface. Wheel chocks shall be installed before using an aerial lift on an incline, provided they can be safely installed. An aerial lift truck shall not be moved when the boom is elevated in a working position with men in the basket, except for equipment which is specifically designed for this type of operation in accordance with the provisions of paragraph "General Requirements" of this section.

Articulating boom and extensible boom platforms, primarily designed as personnel carriers, shall have both platform (upper) and lower controls. Upper controls shall be in or beside the platform within easy reach of the operator. Lower controls shall provide for overriding the upper controls. Controls shall be plainly marked as to their function. Lower level controls shall not be operated unless permission has been obtained from the employee in the lift, except in case of emergency.

Climbers shall not be worn while performing work from an aerial lift. The insulated portion of an aerial lift shall not be altered in any manner that might reduce its insulating value. Before moving an aerial lift for travel, the boom(s) shall be inspected to see that it is properly cradled and outriggers are in stowed position except as provided in paragraph (b)(2)(viii) of this section.

#### **EXCAVATIONS**

According to the OSHA construction safety and health standards, a *trench* is referred to as a narrow excavation made below the surface of the ground in which the depth is greater than the width-the width not exceeding 15 feet. An *excavation* is any man-made cut, cavity, trench, or

Before any excavation actually begins, the standard requires the employer to determine the estimated location of utility installations-sewer, telephone, fuel, electric, water lines, or any other underground installations—that may be encountered during digging. Also, before starting the excavation, the contractor must contact the utility companies or owners involved and inform them, within established or customary local response times, of the proposed work. The contractor must also ask the utility companies or owners to find the exact location of the underground installations. If they cannot respond within 24 hours (unless the period required by state or local law is longer), or if they cannot find the exact location of the utility installations, the contractor may proceed with caution. To find the exact location of underground installations, workers must use safe and acceptable means. If underground installations are exposed, OSHA regulations also require that they be removed, protected or properly supported.

When all the necessary specific information about the job site is assembled, the contractor is ready to determine the amount, kind, and cost of the safety equipment needed. A careful inventory of the safety items on hand should be made before deciding what additional safety material must be acquired. No matter how many trenching, shoring and backfilling jobs have been done in the past, each job should be approached with the utmost care and preparation.

It is also important, before beginning work, for employers to provide employees who are exposed to public vehicular traffic with warning vests or other suitable garments marked with or made of reflectorized or high-visibility material and ensure that they wear them. Workers must also be instructed to remove or neutralize surface encumbrances that may create a hazard.

The standard requires that a competent person inspect, on a daily basis, excavations and the adjacent areas for possible cave-ins, failures of protective systems and equipment, hazardous atmospheres, or other hazardous conditions. If these conditions are encountered, exposed employees must be removed from the hazardous area until the necessary safety precautions have been taken. Inspections are also required after natural (e.g., heavy rains) or man-made events such as blasting that may increase the potential for hazards.

The standard requires the employer to provide support systems such as shoring, bracing, or underpinning to ensure the stability of adjacent structures such as buildings, walls, sidewalks or pavements.

The standard prohibits excavation below the level of the base or footing of any foundation or retaining wall unless (1) a support system such as underpinning is provided, (2) the excavation is in stable rock, or (3) a registered professional engineer determines that the structure is sufficiently removed from the excavation and that excavation will not pose a hazard to employees. Excavations under sidewalks and pavements are also prohibited unless an appropriately designed support system is provided or another effective method is used.

The standard requires the following procedures for the protection of employees when installing support systems:

- Securely connect members of support systems,
- Safely install support systems,
- Never overload members of support systems, and
- Install other structural members to carry loads imposed on the support system when temporary removal of individual members is necessary.

In addition, the standard permits excavation of 2 feet or less below the bottom of the members of a support or shield system of a trench if (1) the system is designed to resist the forces calculated for the full depth of the trench, and (2) there are no indications, while the trench is open, of a possible cave-in below the bottom of the support system. Also, the installation of support systems must be closely coordinated with the excavation of trenches. As soon as work is completed, the excavation should be back-filled as the protective system is dismantled. After the excavation has been cleared, workers should slowly remove the protective system from the bottom up, taking care to release members slowly.

OSHA requires the employer to take the following precautions:

- Keep materials or equipment that might fall or roll into an excavation at least 2 feet from the edge of excavations, or have retaining devices, or both.
- Provide warning systems such as mobile equipment, barricades, hand or mechanical signals, or stop logs, to alert operators of the edge of an excavation. If possible, keep the grade away from the excavation.
- Provide scaling to remove loose rock or soil or install protective barricades and other equivalent protection to protect employees against falling rock, soil, or materials.
- Prohibit employees from working on faces of sloped or benched excavations at levels above other employees unless employees at lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.
- Prohibit employees under loads that are handled by lifting or digging equipment. To avoid being struck by any spillage or falling materials, require employees to stand away from vehicles being loaded or unloaded. If cabs of vehicles provide adequate protection from falling loads during loading and unloading operations, the operators may remain in them.

**Water Accumulation** - The standard prohibits employees from working in excavations where water has accumulated or is accumulating unless adequate protection has been taken. If water removal equipment is used to control or prevent water from accumulating, the equipment and operations of the equipment must be monitored by a competent person to ensure proper use. OSHA standards also require that diversion ditches, dikes, or other suitable means be used to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Also, a competent person must inspect excavations subject to runoffs from heavy rains.

**Hazardous Atmospheres** - Under this provision, a competent person must test excavations greater than 4 feet in depth as well as ones where oxygen deficiency or a hazardous atmosphere exists or could reasonably be expected to exist, before an employee enters the excavation. If hazardous conditions exist, controls such as proper respiratory protection or ventilation must be provided. Also, controls used to reduce atmospheric contaminants to acceptable levels must be tested regularly. Where adverse atmospheric conditions may exist or develop in an excavation, the employer also must provide and ensure that emergency rescue equipment, (e.g., breathing apparatus, a safety harness and line, basket stretcher, etc.) is readily available. This equipment must be attended when used. When an employee enters bell-bottom pier holes and similar deep and confined footing excavations, the employee must wear a harness with a lifeline. The lifeline must be securely attached to the harness and must be separate from any line used to handle materials. Also, while the employee wearing the lifeline is in the excavation, an observer must be present to ensure that the lifeline is working properly and to maintain communication with the employee.

**Access and Egress** - Under the standard, the employer must provide safe access and egress to all excavations. According to OSHA regulations, when employees are required to be in trench excavations 4-feet deep or more, adequate means of exit, such as ladders, steps, ramps or other safe means of egress, must be provided and be within 25 feet of lateral travel. If structural ramps are used as a means of access or egress, they must be designed by a competent person if used for employee access or egress, or a competent person qualified in structural design if used by vehicles. Also, structural members used for ramps or runways must be uniform in thickness and joined in a manner to prevent tripping or displacement.

## **CONCRETE AND MASONRY CONSTRUCTION – 1926.700 thru 706**

**Construction Loads** - Employers must not place construction loads on a concrete structure or portion of a concrete structure unless the employer determines, based on information received from a person who is qualified in structural design, that the structure or portion of the structure is capable of supporting the intended loads.

**Reinforcing Steel** - All protruding reinforcing steel, onto and into which employees could fall, must be guarded to eliminate the hazard of impalement.

**Post-Tensioning Operations** - Employees (except those essential to the post-tensioning operations) must not be permitted to be behind the jack during tensioning operations. Signs and barriers must be erected to limit employee access to the post-tensioning area during tensioning operations.

**Concrete Buckets** - Employees must not be permitted to ride concrete buckets.

**Working Under Loads** - Employees must not be permitted to work under concrete buckets while the buckets are being elevated or lowered into position. To the extent practicable, elevated concrete buckets must be routed so that no employee or the fewest employees possible are exposed to the hazards associated with falling concrete buckets.

**Personal Protective Equipment - Employees** must not be permitted to apply a cement, sand, and water mixture through a pneumatic hose unless they are wearing protective head and face equipment.

Employees must not be permitted to place or tie reinforcing steel more than 6 feet above any adjacent working surfaces unless they are protected by the use of a safety belt or equivalent fall protection meeting the criteria in OSHA standards on Personal Protective and Life Saving Equipment ([29 CFR 1926 Subpart E](#)).

### **CAST-IN-PLACE CONCRETE**

Formwork must be designed, fabricated, erected, supported, braced, and maintained so that it will be capable of supporting without failure all vertical and lateral loads that might be applied to the formwork. All shoring equipment (including equipment used in reshoring operations) must be inspected prior to erection to determine that the equipment meets the requirements specified in the formwork drawings.

Erected shoring equipment must be inspected immediately prior to, during, and immediately after concrete placement. Shoring equipment that is found to be damaged or weakened after erection must be immediately reinforced.

- Designed by a qualified designer and the erected shoring must be inspected by an engineer qualified in structural design,
- Vertically aligned,
- Spliced to prevent misalignment, and
- Adequately braced in two mutually perpendicular directions at the splice level. Each tier also must be diagonally braced in the same two directions.

Adjustment of single-post shores to raise formwork must not be made after the placement of concrete. Reshoring must be erected, as the original forms and shores are removed, whenever the concrete is required to support loads in excess of its capacity.

**Vertical Slip Forms** - The steel rods or pipes on which jacks climb or by which the forms are lifted must be (1) specifically designed for that purpose and (2) adequately braced where not encased in concrete. Forms must be designed to prevent excessive distortion of the structure during the jacking operation. Jacks and vertical supports must be positioned in such a manner that the loads do not exceed the rated capacity of the jacks. The jacks or other lifting devices must be provided with mechanical dogs or other automatic holding devices to support the slip forms whenever failure of the power supply or lifting mechanisms occurs. The form structure must be maintained within all design tolerances specified for plumpness during the jacking operation. The predetermined safe rate of lift must not be exceeded. All vertical slip forms must be provided with scaffolds or work platforms where employees are required to work or pass.

**Reinforcing Steel** - Reinforcing steel for walls, piers, columns, and similar vertical structures must be adequately supported to prevent overturning and collapse. Employers must take measures to prevent unrolled wire mesh from recoiling. Such measures may include, but are not limited to, securing each end of the roll or turning over the roll.

**Precast Concrete** - Precast concrete wall units, structural framing, and tilt-up wall panels must be adequately supported to prevent overturning and to prevent collapse until permanent connections are completed. Lifting inserts that are embedded or otherwise attached to tilt-up wall panels must be capable of supporting at least two times the maximum intended load applied or transmitted to them; lifting inserts for other precast members must be capable of supporting four times the load. Only essential employees are permitted under precast concrete that is being lifted or tilted into position.

### **Lift-Slab Operations**

- Lift-slab operations must be designed and planned by a registered professional engineer who has experience in lift-slab construction. Such plans and designs must be implemented by the employer and must include detailed instructions and sketches indicating the prescribed method of erection. The plans and designs must also include provisions for ensuring lateral stability of the building/structure during construction.
- Jacking equipment must be capable of supporting at least two and one-half times the load being lifted during jacking operations and the equipment must not be overloaded. For the purpose of this provision, jacking equipment includes any load bearing component that is used to carry out the lifting operation(s). Such equipment includes, but is not

limited to, the following: threaded rods, lifting attachments, lifting nuts, hook-up collars, T-caps, shear heads, columns, and footings.

- No employee, except those essential to the jacking operation, must be permitted in the building/structure while any jacking operation is taking place unless the building/structure has been reinforced sufficiently to ensure its integrity during erection. The phrase "reinforced sufficiently to ensure its integrity" used in this paragraph means that a registered professional engineer, independent of the engineer who designed and planned the lifting operation, has determined from the plans that if there is a loss of support at any jack location, that loss will be confined to that location and the structure as a whole will remain stable.
- Under no circumstances must any employee who is not essential to the jacking operation be permitted immediately beneath a slab while it is being lifted.

### **Masonry Construction**

- Equal to the height of the wall to be constructed plus 4 feet, and shall run the entire length of the wall;
- On the side of the wall that will be un-scaffolded;
- Restricted to entry only by employees actively engaged in constructing the wall; and
- Kept in place until the wall is adequately supported to prevent overturning and collapse unless the height of wall is more than 8 feet and unsupported; in which case, it must be braced. The bracing must remain in place until permanent supporting elements of the

### **STEEL ERECTION – 1926.750 and 1926.751**

**Permanent Flooring - Skeleton Steel Construction in Tiered Buildings** - The permanent floors shall be installed as the erection of structural member's progresses, and there shall be not more than eight stories between the erection floor and the uppermost permanent floor, except where the structural integrity is maintained as a result of the design. At no time shall there be more than four floors or 48 feet of unfinished bolting or welding above the foundation or uppermost permanently secured floor.

**Temporary Flooring - Skeleton Steel Construction in Tiered Buildings** - The derrick or erection floor shall be solidly planked or decked over its entire surface except for access openings. Planking or decking of equivalent strength, shall be of proper thickness to carry the working load. Planking shall not be less than 2 inches thick full size undressed, and shall be laid tight and secured to prevent movement. On buildings or structures not adaptable to temporary floors, and where scaffolds are not used, safety nets shall be installed and maintained whenever the potential fall distance exceeds two stories or 25 feet. The nets shall be hung with sufficient clearance to prevent contacts with the surface of structures below. A safety railing of ½-inch wire rope or equal shall be installed, approximately 42 inches high, around the periphery of all temporary-planked or temporary metal-decked floors of tier buildings and other multi-floored structures during structural steel assembly.

When skeleton steel erection is being done, a tightly planked and substantial floor shall be maintained within two stories or 30 feet, whichever is less, below and directly under that portion of each tier of beams on which any work is being performed, except when gathering and stacking temporary floor planks on a lower floor, in preparation for transferring such planks for use on an upper floor. Where such a floor is not practicable, paragraph (b)(1)(ii) of this section applies. *Paragraph (b)(1)(ii):* On buildings or structures not adaptable to temporary floors, and where scaffolds are not used, safety nets shall be installed and maintained whenever the potential fall distance exceeds two stories or 25 feet. The nets shall be hung with sufficient clearance to prevent contacts with the surface of structures below. When gathering and stacking temporary floor planks, the planks shall be removed successively, working toward the last panel of the temporary floor so that the work is always done from the planked floor. When gathering and stacking temporary floor planks from the last panel, the employees assigned to such work shall be protected by safety belts with safety lines attached to a catenary line or other substantial anchorage.

**Flooring - Other Construction** - In the erection of a building having double wood floor construction, the rough flooring shall be completed as the building progresses, including the tier below the one on which floor joists are being installed. For single wood floor or other flooring systems, the floor immediately below the story where the floor joists are being installed shall be kept planked or decked over.

### **Structural Steel Assembly**

- During the final placing of solid web structural members, the load shall not be released from the hoisting line until the members are secured with not less than two bolts, or the equivalent at each connection and drawn up wrench tight.

- Open web steel joists shall not be placed on any structural steel framework unless such framework is safely bolted or welded.
- In steel framing, where bar joists are utilized, and columns are not framed in at least two directions with structural steel members, a bar joist shall be field-bolted at columns to provide lateral stability during construction.
- Where long span joists or trusses, 40 feet or longer, are used, a center row of bolted bridging shall be installed to provide lateral stability during construction prior to slacking of hoisting line.
- No load shall be placed on open web steel joists until these security requirements are met.
- Tag lines shall be used for controlling loads.

#### **BOLTING, RIVETING, FITTING-UP, AND PLUMBING-UP - §1926.752**

- Containers shall be provided for storing or carrying rivets, bolts, and drift pins, and secured against accidental displacement when aloft.
- Pneumatic hand tools shall be disconnected from the power source, and pressure in hose lines shall be released, before any adjustments or repairs are made.
- Airline hose sections shall be tied together except when quick disconnect couplers are used to join sections.
- Eye protection shall be worn.

##### **Bolting**

- When bolts or drift pins are being knocked out, means shall be provided to keep them from falling.
- Impact wrenches shall be provided with a locking device for retaining the socket.

##### **Riveting**

- Riveting shall not be done in the vicinity of combustible material unless precautions are taken to prevent fire.
- When rivet heads are knocked off, or backed out, means shall be provided to keep them from falling.
- A safety wire shall be properly installed on the snap and on the handle of the pneumatic riveting hammer and shall be used at all times. The wire size shall not be less than No. 9 (B&S gauge), leaving the handle and annealed No. 14 on the snap, or equivalent.

##### **Plumbing-Up**

- Connections of the equipment used in plumbing-up shall be properly secured.
- The turnbuckles shall be secured to prevent unwinding while under stress.
- Plumbing-up guy's related equipment shall be placed so that employees can get at the connection points.
- Plumbing-up guys shall be removed only under the supervision of a competent person.

##### **Miscellaneous Requirements**

- Wood planking shall be of proper thickness to carry the working load, but shall be not less than 2 inches thick full size undressed, exterior grade plywood, at least ¾-inch thick, or equivalent material.
- Metal decking of sufficient strength shall be laid tight and secured to prevent movement.
- Planks shall overlap the bearing on each end by a minimum of 12 inches.
- Wire mesh, exterior plywood, or equivalent, shall be used around columns where planks do not fit tightly.
- Provisions shall be made to secure temporary flooring against displacement.
- All unused openings in floors, temporary or permanent, shall be completely planked over or guarded
- Employees shall wear safety belts..

#### **UNDERGROUND CONSTRUCTION (TUNNELING)**



A "competent person" is one who is capable of identifying existing and predictable hazards in the workplace and is authorized to take corrective action to eliminate them [29 CFR 1926.32 (f)]. Under the standard, a competent person is responsible for determining whether air contaminants are present in sufficient quantities to be dangerous to life; for testing the atmosphere for flammable limits before restoring power and equipment and before returning to work after a ventilation system has been shut down due to hazardous levels of flammable gas or methane; for inspecting the work area for ground stability; for inspecting all drilling equipment prior to each use; and for inspecting hauling equipment before each shift and visually checking all hoisting machinery, equipment, anchorages, and rope at the beginning of each shift and during hoisting, as necessary.

The standard requires that employees be taught to recognize and avoid hazards associated with underground construction. The instruction shall include the following topics, as appropriate for the jobsite:

- air monitoring
- ventilation and illumination
- communications
- flood control
- mechanical and personal protective equipment
- explosives; fire prevention and protection
- Emergency procedures - evacuation plans and check-in and check-out procedures.

**Access and Egress** - Under this provision, the employer must provide safe access to and egress from all work stations and must prevent any unauthorized entry underground. Completed or unused sections of an underground work area must be barricaded. Unused openings must be covered, fenced off, or posted with warning signs indicating "Keep Out," or other similar language.

**Check-in/Check-out** - The employer is required to maintain a check-in/check-out procedure that insures that aboveground personnel can have an accurate count of the number of persons underground in an emergency. At least one designated person is to be on duty aboveground whenever anyone is working underground. This person is also responsible for securing immediate aid for and keeping an accurate count of employees underground in case of an emergency. A check-in/check-out procedure is not required, however, when the underground construction is sufficiently completed so that permanent environmental controls are effective and when remaining construction activity will not cause an environmental hazard or structural failure of the construction.

**Potentially Gassy Operations** - Potentially gassy operations occur under either of the following circumstances:

- When air monitoring shows, for more than a 24-hour period, 10 percent or more of the lower explosive limit (LEL) for methane or other flammable gases measured at 12 inches 1 0.25 inch from the roof, face, floor, or walls in any underground work area; or
- When the geological formation or history of the area shows that 10 percent or more of the LEL for methane or other flammable gases is likely to be encountered in the underground operation.

**Gassy Operations** - Gassy operations occur under the following conditions:

- When air monitoring shows, for 3 consecutive days, 10 percent or more of the LEL for methane or other flammable gases measured at 12 inches 1 0.25 inch from the roof, face, floor, or walls in any underground work area; or
- When methane or other flammable gases mandating from the strata have ignited, indicating the presence of such gases; or
- When the underground operation is connected to a currently gassy underground work area and is subject to a continuous course of air containing a flammable gas concentration.

When a gassy operation exists, additional safety precautions are required. These include using more stringent ventilation requirements; using diesel equipment only if it is approved for use in gassy operations; posting each entrance with warning signs, prohibiting smoking and personal sources of ignition, maintaining a fire watch when hot work is performed, and suspending all operations in the affected area until all special requirements are met or the operation is declassified. Additional air monitoring is also required during gassy conditions.

**Air Monitoring** - Under the standard, the employer is required to assign a competent person to perform all air monitoring required to determine proper ventilation and quantitative measurements of potentially hazardous gases. In instances where monitoring of airborne contaminants is required by the standard to be conducted "as often as necessary," this individual is responsible for determining which substances to monitor and how frequently, taking into consideration factors such as jobsite location, geology, history, work practices, and conditions. The atmosphere in all underground areas shall be tested quantitatively for carbon monoxide, nitrogen dioxide, hydrogen sulfide, and other toxic gases, dusts, vapors, mists, and fumes as often as necessary to ensure that prescribed limits (29 CFR 1926.55) are met. Quantitative tests for methane shall also be performed in order to determine whether an operation is gassy or potentially gassy and in order to comply with other sections of the standard [(j) (1) vii, viii, ix]. A record of all air quality tests (including location, date, time, substances, and amount monitored) is to be kept aboveground at the worksite and shall be made available to the Secretary of Labor upon request.

**Oxygen** - Testing is to be performed as often as necessary to assure that the atmosphere at normal atmospheric pressure contains at least 19.5 percent oxygen, but not more than 22 percent.

**Hydrogen Sulfide** - When air monitoring indicates the presence of 5 parts per million (ppm) or more of hydrogen sulfide, testing is to be conducted in the affected area at the beginning and midpoint of each shift until the concentration of hydrogen sulfide has been less than 5 ppm for 3 consecutive days. Continuous monitoring shall be performed when hydrogen sulfide is present above 10 ppm. Employees must be notified when the concentration of hydrogen sulfide is above 10 ppm. At concentrations of 20 ppm, an alarm (visual and aural) must signal to indicate that additional measures might be required (e.g., respirators, increased ventilation, evacuation) to maintain the proper exposure levels.

**Ventilation** - There are a number of requirements for ventilation in underground construction activities. In general, fresh air must be supplied to all underground work areas in sufficient amounts to prevent any dangerous or harmful accumulation of dusts, fumes, mists, vapors, or gases. A minimum of 200 cubic feet of fresh air per minute is to be supplied for each employee underground. Mechanical ventilation, with reversible airflow, is to be provided in all of these work areas, except where natural ventilation is demonstrably sufficient. Where blasting or drilling is performed or other types of work operations that may cause harmful amounts of dust, fumes, vapors, etc., the velocity of airflow must be at least 30 feet per minute. For gassy or potentially gassy operations, ventilation systems must meet additional requirements. Ventilation systems used during gassy operations also must have controls located aboveground for reversing airflow.

**Illumination** - As in all construction operations, the standard requires that proper illumination be provided during tunneling operations, as specified in 29 CFR 1926.56. When explosives are handled, only acceptable portable lighting equipment shall be used within 50 feet of any underground heading.

**Fire Prevention and Control** - In addition to the requirements of Subpart F, "Fire Protection and Prevention" (29 CFR 1926), open flames and fires are prohibited in all underground construction activities, except for hot work operations. Smoking is allowed only in areas free of fire and explosion hazards, and the employer is required to post signs prohibiting smoking and open flames where these hazards exist. Various work practices are also identified as preventive measures. For example, there are limitations on the piping of diesel fuel from the surface to an underground location. Also, the pipe or hose system used to transfer fuel from the surface to the storage tank must remain empty except when transferring the fuel. Gasoline is not to be used, stored, or carried underground. Gasses such as acetylene, liquefied petroleum, and methyl acetylene prop diene (stabilized) may be used underground only for hot work operations. Leaks and spills of flammable or combustible fluids must be cleaned up immediately. The standard also requires fire prevention measures regarding fire-resistant barriers, fire-resistant hydraulic fluids, the location and storage of combustible materials near openings or access to underground operations, electrical installations underground, lighting fixtures, fire extinguishers, etc.

**Hot Work** - During hot work operations such as welding, noncombustible barriers must be installed below work being performed in or over a shaft or raise. As mentioned earlier, during these operations, only the amount of fuel gas and oxygen cylinders necessary to perform welding, cutting or other hot work over the next 24-hour period shall be kept underground. When work is completed, gas and oxygen cylinders shall be removed.

**Cranes and Hoists** - The standard contains provisions applicable to hoisting that are unique to underground construction. The standard incorporates by reference 1925.550 with respect to cranes; 1925.550(g) with respect to crane-hoisting of personnel, except that the limitations in paragraph (g)(2) do not apply to the routine access of employees to the underground via a shaft; 1926.552(a) and (b) with respect to requirements for material hoists and 1926.552(a), (c) and (d) with respect to requirements of personnel hoists and elevators. The provisions for underground construction include the following:

- Securing or stacking materials, tools, etc. being raised or lowered in a way to prevent the load from shifting or snagging, or from falling into the shaft.
- Using a flashing warning light for employees at the shaft bottom and subsurface shaft entrances whenever a load is above these locations or is being moved in the shaft.
- Following procedures for the proper lowering of loads when a hoist way is not fully enclosed and employees are at the shaft bottom.
- Informing and instructing employees of maintenance and repair work that is to commence in a shaft served by a cage, skip, or bucket.
- Providing a warning sign at the shaft collar, at the operator's station, and at each underground landing for work being performed in the shaft.
- Using connections between the hoisting rope and cage or skip that are compatible with the wire rope used for hoisting.
- Using cage, skip and load connections that will not disengage from the force of the hoist pull, vibration, misalignment, release of lift force, or impact.
- Maintaining spin-type connections in a clean condition.
- Assuring that wire rope wedge sockets, when used, are properly seated.

Additional requirements for cranes include the use of limit switches, or anti-two-block devices. These operational aids are to be used only to limit travel of loads when operational controls malfunction and not as a substitute for other operational controls.

**Emergencies** - At work sites where 25 or more employees work underground at one time, employers are required to provide rescue teams or rescue services that include at least two 5-person teams (one on the jobsite or within one-half hour travel time and one within 2 hours travel time). Where there are fewer than 25 employees underground at one time, the employer shall provide or make available in advance one 5-person rescue team on site or within one-half hour travel time. Rescue team members have to be qualified in rescue procedures and in the use of firefighting equipment and breathing apparatus. Their qualifications must be reviewed annually. The employer must ensure that rescue teams are familiar with the jobsite conditions. Rescue team members are required to practice donning and using self-contained breathing apparatus on a monthly basis for jobsites where flammable or noxious gases are encountered or anticipated in hazardous quantities. As part of emergency procedures, the employer shall provide self-rescuers (currently approved by NIOSH and MSHA) to be immediately available to all employees at underground work stations who might be trapped by smoke or gas. The selection, use, and care of respirators shall be in accordance with 1926.103 (b) and (c). A "designated," or authorized, person shall be responsible for securing immediate aid for workers and for keeping an accurate count of employees underground. Emergency lighting, a portable hand or cap lamp, shall be provided to all underground workers in their work areas to provide adequate light for escape.

**Recordkeeping** - Under OSHA standard 29 CFR 1910.20, records of exposure to toxic substances and data analyses based on these records are to be kept for 30 years. Medical records are to be kept for at least the duration of employment plus 30 years. Background data for exposure records such as laboratory reports and work sheets need to be kept only for 1 year. Records of employees who have worked for less than 1 year need not be retained after employment, but the employer must provide these records to the employee upon termination of employment. First-aid records of one-time treatment need not be retained for any specified period.

## **DEMOLITION**

Prior to starting all demolition operations, OSHA Standard 1926.850(a) requires that an engineering survey of the structure must be conducted by a competent person. The purpose of this survey is to determine the condition of the framing, floors, and walls so that measures can be taken, if necessary, to prevent the premature collapse of any portion of the structure. When indicated as advisable, any adjacent structure(s) or improvements should also be similarly checked. The demolition contractor must maintain a written copy of this survey. Photographing existing damage in neighboring structures is also advisable.

**Utility Location** - One of the most important elements of the pre-job planning is the location of all utility services. All electric, gas, water, steam, sewer, and other services lines should be shut off, capped, or otherwise controlled, at or outside the building before demolition work is started. In each case, any utility company which is involved should be notified in advance, and its approval or services, if necessary, shall be obtained.

A "**fire plan**" should be set up prior to beginning a demolition job. This plan should outline the assignments of key personnel in

the event of a fire and provide an evacuation plan for workers on the site.

#### **TOOLS AND PROTECTIVE EQUIPMENT - §1926.951**

**Personal Climbing Equipment** - Body belts with straps or lanyards shall be worn to protect employees working at elevated locations on poles, towers, or other structures except where such use creates a greater hazard to the safety of the employees, in which case other safeguards shall be employed. Body belts and safety straps shall meet the requirements of §1926.959. In addition to being used as an employee safeguarding item, body belts with approved tool loops may be used for the purpose of holding tools. Body belts shall be free from additional metal hooks and tool loops other than those permitted in §1926.959. Body belts and straps shall be inspected before use and each day to determine that they are in safe working condition. Life lines and lanyards shall comply with the provisions of §1926.104. Safety lines are not intended to be subjected to shock loading and are used for emergency rescue such as lowering a person to the ground. Such safety lines shall be a minimum of 1/2-inch diameter and three or four strand first-grade manila or its equivalent in strength (2,650 lb.) and durability. Defective ropes shall be replaced.

**Ladders** - Portable metal or conductive ladders shall not be used near energized lines or equipment except as may be necessary in specialized work such as in high voltage substations where nonconductive ladders might present a greater hazard than conductive ladders. Conductive or metal ladders shall be prominently marked as conductive and all necessary precautions shall be taken when used in specialized work. Hook or other type ladders used in structures shall be positively secured to prevent the ladder from being accidentally displaced.

**Live-Line Tools** - Only live-line tool poles having a manufacturer's certification to withstand the following minimum tests shall be used:

- 100,000 volts per foot of length for 5 minutes when the tool is made of fiberglass; or
- 75,000 volts per foot of length for 3 minutes when the tool is made of wood; or
- Other tests equivalent to these tests as appropriate.

All live-line tools shall be visually inspected before use each day. Tools to be used shall be wiped clean and if any hazardous defects are indicated, removed from service.

**Measuring Tapes or Measuring Ropes** - Measuring tapes or measuring ropes which are metal or contain conductive strands shall not be used when working on or near energized parts.

**Hand Tools** - Switches for all powered hand tools shall comply with §1926.300(d). All portable electric hand tools shall:

- Be equipped with three-wire cord having the ground wire permanently connected to the tool frame and means for grounding the other end; or
- Be of the double insulated type and permanently labeled as "Double Insulated"; or
- Be connected to the power supply by means of an isolating transformer, or other isolated power supply.

All hydraulic tools which are used on or around energized lines or equipment shall use no conducting hoses having adequate strength for the normal operating pressures. It should be noted that the provisions of §1926.302(d)(2) shall also apply. All pneumatic tools which are used on or around energized lines or equipment shall:

- Have no conducting hoses having adequate strength for the normal operating pressures, and
- Have an accumulator on the compressor to collect moisture.

#### **MATERIAL HANDLING - §1926.953**

**Unloading** - Prior to unloading steel, poles, cross arms and similar material, the load shall be thoroughly examined to ascertain if the load has shifted, binders or stakes have broken or the load is otherwise hazardous to employees.

**Pole Hauling** - During pole hauling operations, all loads shall be secured to prevent displacement and a red flag shall be

displayed at the trailing end of the longest pole. Precautions shall be exercised to prevent blocking of roadways or endangering other traffic. When hauling poles during the hours of darkness, illuminated warning devices shall be attached to the trailing end of the longest pole.

**Storage** - No materials or equipment shall be stored under energized bus, energized lines, or near energized equipment, if it is practical to store them elsewhere. When materials or equipment are stored under energized lines or near energized equipment, applicable clearances shall be maintained as stated in Table V-1; and extraordinary caution shall be exercised when moving materials near such energized equipment.

**Tag Line** - Where hazards to employees exist, tag lines or other suitable devices shall be used to control loads being handled by hoisting equipment.

**Oil Filled Equipment** - During construction or repair of oil filled equipment, the oil may be stored in temporary containers other than those required in §1926.152, such as pillow tanks.

**Framing** - During framing operations, employees shall not work under a pole or a structure suspended by a crane, A-frame or similar equipment unless the pole or structure is adequately supported.

**Attaching the Load** - The hoist rope shall not be wrapped around the load. This provision shall not apply to electric construction crews when setting or removing poles.

#### **GROUNDING FOR PROTECTION OF EMPLOYEES - §1926.954**

All conductors and equipment shall be treated as energized until tested or otherwise determined to be de-energized or until grounded.

New lines or equipment may be considered de-energized and worked as such where:

- The lines or equipment are grounded, or
- The hazard of induced voltages is not present, and adequate clearances or other means are implemented to prevent contact with energized lines or equipment and the new lines or equipment.

**Communication Conductors** - Bare wire communication conductors on power poles or structures shall be treated as energized lines unless protected by insulating materials.

**Voltage Testing** - DE energized conductors and equipment which are to be grounded shall be tested for voltage. The results of this test shall determine the subsequent procedures as required in §1926.950(d).

**Attaching Grounds** - When attaching grounds, the ground end shall be attached first, and the other end shall be attached and removed by means of insulated tools or other suitable devices. When removing grounds, the grounding device shall first be removed from the line or equipment using insulating tools or other suitable devices.

**Grounds Placement** - Grounds shall be placed between the work location and all sources of energy and as close as practicable to the work location, or grounds shall be placed at the work location. If work is to be performed at more than one location in a line section, the line section must be grounded and short circuited at one location in the line section and the conductor to be worked on shall be grounded at each work location. The minimum distance shown in Table V-1 shall be maintained from ungrounded conductors at the work location. Where the making of a ground is impracticable, or the conditions resulting would be more hazardous than working on the lines or equipment without grounding, the grounds may be omitted and the line or equipment worked as energized.

**Testing Without Grounds** - Grounds may be temporarily removed only when necessary for test purposes and extreme caution shall be exercised during the test procedures.

**Grounding Electrode** - When grounding electrodes are utilized, such electrodes shall have a resistance to ground low enough to remove the danger of harm to personnel or permit prompt operation of protective devices.

**Grounding to Tower** - Grounding to tower shall be made with a tower clamp capable of conducting the anticipated fault

current.

**Ground Lead** - A ground lead, to be attached to either a tower ground or driven ground, shall be capable of conducting the anticipated fault current and have a minimum conductance of No. 2 AWG copper.

#### **OVERHEAD LINES - §1926.955**

When working on or with overhead lines, the following provisions shall be complied with:

- Prior to climbing poles, ladders, scaffolds, or other elevated structures, an inspection shall be made to determine that the structures are capable of sustaining the additional or unbalanced stresses to which they will be subjected.
- Where poles or structures may be unsafe for climbing, they shall not be climbed until made safe by guying, bracing, or other adequate means.
- Before installing or removing wire or cable, strains to which poles and structures will be subjected shall be considered and necessary action taken to prevent failure of supporting structures.
- When setting, moving, or removing poles using cranes, derricks, gin poles, A-frames, or other mechanized equipment near energized lines or equipment, precautions shall be taken to avoid contact with energized lines or equipment, except in bare-hand live-line work, or where barriers or protective devices are used.
- Equipment and machinery operating adjacent to energized lines or equipment shall comply with §1926.952(c)(2).
- Unless using suitable protective equipment for the voltage involved, employees standing on the ground shall avoid contacting equipment or machinery working adjacent to energized lines or equipment.
- Lifting equipment shall be bonded to an effective ground or it shall be considered energized and barricaded when utilized near energized equipment or lines.
- Pole holes shall not be left unattended or unguarded in areas where employees are currently working.
- Tag lines shall be of a nonconductive type when used near energized lines.

#### **STAIRWAYS AND LADDERS – 1926.1050 thru 1926.1060**

- A stairway or ladder must be provided at all worker points of access where there is a break in elevation of 19 inches (48 cm) or more and no ramp, runway, embankment, or personnel hoist is provided.
- When there is only one point of access between levels, it must be kept clear to permit free passage by workers. If free passage becomes restricted, a second point of access must be provided and used.
- When there are more than two points of access between levels, at least one point of access must be kept clear.
- All stairway and ladder fall protection systems required by these rules must be installed and all duties required by the stairway and ladder rules must be performed before employees begin work that requires them to use stairways or ladders and their respective fall protection systems.

#### **Stairways**

The following general requirements apply to all stairways used during the process of construction, as indicated:

- Stairways that will not be a permanent part of the structure on which construction work is performed must have landings at least 30 inches deep and 22 inches wide (76 x 56 cm) at every 12 feet (3.7 m) or less of vertical rise.
- Stairways must be installed at least 30 degrees, and no more than 50 degrees, from the horizontal.
- Variations in riser height or stair tread depth must not exceed 1/4 inch in any stairway system, including any foundation structure used as one or more treads of the stairs.
- Where doors or gates open directly onto a stairway, a platform must be provided that is at least 20 inches (51 cm) in width beyond the swing of the door.
- Metal pan landings and metal pan treads must be secured in place before filling.
- All stairway parts must be free of dangerous projections such as protruding nails.
- Slippery conditions on stairways must be corrected.
- Spiral stairways that will not be a permanent part of the structure may not be used by workers.

The following requirements apply to stairs in temporary service during construction:

- Except during construction of the actual stairway, stairways with metal pan landings and treads must not be used where the treads and/or landings have not been filled in with concrete or other material, unless the pans of the stairs and/or landings are temporarily filled in with wood or other material. All treads and landings must be replaced when worn below the top edge of the pan.
- Except during construction of the actual stairway, skeleton metal frame structures and steps must not be used (where treads and/or landings are to be installed at a later date) unless the stairs are fitted with secured temporary treads and landings.
- Temporary treads must be made of wood or other solid material and installed the full width and depth of the stair.

### **STAIR RAILS AND HANDRAILS**

The following general requirements apply to all stair rails and handrails:

- Stairways having four or more risers, or rising more than 30 inches (76 cm) in height, whichever is less, must have at least one handrail. A stair rail also must be installed along each unprotected side or edge. When the top edge of a stair rail system also serves as a handrail, the height of the top edge must not be more than 37 inches (94 cm) nor less than 36 inches (91.5 cm) from the upper surface of the stair rail to the surface of the tread.
- Winding or spiral stairways must be equipped with a handrail to prevent using areas where the tread width is less than 6 inches (15 cm).
- Stair rails installed after March 15, 1991, must not be less than 36 inches (91.5 cm) in height.
- Midrails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members must be provided between the top rail and stairway steps of the stair rail system.
- Midrails, when used, must be located midway between the top of the stair rail system and the stairway steps.
- Screens or mesh, when used, must extend from the top rail to the stairway step, and along the opening between top rail supports.
- Intermediate vertical members, such as balusters, when used, must not be more than 19 inches (48 cm) apart.
- Other intermediate structural members, when used, must be installed so that there are no openings of more than 19 inches (48 cm) wide.
- Handrails and the top rails of the stair rail systems must be capable of withstanding, without failure, at least 200 pounds (890 n) of weight applied within 2 inches (5 cm) of the top edge in any downward or outward direction, at any point along the top edge.
- The height of handrails must not be more than 37 inches (94 cm) nor less than 30 inches (76 cm) from the upper surface of the handrail to the surface of the tread.
- The height of the top edge of a stair rail system used as a handrail must not be more than 37 inches (94 cm) nor less than 36 inches (91.5 cm)<sup>1</sup> from the upper surface of the stair rail system to the surface of the tread.
- Stair rail systems and handrails must be surfaced to prevent injuries such as punctures or lacerations and to keep clothing from snagging.
- Handrails must provide an adequate handhold for employees to grasp to prevent falls.
- The ends of stair rail systems and handrails must be constructed to prevent dangerous projections such as rails protruding beyond the end posts of the system.
- Temporary handrails must have a minimum clearance of 3 inches (8 cm) between the handrail and walls, stair rails systems, and other objects.
- Unprotected sides and edges of stairway landings must be provided with standard 44-inch (1.1 m) guardrail systems.

### **LADDERS**

The following general requirements apply to all ladders, including job-made ladders:

- A double-cleared ladder or two or more ladders must be provided when ladders are the only way to enter or exit a work area having 25 or more employees, or when a ladder serves simultaneous two-way traffic.
- Ladder rungs, cleats, and steps must be parallel, level, and uniformly spaced when the ladder is in position for use.

- Rungs, cleats, and steps of portable and fixed ladders (except as provided below) must not be spaced less than 10 inches (25 cm) apart, nor more than 14 inches (36 cm) apart, along the ladder's side rails.
- Rungs, cleats, and steps of step stools must not be less than 8 inches (20 cm) apart, nor more than 12 inches (31 cm) apart, between center lines of the rungs, cleats, and steps.
- Rungs, cleats, and steps at the base section of extension trestle ladders must not be less than 8 inches (20 cm) nor more than 18 inches (46 cm) apart, between center lines of the rungs, cleats, and steps. The rung spacing on the extension section must not be less than 6 inches (15 cm) nor more than 12 inches (31 cm).
- Ladders must not be tied or fastened together to create longer sections unless they are specifically designed for such use.
- A metal spreader or locking device must be provided on each stepladder to hold the front and back sections in an open position when the ladder is being used.
- When splicing side rails, the resulting side rail must be equivalent in strength to a one-piece side rail made of the same material.
- Two or more separate ladders used to reach an elevated work area must be offset with a platform or landing between the ladders, except when portable ladders are used to gain access to fixed ladders.
- Ladder components must be surfaced to prevent injury from punctures or lacerations, and prevent snagging of clothing.
- Wood ladders must not be coated with any opaque covering, except for identification or warning labels which may be placed only on one face of a side rail.

#### **Portable Ladders**

- Non-self-supporting and self-supporting portable ladders must support at least four times the maximum intended load; extra heavy-duty type 1A metal or plastic ladders must sustain 3.3 times the maximum intended load. The ability of a self-supporting ladder to sustain loads must be determined by applying the load to the ladder in a downward vertical direction. The ability of a non-self-supporting ladder to sustain loads must be determined by applying the load in a downward vertical direction when the ladder is placed at a horizontal angle of 75.5 degrees.
- The minimum clear distance between side rails for all portable ladders must be 11.5 inches (29 cm).
- The rungs and steps of portable metal ladders must be corrugated, knurled, dimpled, coated with skid-resistant material, or treated to minimize slipping.

#### **Fixed Ladders**

- A fixed ladder must be capable of supporting at least two loads of 250 pounds (114 kg) each, concentrated between any two consecutive attachments. Fixed ladders also must support added anticipated loads caused by ice buildup, winds, rigging, and impact loads resulting from the use of ladder safety devices.
- Individual rung/step ladders must extend at least 42 inches (1.1 m) above an access level or landing platform either by the continuation of the rung spacing's as horizontal grab bars or by providing vertical grab bars that must have the same lateral spacing as the vertical legs of the ladder rails.
- Each step or rung of a fixed ladder must be capable of supporting a load of at least 250 pounds (114 kg) applied in the middle of the step or rung.
- The minimum clear distance between the sides of individual rung/step ladders and between the side rails of other fixed ladders must be 16 inches (41 cm).
- The rungs of individual rung/step ladders must be shaped to prevent slipping off the end of the rungs.
- The rungs and steps of fixed metal ladders manufactured after January 14, 1991, must be corrugated, knurled, dimpled, coated with skid-resistant material, or treated to minimize slipping.
- The minimum perpendicular clearance between fixed ladder rungs, cleats, and steps, and any obstruction behind the ladder must be 7 inches (18 cm), except that the clearance for an elevator pit ladder must be 4.5 inches (11 cm).
- The minimum perpendicular clearance between the centerline of fixed ladder rungs, cleats, and steps, and any obstruction on the climbing side of the ladder must be 30 inches (76 cm). If obstructions are unavoidable, clearance may be reduced to 24 inches (61 cm), provided a deflection device is installed to guide workers around the obstruction.
- The step-across distance between the center of the steps or rungs of fixed ladders and the nearest edge of a landing area must be no less than 7 inches (18 cm) and no more than 12 inches (30 cm). A landing platform must be provided if the step-across distance exceeds 12 inches (30 cm).



- Fixed ladders without cages or wells must have at least a 15-inch (38 cm) clear width to the nearest permanent object on each side of the centerline of the ladder.
- Fixed ladders must be provided with cages, wells, ladder safety devices, or self-retracting lifelines where the length of climb is less than 24 feet (7.3 m) but the top of the ladder is at a distance greater than 24 feet (7.3 m) above lower levels.
- If the total length of a climb on a fixed ladder equals or exceeds 24 feet (7.3 m), the following requirements must be met: fixed ladders must be equipped with either (a) ladder safety devices; (b) self-retracting lifelines, and rest platforms at intervals not to exceed 150 feet (45.7 m); or (c) a cage or well, and multiple ladder sections, each ladder section not to exceed 50 feet (15.2 m) in length. These ladder sections must be offset from adjacent sections, and landing platforms must be provided at maximum intervals of 50 feet (15.2 m).
- The side rails of through or side-step fixed ladders must extend 42 inches (1.1 m) above the top level or landing platform served by the ladder. For a parapet ladder, the access level must be at the roof if the parapet is cut to permit passage through it; if the parapet is continuous, the access level is the top of the parapet.
- Steps or rungs for through-fixed-ladder extensions must be omitted from the extension; and the extension of side rails must be flared to provide between 24 inches (61 cm) and 30 inches (76 cm) clearance between side rails.
- When safety devices are provided, the maximum clearance between side rail extensions must not exceed 36 inches (91 cm).

#### ***Cages for Fixed Ladders***

- Horizontal bands must be fastened to the side rails of rail ladders, or directly to the structure, building, or equipment for individual-rung ladders.
- Vertical bars must be on the inside of the horizontal bands and must be fastened to them.
- Cages must not extend less than 27 inches (68 cm), or more than 30 inches (76 cm) from the centerline of the step or rung, and must not be less than 27 inches (68 cm) wide.
- The inside of the cage must be clear of projections.
- Horizontal bands must be spaced at intervals not more than 4 feet (1.2 m) apart measured from centerline to centerline.
- Vertical bars must be spaced at intervals not more than 9.5 inches (24 cm) apart measured from centerline to centerline.
- The bottom of the cage must be between 7 feet (2.1 m) and 8 feet (2.4 m) above the point of access to the bottom of the ladder. The bottom of the cage must be flared not less than 4 inches (10 cm) between the bottom horizontal band and the next higher band.
- The top of the cage must be a minimum of 42 inches (1.1 m) above the top of the platform, or the point of access at the top of the ladder. Provisions must be made for access to the platform or other point of access.

#### ***Wells for Fixed Ladders***

- Wells must completely encircle the ladder.
- Wells must be free of projections.
- The inside face of the well on the climbing side of the ladder must extend between 27 inches (68 cm) and 30 inches (76 cm) from the centerline of the step or rung.
- The inside width of the well must be at least 30 inches (76 cm).
- The bottom of the well above the point of access to the bottom of the ladder must be between 7 feet (2.1 m) and 8 feet (2.4 m).

#### ***Ladder Safety Devices and Related Support Systems for Fixed Ladders***

- All safety devices must be capable of withstanding, without failure, a drop test consisting of a 500-pound weight (226 kg) dropping 18 inches (41 cm).
- All safety devices must permit the worker to ascend or descend without continually having to hold, push, or pull any part of the device, leaving both hands free for climbing.
- All safety devices must be activated within 2 feet (.61 m) after a fall occurs, and limit the descending velocity of an employee to 7 feet/second (2.1 m/sec) or less.

- The connection between the carrier or lifeline and the point of attachment to the body belt or harness must not exceed 9 inches (23 cm) in length.

***Mounting Ladder Safety Devices for Fixed Ladders***

- Mountings for rigid carriers must be attached at each end of the carrier, with intermediate mountings, spaced along the entire length of the carrier, to provide the necessary strength to stop workers' falls.
- Mountings for flexible carriers must be attached at each end of the carrier. Cable guides for flexible carriers must be installed with a spacing between 25 feet (7.6 m) and 40 feet (12.2 m) along the entire length of the carrier, to prevent wind damage to the system.
- The design and installation of mountings and cable guides must not reduce the strength of the ladder.
- Side rails, and steps or rungs for side-step fixed ladders must be continuous in extension.

