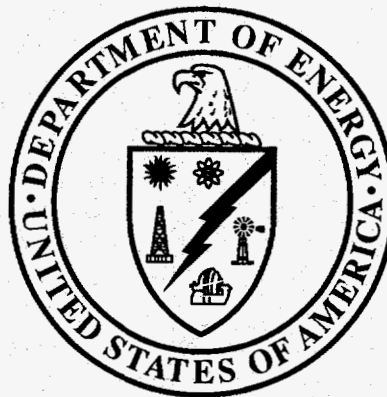


**Department of Energy**

**CONSTRUCTION SAFETY REFERENCE  
GUIDE**



September 1993

**U.S. DEPARTMENT OF ENERGY**

**Assistant Secretary for Environment, Safety and Health  
Washington, DC 20585**

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The Construction Safety Reference Guide is not intended to be an all-encompassing construction safety document. It is intended to be a nonmandatory reference guide for the most common safety concerns encountered during construction activities.

This document has been developed for and by the U.S. Department of Energy (DOE) as a construction industry safety reference guide. The contents are intended for safety guidance, training, and awareness purposes only and are gathered from safety codes, standards, regulations, and recognized acceptable safe-work practices that affect construction operations. Most of the text is interpreted from U.S. Department of Labor Occupational Safety and Health Administration regulations found in applicable parts of Title 29 Code of Federal Regulations (CFR) 1926, "Safety and Health Regulations for Construction;" 29 CFR 1910, "Occupational Safety and Health Standards;" and from codes and standards such as National Fire Protection Association, American National Standards Institute, Society of Automotive Engineers, and DOE directives and programs.

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## **I. USING THE CONSTRUCTION SAFETY REFERENCE GUIDE**

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## Using the Construction Safety Reference Guide

*The keys to a safe worksite are knowledge, understanding, application, and communications. The keys to achieving safety goals are (1) knowing what is to be done, (2) understanding the reason why certain actions must be taken and the consequences of not taking them, and (3) making sure all personnel are aware of the necessity for safety procedures in their work assignments. No job is so important or so urgent that time cannot be taken to perform it safely. This guide is designed to assist in promoting worker safety and a safe work environment.*

### Introduction

The DOE has adopted the Occupational Safety and Health Administration (OSHA) regulations Title 29 Code of Federal Regulations (CFR) 1926, "Safety and Health Regulations for Construction," and related parts of 29 CFR 1910, "Occupational Safety and Health Standards." This nonmandatory reference guide is based on these OSHA regulations and, where appropriate, incorporates additional standards, codes, directives, and work practices that are recognized and accepted by DOE and the construction industry.

In most cases, the regulation, standard, or code has been reworded to make it more easily understood and user friendly. Illustrations have been incorporated into the guide to draw attention to a subject or to clarify the text. The Construction Safety Reference Guide is not intended to be an all-encompassing comprehensive safety document. It is intended to be a nonmandatory reference guide for the most common safety concerns encountered during construction activities. The guide will be periodically updated based on changes in applicable OSHA standards and DOE directives as well as feedback from its users. Users are encouraged to use Page i to submit comments concerning any desired changes, corrections, or improvements to the guide.

### Key Items Check Lists

At the end of each major section is a listing of basic definitions. A key item checklist is also provided to assist in ensuring that all key specific safety demands can be monitored or noted during each phase of construction activity.

## Ways the Guide Can Be Used

1. The guide is a source of general and specific information about construction safety, health, and environment and provides a good resource for information about an overall safety and health program.
2. Selected parts of any section of the guide, as appropriate, may be used for safety subject material for employee safety meetings and onsite safety sessions.
3. The three appendixes of the guide may be used as stand-alone documents in support of the overall construction safety effort:
  - Appendix A is reserved for implementation guidance for DOE Order 5480.9A, "Construction Project Safety and Health Management."
  - Appendix B is a complete worker safety orientation program. It may be used as it stands or adapted to specific applications for workers or supervisors. This Eight-Block Safety Program is a basic program covering the primary attitudes in worker safety, from a general standpoint to a technical application as desired.
  - Appendix C covers all the general and technical requirements relating to training needs associated with the regulations. Within the text a noted circled T following the statement or regulation indicates that there is some degree of knowledge or training needed. The appendix contains a list of all training requirements identified within the text indexed according to section headings and paragraphs. See Appendix C for more detailed training information and direction.

### Summary

It is recommended that this safety guide for construction be used to the fullest as a tool for promoting and encouraging construction site safety, worker safety, the control or elimination of property damage, and protection of the environment.

## **II. SITE PREPARATION**

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## Site Preparation

### Introduction

Advanced planning and quality site preparations are important for a safe, well-organized construction site and will ensure the efficient layout for the site, movement of material, storage, and servicing. A well-arranged and well-controlled construction site will also positively influence attitudes toward work quality and safety of site workers.

The following is a guide that will be helpful to those conducting the initial site preparation and layout.

### Review of Overall Construction Site

The employer should visit the site location and review upcoming plans and procedures with the site supervisor. Using a plot plan, the employer and site supervisor should evaluate the site for the following items:

**1. Access.** How many points of access to the site are needed and available? Are access points near a highway, busy street, or business area? Can access to the site be controlled or does access need to be controlled? How will the number and location of access points influence the accessibility of the site to workers and equipment? What access actions or controls will be needed?

**2. Neighbors.** How far from the site are the closest neighbors and how will the construction operations affect them? Will any hazardous materials, which may affect the neighbors, be used on the construction site? Are appropriate control measures in place? Are there any nuisance operations that may need control, such as dust, noise, or odor? Are there other potential problems that may affect the neighbors? A scheduled visit to the neighbors may be necessary to work out or avoid problems.

**3. Site Security.** Will it be necessary to provide a security fence around the site? Will it be necessary to have security patrol after hours? Will DOE badges be required for access to the site? What other security precautions must be taken?

**4. Facilities for Worker Parking.** Is the site large enough to allow worker parking inside the site, or will workers have to park in adjacent areas? Will outside parking be a problem to neighbors or cause congestion? Parking problems should be discussed with workers.

**5. Storage of Heavy Equipment.** Where will heavy equipment, accessories, and parts be stored? Where and how will the equipment be fueled and serviced? Will there be an on-site service or fueling station?

**6. Site Superintendent's Office.** The answers to the following may help in determining the location of the superintendent's office. What will be the ideal location from which to supervise the site? How will the office be used? Will deliveries be made through contact with the superintendent's office? Will employees report and leave via the superintendent's office? Will visitors report through the superintendent's office? Will the office be used as a communications center?

**7. Location for Material Storage.** The following factors should be taken into account when material storage areas are identified: type and quantity of materials, type and quantity of generated waste, and requirements to meet fire and other safety needs and regulations and restrictions by the owner?

**8. On-Site Roadways.** Roadways within the site must be adequate to accommodate delivery of materials, movement of large equipment, and emergency fire and other rescue vehicles. Roadways should be built so as not to interfere with other site operations, such as excavations or electrical service installations. If there is a major street or highway adjacent to the site, a connection to these roadways may be necessary; and all local traffic control ordinances must be observed. All appropriate traffic control and warning signs shall be posted where necessary.

**9. Utilities.** The following should be considered with reference to utilities on the construction site. Where are utility connections located, especially potable water, fire water mains or hydrants, and electrical? Where are the best locations to tie in branch circuits for serving the site and eliminating damage? What location requires the most use of water? If utilities come into the site over an active work area or roadway on which equipment over 16 feet high is moved, all equipment operators must be warned and signs posted as necessary.

**10. Safety and Health Program and Inspections.** Is there an established and written safety and health program ready for site use? [29 CFR 1926.20(b)(1)]. Have arrangements been made for available competent personnel to conduct frequent and regular site safety inspections of all areas and operations?

[29 CFR 1926.20(b)(2)].



### Other Items

Construction activities on a DOE site require some special coordination. Activities such as security and control, radiation monitoring, and others, present special problems and should be carefully planned. Other items of concern are

- supply, servicing, and placement of toilets and washing facilities;
- supply and issue of general-use safety items, glasses, hard hats, and others;
- site-posting information (warning signs, site name, safety and other postings, receiving, etc.);
- drainage control;
- site history, use or misuse;
- information about hazards, irritants, and toxic plants and instruction in first aid or methods of medical treatment for personnel clearing the site.

29 CFR 1926.604(a)(1).



### Summary

Understanding and taking the above actions should help in the prearrangement of a construction site and help in planning toward avoidance of major and minor items that could be a conflict to the site operations. It is understood that not every item of site-preparation concern is included in the above list; however, the list is a key to the start of and continuance to a safe construction site.

### **III. REQUIREMENT GUIDE FOR CONSTRUCTION SAFETY**

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## Section A. Site and Worker Safety



### 1. Site Keeping (Housekeeping)

a. To ensure the safety of construction-site workers and the public, each work site shall be kept broom clean and orderly.

29 Code of Federal Regulations (CFR) 1926.25

b. Scrap, waste material, and debris shall be kept away from work areas, passageways, stairs, ladders, elevator openings, and from open sides of floors and landings. This material shall also be kept off roads inside the worksite.

29 CFR 1926.25

c. Worksites shall be cleared of all scrap and waste material daily or at the end of the workshift. Debris that may be a fire hazard shall be cleared during or immediately following an operation. Combustible scrap from welding and burning operations shall be removed at regular intervals throughout the day.

29 CFR 1926.25(a,b)

d. Flammable, toxic, and other hazardous waste (for example, containers, applicators, oily rags, and used tubes of caulk) shall be stored in closed, approved containers and removed from the worksite on a regular basis throughout the day.

29 CFR 1926.25(c)

e. Garbage and other waste material shall be kept in closed containers and disposed of on a regular basis.

29 CFR 1926.25(c)

### 2. Personal Protective Equipment

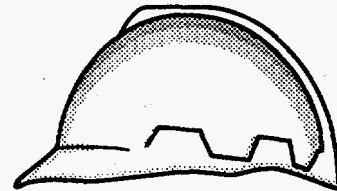
The need for and use of personal protective equipment is as essential to the job as is any tool used for the job. The minimum personal protection for any worker or visitor to a DOE construction site shall be safety-approved eye, head, and foot protection generally referred to as safety glasses, hard hat, and safety shoes or boots. Other safety protective devices or equipment may be required for specific jobs or operations and shall be worn or used as prescribed.

29 CFR 1926.28(a)

#### a. Head Protection

(1) Workers and visitors on a construction site shall wear a nonconductive safety-approved hat or cap (hard hat) meeting the requirements of American National Standards Institute (ANSI) Z89.1-1969 (standard use) or ANSI Z89.2-1971 (electrical use) for job being performed. Hard hats must bear a safety approval label or marking.

29 CFR 1926.100 (a,b,c)



Safety-Approved Hard Hat

(2) Hard hats shall not be modified or changed in any way. Hard hats that have been altered or damaged or are otherwise unsafe shall be removed from service immediately.

(3) A hard hat shall not be altered so that additional appliances such as hearing protective devices, face shields, and goggles can be added. Any appliance or device added to a hard hat shall be specifically designed for that purpose and shall meet the hard hat manufacturer's specifications. Any badges, logos, decals, and symbols affixed to a hard hat shall be of nonconductive material.

(4) Where no overhead hazard exists, workers may not be required to wear head protection in roofed offices, living quarters, or inside the cab of over-the-road vehicles.

(5) For operations that require blasting hoods, welding hoods, respirators, face shields, and other head-worn protective equipment, appropriate head protection must be provided as part of the specific equipment, or hard hats must be provided that accommodate the required equipment without interfering with its function.





*Eye and face protective equipment shall meet ANSI Z87.1-1968 standards for occupational use. All eye protective equipment shall be appropriately marked as meeting this standard. Manufacturers of eye and face protection equipment produce a variety of styles of safety-approved occupational eye and face wear and devices that meet ANSI Z87.1. One should be selective in choosing the best applicable protection.*

*It is to be noted that street-wear glasses approved by the Food and Drug Administration (FDA), often referred to as safety glasses, do not meet the occupational safety standards of ANSI Z87.1 and should not be considered as approved eye protection for construction-site safety.*

(1) Safety-approved eye protection shall be worn by all workers and visitors on a construction site with the minimum protection being safety glasses or spectacles. This is important because varied construction operations may produce hazards to the eyes in the form of chips and fines, dust and flying particles, possible chemical splash or contact, radiant energy light rays, and other work-associated eye hazards. Additional safety-approved eye and face protection shall be worn as required for protection from specific operations and their associated hazards. See the following paragraphs and Table A-1 for the basic eye and face protection descriptions, use, and applications.

**The recommended and most-often-required standard eye protection for DOE construction site workers is safety glasses with side shields.**

29 CFR 1926.102

## (2) Safety Glasses, Goggles, and Shields

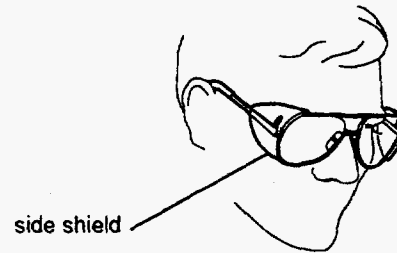
### (a) Safety Glasses – Type 1

Type 1 safety glasses may have plano (nonprescription) or Rx (prescription) lenses mounted in a metal or plastic frame without side shields. They provide basic protection from frontal impact hazards. The lenses are usually available in clear and a variety of shades.

### (b) Safety Glasses With Side Shields – Type 1A

These are the same as Type 1 except with fixed or attached side shields that offer added protection to the sides. Some safety glasses are designed with an upper frame extended

to the wearer's head. This is generally referred to as a "brow guard," which offers added protection at the top of the glasses.



### (c) Cover Goggles – Type 2

These goggles are generally a one-piece full-view lens affixed in a rigid or flexible plastic face-fitting body held in wearing position with an adjustable head piece, band, or attachment to a hard hat. Most often the body has holes or perforations on the top and sides for venting. Their general use is for frontal impact protection and protection from heavy chips and fines. They may be worn as protection over nonsafety prescription glasses or by workers and visitors for basic eye protection. They are available in clear and a variety of shades.

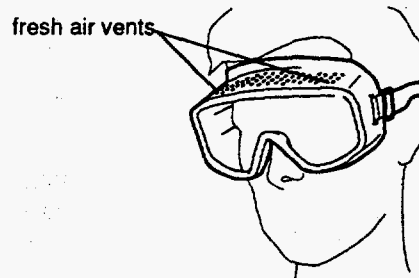




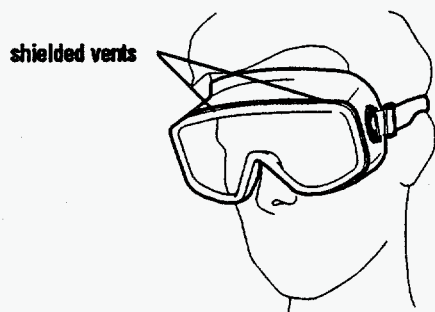
Table A-1 Basic Eye Protection Operations Recommendations

Operation	Hazard	Protection Type Description
Acetylene (burning, cutting, welding)	Sparks, harmful rays, molten metal, flying particles	5-Burning goggles
Chemical handling	Splash, corrosive burns, fumes	4-Chemical goggles, 8-Plastic face shield
Chipping	Flying particles	2,3-Cover goggles, 8-Plastic face shield
Arc welding (electric)	Sparks, rays, molten metal	9-Welding helmet
Furnace viewing	Glare, heat, molten metal	6-Furnace goggles, 8-Plastic or wire shield
Grinding (light)	Flying particles	2,3-Cover goggles, 8-Plastic face shield
Grinding (heavy)	Flying particles	1A,2,3, 8-Plastic face shield
Laboratory	Chemical splash, broken glass	4-Chemical goggle, 8-Plastic face shield
Machining	Flying particles	1A-Safety glasses, 2,3-Cover goggles
Molten metal	Heat, glare, sparks, splash	5-Furnace goggles, 8-Plastic or wire shield 9-welding helmet
Spot welding	Flying particles, sparks	2,3-cover goggles, 8-Plastic face shield, 9-welding helmet
Visitor (occasional, not exposed to direct hazard operations)	General site touring	1,1A-Safety glasses, 2,3-Cover goggles, 8-Plastic face shield
Basic worker requirement	Construction site	1,1A-Safety glasses

Note: The more severe the eye and face hazard, the more demanding the protection.

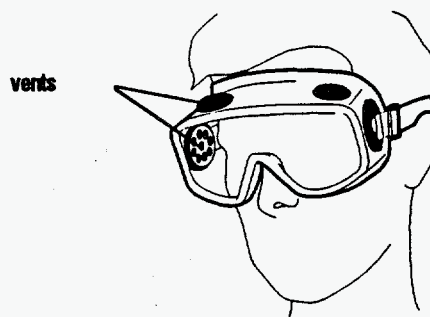
(d) Cover Goggles – Type 3

These cover goggles are the same as Type 2 except with indirect or shielded venting. They provide additional protection from fines and dust.



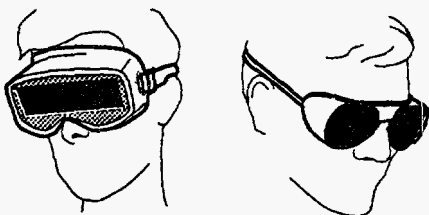
(e) Chemical Goggles – Type 4

Chemical goggles are the same as Types 2 and 3 except with protected indirect or filtered venting on the body. They provide additional protection for chemical splashes, heavy mist, and overspray.



**(f) Burning Goggles – Type 5**

These goggles have either a single full-lens or eye-cup design equipped with a filtered lens appropriate to the radiant-light ray hazard. The body of each is usually made of solid plastic with indirect venting designed to prevent entry of radiant light. Some full-body goggles are designed to hold a standard 2" x 4 1/2" filter lens. These goggles are also available with a flip-up front filtered lens with a clear safety lens behind it allowing protection for chipping and grinding. Goggles may be held in wearing position by a head piece or band or may be attached to a hard hat in head hazard areas. See Table A-2 for selection of recommended filter lenses.

**Table A-2 Guide to Selecting Filtered and Tinted Lens Shades**

Welding Operations	Shade Number
Shielded metal arc 1/16-in. to 5/32-in. diameter electrode	10
Gas-shielded arc (nonferrous) 1/16-in. to 5/32-in. diameter electrode	11
Gas-shielded arc (ferrous) 1/16-in. to 5/32-in. diameter electrode	12
Shielded metal arc 3/16 in. to 1/4 in. 5/16-in. to 3/8-in. diameter exchange	12 14
Atomic hydrogen	10 to 14
Carbon arc	14

Gas Operation	Shade Number
Torch soldering	2
Torch brazing	3 or 4
Cutting to 1 in.	3 or 4
Cutting 1 in. to 6 in. thick	4 or 5
Cutting over 6 in. thick	5 or 6
Gas welding to 1/8 in. thick	4 or 5
Gas welding from 1/8 in. to 1/2 in. thick	5 or 6
Gas welding over 1/2 in. thick	6 or 8

**(g) Furnace Goggles – Type 6**

Furnace goggles are the same as Type 5 fitted with the appropriate tinted or filtering lens to protect from glare, radiant light, and heat. (They can be worn behind a standard face shield or metal mesh face shield to protect the face from heat.)

**(h) Laser Glasses/Goggles – Type 7**

Laser glasses/goggles are worn for protection from harmful laser radiation. They are available in safety glasses or goggle design (as Type 1A or 5) fitted with the appropriate laser protective lens. For lens absorption and attenuation factors, refer to the laser equipment manufacturer's recommendation in accordance with the watts per square centimeter (CW) power density, optical density, and attenuation factor. See Table A-3 below for information in selecting laser protection.

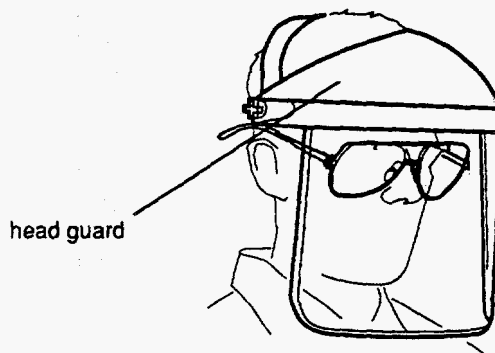
**Table A-3 Basic Laser Protection Guide**

Intensity, CW	Optical Density, (O.D. )	Attenuation Factor
10 <sup>-2</sup>	5	10 <sup>5</sup>
10 <sup>-1</sup>	6	10 <sup>6</sup>
1.0	7	10 <sup>7</sup>
10.0	8	10 <sup>8</sup>

Note - Output levels falling between line in this table shall require the higher O.D.

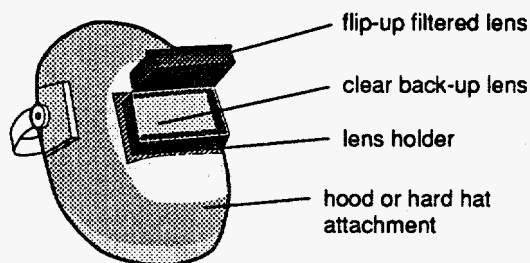
**(i) Face Shield – Type 8**

A face shield is generally a plastic face piece or shield attached to an adjustable fitting head band or attached to a hard hat for use in head hazard areas. It provides face protection from chemicals and other face hazards and is to be worn over other eye protection. The face piece or shield is available in clear, shades, and in see-through reflective plastic with a metal mesh for protection from flying debris, heat, and glare.



**(j) Welding Helmet – Type 9**

Welding helmets are designed for protection from arc-welding radiant-light rays and molten metal and slag. They are made of a solid fabricated face piece or hood that is equipped with a filter-lens holder at the wearer's eye level and an adjustable head band. The helmets may be attached to a hard hat for wear in head hazard areas. On some welding hoods the filter-lens holder can be a flip-up type with a back-up clear safety lens providing viewing and protection while chipping and grinding without having to remove the hood. Welding hoods are not limited to use in welding as they may be used for added eye and face protection in other high-energy light and heat-producing operations. See Table A-2 for recommended filter-lens selection.

**(k) Shaded, Tinted, and Filter Lenses**

Shaded, tinted, or filter lenses are available in almost all types of eye and face protection. These are provided for specific purposes such as for protection from bright sun-light reflection (sun reflected off of sheet-metal roofing) to radiant-light rays (furnace operations and weld-flash). Shaded or tinted lenses come in a variety of colors and color densities from light to dark and commonly in colors of green, gray, or special-purpose design. For filter shades in operations of radiant-light rays, refer to Table A-2 or recommendations specified in ANSI Z87.1. For glare or other purposes, refer to the manufacturer's information and recommendations.

**(l) Inspection and Care**

All eye protection devices should be inspected daily. Welding helmets should be periodically examined for cracked or broken shade lenses and light leakage. Lenses should be cleaned to maintain good vision. When slag or abrasives may damage the lenses of safety glasses, especially prescription glasses, added cover protection should always be used such as cover goggles or a face shield. Damaged eye and face wear should be replaced.

**(m) Visitors' Eye Protection**

Visitors shall be furnished with and wear approved eye protection that shall at a minimum include safety glasses with or without side shields. Those wearing nonsafety prescription glasses may wear any type of safety approved eye cover protection that fits securely over their prescription glasses (i.e., cover goggles, face shield, or safety-approved visitor specs). Should visitors be subject to operational eye hazards, they shall be provided with appropriate eye and face protection for the specific hazard.

**(n) Arc Welding Flash Burn Protection**

Precautions should be taken to avoid flash hazards because electric arc welders and those working nearby are subject to flash burns to the eyes. Control methods include correctly using the following:

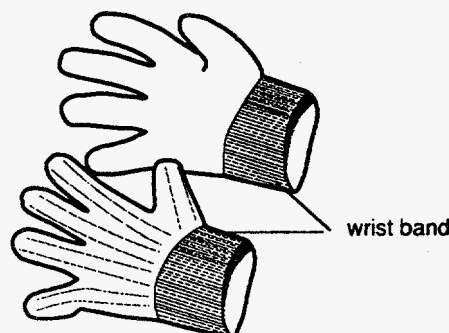
- nonreflective shields,
- light-absorbent curtains,
- appropriate safety glasses fitted with solid or colored side shields and colored lenses, and
- welding helmets.

**Note:** In multiwelder operations, welders shall wear safety-approved glasses with side shields and filtered lenses under their helmet. The lenses shall be of a shade number consistent with the maximum weld-flash hazard in the welding operation. Welders should affix a dark flame retardant cloth to the entire back (top and sides) of their welding helmet that extends past the collar to protect exposed skin and neck from other welding operations. To the greatest extent possible, shields or curtains should be used to separate welding operations.

**c. Hand and Wrist Protection**

(1) Gloves are worn at construction sites to protect the hands and wrists from injuries caused by sharp instruments, rough material, friction, heat, chemicals, and other hazards.

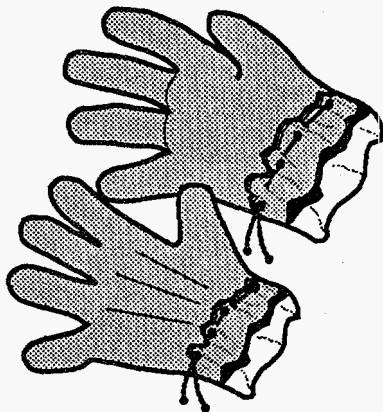
(2) Cotton gloves are worn when workers handle material with rough surfaces or have minimal contact with material such as tar, paint, and grease. Cotton gloves shall not be worn by those working near flames or handling material that splinters, snags, or can be absorbed through the skin.



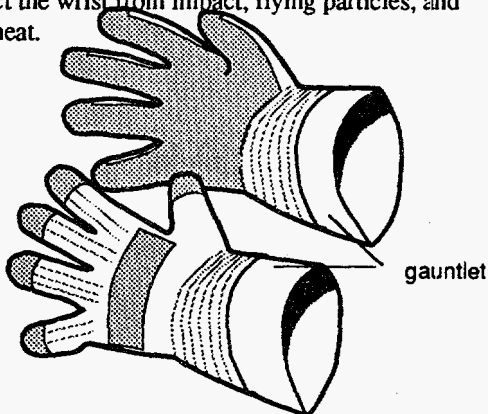


b. Eye and Face Protection

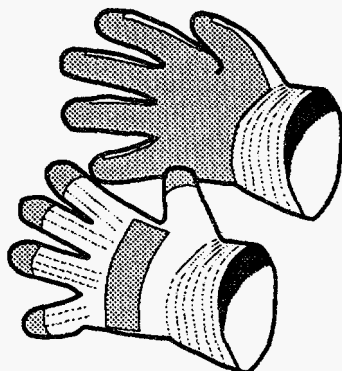
(3) Leather gloves provide the best all-purpose hand protection and should be worn when workers handle rough material or material that splinters or snags. Leather gloves shall be worn when the worker is handling moderately hot material or when the worker is welding, cutting, servicing equipment, or rigging. Leather gloves should not be worn when workers are handling chemicals that



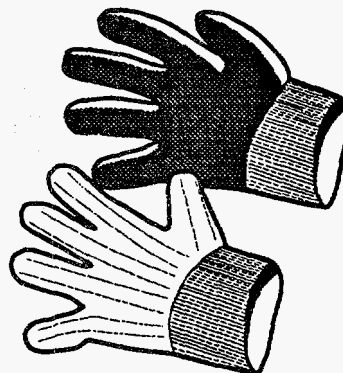
(4) Leather gloves with attached gauntlets should be worn to protect the wrist from impact, flying particles, and radiant heat.



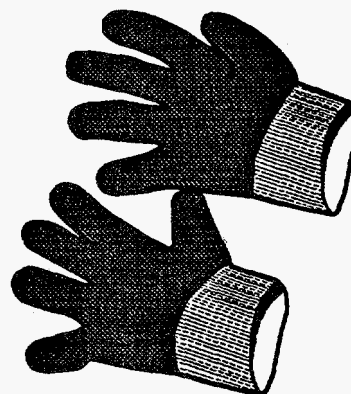
(5) Cloth gloves with leather palms, with or without gauntlets, should be worn to protect the worker from impacts and flying particles. They are not recommended for heat or flame work.



(6) Cotton gloves with synthetic palms should be worn when handling material that will splinter or has sharp edges.



(7) Synthetic gloves, with or without gauntlets, should be worn when working with adhesives, caulks, resins, or other similar material, as well as with concrete. These gloves are not recommended for handling hot material or when working near flames.



(8) Chemical gloves (rubber, neoprene, latex) should be worn for protection of hand exposure to hazardous chemicals such as corrosives, solvents, epoxies, and other materials. It is very important to review the glove selection for each chemical exposure as some chemicals will readily deteriorate or penetrate certain types of synthetic gloves. Refer to the product material safety data sheet (MSDS) or the glove manufacturer's recommendation for the appropriate glove protection against specific chemicals or materials.

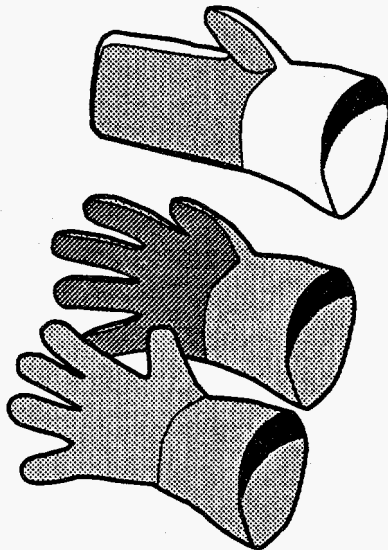




(9) Lineman's gloves, which are protected with an over-glove, shall be used for protection from electric shock. They are voltage-rated and require special inspection and testing.

(10) Special protective hand wear such as gloves and mitts are available for handling specific material (for example, material that is extremely hot or cold and certain hazardous chemicals).

**Special Protective Hand Wear**



(11) Gloves should be free of tears and holes that may cause unwanted exposure during use. Dirty gloves should never be washed in solvents because they may deteriorate the glove material, especially leather, and may leave a harmful residue. Certain gloves, cotton or other fabric, may be washed in laundry detergent and rinsed well for reuse. For specific guidance on appropriate glove cleaning methods, refer to the glove manufacturer's recommendations.

(12) Gloves should not be worn near moving machinery (for example, chain drives, belt drives, pulleys, transmission drives, gear trains, and cutting tools). Wearing gloves near such equipment could result in an amputation or other serious injury.

#### d. Foot Protection

(1) To prevent injury to feet and toes, construction workers and visitors exposed to foot hazards shall wear safety shoes or safety boots with protective toes. Safety shoes and safety boots shall meet the foot and toe protection standards of ANSI Z41.1 at a minimum.

29 CFR 1910.136

**Safety Shoe**



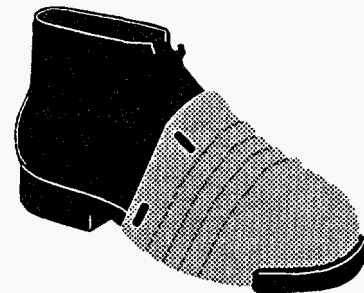
(2) Safety shoes or boots with an instep guard should be used for operations that may be very hazardous to the feet. They are used in heavy metal fabrication and heavy demolition where additional foot hazards may be introduced.

**Metatarsal Guard**



(3) Attachable metal or fiber shoe guards to fit over regular shoes may be provided when necessary.

**Metal or Fiber Shoe Guard**



(4) Nonconductive and static-resistant safety shoes are also available to meet specific electrical and other safety requirements.

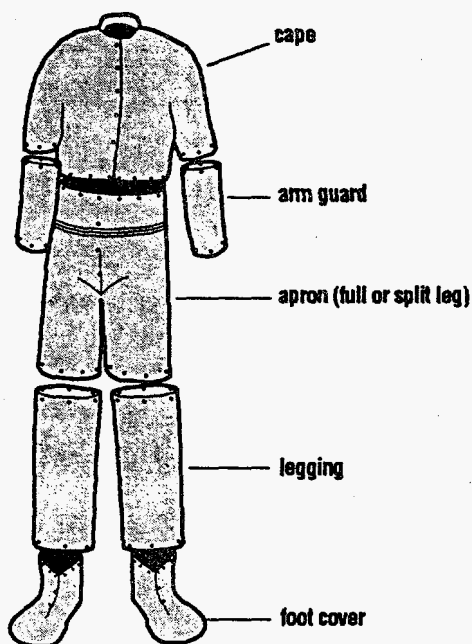
(5) Special protective footwear shall be used under certain conditions. Rubber overshoes should be used when the ground is wet, and rubber boots should be used in extremely wet weather. Rubber overshoes or boots should also be used to protect the worker from ground contamination such as a chemical spill. Disposable plastic shoe covers may be necessary to protect from toxic or highly contaminated material. Contaminated foot wear shall be handled and disposed of in accordance with applicable instructions and regulations.



### e. Special Personal Protective Clothing

#### (1) Welding

Workers need special protection from molten metal and slag during an overhead or other heavy welding operation. Leather or flame-proof aprons, leggings, chaps, leather capes, and arm protection may be used for this purpose. To avoid weld-flash burns, welders and other workers in the vicinity subject to flash burn should be certain that the entire body is covered and their clothing has no holes or gaps. See paragraph 2b of this section for specific eye and face protection for welding operations.

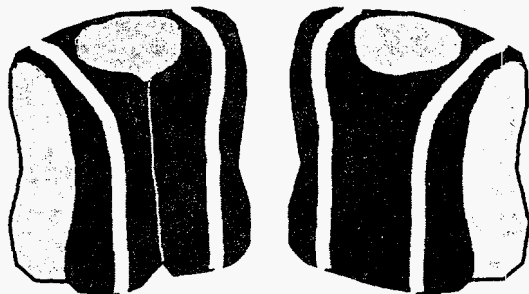


Welder's Clothing

#### (2) Working in Traffic

Department of Transportation (DOT) orange vests shall be worn by workers who direct traffic or are engaged in construction adjacent to highways or secondary roads.

29 CFR 1926.201(a)(4)



DOT Orange Vests

#### (3) Disposable Apparel

If disposable apparel (for example, coveralls, shoe covers, head covers) is necessary for specific operations such as when working with polychlorinated biphenyls (PCB's), asbestos, hazardous waste, or other toxic materials, appropriate protective clothing shall be furnished to affected personnel. Personnel required to use disposable apparel shall be trained in the appropriate use and disposal procedures.

29 CFR 1910.120

### f. Personal Attire

Workers should consider both the demands of the job assignment and current weather conditions when dressing for the worksite. Because appropriate dress contributes to each employee's personal safety, it should always be of primary concern to the worker and supervisor.

*The contractor should establish a worksite dress code. Workers should follow it at all times.*

(1) Workers should dress in clothing suitable to their job assignment. Clothing should be durable and washable and protect workers from on-the-job hazards, inclement weather, and sunburn. Clothing should fit close to the body so that it will not catch on power machinery or other objects.

(2) Workers subject to hazards of weld-flash, sunburn, or other radiant light energy should wear clothing that covers the entire body, including the neck and arms.

(3) Because of the potential for accidents, workers should not wear jewelry such as rings, necklaces, and bracelets. Wrist watches with a rip-away band are acceptable. Conductive jewelry of any type should never be worn for jobs that involve electric wiring.

### g. Fall Protection

#### (1) General Requirements

(a) Fall protection devices shall be provided for and used by workers who climb utility poles, work over water, perform extensive climbing, or are subject to falls as otherwise prescribed in this guide.

29 CFR 1926.104(a)

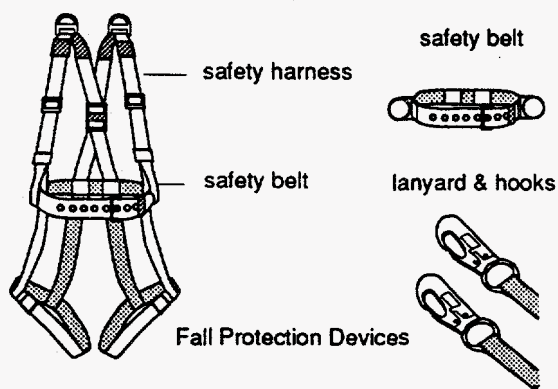
(b) Fall protection devices, including safety belts, safety harnesses, body belts, safety nets, life lines, lanyards, and motion-stopping safety systems (MSS), shall be used *only* for worker safeguarding and not for any other purpose.

29 CFR 1926.104(a)





*The use of a safety harness is strongly recommended over the use of a safety belt or body belt. In the event of a fall, the safety harness distributes the force of the fall to the whole torso as opposed to a safety belt or body belt where the entire force of the fall is applied to the midsection of the body, which can result in significant internal injuries. The use of a safety belt or body belt in lieu of a safety harness is only appropriate when used as part of a MSS where the worker is restrained from reaching fall hazard areas.*



(c) Workers required to use fall protection shall be trained in its use and inspection. **(T)**

(d) Fall protection devices shall be thoroughly inspected before each use for overall deformities, general wear and tear, cracks in leather and metal rings, bent and broken parts in metal rings and buckles, separation of stitching, and decomposition caused by chemical contact or environmental exposure.

29 CFR 1926.20(b)(2)

(e) Safety hooks, shackles, and other items used to tie down the fall protection device shall be inspected for bends, cracks, and any other kind of deterioration.

29 CFR 1926.20(b)(2)

## (2) Life Lines      yards

(a) Ropes and lanyards shall be checked for frays, cuts, and separations; the lay of the ropes and lanyards shall be checked by a competent person.

29 CFR 1926.20(b)(2)



(b) Any new or used life line or lanyard that is found to be defective or has been subjected to inservice loading (as opposed to test loading) shall be immediately removed from service and not used again for worker safeguarding.

(c) Life lines and lanyards shall be secured above the point of operation and anchored to a structure that can support at least 5,400 pounds.

29 CFR 1926.104(c)

(d) Life lines that may be subjected to abrasion or cuts shall be made of 7/8-inch wire-core manila rope; for other applications, a minimum of 3/4-inch manila, or equivalent, may be used.

29 CFR 1926.104(c)

(e) Lanyards shall be made of at least 1/2-inch nylon rope or equivalent.

29 CFR 1926.104(d)

(f) Life lines and lanyards shall be short enough or adjusted to permit a fall of no more than 6 feet.

29 CFR 1926.104(d)

## (3) Safety Belts, Safety Harness, and Life Lines

(a) Safety belts, safety harnesses, and life lines shall be used for elevated construction work (for example, roof work, erecting steel structures, scaling rocks, and reaching material stored in silos, hoppers, and tanks). They should also be used when required on scaffolds, with the MSS (for work on low-pitched roofs that are not equipped with warning lines), and in other operations in which the worker does not have complete fall protection.

29 CFR 1926.104; .250(b)(2); .451(i)(8), (p)(9); .500(g)(1-6); .951(b)

(b) A lineman's body belt that meets specific hardware and conductivity requirements shall be used by workers who climb utility poles. See Section B.5. "Confined Spaces."

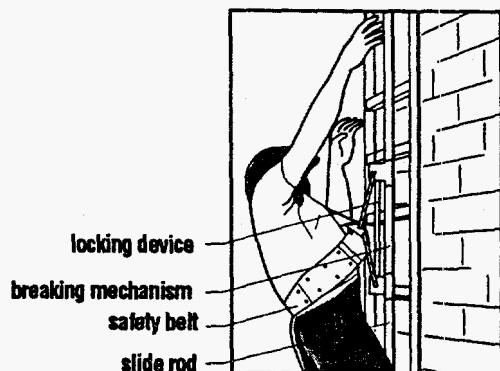
29 CFR 1926.959

## (4) Ladder-Climbing Safety Devices

A ladder-climbing safety device, which has a breaking mechanism to prevent falls, may be used for fall protection in lieu of cages for ladders on towers, water tanks, chimneys, or similar structures over 20 feet. The ladder-climbing safety device shall always be compatible with the ladder used. See Section K.

29 CFR 1910.27(d)(5)





Worker Using a Ladder-Climbing Safety Device

### (5) Safety Nets

(a) Safety nets shall be provided when construction work is performed 25 feet or more above ground or over water or other surfaces and where the use of ladders, scaffolds, temporary floors, catch platforms, or life lines is not practical.

29 CFR 1926.105(a)

(b) The safety net shall be installed, inspected, and approved before it is used at the construction site. Safety nets shall extend 8 feet beyond the edge of the work area and be as close as possible, but never more than 25 feet below the work surface. They shall be hung so that there is satisfactory loaded clearance between the safety net and surface below the net.

29 CFR 1926.105(c)(1)

(c) The mesh size of the safety net shall not exceed 6 x 6 inches. It shall have a minimum impact resistance of 17,500 pounds, and the manufacturer's label of proof-testing shall be attached. All edge ropes shall have a minimum breaking strength of 5,000 pounds, and forged-steel safety hooks and shackles shall be used to fasten the net to its supports.

29 CFR 1926.105(d)

(d) Only one level of safety nets shall be required for bridge construction.

29 CFR 1926.105(c)(2)

(e) The safety net shall be at full strength when all the panels are connected.

29 CFR 1926.105(f)

(f) When safety nets are used for an operation, no work shall begin until the nets are in place and are tested.

29 CFR 1926.105(b)

### (6) Life Preservers, Life Jackets, Buoyos, Skiffs

(a) Where danger of drowning exists, life jackets or preservers approved by the US Coast Guard shall be provided for workers who work over or near water. They shall be tested for buoyancy before and after use. Defective life preservers and life jackets shall be removed from service.

29 CFR 1926.106(a,b)

(b) Ring buoys (life ring/life saver) with at least 90 feet of line shall be available for emergency rescue efforts; the distance between ring buoys shall not exceed 200 feet.

29 CFR 1926.106(c)

(c) At least one skiff shall be immediately available at locations where employees work over or near water.

29 CFR 1926.106(d)

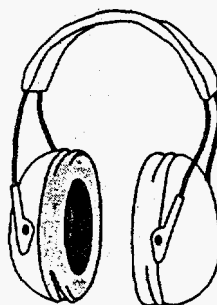
### h. Hearing Protection Devices

(1) Hearing protective devices are generally used to control worker noise exposure on a construction site. Such devices are commonly found as ear muffs or ear plugs.

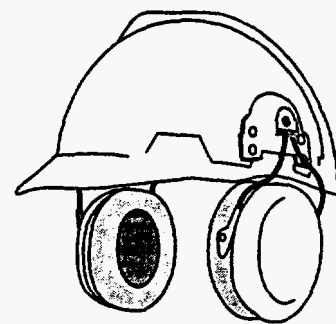
(2) Workers required to use hearing protective devices shall have the opportunity to select the type of device to be worn from a variety of suitable hearing protectors.

29 CFR 1910.95(i)(3)

(3) Ear muffs cover the user's ears, are usually cup-shaped, and are attached to a tension band that is worn about the user's head or attached to a hard hat. Ear muffs have a rated noise attenuation factor that varies with type and manufacturer.



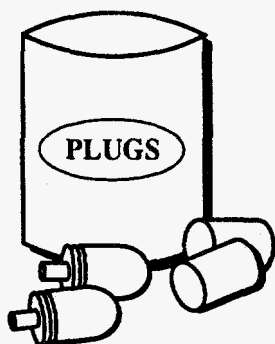
Ear muffs



Hard hat with attached ear muffs



(4) Ear plugs are devices that fit into the ear canal. Such devices are commonly made of fibrous material, soft plastic, or sponge-like material. Ear plugs may be found as individual plugs or in pairs attached with a cord or tension head band. Ear plugs also have a rated noise attenuation factor that differs by type and manufacturer.



Ear plugs

(5) Workers using hearing protective devices shall be fitted with the protective device and instructed in its proper use and care.

29 CFR 1910.95(i)(4,5)

(6) Hearing protection devices shall provide the necessary noise exposure attenuation to limit a worker's 8-hour time-weight-average noise exposure to no more than 90 decibel (dB), 85 dB for workers who have experienced a standard threshold shift.

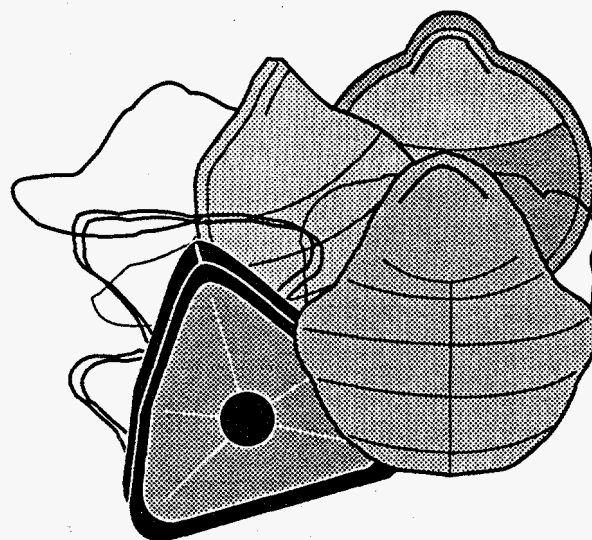
29 CFR 1910.95(j)(2,3)

(7) See Section III.B.3. "Hearing Protection Program."

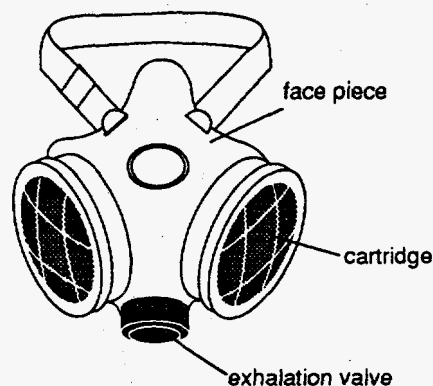
#### i. Respiratory Protective Devices

(1) Three basic types of respiratory protective devices, commonly referred to as respirators, are used on a construction site.

(a) Disposable-Type Mask. These masks are used for protection from nuisance dust, mist, vapors, and fumes that are not of a toxic or hazardous nature. Disposable-type masks cover the breathing zone (nose and mouth) of the wearer with a fine mesh or filtering media and are usually discarded following their use. These masks have very limited protective values and should not be used for protection against toxic or hazardous materials.

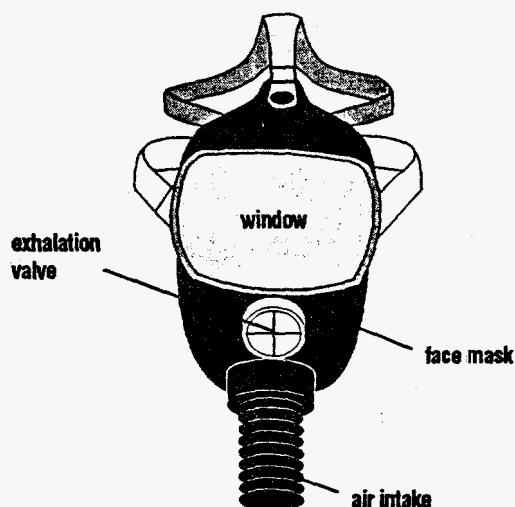


(b) Half-Mask Respirator. A half-mask respirator is a face piece that fits tightly (forming a seal) against the wearer's face covering only the nose and mouth. This type of respirator may be an air-purifying type (equipped with filter cartridges or canisters) or air-supplied (provided with supplied breathable air).

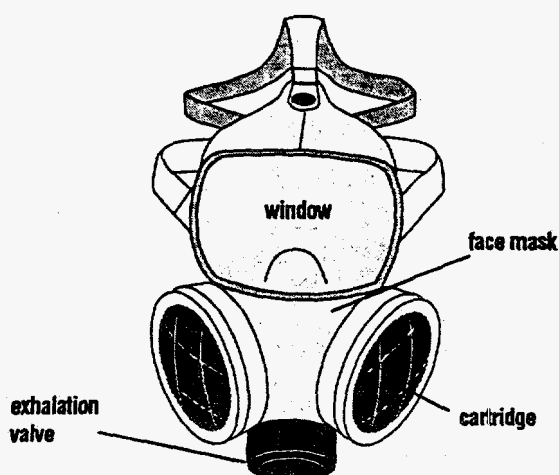




(c) **Full-Face Respirator.** A full-face respirator is a face piece that fits tightly (forming a seal) over the wearer's face, covering the nose, mouth, eyes, and full face. They also have a sealed window for vision purposes. This type of respirator may be an air-purifying type (equipped with filter cartridges or canisters) or be air supplied (provided with breathing air).



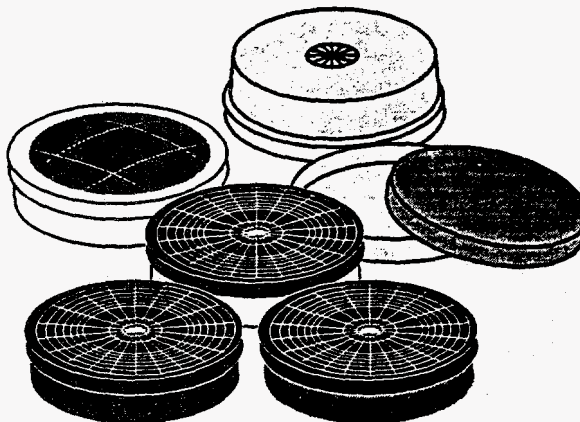
Full Face, Air-Supplied Respirator



Full-Face, Air-Purifying Respirator

(2) **Cartridges and Canisters.** These air-purifying devices are fitted to respirators to filter limited amounts of specific types of hazardous materials from the user's breathing zone. Users should refer to the manufacturer's literature for assistance in selecting the appropriate cartridge or canister for the specific hazardous materials in the work area and to ensure that the equipment is used within its specific limitations. Generally, air-purifying cartridges or canisters are used as limited protection against the following substances:

- asbestos
- organic vapors
- acid gases
- ammonia
- hydrogen chloride
- chlorine
- pesticides
- radionuclides
- hazardous dust
- formaldehyde
- methylamine
- combinations of
- two or more substances
- other



(3) **Prefilters.** A prefilter is an additional filtering device that fits outside and over an air-purifying cartridge to trap or prefilter materials, such as dust and mist, preventing clogging of the primary cartridge.

(4) **Respirator-User Program.** See Section III.B.9. "Respirator Protection Program" for more details on respiratory protective equipment and their appropriate uses.



### 3. Worksite Lighting

a. If the level of natural light is inadequate, artificial lighting shall be provided for ramps, runways, corridors, workshops, storage areas, offices, and other areas where a specific level of light is necessary for the safe movement of workers and for the performance of operations.

29 CFR 1926.56(a)

b. Table A-4 below shows the minimum lighting requirements for specific activities. As the visual demands increase, the lighting levels should also increase.

29 CFR 1926.56(a)

c. Emergency lighting shall be provided for emergency exiting from work areas, stairways, and other passageways.

National Fire Protection Association (NFPA) 101

(d) If a work area contains or may contain a flammable atmosphere, only approved electrical devices and lighting for such an atmosphere shall be used.

29 CFR 1926.407; NFPA 70 Ch.5, Art.500

**Table A-4 Worksite Minimum Lighting**

Operation / Location	Minimum Ft Candles
General construction area	5
General construction areas, concrete placement, excavation and waste areas, accessways, active storage, loading platforms, refueling, field maintenance	3
Warehouses, corridors, hallways, exitways	5
Tunnels, shafts, general underground work areas. (Exception - minimum 10 ft candles are required at tunnel and shaft headings during drilling, mucking, and scaling. Bureau-of-Mines-approved cap light shall be acceptable for use in tunnel heading.)	5
General construction plant and shops (e.g., batch plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts and active store rooms, barracks or living quarters, locker or dressing rooms, mess halls, and indoor toilets and workrooms).	10
First aid stations, infirmaries, and offices 29 CFR 1926.56(a)	30



## DEFINITIONS

**Apron** — A garment worn over the front part of the body to protect welders from heat or sparks.

**Appliance** — Personal protective equipment that attaches to a hard hat or welder's helmet (for example, ear muffs, face shield, or goggles).

**Approved** — Meets the requirements of a code, regulation, law, standard, or ordinance; is accepted by a controlling agency or testing laboratory.

**Barrier** — A fence, wall, or other structure that bars passage.

**Broom Clean** — Swept up, free of debris.

**Brow Fitting** — Fitted to the forehead.

**Cape** — Clothing item made of leather or other fire-retardant material, has sleeves or partial sleeves, and provides protection to the chest from flashes and sparks.

**Combustible Material** — Solid or liquid material (wood, paper, cloth, heavy oil, or grease) with a flash point of 100°F or above.

**Disposable** — Designed to be discarded after use.

**DOT Orange Vest** — A reflective vest that has been approved by the Department of Transportation (DOT) and is worn by workers in traffic areas.

**Fire-Retardant** — Resistant to catching fire.

**Flammable Material** — A solid or liquid material with a flash point of less than 100°F.

**Gauntlet** — A flaring cuff.

**Hard Hat** — A lightweight protective helmet that meets the requirement of ANSI Z89.1-1969 or Z89.2, usually made of metal or reinforced plastic.

**Hood** — A garment made of cloth or other material and used for protection from weld-flash; may be draped over the back of the head, neck, and shoulders; or may be directly attached to the welding helmet.

**Ignition Source** — A potential source of energy such as a spark, arc, ember, flame, or lit cigarette that may ignite flammable or combustible materials.

**Instep Guard** — Additional protection for the foot instep (metatarsal).

**Lanyard** — A short rope or line with one end connected to a worker's safety belt and the other end connected to a cable or life line firmly attached to a structure.

**Leggings** — Welder's leg covers made of fire-retardant material to protect legs and clothing from heat or sparks.

**Life Line** — Rope or cable rated to support one person and to which a lanyard is attached.

**Life Preserver** — A buoyant device designed to keep a person afloat in the water.



**Lineman's Glove** — A special nonconductive voltage-rated glove used for protection from electric shock. This glove requires special inspection and testing. Ref. ANSI J6.6

**MSS (Motion-Stopping Safety System)** — A system that restricts a worker's movement in an elevated area such as on a flat roof. MSS includes a lanyard (whose length is restricted) attached to a structure on one end and to a worker's safety belt on the other.

**Multiwelder Operation** — An operation involving two or more welders who must work close to each other.

**Nonconductive** — Does not conduct electric current.

**Plano Lens** — Nonprescription lens.

**Safety-Approved Eye Wear** — Eye wear that meets or exceeds ANSI Z87.1-1968 standards.

**Safety Belt** — A fall protection device, worn around a worker's waist, that is attached to a lanyard, which is attached to a secure structure.

**Safety Harness** — A fall protection device that fits around a worker's waist, upper torso, and legs, that is attached to a lanyard, which is attached to a secure structure.

**Safety Net** — A group of nets installed in a horizontal position below those working at a height of 25 feet or more.

**Safety Shoes or Boots** — Foot wear that meets or exceeds ANSI Z41.1-1967 standards.

**Street-Wear Safety Glasses** — Safety glasses that are approved by the FDA. These glasses are not approved for use on a DOE construction site as they do not meet safety eye-wear standards of ANSI Z87.1-1968.

**Vent** — An opening permitting the passage of liquids, gases, fumes, steam, or other substances.

**Visitor** — Nonworker present on the worksite.

**Weld-Flash** — High-intensity light from a welding arc that is harmful to the body and eyes.

**Welding Helmet** — Also known as a welder's hood; worn by welders and equipped with filtered lenses to protect them from weld-flash.

**KEY ITEMS CHECK LIST**  
**SECTION A. SITE AND WORKER SAFETY**

Item	Paragraph	Notes
1. SITE KEEPING (HOUSEKEEPING)	A.1	
Is the site free of accumulation of scrap, debris, garbage, and flammable and toxic materials?	A.1.a A.1.b A.1.d A.1.e	
2. PERSONAL PROTECTIVE EQUIPMENT	A.2	
a. <i>Head Protection</i>	A.2.a	
Is an appropriate hard-hat policy enforced?	A.2.a	
b. <i>Eye and Face Protection</i>	A.2.b	
Is an appropriate policy for safety glasses enforced with regard to type and application?	A.2.b	
c. <i>Hand and Wrist Protection</i>	A.2.c	
Is an appropriate hand-wear policy established?	A.2.c (1)	
Is hand wear that may cause increased risk of hand injury prohibited?	A.2.c (11) A.2.c (12)	
d. <i>Foot Protection</i>	A.2.d	
Is an appropriate foot-protection policy established?	A.2.d	
e. <i>Special Personal Protective Clothing</i>	A.2.e	
Are welding suits provided where circumstances require them?	A.2.e (1)	
Are DOT orange vests required for workers near road traffic?	A.2.e (2)	
f. <i>Personal Attire</i>	A.2.f	
Is there a policy that requires wearing clothing suitable for a construction site?	A.2.f (1)	
g. <i>Fall Protection</i>	A.2.g (1)	
(1) <i>General Requirements</i>	A.2.g (1)	
Is fall protection provided for workers who work at heights over 6 feet?	A.2.g (1) (a)	
Are workers trained in the use and inspection of safety belts, harnesses, lanyards, etc.?	A.2.g (1) (c)	

## KEY ITEMS CHECKLIST (continued)

Item	Paragraph	Notes
(2) <i>Life Lines and Lanyards</i>	A.2.g (2)	
Are all ropes and lanyards inspected for damage?	A.2.g (2) (a)	
	A.2.g (2) (c)	
Are lanyards and ropes made of the correct materials?	A.2.g (2) (e)	
(3) <i>Safety Belts, Safety Harnesses, and Life Lines</i>	A.2.g (3)	
Are safety harnesses used for jobs that require them?	A.2.g (3) (a)	
Do life lines and harnesses meet specific conductivity and hardware specifications?	A.2.g (3) (b)	
(4) <i>Ladder-Climbing Safety Devices</i>	A.2.g (4)	
Is the ladder-climbing device compatible with the ladder used?	A.2.g (4)	
(5) <i>Safety Nets</i>	A.2.g (5)	
Are nets used at heights over 25 feet?	A.2.g (5) (a)	
Are nets used where ladders, scaffolds, temporary floors, catch platforms, or lifelines are not practical?	A.2.g (5) (a)	
Are safety nets inspected before installation and daily thereafter?	A.2.g (5) (b)	
(6) <i>Life Preservers, Life Jackets, Buoys, Skiffs</i>	A.2.g (6)	
Is approved water safety equipment available, inspected, and maintained for workers who work over or near water?	A.2.g (6)	
h. <i>Hearing Protection Devices</i>	A.2.h	
Are fitted hearing protectors correctly worn where they are required under the hearing protection program?	A.2.h (1)	
	A.2.h (2)	
	B.3	
i. <i>Respiratory Protective Devices</i>	A.2.i	
Are correctly fitted and tested respirators worn where they are required under the respiratory protection program?	A.2.i (1)	
	A.2.i (2)	
	B.9	
3. WORKSITE LIGHTING	A.3	
Are lighting requirements met?	A.3.b	





## Section B. Protection for Worker Safety, Health, and the Environment



### 1. Medical and First Aid

a. The employer shall ensure that medical personnel are available to advise and consult on matters of occupational health.

29 Code of Federal Regulations  
(CFR) 1926.50(a)

b. Before the start of a project, provisions shall be made for prompt medical attention in the event of serious injury. Supervisors are responsible for arranging transportation of an injured worker to a source of medical attention, either by company vehicle or ambulance. A means of communication, along with telephone numbers and numbers of the local ambulance service, hospital, and designated health-care provider shall be provided in a location accessible to all employees.

29 CFR 1926.50(b,e,f)

c. If a health-care provider or facility is not reasonably accessible to the construction site, an individual certified in first aid (by US Bureau of Mines, American Red Cross, or an equivalent organization) shall be available on site to give first aid.

29 CFR 1926.50(c)



d. First aid supplies approved by a consulting physician shall be wrapped in individually sealed packages and kept in a weatherproof container. The contents of this container shall be examined before the job begins and weekly thereafter to ensure that all used items are replaced.

29 CFR 1926.50(d)(1),(d)(2)

e. Where corrosives are used, a method for drenching or flushing shall be provided, such as eyewash or safety shower.

29 CFR 1910.151(c)

### 2. Sanitation

a. Toilet facilities shall be provided for all construction workers, except mobile crews who have access to nearby facilities. For worksites with no sanitary sewer system, a chemical, recirculating, or combustion toilet (and toilet

supplies) shall be provided, unless they are prohibited by local code.

29 CFR 1926.51(c)(3)(i-iv)

Toilets shall be provided for workers according to the following requirements.

29 CFR 1926.51(c)

Number of workers	Number of facilities
20 or less	1 toilet seat
20 or more	1 toilet seat and 1 urinal per 40 workers
200 or more	1 toilet seat and 1 urinal per 50 workers

b. Drinking (potable) water shall be provided at the construction site. If no permanent source is available, a sealed container of water (with a dispensing tap) marked "DRINKING WATER" shall be available. Disposable cups (kept in a sanitary container) shall also be available.

29 CFR 1926.51(a)

c. Nonpotable water outlets shall be identified with a sign bearing the words "UNSAFE FOR DRINKING, COOKING, OR WASHING." There shall be no cross connection between potable and nonpotable water supply systems.

*Antisiphon or backflow prevention methods or devices should be used at any potable water service location where there is a possibility of siphoning or backflow of impurities.*

29 CFR 1926.51(b)

d. Washing facilities shall be available near areas where workers apply paints, coatings, herbicides, insecticides, or other contaminants.

29 CFR 1926.51(f)

e. Food service facilities at the construction site shall conform to local sanitation ordinances.

29 CFR 1926.51(d)

f. All temporary sleeping facilities shall have heat, ventilation, and light.

29 CFR 1926.51(e)



### 3. Hearing Protection Program

a. Worker exposure to noise shall not exceed the limits provided in Table B-1, "Noise Exposure Levels."

b. If a worker's noise exposure includes two or more periods at different noise levels, the combined noise exposure level is determined as follows:

$$F = (T_1/L_1) + (T_2/L_2) + \dots + (T_n/L_n)$$

where F = equivalent noise exposure factor

T = actual time period of noise exposure at a given noise level

L = permissible duration of exposure at a given noise level

**Note:** F value greater than 1.0 indicates the noise level exposure exceeds permissible limits.

For example, a worker was exposed to noise levels as follows: (**Note:** dBA indicates noise level measured on an A-weighted sound level.)

110 dBA for a time period (T1) of 1/4 or 0.25 hours  
100 dBA for a time period (T2) of 1/2 or 0.5 hours  
90 dBA for a time period (T3) of 1 1/2 or 1.5 hours

The values of T and L or the example are as follows: (L values from Table B-1)

for 110 dBA	T1 = 0.25	L1 = 0.5
for 100 dBA	T2 = 0.5	L2 = 2
for 90 dBA	T3 = 1.5	L3 = 8

Substituting the values for T and L in the above equation yields

$$F = (0.25/0.5) + (0.5/2) + (1.5/8)$$

$$F = 0.5 + 0.25 + 0.19$$

$$F = 0.94$$

Because F does not exceed 1, the exposure is within permissible limits. However, F is greater than the noise exposure action level of 0.5 as discussed in paragraph 3.d below; therefore, the employer must implement a hearing conservation program.

**Table B-1. Noise Exposure Levels\***

Duration - Hrs. per Day At Exposed Level (T)	Permissible Level dBA Slow Response (L)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25	115

\*For a more complete table and additional information on calculating noise exposure, refer to 29 CFR 1910.95 Appendix A.

c. When noise levels exceed the permissible limits, worker exposure levels shall be controlled through the use of engineering controls, administrative controls, personnel protective equipment, or any combination thereof.

(1) **Engineering controls** may consist of isolating, enclosing, or insulating noise producing equipment or operations, dampening equipment vibration, or substituting quieter alternatives for noisy equipment or operations. Engineering controls eliminate or lessen the actual physical hazard and are therefore the preferred method of limiting noise exposure.

(2) **Administrative controls** typically involve altering worker assignments or work shifts to reduce the amount of time the worker spends in a high-noise-level area. Administrative controls are preferred over the use of personal protective equipment because they are more reliable and more easily implemented.

(3) **Personal protective equipment**, ear muffs, or plugs shall be used by workers to reduce the noise exposure to within acceptable limits when engineering or administrative controls fail or are not feasible. See paragraph III, A, 2, h of this guide for more information on hearing protection devices.

d. A noise exposure of 85 dBA averaged over an 8-hour workday (time-weight-average or TWA) or an equivalent noise exposure factor (F) of 0.5 is referred to as the noise exposure action level. Where exposures are at or above the action level, regardless of the use of personal protective equipment, the employer must implement a hearing conservation program that at a minimum includes the following elements:

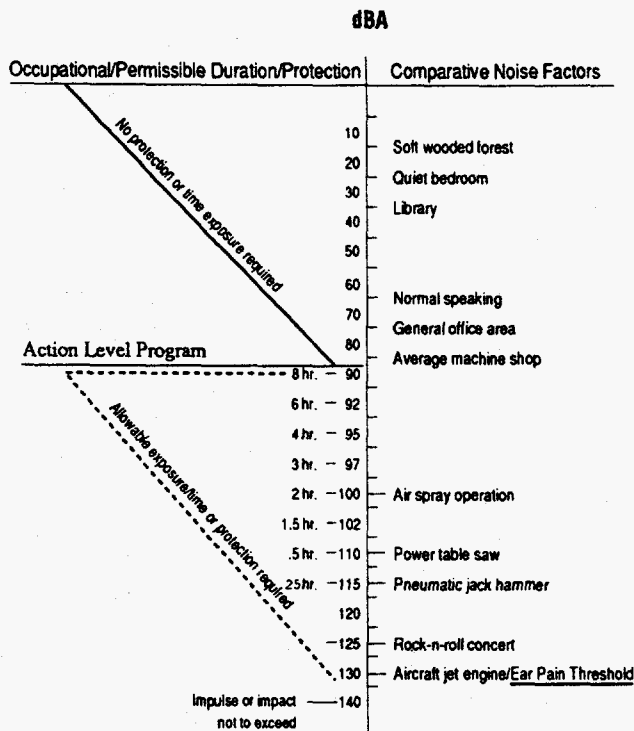
- monitoring
- employee notification
- observation of monitoring



- audiometric testing (initial and annual)
- audiogram evaluation
- noise-training program, and
- record keeping.

(T)

e. The following chart is supplied as a guide to common information concerning produced noise factors, levels, program, and protection.

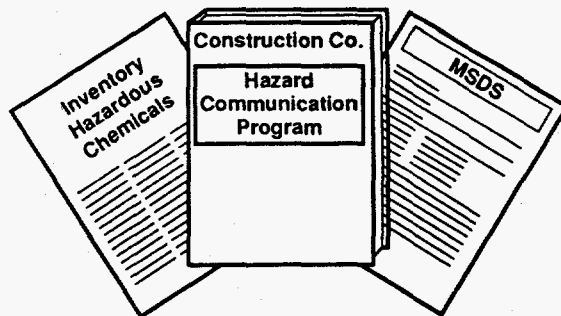


**Noise Protection Guidelines**

*Noise Rule of Thumb: Standing face-to-face, if it is necessary to raise the voice to be heard, it is most likely that the background noise level is in excess of 85 dBA, the noise action level.*

29 CFR 1926.52; 1910.95

#### 4. Hazard Communication Program (HAZ COM)



a. If hazardous material is used or stored at the construction site, a written hazard communication (HAZ COM) program shall be developed, implemented, and maintained.  
29 CFR 1926.59(e)(1)

b. In order to prevent and/or control employee exposure, it is essential that the supervisor inform all workers about any hazardous material at the construction site.  
29 CFR 1926.59(b)

c. The HAZ COM program shall include

- (1) labels and warning forms,
- (2) material safety data sheets (MSDSs),
- (3) specific worker training requirements, and
- (4) a list or inventory of hazardous material at the construction site.

29 CFR 1926.59(e)

(T)

d. Information about hazardous material at the construction site shall be provided to workers as soon they are assigned and when additional hazardous material is brought to the site. Workers shall be informed of the location of the HAZ COM program, listing of hazardous substances, and MSDSs, which shall be available for worker review during his or her work period.  
29 CFR 1926.59(h)

(T)

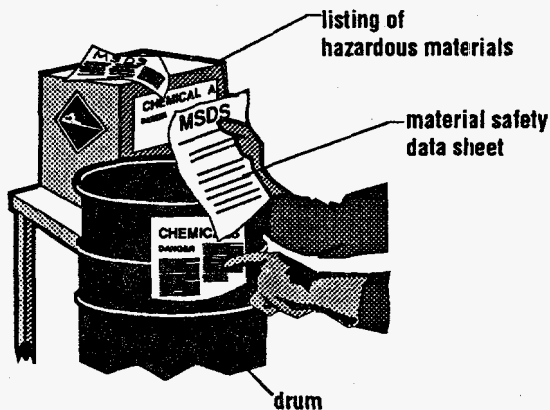
e. For multicontractor worksites, each contractor shall provide the others with appropriate MSDSs, or the contractors shall have all MSDSs made available at a central location. Each contractor shall inform the others about procedures for labeling and worker protection.  
29 CFR 1926.59(e)(2)

*The ultimate responsibility for coordinating the program shall be that of the prime contractor, i.e., to and with all subcontractors.*



## f. Labels

(1) Labels on hazardous material containers shall not be removed or defaced. They shall be legible and in English, identify the substance in the container, and display the appropriate warning about the substance. The material identity listed on the label shall correspond to the identity on the MSDS and on the list or inventory of hazardous materials at the construction site.



(2) Unless the contents are used immediately, labels shall be placed on all secondary containers or supply pipes.

29 CFR 1926.59(f)(6-10)

(3) Employers need not affix a new label to the container if the existing label is sufficient.

## g. MSDS-Training

(1) An MSDS for each chemical shall be available at all construction sites at which hazardous material is present. The MSDS shall be legible, in English, and available for worker review. If workers travel between local worksites, the MSDS shall be readily available at a central location for review in an emergency. **Note:** Electronic retrieval is allowed, provided all persons who may need a MSDS are trained in retrieval and have unrestricted access to the system.

29 CFR 1926.59(g)



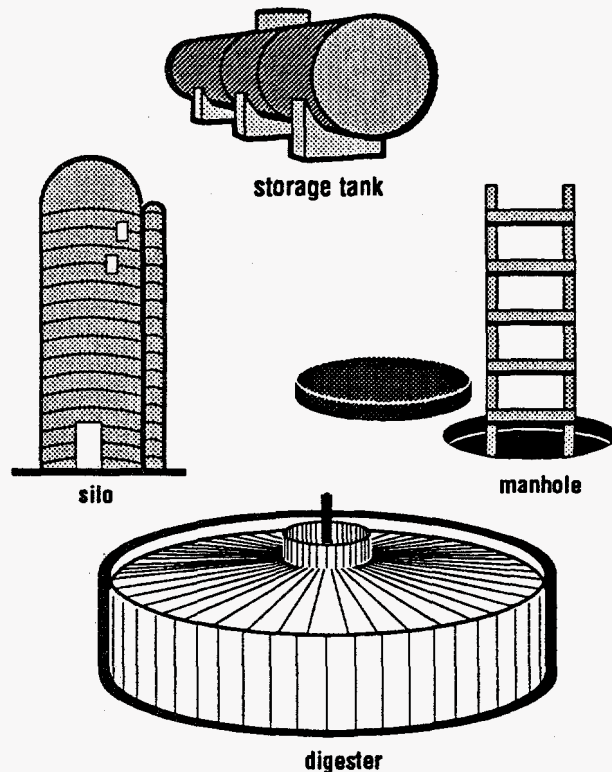
(2) A training program for workers who handle or may be exposed to hazardous material shall be established as part of the HAZ COM program. Training shall include information regarding the HAZ COM program, health and environmental hazards of the various chemicals in the workplace, ways to detect the presence of hazardous material at a construction site (including monitoring methods and devices used), and how workers can protect themselves from harmful exposure (for example, safe work practices, personal hygiene, and protective equipment).

29 CFR 1926.59(h)(2)



## 5. Confined Spaces

a. Because of the nature of confined spaces, the possibility of dangerous atmospheres, and the type of operations performed in them, confined-space workers and supervisors must take every possible precaution.



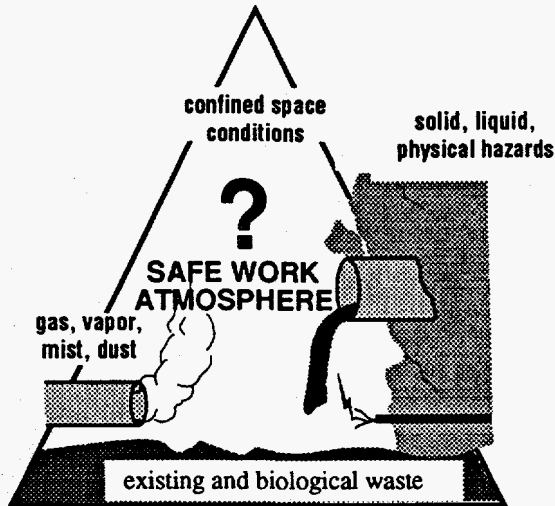
Examples of Confined Spaces

b. Pits more than 4 feet deep, tanks, vessels, silos, utility vaults, pipelines, ducts, sewers, digesters, tunnels, process tanks, and vats are examples of confined spaces. Confined spaces are areas with one or more of the following characteristics:

- atmosphere that contains or has the potential to contain less than 19.5% oxygen;
- atmosphere that is or can become flammable, combustible, explosive, or toxic;
- area unprotected from entry of water, gas, sand, earth, ore, grain, gravel, coal, biological waste, radiation, corrosive chemicals, or other hazardous substances present;
- ventilation inadequate (natural or mechanical);
- entry or exit restricted; or
- design not suitable for normal occupancy.



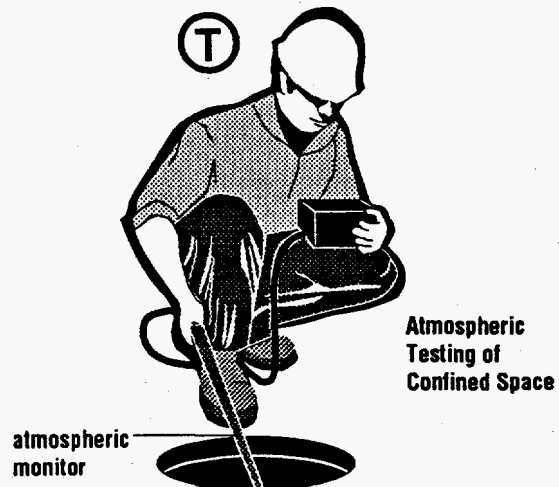
c. Confined spaces found on construction sites typically include pits or excavations more than 4 feet deep with a potential for accumulating hazardous materials or vapors or for displacing oxygen.



d. All confined spaces shall be identified by a sign stating "DANGER—CONFINED SPACE," with other appropriate warning or information.



e. To determine if the atmosphere is hazardous, confined-space atmospheres shall be monitored by a qualified person using approved meters and sampling methods. To determine safe levels of a contaminant, see Subpart Z of "Toxic and Hazardous Substances," 29 CFR 1910.1000, "Air Contaminants."



f. All personal protective equipment (PPE) and other equipment used in a confined space shall be inspected before it is used or brought into a confined space. Defective or dangerous equipment shall not be used. PPE or other safety equipment or devices likely to be used in a confined space entry include, but are not limited to, respiratory protection (air purifying, air supplied, self-contained breathing apparatus [SCBA]), fresh-air supply system, powered exhaust system, safety harness and life line, atmospheric sampler or monitor, and regular PPE.

g. A supervisor shall complete the following actions before allowing workers to enter confined spaces:

- (1) conduct a planning session with confined-space workers to determine work objectives, date and time the work will begin, and who will be assigned as confined-space workers, safety watch, and other associated workers;
- (2) perform an activity hazard analysis of the proposed operations to identify (as applicable)
  - chemicals or materials presently or previously stored or used in the confined space,
  - unexplained leaks or spills of hazardous chemicals or materials,
  - hazardous properties or incompatible combinations of materials or by-products, hazardous or toxic gases, vapors, dust, mist, or fumes,



- existing and probable physical hazards such as slipping, tripping, falling, or potential contact with moving equipment; electrical hazards, rodents, snakes, or insects,
- methods of operation for necessary clearing, purging, ventilation, or guarding,
- safety procedures including first aid, cardiopulmonary resuscitation (CPR), decontamination, communication methods, and other safety and emergency rescue methods, and
- date and time of pre-entry work session;

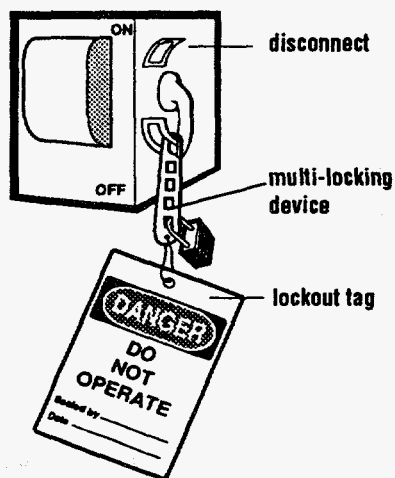
(3) make initial test for hazardous atmospheres and oxygen level and provide continuous monitoring method as necessary;

(4) determine need for specific PPE identified in the activity hazard analysis, provide required equipment, and make certain all workers required to use PPE are knowledgeable and qualified for its operation;

(5) provide adequate ventilation where necessary (ignition-proof or explosion-proof as may be required). See paragraph III,B,6 for discussion on ventilation;

(6) lockout and tagout all electrical and mechanical equipment and entry pipes or valves in the confined space that may pose a hazard; and

(7) select and complete an entry permit (see sample permit on following page).

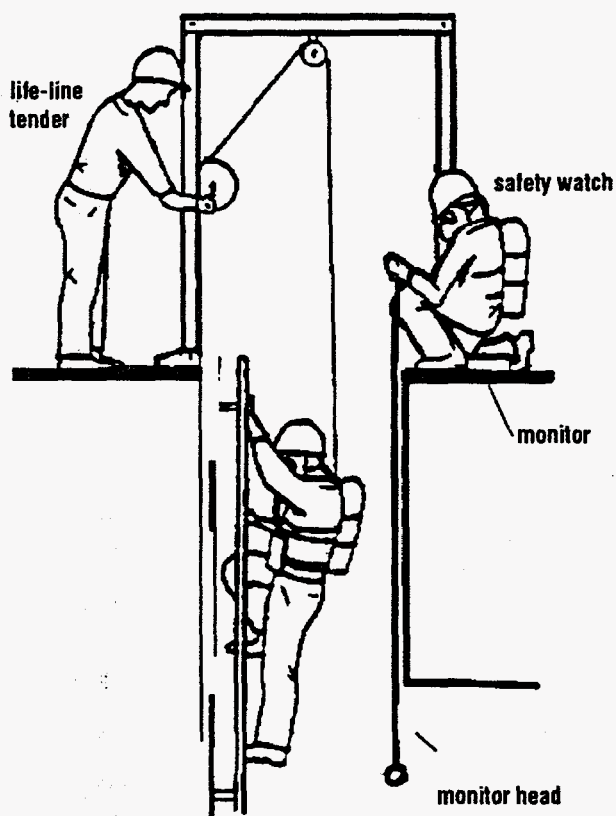


#### h. Training Requirements for Confined Spaces

##### (1) General Training

(a) Confined-space workers, standby workers, and supervisors shall be trained in the following:

- emergency and routine entry/exit procedures;
- use of respirators;
- first aid and CPR;
- lockout and tagout procedures and isolation of entry sources (electricity, gas, water);
- rescue methods; and
- use of safety equipment. **T**



Confined-Space Entry Procedures



## SAMPLE

**CONFINED-SPACE ENTRY PERMIT**

NOTE — TO BE COMPLETED ON INITIAL ENTRY AND EACH ENTRY THEREAFTER

Assessment Date \_\_\_\_\_ Time \_\_\_\_\_

Entry Date \_\_\_\_\_ Time \_\_\_\_\_

Workers Assigned (All)

\_\_\_\_\_

Location \_\_\_\_\_

Description of work \_\_\_\_\_

Precautions/Actions

Yes

No

NA

Note

Qualified Person				
Safety Watch				
Space Clean				
Atmosphere Safe				
Periodic Monitor for Atmosphere				
Continuous Monitor for Atmosphere				
Lines Shut/Capped				
Lockout Complete				
Safety Lights				
Communication System Established				
Safety Belt/Life Line				
Respirator (Air Line/Filter Type)				
Filter Respirator				
Warning Signs				
Protective Gear				
Rescue Gear				
Fire Protection Equipment				
Tool/Equipment Inspected				
Other/Miscellaneous (List)				
Test Instruments Used				

Name of Safety Watch \_\_\_\_\_

Permit Issued By \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_

(Site Supervisor)

Use reverse side for additional comments.



- (b) Standby workers shall also be trained in
- emergency response techniques and
  - methods of communicating with workers in confined spaces.



(2) Specific Training

Before beginning a confined-space entry operation, the supervisor shall provide prephase training to all workers involved in the operation. This training shall at a minimum include a thorough review of the activity hazard analysis for the operation.



**TEN RULES FOR CONFINED-SPACE ENTRY**

1. Planning Sessions shall be conducted by a qualified person.
2. Atmospheres shall be tested.
3. Ventilation shall be adequate.
4. Workers shall be trained.
5. Lockout/Tagout procedures shall be used.
6. Standby workers shall use proper communication methods.
7. Safe tools and equipment shall be used.
8. Entry permits shall be up-to-date.
9. Atmospheres shall be monitored continuously.
10. Record-keeping requirements shall be followed.

29 CFR 1910.134; .146; .1000; 1915.4(p);  
1926.21(b)(6)(i); 1926.353(b)(1,2); ANSI Z88.2;  
ANSI Z117.1; NIOSH Pub. 80-106

## 6. Ventilation

*Exhaust systems operate in one of two ways: they draw inside air out to the open and replace it with clean air; or they remove, scrub, or separate hazardous substances in the air and return the cleaned air to the work area. On the construction site, if harmful quantities of dust, fumes, mist, vapors, or gases are produced, they shall be removed by the appropriate mechanical exhaust system; only clean (or cleaned) air shall be returned to the work area.*

### General Requirements for Mechanical-Exhaust Systems

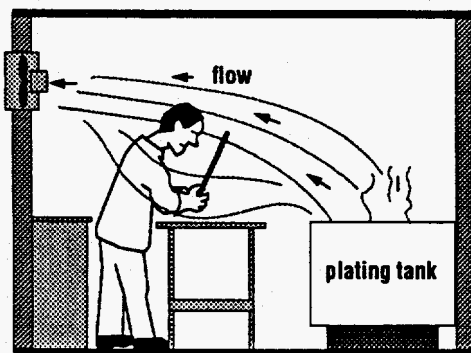
- a. Hazardous concentrations of contaminants in the air shall be determined as specified in the "Threshold Limit Values of Toxic Chemicals of the American Conference of Governmental Industrial Hygienists" and in 29 CFR 1910.1000, "Limits of Air Contaminants," Tables B-1,2,3.
- b. Where local exhaust ventilation systems are used, they shall be designed to prevent the dispersion of harmful concentrations of hazardous materials from the source or operation (i.e., welding, sanding, grinding) into the workers breathing zone.  
29 CFR 1926.57(b)
- c. Exhaust systems shall operate for the duration of the operation it is designed to serve.  
29 CFR 1926.57(d)(1)
- d. Exhaust systems shall operate for as long as it takes to clear an occupied work area of hazardous substances.  
29 CFR 1926.57(d)(2)
- e. Workers wearing respiratory protective equipment (RPE) in an area where an exhaust system is used to remove dust shall not remove the respirator until the atmosphere in the work area is clear.  
29 CFR 1926.57(d)(2)





f. Exhaust systems shall be designed, built, and maintained so that hazardous substances are not drawn through the work area.

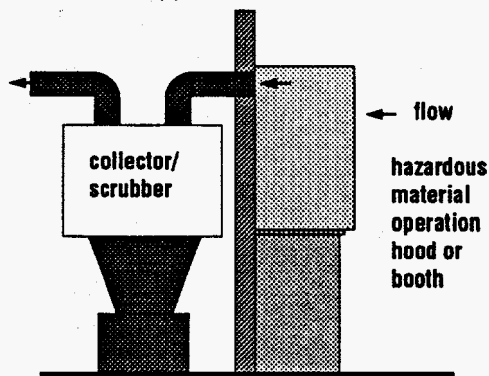
29 CFR 1926.57(b)



**Improper Exhaust Method in Work Area**

g. Exhaust systems shall be designed, built, maintained, and operated in a manner that ensures the volume and velocity of exhaust air is sufficient to capture harmful substances from the work place and carry them to areas of safe disposal.

29 CFR 1926.57(c)



**Exhaust System with Collector**

h. Equipment and technical measures used to keep employee exposure to air contaminants within the prescribed limits must be approved by a competent person, that is, an industrial hygienist or other technically qualified person.

29 CFR 1926.55(b)

i. For assistance in identifying hazardous substances and atmospheres, refer to the appropriate MSDSs.

j. For further information about ventilation for welding operations, see Section III.L.4., "Ventilation for Welding and Cutting" in this guide.

## 7. Asbestos and Associated Products

a. The term "asbestos" means pure or chemically treated chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, or actinolite asbestos.

29 CFR 1926.58(a)

b. This section applies to the following construction operations:

- demolition or salvage of structures in which asbestos is present;
- removal or encapsulation of material containing asbestos;
- construction, alteration, repair, maintenance, and/or renovation of structures that contain asbestos;
- installation of products containing asbestos;
- spill or emergency cleanup of asbestos; and
- transportation, storage, disposal, or containment of asbestos.

29 CFR 1926.58(a)(1-6)

c. The site superintendent or project engineer shall ascertain if asbestos is likely to be encountered by workers on the site.

d. The contractor shall ensure that every effort is taken to avoid worker or public exposure to asbestos or its associated products. If asbestos or its associated products are found during operations, work shall immediately be stopped and site access strictly controlled until the suspected material is identified by a competent person using an approved identification method.

e. If asbestos or its associated products are identified, a competent person shall supervise its control and removal in accordance with all the requirements set forth in 29 CFR 1926.58.





## 8. Lockout/Tagout Program

*The following information may be found in 29 CFR 1910.147, Volume 54, Number 169, September 1, 1989, and in Occupational Safety and Health Administration (OSHA) Education and Training, Advice for Lockout/Tagout Proceedings, Part I and II.*

### a. General Requirements

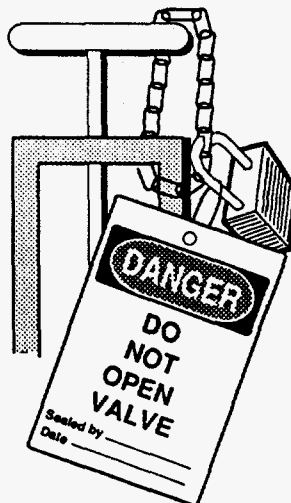
- (1) A lockout/tagout program shall be established for the construction site and coordinated with the construction manager, other subcontractors, and the facility owner.
- (2) As part of this program, workers shall be protected from unplanned releases of energy or hazardous material when they set up, install, maintain, repair, or service equipment or machinery.
- (3) Workers shall be informed about lockout/tagout program requirements when they are first assigned to a job and periodically thereafter.



### b. Requirements of the Lockout/Tagout Program

- (1) Before the work phase of operation begins, it shall be determined in the activity hazard analysis if it is possible for a worker to be exposed to unplanned releases of energy or hazardous material.

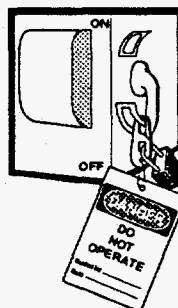
## Methods for Locking and Tagging Out Different Kinds of Equipment



Open-stem and Yoke Valve with Chain or Cable



Lockout of Open Wheel Line Valve with Chain or Cable

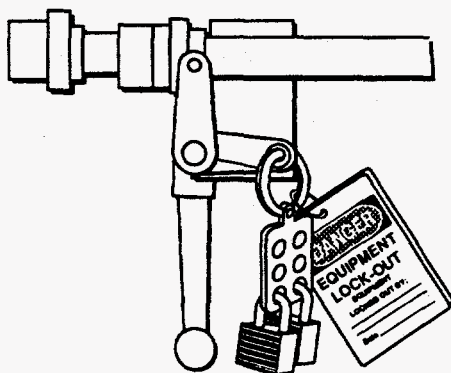


lockout of electric equipment

Disconnecting Power Using a Single Lock



Lockout of a Butt Flange



Lockout of Pneumatic Equipment

Workers shall complete all required information on tags—especially name and date.

(2) Employers shall provide workers with appropriate single and/or multi-locking devices and tags and other items needed to comply with the program.

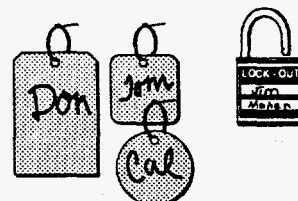
(3) If workers have questions about their safety during lockout or tagout of equipment, they shall consult with their supervisor.

#### c. Procedures for Lockout and Tagout of Equipment

(1) Equipment that might inadvertently release energy or hazardous material when turned on, and consequently injure workers, shall be locked out and tagged out.

(2) A system for workers to obtain locks, multi-locking devices, and tags shall be established; workers shall be instructed in how to obtain appropriate locks and tags.

(3) Each worker must identify his/her locks in an individual way; they may be identified by brass rings, tags, or special marking.



Individually Identified Lock and Tags

(4) A key to each lock issued to a worker shall be retained by the worker; the only other key shall be in the care of a supervisor or the site superintendent and stored in a secure location.

(5) Workers shall request assistance from their supervisor if they are not sure how to lock out equipment. Procedures should be developed for methods of locking-out specific pieces of equipment.

*Power or energy isolation control by locking out is the most accepted method of safety control.*

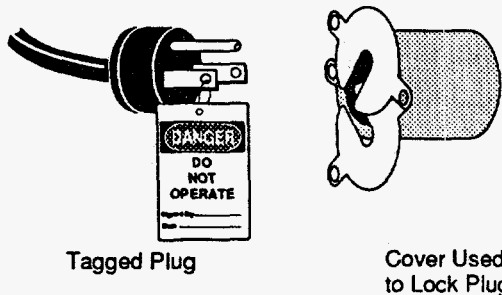
29 CFR 1910.147(a)(1)(c)(2)(ii)

#### d. Lockout of Power Sources

(1) Equipment and machinery including valves, flanges, switches, and similar items shall be locked out at the point of control (for example, at the switch box or valve). If it cannot be locked out at the point of control, it shall be locked out at the next feed source of energy supply.



(2) Cord and plug connections that are out of sight shall be locked out at the energy source (for example, the breaker or disconnect feeding), and the worker's tag or lock shall be applied to the plug end of the cord.



(3) A machine connected by a 110-volt cord and plug shall be considered locked out if the worker is in full control of the cord and plug or if a "DANGER—DO NOT OPERATE" or a "DO NOT START" tag has been applied through the holes of the flat plug connectors.

(4) After a power or energy source is locked out, the worker shall ensure by test or other allowed method that the energy source is isolated.

(5) When two or more persons are working on the same equipment, each person shall attach his or her personal lock to the lever, valve, switch, or disconnect (off) switch. An adaptor or multi-locking device may be used to attach one or more locks to a single control mechanism.

(6) A worker who is assigned to work on locked-out equipment shall place his or her lock and tag on the equipment and determine that there is no power to the equipment. The worker shall also check with others on the site about the status of the machinery if necessary.

(7) The worker shall arrange for jacks, blocks, or other safeguards to be in place along with the lockout.

(8) Periodic audit of the lockout/tagout system shall be conducted, as well as worker training and retraining.

#### e. Removing Locks and Tags and Restoring Power

(1) When work is completed, each worker shall remove only his or her own lock. The equipment should be operable when the last lock is removed.

(2) Power may be turned on to test or adjust the equipment. Each worker who has a lock attached to the equipment shall be advised of the potential danger before removal of his/her lock. Locks shall be reattached by all affected workers after the equipment is tested or adjusted.

(3) Before removing the last lock from locked-out equipment, the worker shall ensure that

- all guards have been replaced;
- equipment, machine, or process is cleared; and
- appropriate personnel are notified of power being restored.

#### f. Equipment Locks

(1) An equipment lock is used to replace a worker lock when equipment is to be locked out for an extended period.

(2) Equipment locks and tags are applied by supervisors. Except for the markings, they are the same type of locks as those applied by workers. The name of the person placing the lock on the equipment shall be indicated on the equipment lock.

(3) Equipment locks may be identified by a brass tag, a specific color, or another recognized marking; an accompanying danger tag shall indicate why the equipment is locked out.

(4) Before the supervisor removes the equipment lock from locked-out equipment, he or she shall ensure that

- all guards have been replaced;
- equipment, machine, or process is cleared; and
- appropriate personnel are notified of power being restored.

#### g. Requirements for Removing Another Worker's Lock

(1) A plan shall be established for removing the lock of a worker who is absent.

(2) The plan shall include a statement, which will be signed by the appropriate superintendent or supervisor, requesting that the lock be removed, indicating the date and time the lock was removed, stating the purpose of the removal, and verifying that the lock owner is indeed absent from the worksite. The statement will be kept on file.

(3) Before removing the lock, the superintendent or supervisor shall ensure that those working on the equipment know that it was previously locked out. The equipment shall be power-tested and inspected; all requirements shall be followed for restoring power according to paragraph f.(4).

(4) The lock owner shall be notified of the lock removal immediately upon his or her return to the worksite.

#### h. Control of the Second Key

(1) The site superintendent, or person on site with the



highest level of responsibility, shall have a second key to workers' locks.

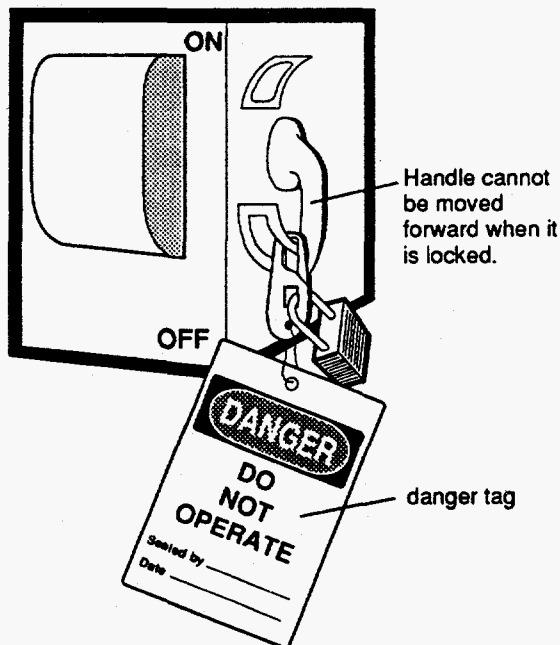
(2) Keys to workers' locks shall be kept in a secure location and made available only to the person with the highest level of responsibility on site. A record indicating that a second key has been removed shall be maintained on the site. If a master key system is used with the second key system, the same control process shall apply.

#### i. Tags

(1) It is recommended that a tag stating either "DANGER—DO NOT OPERATE" or "DANGER—DO NOT START" or another appropriate warning be used along with a lock when equipment or machinery is locked out.

(2) Tags shall be placed to clearly identify the equipment or circuits being worked on. (See examples under 8.B.1 of this section.)

29 CFR 1926.417(c)



Lockout and Tagout of Disconnect

## 9. Respiratory Protection Program

a. Natural ventilation or mechanical exhaust systems shall be used to control harmful dust, mist, gases, fumes, sprays, and vapors. When natural ventilation or mechanical exhaust systems are neither feasible nor effective, workers shall be protected from hazardous atmospheres with respirator protective equipment (RPE).

29 CFR 1926.55(b); 1910.134(a); 1926.103(a)(1)

b. A written respiratory protection program shall be established. The program shall include information and operating procedures for

- purchasing approved equipment;
- training workers;
- maintaining, storing, and servicing RPE;
- selecting, fitting, and wearing RPE;
- restricting the use of RPE;
- evaluating with a medical exam if wearer is physically capable of using a respirator; and
- establishing procedures for using respirators.

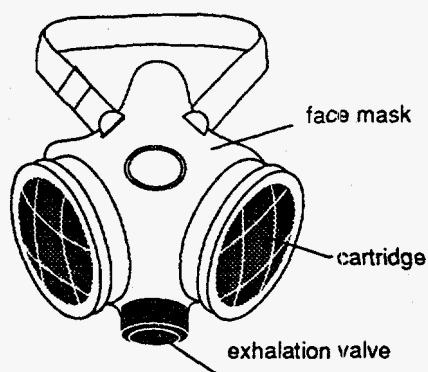
29 CFR 1910.134(b)(1)



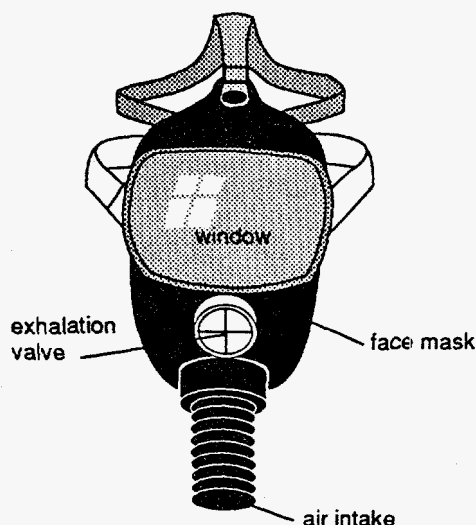
*Note: DOE Order 5480.4 sets forth ANSI Z88.2-1980 as the standard for respiratory protection programs.*



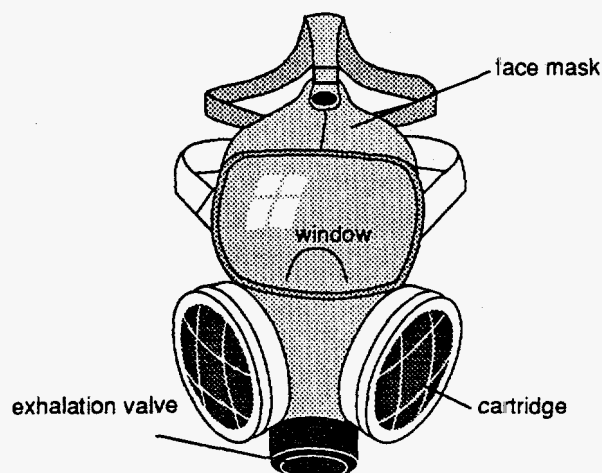
### Basic Types of Respirators



Half-Mask, Air-Purifying Respirator



Full-Face, Air-Supplied Respirator



Full-Face, Air-Purifying Respirator

c. The chemical and physical properties of contaminants and the toxicity and concentration of hazardous material shall be considered when RPE is selected. Only National Institute of Occupational Safety and Health (NIOSH) / Mine Safety and Health Administration (MSHA) approved RPE shall be used.

29 CFR 1926.103(a)(2), (b)(1,2)

d. The following shall be considered when respiratory protective equipment is selected:

- work requirements;
- nature and extent of the hazards; and
- limitations of each piece of equipment.

29 CFR 1926.103(b)(2)

e. Table B-2 lists the types of RPE required for specific hazards.

29 CFR 1926.103(b)(3)

f. Workers shall be trained in the safe use and limitations of the respiratory equipment to be used.

29 CFR 1926.103(c)(1)



g. Workers who issue RPE shall be trained in how to select the appropriate equipment for the job, including respirators and cartridges.

29 CFR 1910.134(e)(2)



h. Medical surveillance and determination of workers' health are required if workers are required to wear respirators.

29 CFR 1910.134(a)(10)

i. A respirator shall not be worn if an adequate seal between the face and respirator cannot be made. The following may cause an inadequate seal: sideburns, a beard, absence of upper or lower dentures, and temples on glasses. A clean shaven face is required to maintain a good seal.

29 CFR 1910.134(e)(5)(i)

j. RPE shall be inspected daily and maintained in good condition. Canisters, cartridges, and air-line filters shall be replaced as necessary. For further information, refer to the manufacturer's recommendations for each respirator.

29 CFR 1926.103(c)(2)

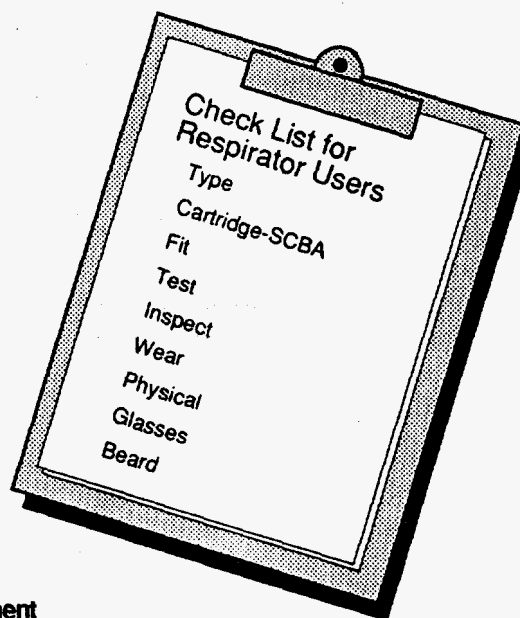
k. SCBA equipment, including air cylinders, shall be thoroughly inspected at least monthly and before each use. Records of all inspections, including inspections of emergency rescue equipment, shall be maintained.

29 CFR 1910.134(f)(2)



1. Air supplied to RPE from bottles, cylinders, or compressors shall be clean, respirable, and free of contaminants. The air shall be at least grade "D" breathing air, as set forth in Compressed Gas Association Commodity Specification G07.1.

29 CFR 1910.134(d)(1)



**Table B-2. Guide to Selecting Respiratory Protective Equipment**

Oxygen deficiency; immediately dangerous to life and health	Self-contained breathing apparatus (SCBA), hose mask with blower, combination air-line respirator with auxiliary self-contained air supply, air-storage receiver with alarm
Gas and vapor contaminants immediately dangerous to life and health	SCBA, hose mask with blower, air-purifying, full-face respirator with chemical canister (gas mask), self-rescue mouthpiece respirator (for escape only), combination air-line respirator with auxiliary self-contained air supply, air-storage receiver with alarm
Gas and vapor contaminants not immediately dangerous to life and health	Air-line respirator, hose mask without blower, air-purifying, half-mask or mouthpiece respirator with chemical cartridge
Particulate contaminants immediately dangerous to life and health	SCBA, hose mask with blower, air-purifying, full-face respirator with appropriate filter, SCBA (for escape only), combination air-line respirator with auxiliary self-contained air supply, air-storage receiver with alarm
Particulate contaminants not immediately dangerous to life and health	Air-purifying, half-mask or mouthpiece respirator with filter pad or cartridge, air-line respirator, air-line abrasive-blasting respirator, hose mask without blower
Combination gas, vapor, and particulate contaminants immediately dangerous to life and health	SCBA, hose mask with blower, air-purifying, full-face respirator with chemical canister and appropriate filter (gas mask with filter), self-rescue mouthpiece respirator (for escape only), combination air-line respirator with auxiliary self-contained air supply, or air supply, or air-storage receiver with alarm
Combination gas, vapor, and particulate contaminants not immediately dangerous to life and health	Air-line respirator, hose mask without blower, air-purifying, half-mask or mouthpiece respirator with chemical cartridge and appropriate filter
<b>Note:</b> For the purpose of this section "immediately dangerous to life and health" is defined as a condition that either poses an immediate threat to life and health or an immediate threat of severe exposure to contaminants such as radioactive materials, which may have adverse delayed effects on health.	





m. Hose connections used to supply air to RPE shall be incompatible with connections on other gas cylinders or fittings.

29 CFR 1910.134(d)(3)

n. Workers who use air-line- or SCBA-RPE in high-hazard atmospheres or those immediately dangerous to life shall be equipped with a safety harness and life line. Also, a safety watch or stand-by worker with the same equipment shall be immediately outside the area. A method of communication between the respirator user and the safety watch shall be established before workers enter these areas.

29 CFR 1910.134(e)(3)

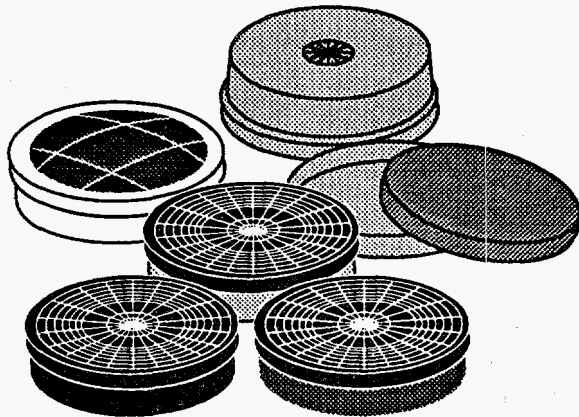
o. Once used, RPE shall be thoroughly cleaned, disinfected, inspected, and determined to be in good condition before it is reissued. New canisters or cartridges that are appropriate for the hazard shall be supplied with the respirator.

29 CFR 1926.103(c)(3)

p. Emergency rescue equipment shall be cleaned and disinfected after each use.

29 CFR 1926.103(c)(3)

q. Workers shall not remove RPE when workers are in a contaminated area.



Types of Cartridges for Respirators

## 10. Radiation (Ionizing and Nonionizing)

### a. Ionizing Radiation

(1) 10 CFR Part 20 and 29 CFR 1910.96 "Ionizing Radiation" shall apply in construction and related activities that use ionizing radiation.

29 CFR 1926.53(a)

(2) Any activity that involves the use of radioactive materials or x-rays, whether or not under license, shall be performed by a competent person specially trained in the proper use and safe operation of such equipment. In the case of materials used under license, only persons actually licensed, or a competent person under direction of the licensee, shall perform such work.

29 CFR 1926.53(b)



(3) The contractor shall ensure that all workers who could be exposed to radiation sources or materials are aware of the operations and are instructed in necessary safeguards.

29 CFR 1926.21(b)

(4) For complete discussion on requirements relating to ionizing radiation, refer to 29 CFR 1910.96.

### b. Nonionizing Radiation (Lasers)

(1) Only qualified and trained workers shall install, adjust, and operate laser equipment. Proof of the laser equipment operator's qualifications shall be in his or her possession at all times.

29 CFR 1926.54(a,b)



(2) Workers who may be exposed to direct or reflected laser light shall be provided with appropriate antilaser eye protection. Refer to paragraph III,A,2,b,(2),(h) for more information.

29 CFR 1926.54(c)

(3) Areas in which lasers are used shall be posted with warning placards.

29 CFR 1926.54(d)

(4) A laser that is to be unattended for 1 hour or more shall be turned off.

29 CFR 1926.54(e)

(5) Only mechanical or electronic detectors shall be used to internally align the laser.

29 CFR 1926.54(f)

(6) The laser beam shall not be directed at workers.

29 CFR 1926.54(g)





(7) If practical, lasers shall not be operated during rain, snow, or in dusty or foggy conditions.

29 CFR 1926.54(h)

(8) Laser equipment shall be labeled with its maximum output.

29 CFR 1926.54(i)

(9) The following worker exposure limits for laser light shall be observed:

- direct staring – 1 microwatt per square centimeter
- incidental observing – 1 milliwatt per square centimeter
- diffused reflected light – 2 1/2 watts per square centimeter.

(Note: DOE 5480.4 prescribes ANSI Z136.1 for laser safety.)

29 CFR 1926.54(j)

(10) When possible, laser units should be set up above the heads of employees and not at eye level.

29 CFR 1926.54(k)

**c. Microwave Radiation (Electromagnetic)**

Workers shall not be exposed to microwave power densities in excess of 10 milliwatts per square centimeter.

(Note: DOE 5480.4 prescribes ANSI C95.1 for microwave exposure/exposure therein from 300 kHz to 100 GHz.)



## DEFINITIONS

**Abrasive Blasting Hood or Helmet** — A helmet covering the face, neck, and shoulders that protects the worker from rebounding abrasive particles during blasting operations.

**Administrative Control** — A nonengineered control, such as reducing the amount of time a worker is exposed to a specific hazard.

**Approved** — Meets the requirements of a code, regulation, law, standard, or ordinance or is accepted by a controlling agency or testing laboratory.

**Beam Cap** — A cover placed over the output opening of a laser beam.

**Cartridge/Canister** — An air-purifying device, attached to a respirator, that is designed to remove specific contaminants.

**dBA** — A scale of sound measurement that approximates the response of the normal human ear to the intensity levels of specific frequencies. Noise exposure is given in dBA.

**Disposable Mask** — A filtering mask that is discarded after it is used.

**Ear Muffs** — A hearing-protection device that fits over the ears.

**Ear Plug** — A hearing-protection device that is inserted into the ear canal, providing an acoustical seal.

**Engineered Control** — A physical control, as opposed to an administrative control, such as a barrier that reduces worker noise exposure or a ventilation system that removes air contaminants.

**Filter** — Porous material, through which a liquid or gas is passed, that removes contaminants.

**Full-Face Mask** — A full-face respirator that has a face piece with a viewing window.

**Half-Mask** — A respirator with a face piece that covers only the mouth and nose.

**Hazardous Material/Chemical** — Any material that has a physical or health hazard, such as poison, corrosive agent, flammable substance, explosive, radioactive chemical, or any other material that can endanger human health or well-being if handled improperly.

**Hearing-Protection Device** — A device, such as ear plugs or ear muffs, that protects workers from high-noise levels.

**Immediately Dangerous to Life or Health** — A condition that either poses an immediate threat to life and health or an immediate threat of severe contaminant exposure such as from radioactive materials, which may have adverse delayed effects on health.

**Industrial Hygienist** — A professional who anticipates and remediates unhealthy conditions in the workplace in order to prevent illness among employees.



**Material Safety Data Sheet (MSDS)** — A document that contains data on the hazards and properties of a particular material, including instructions for its safe use.

**Permissible Noise Level Exposure** — The maximum sound pressure level measured in dBA that a worker may be safely exposed to (85 dBA or below).

**Potable** — Fit to drink.

**Qualified person** — A person who is trained in a specific field and is experienced in performing a specific task.

**Respirable Air** — Air that is free of harmful contaminants and at a minimum meets the requirements of the specification for grade "D" breathing air as described in Compressed Gas Association Commodity Specification G-7.1-1966.

**Respirator** — A device worn to protect the wearer from inhaling toxic or harmful atmospheres. This may include half-face and full-face air-purifying respirators, SCBA, supplied-air face pieces, and supplied-air suits and hoods.

**Self-Contained Breathing Apparatus (SCBA)** — A portable breathing unit in which the breathing air is an integral part of the respirator, allowing freedom for movement, usually a full-face mask type respirator.

**Time Weighted Average (TWA)** — Worker exposure averaged over a specific time period, typically an 8-hour work period.

**Toxic Material** — A material that has a harmful effect on the body.

**Worker Health Hazard** — A possible source of danger to workers caused by a specific event, such as ingestion of hazardous material, respiration of hazardous fumes or dust, or absorption of hazardous chemicals through the skin.

**Worker Physical Hazard** — A possible source of danger to a worker's external body surface caused by an event such as a burn to the skin from contact with corrosive material.

**KEY ITEMS CHECK LIST**  
**SECTION B. PROTECTION FOR WORKER SAFETY, HEALTH, AND THE ENVIRONMENT**

	Item	Paragraph	Notes
1.	MEDICAL AND FIRST AID	B.1	
	Is prompt medical attention available?	B.1.b	
	Are first aid kits inspected?	B.1.d	
2.	SANITATION	B.2	
	Are the required toilet facilities available?	B.2.a	
	Is drinking water available?	B.2.b	
	Do provided laundry, food service, and lodgings meet sanitation requirements?	B.2.d B.2.e B.2.f	
3.	HEARING PROTECTION PROGRAM	B.3	
	Are potential noise-hazard areas identified?	B.3.a B.3.d B.3.e	
	Are administrative or engineering controls applied to hazardous noise?	B.3.c(1),(2)	
	Has hearing protection been correctly selected, fitted, and worn where it is required?	B.3.c(3) A.2.h	
	Are exposed employees monitored for hearing loss?	B.3.d	
	Are training requirements met?	B.3.d	
	Are audiometric testing records maintained?	B.3.d	
4.	HAZARD COMMUNICATION PROGRAM	B.4	
	Is a written program established where hazardous materials are used on site?	B.4.a	
	Are hazardous materials inventoried?	B.4.c(4)	
	Are materials labeled?	B.4.f	
	Are MSDS provided for all hazardous material?	B.4.c(2) B.4.g	
	Are training requirements met?	B.4.c(3) B.4.g	

## KEY ITEMS CHECK LIST (continued)

	Item	Paragraph	Notes
5.	CONFINED SPACES	B.5	
	Is there full understanding of the defined characteristics of a confined space?	B.5.b B.5.c	
	Are confined spaces identified and posted?	B.5.d	
	Are confined-space workers provided with appropriate PPE and other protective devices or equipment?	B.5.f	
	Are confined-space workers trained and approved to use PPE as required?	B.5.f	
	Is correct equipment used and inspected before use?	B.5.f	
	Has a confined-space activity hazard analysis been made and a pre-entry planning session been conducted?	B.5.e B.5.g	
	Have workers received general and specific training for the confined-space activity?	B.5.h (1) B.5.h (2)	
	Are required permits obtained and completed?	B.5.h (2) B.5.g (7)	
6.	VENTILATION	B.6	
	Are the systems that are used to eliminate toxic or hazardous contaminants approved by a technically qualified person?	B.6.h	
	Are local exhaust systems correctly used to eliminate air contaminants?	B.6.g B.6.c	
	Do local exhaust systems prevent dispersion of harmful concentrations of hazardous materials to workers breathing zone?	B.6.b	
7.	ASBESTOS AND ASSOCIATED PRODUCTS	B.7	
	Are all asbestos-containing materials identified?	B.7.c	
	Have all employee exposure and ambient air standards been met?	B.7.d B.7.e	
8.	LOCKOUT/TAGOUT PROGRAM	B.8	
	Is a program established and coordinated with workers, managers, subcontractors, and the facility owner?	B.8.a	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
Is equipment under maintenance locked and tagged to prevent worker injury resulting from unplanned energy release?	B.8.b	
Are procedures established, known, and followed for lockout and tagout operations?	B.8.c	
Are locks and tags removed only according to the established procedure?	B.8.e	
Is there a plan for removing an absent worker's lock?	B.8.g	
9. RESPIRATORY PROTECTION PROGRAM	B.9	
Is respiratory protection used only after other hazard control measures have been considered?	B.9.a	
Is there a written and approved respiratory protection program?	B.9.b	
Are established criteria used for selecting and fitting respirators?	B.9.d B.9.b	
Are workers who issue or must use respirators trained in their selection and use?	B.9.f B.9.g	
Are respirators inspected and cleaned?	B.9.j, k, o, p	
10. RADIATION (IONIZING AND NONIONIZING)	B.10	
a. <i>Ionizing Radiation</i>	B.10.a	
Are requirements unique to DOE facilities followed on DOE construction sites?	B.10.a.1	
Are all x-ray and materials-licensing requirements met?	B.10.a.2	
Are training requirements met?	B.10.a.2	
b. <i>Nonionizing Radiation (Lasers)</i>	B.10.b	
Are laser safety training requirements met?	B.10.b.1	
Are lasers correctly labeled as to maximum output?	B.10.b.8	
Are the correct signs posted?	B.10.b.3	
Are laser-light exposure limits observed?	B.10.b.9	
Are exposed workers provided with the correct laser eye protection?	B.10.b.2	
c. <i>Microwave Radiation (Electromagnetic)</i>	B.10.c	
Are radar-power-density exposure limits observed?	B.10.c	



## Section C. Excavations



*Excavation operations are among the first undertaken at a construction site. Accidental cave-ins of earth that has been excavated account for a large majority of construction-site fatalities each year. In many cases, workers receive no warning when excavated ground collapses, and they find themselves trapped under tons of soil.*

*Because of a lack of distinction between a trench and an excavation, both shall be considered an excavation and are subject to the same requirements.*

### 1. General Requirements

a. All surface material that may be hazardous to workers (for example, piles of soil, construction material, or weakened walkways) shall be removed or supported using appropriate methods.

29 Code of Federal Regulations (CFR) 1926.651(a)

b. Before excavating begins, the responsible supervisor shall request that local utility companies locate and mark all underground installations (for example, sewer, telephone, fuel, electric, natural gas, and water lines).

29 CFR 1926.651(b)(1,2)

c. To prevent worker accidents during excavation, all underground installations shall be identified, located, protected, supported, or removed as necessary (for example, electrical lines shall be de-energized, gas or water lines shall be chained or blocked, and boulders or other items that could be hazardous shall be removed from the excavation area).

29 CFR 1926.651(b)(1,4)

d. When excavation operations approach the estimated location of underground installations, every effort shall be taken to determine the exact location of the service by instrumentation, cautious hand digging, probing, etc. Located service will be marked and continuing digging

activities closely monitored to avoid service damage.

29 CFR 1926.651(b)(3)

e. Ramps and runways used as a means of access or egress from an excavation shall be designed by a competent person and shall meet the following requirements:

- When a ramp or runway is constructed of two or more structural members, the structural members shall be uniform in thickness and connected together to prevent displacement. Cleats or other material used to connect structural members shall be attached to the underside of the ramp or runway to prevent workers from tripping.
- Ramps or runways used in place of steps shall be provided with surfacing on the top to prevent slipping.

29 CFR 1926.651(c)(1)(i-v)



f. A stairway, ladder, ramp, or other safe means of egress shall be located inside excavations that are more than 4 feet deep. The means of egress shall not be more than 25 feet from any worker in the excavation. If a ladder is used, it shall be properly secured and extend at least 3 feet beyond the surface or top of trench box.

29 CFR 1926.651(c)(2)

g. Workers exposed to vehicular traffic shall be provided with Department of Transportation (DOT) orange vests.

29 CFR 1926.651(d)

h. To ensure that workers are not struck by spillage or falling material, the supervisor shall prohibit workers from entering an area that is occupied by lifting or digging equipment (for example, a worker shall not enter (1) an excavation during digging operations, (2) an area where material is being mechanically lowered or raised, or (3) an area where vehicles are being loaded or unloaded).

29 CFR 1926.651(e)

i. When workers operate mobile equipment near the edge of an excavation, warning symbols such as barricades, hand, or mechanical signals, or stop logs (curbing) shall be used.

29 CFR 1926.651(f)



j. When the atmosphere in an excavation is hazardous, has a potential to become hazardous, or is deficient in oxygen (for example, in land fills, digouts for underground storage tanks, exposed pipes, above-ground storage areas, or during operations where gasoline-powered equipment is being used), the atmosphere shall be tested each time workers enter to begin their activities, and as often as necessary during the operation, to ensure safety. The procedures outlined in Section III.B.5. "Confined Spaces" of this guide shall be applied to excavations with the potential for hazardous atmospheres.

29 CFR 1926.651(g)(1)(i-iv); (g)(2)(i-ii)

k. Daily inspections of excavations and adjacent areas shall be conducted by a competent person before work begins and as needed throughout the shift. Of particular concern is the presence of rain, snow, or excessive vibration (for example, earthquakes, the use of heavy equipment, heavily traveled roads, railroads), which can adversely affect the integrity of the excavation. If there are indications of water accumulation, water seepage soil cracks, sloughing, cave-ins, hazardous atmospheres, or failure of protective systems, work shall be stopped immediately, and the excavations shall be evacuated until appropriate support systems or control measures are installed.

29 CFR 1926.651(k)(1,2)

l. Excavations shall be shored or braced when the stability of adjoining structures (for example, adjoining buildings, pavement, sidewalks, high walls, or loose rocks) is endangered.

29 CFR 1926.651(i)

m. All material, including soil that has been excavated, shall be stored not less than 2 feet from the edge of any excavation. If sufficient room for storage is not available, material shall be moved to another safe location. Retaining devices, such as stoplogs or curbing, that are sufficient to prevent materials or equipment from rolling or falling into the excavation also may be used.

29 CFR 1926.651(j)(1,2)

n. If it is necessary for employees or equipment to pass over areas that have been excavated, walkways or bridges with guard rails shall be provided.

29 CFR 1926.651(l)(1)

o. Adequate physical barriers shall be provided at all remotely located excavations (for example, wells, pits, or shafts). The excavation shall be backfilled when exploration or similar operations are complete.

29 CFR 1926.651(l)(2)

p. Backfilling of an excavation shall be conducted as the support systems are removed from the bottom up.

29 CFR 1926.652(e)(1)(iv)

## 2. Requirements for Protective Systems

a. An adequate protective system shall be used to protect workers in excavations from cave-ins. A protective system is not required if the excavation meets one of the following conditions:

- The excavation is entirely in stable rock.
- The excavation is less than 5 feet deep and has been examined by a competent person, who has found no indication of a potential cave-in.

29 CFR 1926.652(a)(1)(i-ii)

b. Workers shall not be permitted to work at levels above other workers, when there is inadequate protection from the hazards of falling, rolling, or sliding material or equipment.

29 CFR 1926.652(f)

c. To protect workers from cave-ins, all vertically cut walls 5 feet or more in depth shall be (1) sloped; (2) braced using timber shoring, hydraulic aluminum shoring, or shielding; or (3) otherwise protected by a system designed by a professional engineer.

29 CFR 1926.652(b)

d. Manufactured material and equipment used for protective systems shall be used and maintained in a manner that is consistent with the recommendations of the manufacturer and that will prevent employee exposure to hazards.

29 CFR 1926.652(d)(2)

## 3. Sloping Requirements

*NOTE: Sloping for excavations greater than 20 feet deep shall be designed by a registered professional engineer. When using sloping as a protective system, DOE recommends 1 1/2 horizontal to 1 vertical for all excavations. Any other sloping shall be in accordance with 29 CFR 1926.652.*



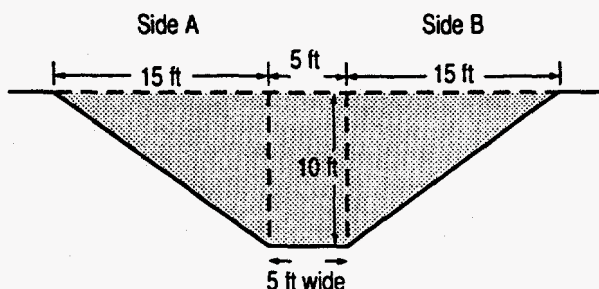




### Recommended Sloping Configurations (required for Type-C soils)

Excavations 20 feet or less in depth shall have a slope of 1 1/2 horizontal to 1 vertical (34 degrees measured from the horizontal). For example, if an excavation is 10 feet deep and 5 feet wide at its bottom, the total width of the excavation at the top will be 35 feet (15 feet wide Side A + 15 feet wide Side B + 5 feet wide at the bottom of the excavation).

29 CFR 1926.652(b)(1)(i)

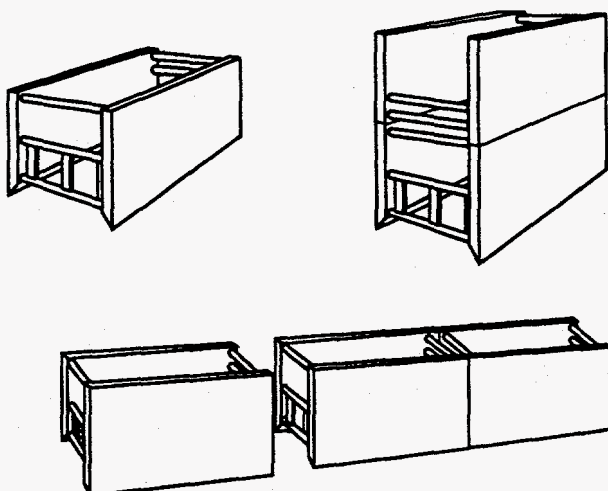


Slope Configuration

### 4. Timber or Hydraulic Aluminum Shoring

*Refer to 29 CFR 1926.652 for the specific requirements for the use of timber or hydraulic aluminum shoring.*

### 5. Shielding (Trench Boxes)



Shielding (Trench Box) Configurations

a. Shielding systems shall not be subjected to loads exceeding those which the system was designed to withstand.

29 CFR 1926.652(g)(1)(i)

b. Shields shall be installed in a manner so as to restrict lateral or other hazardous movement of the shield in case of sudden lateral loads.

29 CFR 1926.652(g)(1)(ii)

c. Employees shall be protected by shields from cave-ins when entering or exiting areas.

29 CFR 1926.652(g)(1)(iii)

d. Workers shall enter and exit a shield *only* through the opening at the top of the shield.

CFR 1926.652(g)(1)(iii)

e. Workers shall exit the shield or trench box when it is installed, removed, or moved.

CFR 1926.652(g)(1)(iv)

f. When trenches are deeper than the height of the trench box, soils above the trench box shall be sloped back to the allowable slope based on soil classification, and the trench box shall extend at least 18" above the bottom of the sloped area.

29 CFR 1926.652(a)

### 6. Requirements for Systems Designed by a Registered Professional Engineer

a. If the standard sloping, support, or shield system is not used or the excavation is greater than 20 feet deep, excavation supports shall be designed by a registered professional engineer.



b. Engineering designs shall be written; and, for sloping systems, they shall include the following:

- the magnitude of the slopes determined to be safe for each particular project;
- the configurations determined to be safe for each particular project;
- the identity of the registered professional engineer approving the design; and
- at least one copy of the design maintained at the job site while the slope is being constructed.

29 CFR 1926.652(b)(4)

c. For support and shield systems, the engineering designs shall include the following:

- a plan indicating the sizes, types, and configurations of the materials to be used in the protective system;
- the identity of the registered professional engineer approving the design; and



- at least one copy of the design maintained at the job site during the construction of the protective system.  
29 CFR 1926.652(b)(4)

## 7. Hazardous Materials

Should a potentially hazardous material be discovered during excavation, work should immediately stop until the find can be evaluated by an industrial hygienist (or equivalent competent person). No action should be taken that could spread the material or cause unnecessary exposure.

**SAMPLE FORM****DAILY TRENCH AND EXCAVATION LOG**

Date \_\_\_\_\_ Inspected By \_\_\_\_\_

Project \_\_\_\_\_

Protective System Used: Trench Box ☐ Wood Shoring ☐ Sloping ☐

Other \_\_\_\_\_

Trench / Excavation Purpose: Drainage ☐ Water ☐ Sewer ☐ Gas ☐

Other: \_\_\_\_\_

Visual Soil Test Made: Yes ☐ No ☐ Type: \_\_\_\_\_

Soil Type: \_\_\_\_\_

Soil Strength: \_\_\_\_\_

Water Conditions: Wet ☐ Dry ☐ Submerged ☐Does Hazardous Atmosphere Exist? Yes ☐ No ☐  
(If Yes, Follow Confined-Space Entry Procedure)Trench / Excavation Measurements: Length   
Width   
Depth Ladder Available Within 25 Feet of All Workers? Yes ☐ No ☐Spoil Pile (Excavated Material) No Less than 2 Feet from Edge? Yes ☐ No ☐Other Material Protected from Falling into Trench/Excavation? Yes ☐ No ☐Workers Exposed To Vehicular Traffic Wearing DOT Vest? Yes ☐ No ☐Utilities or Structures Protected? Yes ☐ No ☐Sewer and Gas Lines Exposed? Yes ☐ No ☐(If Yes, Follow Confined-Space Entry Procedure And Monitor for Toxic Atmosphere)Periodic Inspections Made? Yes ☐ No ☐ Date of Last Inspection: Workers Have Received Training in Trench/Excavation Safety? Yes ☐ No ☐

Other Information or Remarks \_\_\_\_\_

\_\_\_\_\_



## DEFINITIONS

**Accepted Engineering Practices** — Practices that are in accordance with the standards required of a registered professional engineer.

**Allowable Slope** — The steepest incline of an excavation face that is allowable as protection against cave-ins.

**Cave-In** — Collapse of an excavation that can entrap, bury, or immobilize anyone within it.

**Cohesive, Fine-Grained Soil** — Soil that does not crumble, can be molded when moist, is hard to break up when dry, and can be excavated with vertical side slopes. Examples include high-content clay silt, sandy clay, silty clay, clay, and organic clay.

**Cross Braces** — The horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

**Excavation** — A man-made cut, cavity, trench, or depression in an earth surface. (In this chapter, excavation and trench are interchangeable.)

**Hazardous Atmosphere** — An atmosphere that is potentially explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen-deficient, toxic, or otherwise harmful.

**Hydraulic Aluminum Shoring** — A pre-engineered shoring system comprised of aluminum hydraulic cylinders (cross braces) used in conjunction with vertical rails (uprights) or horizontal rails (walers). This system is designed to support sidewalls of an excavation and prevent cave-ins.

**Ramp** — An inclined surface used to gain access to one point from another and constructed of earth, steel, or wood.

**Registered Professional Engineer** — A professional engineer who is registered in the state in which work is to be performed.

**Sheeting** — The panels of a shoring system that hold the earth in position and in turn are supported by other members of the shoring system.

**Shield (Trench Box or Trench Shield)** — A protective system used in an excavation to keep dirt from caving into the excavation.

**Shoring** — A structure that supports the sides of an excavation. Examples are metal hydraulic, mechanical, or timber shoring systems.

**Trench** — A narrow excavation made below ground in which the depth is greater than the width and the width is less than 15 feet. (In this section, trench and excavation are interchangeable.)



**Type-A Soil** — Cohesive soils with an unconfined compressive strength of 1.5 tons per square foot (tsf) or greater. Examples are clay, silty clay, sandy clay, clay loam, sandy clay loam, and cemented soils (such as caliche and hardpan).

No soil is Type-A if

- The soil is fissured;
- The soil is subject to vibration from heavy traffic, pile driving, or similar effects;
- The soil has been previously disturbed;
- The soil is part of a sloped, layered system where the layers deep into the excavation on a slope are of 4 horizontal to 1 vertical (4H:1V) or greater; or
- The material is subjected to other factors that would require it to be classified as a less stable material.

**Type-B Soil** — Cohesive soils with an unconfined compressive strength greater than 0.5 tsf but less than 1.5 tsf, or

- Granular cohesionless soils including angular gravel (similar to crushed rock), silt, silt loam, sandy loam, and in some cases, silty clay loam and sandy clay loam;
- Previously disturbed soils except those which would otherwise be classified as Type-C soil;
- Soil that meets the unconfined compressive strength or cementation requirements for Type-A, but is fissured or subject to vibration;
- Dry rock that is not stable; or
- Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less than 4 horizontal to 1 vertical (4H:1V).

**Type-C Soil** — Cohesive soil with an unconfined compressive strength of 0.5 tsf or less, or

- Granular soils including gravel, sand, and loamy sand;
- Submerged soil or soil from which water is freely seeping; or
- Material in a sloped, layered system where the layers dip into the excavation or slope of 4 horizontal to 1 vertical (4H:1V) or steeper.

**Uprights** — The vertical members of a trench shoring system that are placed in contact with the earth.

**Wales** — Horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

**KEY ITEMS CHECK LIST  
SECTION C. EXCAVATIONS**

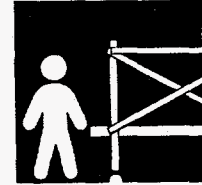
Item	Paragraph	Notes
1. GENERAL REQUIREMENTS	C.1	
Is the site cleared of hazardous materials that could cause cave-ins?	C.1.a	
Are all underground utilities identified and prevented from causing hazards?	C.1.b C.1.c C.1.d	
Are employees kept out during digging or material-handling operations?	C.1.h	
Are orange vests used near vehicular traffic?	C.1.g	
Are safe entry and exit provided for excavations?	C.1.e C.1.f	
Are excavations protected from falling machinery by stop logs, curbs, barricades, signals, or other devices?	C.1.i	
Does a competent person who has the authority to abate hazards inspect the excavation daily for explosive conditions and possible cave-ins?	C.1.k	
Are cave-ins prevented next to adjoining structures by shoring, bracing, or other means?	C.1.l	
2. REQUIREMENTS FOR PROTECTIVE SYSTEMS	C.2	
Are protective systems adequate to protect workers from a cave-in?	C.2.a	
3. SLOPING REQUIREMENTS	C.3	
Are the sloping requirements met for the soil type according to 29 CFR 1926.652?	C.3	
4. TIMBER OR HYDRAULIC ALUMINUM SHORING	C.4	
Is the correct timber or hydraulic aluminum shoring identified for the type of soil, according to the tables in 29 CFR 1926.652?	C.4	
Are the correct shores used for the soil type, according to the requirements of 29 CFR 1926.652?	C.4	

KEY ITEMS CHECK LIST (continued)

	Item	Paragraph	Notes
5.	SHIELDING (TRENCH BOXES)	C.5	
	Can the trench box withstand the loads to which it may be subjected?	C.5.a	
	Are employees protected from cave-ins by entering and exiting the box from the top only?	C.5.d	
	Are employees instructed to leave the trench box when it is moved, installed, or removed?	C.5.e	
6.	REQUIREMENTS FOR SYSTEMS DESIGNED BY A REGISTERED PROFESSIONAL ENGINEER (PE)	C.6	
	Are nonstandard systems of sloping support or shielding designed only by a registered PE?	C.6.a	
	Are protective systems for excavations that are greater than 20 feet deep designed by a registered professional engineer?	C.6.a	



## Section D. Scaffolding



*Scaffolding is a vital part of the construction process. To ensure the safety of workers and the public, scaffolding must be handled properly. A competent person should be present at the worksite during the entire scaffold construction process to ensure that all scaffolding is erected, moved, used, and dismantled safely.*

### 1. General Requirements

- a. Scaffolding shall not be erected, moved, dismantled, or altered except under the supervision of a competent person.

29 Code of Federal Regulations  
(CFR) 1926.451(a)(3)



- b. To prevent the scaffold from swaying or being displaced, the upright members shall be plumb.

29 CFR 1926.451(a)(15)

- c. Shore scaffolds or lean-to scaffolds are prohibited.

29 CFR 1926.451(a)(20)

*Do not use the face of the wall being worked to support worker weight.*

- d. If workers pass under or work under scaffolding, US Standard #18 gauge, 1/2-inch wire mesh shall be installed between the toeboard and the midrail.

29 CFR 1926.451(a)(6)

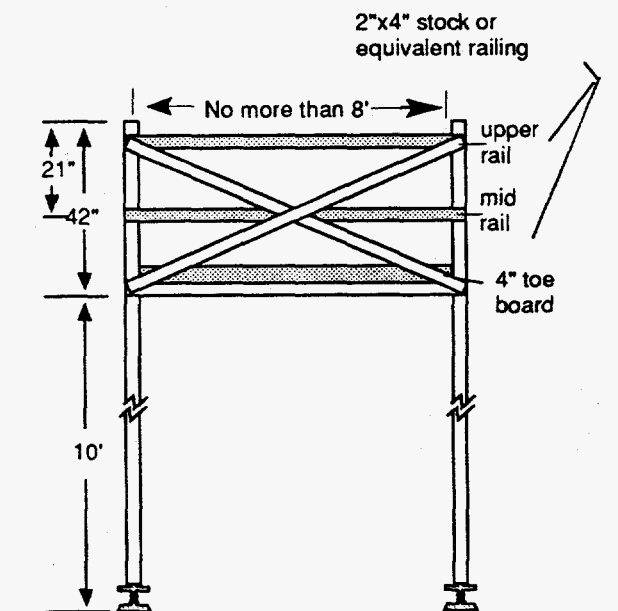
- e. Any part of the scaffolding (including accessories) that is damaged or weakened shall be immediately repaired or replaced.

29 CFR 1926.451(a)(8)

- f. Standard guardrails and toeboards shall be installed on all open sides and ends of scaffolds over 10 feet high, and on scaffolds 4 feet to 10 feet high with a minimum horizontal dimension in either direction of less than 45 inches. Guardrails shall be 2 x 4 inches or the equivalent,

shall be 42 inches high from planking to the top, and have a midrail and a 4-inch-high toeboard. Intervals between vertical supports shall not exceed 8'.

29 CFR 1926.451(a)(4,5)



- g. Unstable objects (for example, barrels, boxes, loose bricks, or loosely stacked wood) shall not be used as a foundation for scaffolding or planking.

29 CFR 1926.451(a)(2)

- h. To prevent the scaffold from settling or being displaced, the footings shall be sound, rigid, and able to support the intended load. To distribute the scaffold load evenly, the footings shall be placed on mud boards.

29 CFR 1926.451(a)(2)

- i. Scaffold workers who are exposed to falling objects shall be provided with overhead protection by planking or 1/2" plywood (or the equivalent) that fully covers the overhead scaffold base.

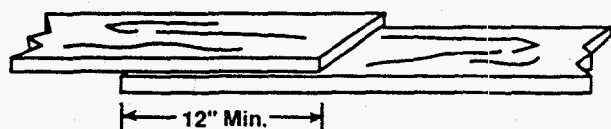
29 CFR 1926.451(a)(16)





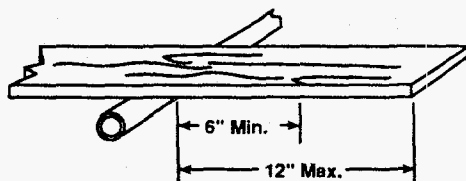
- j. Scaffold planking shall be overlapped a minimum of 12 inches or be securely attached to the scaffolding.

29 CFR 1926.451(a)(12)



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

29 CFR 1926.451(a)(14)



- l. A scaffold may not be used until any tripping or slippery conditions (for example, snow, ice, mud, or loose materials) have been removed.

29 CFR 1926.451(a)(17)

- m. Workers shall use an access ladder or built-on scaffold ladder to reach their work areas; they shall not climb on scaffold cross members.

29 CFR 1926.451(a)(13)

- n. Only materials for immediate use shall be stored on scaffolds, and they shall not overload its capacity. A scaffold must be able to support 4 times the intended load.

29 CFR 1926.250(b)(5); 451(A)(7)

- o. Planking shall be of scaffold grade, or the equivalent, as recognized by approved grading rules for species of wood used. See Table D-1.

29 CFR 1926.451(a)(10)

**Table D-1 Planking Material**

(Maximum permissible spans for 2- x 10-inch or wider planks).					
	Full thickness undressed lumber			Nominal thickness lumber	
Working Load (psf)	25	50	75	25	50
Permissible Span (ft)	10	8	6	8	6

\*Not recommended for heavy duty use.

- p. The following scaffolds must be designed by a registered professional engineer competent in this field:

- wood pole scaffolds over 60 feet in height,
- tube and coupler scaffolds that exceed the parameters in tables D-1 and D-2 of this guide,
- frame scaffolds over 125 feet in height, and
- outrigger scaffolds plus scaffold erections.

29 CFR 1926.451(b)(16), (c)(4), (d)(9), (g)(3)



## 2. Tubular Welded-Frame Scaffolds

- a. Scaffolding shall be cross-braced or braced diagonally so that the vertical members are secure and aligned; the scaffolding must also be plumb, square, and rigid.

29 CFR 1926.451(d)(3)

- b. Individual sections of the scaffolding shall be locked together with cotter pins or another equivalent means. If any defect in the locking mechanism is found, workers shall stop work immediately and wait until the scaffolding is repaired.

29 CFR 1926.451(d)(6)

- c. Scaffolds shall be securely tied to the building at intervals of 30 feet horizontal and 26 feet vertical. Never tie to an unstable support or wall. Ties are for lateral stability only and should never support weight.

29 CFR 1926.451(d)(7)

## 3. Tube and Coupler Scaffolds

- Tube and coupler scaffolds shall be able to support four times the maximum intended load. See Table D-2.

29 CFR 1926.451(c)(5)

**Table D-2 Tube and Coupler Scaffolds Maximum Intended Loads**

Light Duty		
Uniform distributed load.....	Not to exceed 25 psf	
Post spacing (longitudinal).....	10 ft 0 in.	
Post spacing (transverse).....	6 ft 0 in.	
Working levels	Additional planked levels	Maximum height
1	8	125 ft
2	4	125 ft
3	0	91 ft
Medium Duty		
Uniform distributed load.....	Not to exceed 50 psf	
Post spacing (longitudinal).....	8 ft 0 in.	
Post spacing (transverse).....	6 ft 0 in.	
Working levels	Additional planked levels	Maximum height
1	6	125 ft
2	0	78 ft
Heavy Duty		
Uniform distributed load.....	Not to exceed 75 psf	
Post spacing (longitudinal).....	6 ft 6 in.	
Post spacing (transverse).....	6 ft 0 in.	
Working levels	Additional planked levels	Maximum height
1	6	125 ft

**4. Manually Propelled Mobile Scaffolds**

a. When a free-standing mobile scaffold tower is used, the height of the tower shall not exceed 4 times the minimum base dimensions. For example, if the base is 10 feet x 20 feet, the maximum height is 40 feet.

29 CFR 1926.451(e)(1)

b. To prevent planks from moving off the scaffold, they shall be laid close together, extend along the full width of the scaffold and be secured in place.

29 CFR 1926.451(e)(4)

c. Scaffold casters rated to support 4 times the maximum scaffold load (including the workers and equipment) shall be used. All mobile scaffolds shall be equipped with wheel locks that shall be locked at all times when the scaffold is in use.

29 CFR 1926.451(e)(2)

d. Workers should not ride on a scaffold when it is moved. All tools, construction material, and other items that might fall from the scaffold shall be secured or removed before it is relocated.

29 CFR 1926.451(e)(7)

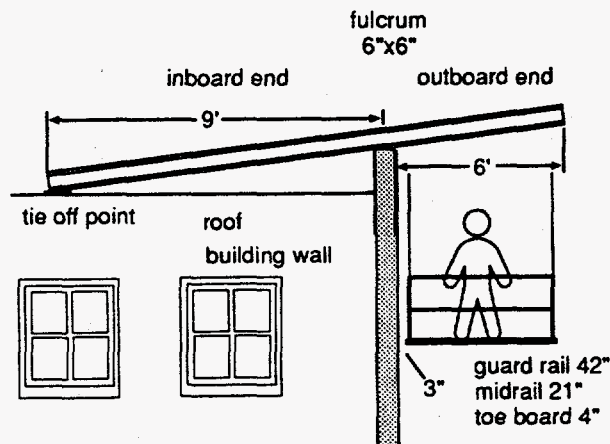
e. At each new location, a mobile scaffold shall be placed on firm ground and kept plumb, and casters shall be locked to prevent movement.

29 CFR 1926.451(e)(8)

**5. Outrigger Scaffolds**

a. Outrigger beams shall not extend more than 6 feet from the face of the building.

29 CFR 1926.451(g)(1)



b. The length of the inboard end of outrigger beams, measured from the fulcrum to anchor point, shall be not less than 1 1/2 times the length of the outboard end. The beams shall rest on edge, the sides shall be plumb, and the edges shall be horizontal.

29 CFR 1926.451(g)(1)

c. The fulcrum of the beam shall rest on a secure bearing that is at least 6 inches in each horizontal direction.

29 CFR 1926.451(g)(1)

d. To ensure that the beam does not move or tip, it shall be secured to the fulcrum.

29 CFR 1926.451(g)(1)

e. To prevent tipping or any horizontal movement, the inboard ends of the beams shall be securely anchored to an adjoining secure structure.

29 CFR 1926.451(g)(2)

**Table D-3 Outrigger Scaffolding Requirements**

Scaffold Accessory	Minimum Dimensions for Light Duty (25 psf)	Minimum Dimensions for Medium Duty (50 psf)
Outrigger beams	2" x 10"	3" x 10"
Maximum outrigger spacing	10'	6'
Planking	2" x 10"	2" x 10"
Guardrail	2" x 4"	2" x 4"
Guardrail uprights	2" x 4"	2" x 4"
Toeboard	4"	4"

f. Scaffold-grade boards shall be used for planking; the boards shall be arranged with no space between them and placed to within 3 inches of the building wall. Planking shall be securely attached to the scaffold beams.

29 CFR 1926.451(g)(4)

g. Outrigger scaffolding shall be designed in accordance with the requirements of Table D-3 or by a registered professional engineer competent in the field.

29 CFR 1926.451(g)(3)



## 6. Two-Point Suspension Scaffolds (Swinging Scaffolds)

a. The platform on a two-point suspension scaffold shall be not less than 20 inches nor more than 36 inches wide. The platform shall be fastened securely to the hangers with U-bolts or other equivalent means.

29 CFR 1926.451(i)(1)

b. Employees shall be protected by a safety harness that is attached to a life line; the life line shall be attached to a secure structure (not to the scaffold). For more details on fall protection, see paragraph III.A.2.g of this guide.

29 CFR 1926.451(i)(8)

c. The roof irons or hooks shall be constructed of mild steel, or other equivalent material, and securely installed and anchored to a solid part of the adjoining structure. Three-quarter-inch manila rope tie-backs, or the equivalent, which must be attached to a structurally sound portion of the building, shall be used as a back-up anchor.

29 CFR 1926.451(i)(4)

d. The scaffold shall be suspended with wire rope, fiber rope, or synthetic rope that can support 6 times the weight

of the scaffold plus workers and equipment. All scaffold components shall be capable of supporting 4 times the scaffold's rated load.

29 CFR 1926.451(i)(5)

e. To prevent damage to the rope, the sheaves of all blocks shall fit the size and type of rope used.

29 CFR 1926.451(i)(6)

f. To prevent the scaffold from swaying, it shall be lashed to the building with nylon rope or other appropriate means.

29 CFR 1926.451(i)(9)

g. All wire, fiber, and synthetic ropes; slings; hangers; platforms; or other supporting parts of the scaffolding shall be inspected before each installation. When the scaffold is being used, these parts shall be inspected daily.

29 CFR 1926.451(i)(7)

h. The number of workers on a suspension scaffold shall be limited to no more than the rated capacity divided by 250 pounds; i.e., a scaffold rated at 500 pounds allows two workers, a 750-pound rating allows three workers.

29 CFR 1926.451(i)(8)

## 7. Boatswain's Chair

a. If a boatswain's chair is used during gas or arc welding, the chair support slings shall be made of 3/8-inch wire rope.

29 CFR 1926.451(l)(3)

b. A worker in a boatswain's chair shall wear a safety harness and a life line that is attached to a secure structure. For more details on fall protection, see III.A.2.g of this guide.

29 CFR 1926.451(l)(4)



c. The roof irons, hooks, and anchor points that support the boatswain's chair shall be securely attached to the structure.

29 CFR 1926.451(l)(6)

d. The seat in a boatswain's chair shall be at least 12 x 24 x 1 inch thick. To prevent the chair from splitting, the underside shall be reinforced with cleats that are securely fastened to the board under the seat. The two fiber

rope seat slings shall be at least 5/8" in diameter, pass through the four seat holes, and cross on the underside.

29 CFR 1926.451(l)(1,2)

## **8. Other Scaffolds**

Other types of scaffolds and scaffold materials or equipment that are allowed but not covered in this section shall meet the specific requirements of 29 CFR 1926.451 and/or ANSI A10.8.



## DEFINITIONS

**Boatswains' Chair** — A type of scaffold that includes a seat supported by slings that are attached to a suspended rope.

**Guardrail** — A horizontal rail that is secured to the upright parts of a scaffold and is installed along the exposed sides and ends of the platforms. The upper rail is installed 42 inches above the planking and the midrail is 21 inches high. Guardrails must be rated to support 200 pounds laterally. A standard guardrail includes a 4 inch toeboard.

**Manually Propelled Mobile Scaffold** — A portable, rolling scaffold supported on casters.

**Maximum Rated Load** — The weight a scaffold is designed to safely support.

**Mud Board** — Plywood, planking, or a metal plate that is placed between the ground and the scaffold footing and is used to level the scaffold. The minimum size must be 10- x 10- x 1-inch plywood, 10- x 10- x 2-inch planking, or a 1/2-inch metal plate.

**Outrigger Scaffold** — A scaffold supported by outriggers or throw-outs projecting from the wall or face of the building. The inboard ends of the scaffold are secured to the building.

**Plumb** — Exactly vertical (90°) or true.

**psf** — Pound per square foot.

**Scaffold** — Any temporary elevated platform, and its supporting structures, that is used for supporting workers and material.

**Scaffold Grade Planking** — Long-grain knot-free 2" x 10" planks that are graded and marked for scaffold use.

**Toeboard** — A barrier along the bottom, sides, and ends of a scaffold that prevents material from falling below. Toeboards shall be at least 4 inches high.

**Tube and Coupler Scaffold** — A scaffold constructed from straight metal pipes (tubes) held together by metal clamps (couplers).

**Tubular Welded-Frame Scaffold** — A sectional panel or frame scaffold that is built of prefabricated, welded horizontal and vertical sections.

**Two-Point Suspension Scaffold (Swinging Scaffold)** — A scaffold that is suspended from overhead supports allowing the work platform to be lowered or raised to any desired height using tackle (line and pulley) or hoisting machines.

**KEY ITEMS CHECK LIST  
SECTION D. SCAFFOLDING**

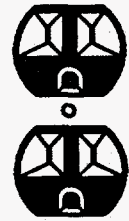
Item	Paragraph	Notes
1. GENERAL REQUIREMENTS	D.1	
Is scaffolding designed, erected, moved, and dismantled only under the direction of a competent person?	D.1.a	
Are only permissible types of scaffolds used?	D.1.c	
Is scaffolding correctly supported on a solid base?	D.1.g	
Are upright members plumbed?	D.1.b D.1.b	
Are workers protected from falling objects by toe boards, wire mesh, solid planking, and overhead protection?	D.1.d	
Are workers protected from falls of 10 feet or more by standard guardrails, safe access ladders, and solid planking and by correcting slippery conditions?	D.1.f D.1.j D.1.k D.1.m	
Are the design requirements met and are scaffolds loaded only to the maximum so as to protect workers from scaffold collapse?	D.1.o D.1.b D.1.h D.1.n	
2. TUBULAR WELDED-FRAME SCAFFOLDS	D.2	
Are sections correctly supported, plumbed, cross braced, aligned, squared, and made rigid?	D.2.a D.2.b D.2.c	
Are sections over 10 feet in height fitted with standard guardrails and toeboards?	D.1.f	
Are sections tied for lateral stability?	D.2.c	
3. TUBE AND COUPLER SCAFFOLDS	D.3	
Is care taken not to exceed load limits?	D.3	
4. MANUALLY PROPELLED MOBILE SCAFFOLDS	D.4	
Is the minimum base dimension at least 1/4 the height?	D.4.a	
Are working platforms fully planked?	D.4.b	
Are wheel locks used?	D.4.c D.4.e	
Are employees prevented from riding scaffolds when the scaffolds are moved?	D.4.d	

# KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
5. OUTRIGGER SCAFFOLDS	D.5	
Does the outrigger extend less than 6 feet beyond the face of the building?	D.5.a	
Is the length of the inboard end of the beam at least 1-1/2 times the outboard end?	D.5.b	
Is the beam securely anchored at the inboard end and also attached to a fulcrum that has at least a 6 x 6 inch base?	D.5.c D.5.e	
6. TWO-POINT SUSPENSION SCAFFOLDS (SWINGING SCAFFOLDS)	D.6	
Are lifelines used to protect workers from falls?	D.6.b	
Are all required ropes and hardware inspected daily for damage and load-bearing adequacy?	D.6.g	
7. BOATSWAIN'S CHAIR	D.7	
Are belts and lifelines used to protect workers from falls?	D.7.b	
Is wire rope used where welding is done from the chair?	D.7.a	
Are roof irons, hooks, and anchors firmly attached?	D.7.c	
Is the seat correctly rigged so that a broken seat will not result in a fall?	D.7.d	



## Section E. Electrical Safety



*Electrical safety is an important component of a construction safety program. To minimize personal injury from contact with energized sources, construction workers shall be trained in the fundamentals of electrical safety; and all electrical hazards found on the construction site must be recorded and corrected immediately.*

*The following section covers safety requirements for users of electricity (general site workers and tradespeople) and electrical workers (electricians). Additional installation requirements, interpretations, and definitions may be found in 29 Code of Federal Regulations (CFR) 1926.400–449 and the National Electric Code (National Fire Protection Association [NFPA 70]); other national, state, and local codes; and manufacturer's instructions attached to equipment. All appropriate requirements shall be followed.*

### 1. Requirements for All Site Workers

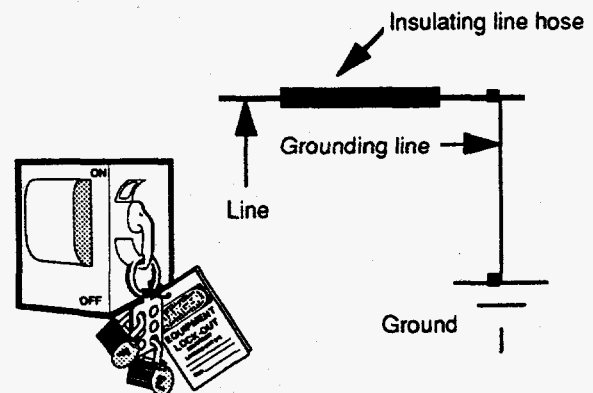
a. Before work begins it shall be determined by inquiry, direct observation, or by instrument that the electric power circuit, exposed or concealed, is so located that work may bring a worker, tools, or machine into physical or electrical contact with the circuit. Where such a circuit exists, warning signs shall be posted and maintained, and workers shall be advised of such circuit locations, the hazard involved, and the protective means to be taken.

29 CFR 1926.416(a)(3)



b. Workers shall not be permitted to work near any part of an electrical power circuit where there could be contact with the circuit in the course of their work unless the worker is protected against shock by guarding or de-energizing and grounding the circuit.

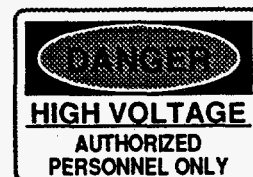
29 CFR 1926.416(a)(1)



### De-energizing, Guarding, and Grounding Methods

c. Entrances to rooms and other guarded locations of exposed live parts shall be posted with warnings forbidding entry of unqualified persons. Workers shall obey all warning signs and tags.

29 CFR 1926.403(i)(2)(iii)



### Obey Warnings

d. Workspaces, walkways, and similar locations shall be clear of electric cords and tools, so that workers can pass freely.

29 CFR 1926.416(b)(2)



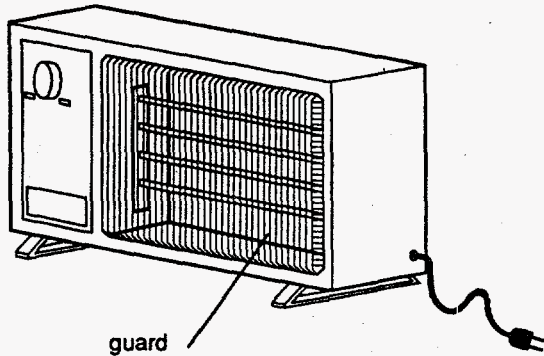


e. Workers shall not store material in or around electrical cabinets or equipment, if the material blocks the service space.

29 CFR 1926.403(i)(1)(i,ii)

f. Appliances shall have no live parts exposed to worker contact. Guards which prevent worker exposure to live parts shall not be removed or altered.

29 CFR 1926.405(j)(3)(i)



Guarded Appliance

g. Workers using electrically powered equipment shall confirm that such equipment is free of recognized hazards.

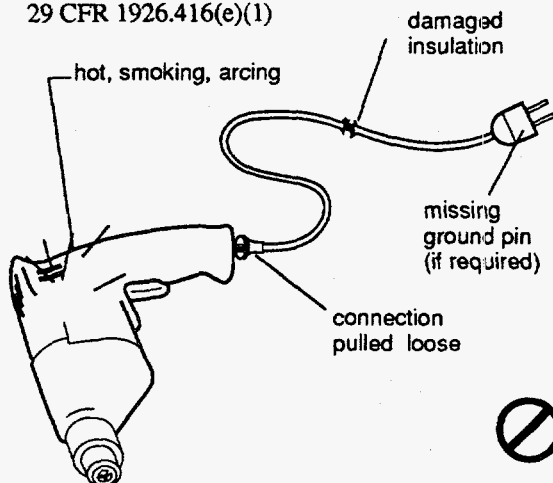
29 CFR 1926.300(a); 403(b)

h. Workers shall inspect electric power tools and equipment (including extension cords and plugs) for the following hazards:

- missing ground pins on plugs (except double insulated);
- insulation pulled free from plugs or support connections;
- damaged insulation (breaks, cuts, or cracks);
- exposed wires; and
- evidence of arcing, sparking, or smoking.

i. If the hazards in paragraph h. above are evident in electric power tools or equipment, the tool or equipment shall be removed from the construction site until repaired.

29 CFR 1926.416(e)(1)

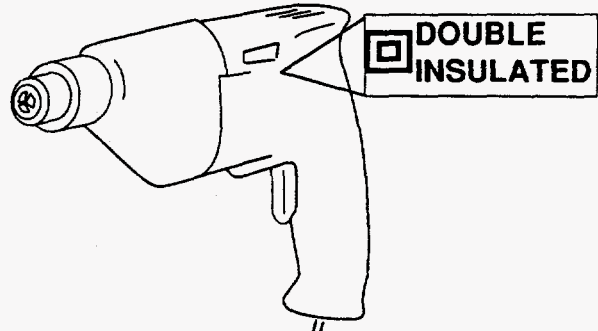


j. Electrically powered equipment shall be connected only to approved outlets or sources that meet the requirements.

29 CFR 1926, subpart K

k. Electric power tools shall be grounded or double insulated. If double insulated, they shall be permanently labeled "DOUBLE INSULATED."

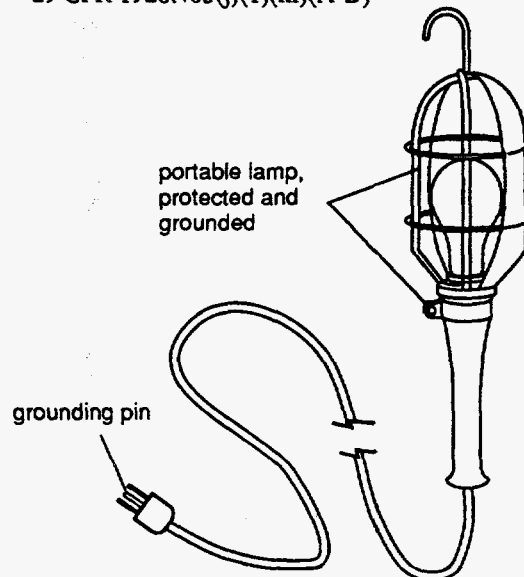
29 CFR 1926.302(a)(1); 404(f)(7)(iv)(C)(6);  
.951(f)(2)(i-ii)



*Note: The use of double-insulated electrical hand tools does not alter the requirements for a ground-fault circuit interrupter (GFCI) system or an assured equipment grounding program for a worksite-supplied electric power system as required in 29 CFR 1926.404(b)(1)(i).*

l. Portable lampholders used by workers shall be wired with flexible cord and a polarized or grounding-type attachment plug; they shall be equipped with an insulated, molded-composition handle. A substantial guard (if metal, it shall be grounded by a conductor run inside the power cord) shall be attached to the handle or lampholder.

29 CFR 1926.405(j)(1)(iii)(A-D)





m. Where the exact location of underground electric power lines is unknown, workers who break ground with jack hammers, metal bars, or similar tools shall use specially insulated gloves to prevent injury. Prior to breaking unmarked ground, the employer shall ascertain by inquiry, observation, or instrument whether there is an underground power source.

29 CFR 1926.416(a)(2,3)

n. The following requirements for flexible cords and extension cords shall be followed:

(1) Flexible cords and cables shall be suitable for the condition and location in which they are used and shall only be used for pendants, fixture wiring, portable lamps and appliances, elevator cables, cranes and hoists, applications to prevent the transmission of vibration or noise, and stationary equipment that requires frequent interchange or removal for maintenance or repair.

29 CFR 1926.405(g)(1)(i)

(2) Three-wire extension cords shall be used with portable electric tools and appliances and shall be designed for hard or extra-hard use. Flexible cords used with temporary or portable lights shall be designed for hard or extra-hard use.

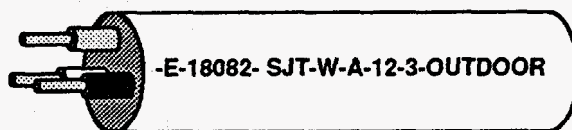
29 CFR 1926.405(a)(2)(ii)(J)



Three-Wire Hard-Use Cord

(3) Only type SJ, SJO, SJT, SJTO, S, SO, ST, and STO extension and flexible cords shall be used on the construction site. Each cord shall have the type, size, and number of conductors durably marked on its surface.

29 CFR 1926.405(g)(2)(ii)



Common Wire Marking

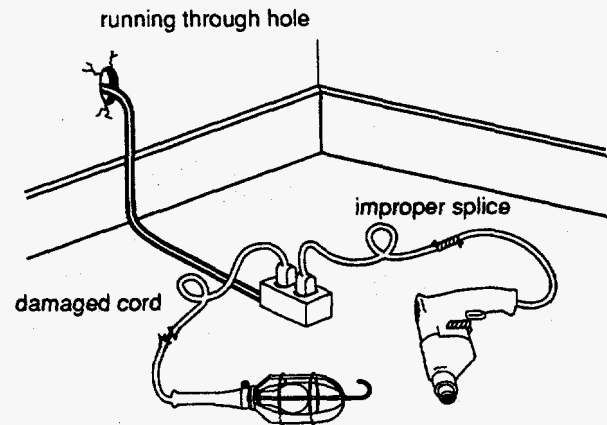
(4) Flexible and extension cords shall be used only in continuous lengths, without splices or taps. Hard-service flexible cords No. 12 or larger may be repaired, if the insulation and outer sheath properties remain the same and the usage characteristics of the original cord are retained.

29 CFR 1926.405(g)(2)(iii)

(5) Unless otherwise permitted, flexible cords and cables shall not be used for the following: as substitutes for fixed wiring; run through holes in walls, ceilings, or floors; run through doorways, windows, or similar openings except as

indicated in (6) below; as attachments to buildings or structures; or in concealed areas behind building walls, ceilings, or floors.

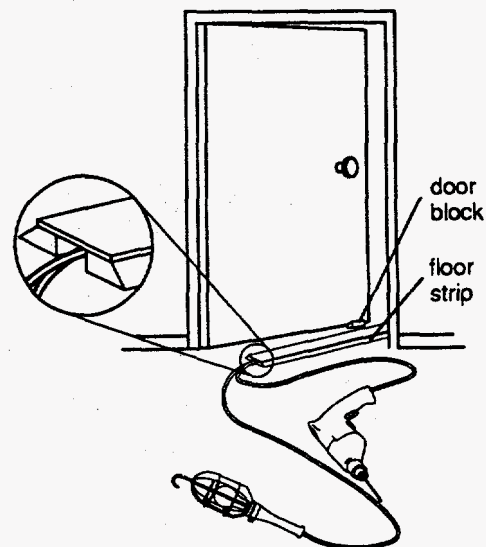
29 CFR 1926.405(g)(1)(iii)(A-E)



Unsafe Portable Cord Methods

(6) Flexible cords and cables may pass through doorways and other pinch points, if protection is provided to prevent damage.

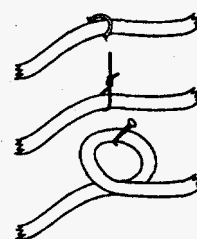
29 CFR 1926.405(a)(2)(ii)(I)



Cord Protection

(7) Extension cords shall not be fastened with staples, hung with nails, or suspended on wires.

29 CFR 1926.416(e)(2)





## 2. Requirements for Electrical Workers

a. Workers shall be trained in the safety-related work practices, safety procedures, and other safety requirements that pertain to their respective job assignments and shall not be permitted to work in an area likely to encounter electrical hazards unless they have been trained to recognize and avoid the hazards to which they will be exposed.

NFPA 70E II,1,A



b. Only qualified workers may work on electric circuit parts or equipment that has not been de-energized. Such workers shall be capable of working safely on energized circuits and shall be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulating tools.

29 CFR 1910.333(c)(2)

c. Only qualified workers trained to use test instruments shall test circuits or equipment.

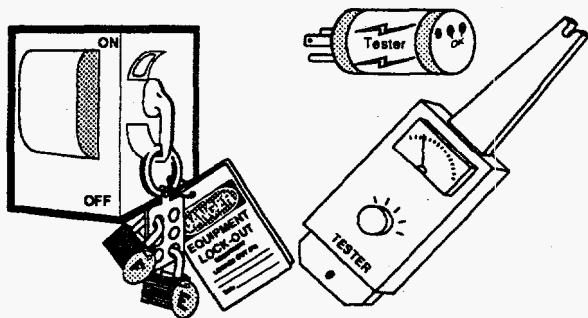
29 CFR 1910.334(c)(1)



d. Test equipment shall be visually inspected for external defects or damage before it is used; and, if there is evidence of a defect or damage, the equipment shall not be used. Test equipment shall be kept dry and damage-free.

29 CFR 1910.334(c)(2)

e. Electrical workers should test or observe electrical equipment or circuits to be worked on, to confirm if they are energized or de-energized.



f. Workers shall lockout and tagout any circuit or equipment that is being worked on to prevent the circuit or equipment from being energized accidentally. Workers shall verify that the equipment is de-energized.

29 CFR 1926.417(a-c)

g. Electrical workers shall not wear conductive apparel, such as metal watch bands, bracelets, rings, necklaces, or head gear.

NFPA 70E II,1,B,(2)(c)

h. Rubber personal protective equipment (PPE), such as gloves, blankets, hoods, line hoses, sleeves, and mats shall be used as prescribed for protection from energized sources. The PPE shall be inspected before use and kept dry and damage-free. Care must be taken to ensure that the correct class of rubber protective equipment is used, in accordance with the rated voltage and application. The manufacturer's recommendations should be followed for care, testing, and use.

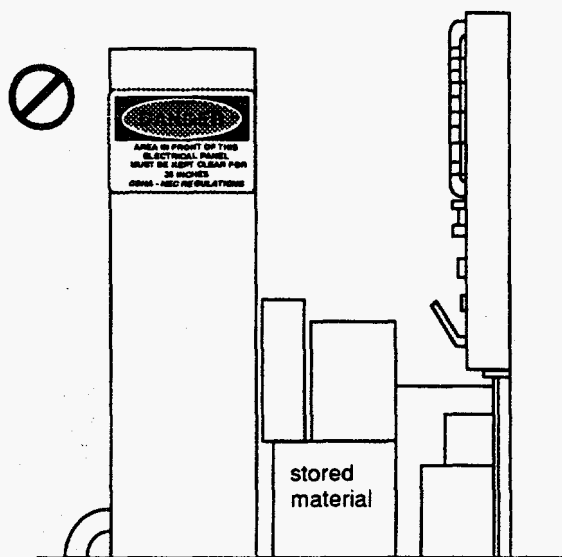
29 CFR 1926.951(a)(1)(i-iii)

i. Portable metal ladders or ladders with longitudinal metallic reinforcement shall not be used on or near exposed energized parts, circuits, or equipment.

NFPA 70E II,1,B,(2),(g)

j. There shall be sufficient space maintained in front of electrical equipment, and materials shall not be stored in this space. Space shall be maintained in accordance with Table E-1 for 600 volts, nominal, or less and Table E-2 for more than 600 volts, nominal.

29 CFR 1926.403(i)(1)(i),(j)(3)(i)



Improper Storage



**Table E-1. Clearance for Energized Parts, Workspace < 600 Volts**

Nominal Voltage	Minimum Clear Distance		
	(a)*	(b)	(c)*
0-150	3 ft	3 ft	3 ft
151-600	3 ft	3.5 ft	4 ft

**Table E-2. Minimum Depth of Clear Working Space in Front of Electrical Equipment, > 600 Volts**

Nominal Voltage to Ground	Conditions		
	(a)*	(b)*	(c)*
601-2,500	3 ft	4 ft	5 ft
2,500-9,000	4 ft	5 ft	6 ft
9,001-25,000	5 ft	6 ft	9 ft
25,001-75 kV	6 ft	8 ft	10 ft
Above 75 kV	8 ft	10 ft	12 ft

\*Conditions: Tables E-1 and E-2

\*(a) Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by insulating materials. Insulated wire or insulated busbars operating at not more than 300 volts are not considered live parts.

\*(b) Exposed live parts on one side and grounded parts on the other side. Walls of concrete, block, or tile are considered grounded surfaces.

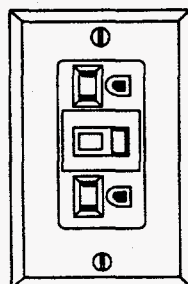
\*(c) Exposed live parts on both sides of the workspace [not guarded as specified in (a) above] with the operator between.

k. Special voltage-rated tools or fuse pullers shall be used to remove or install fuses in energized terminals.

29 CFR 1926.416(d); NFPA 70E II 1, B (2)(e)(i)

### 3. On-Site Electrical Safety Requirements

a. To protect workers from electric shock, the construction site shall be protected by ground-fault circuit interrupters, and/or an assured equipment-grounding conductor program.



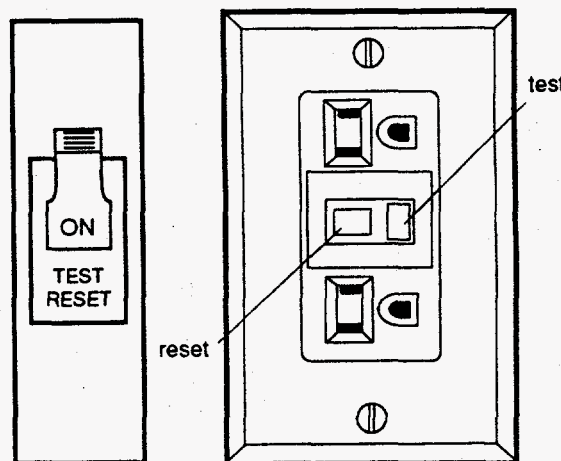
GFCI Outlet

*The DOE-recommended method for worker protection from electric shock is the use of ground-fault circuit interrupters because of their greater effectiveness and ease in implementation and verification. If, however, an assured equipment grounding program is selected, refer to 29 CFR 1926.404(b)(1)(iii).*

29 CFR 1926.404(b)(1)(i)

b. Single-phase, 120-volt, 15- and 20-ampere receptacle outlets that are not part of the permanent wiring of a building or structure shall have approved ground-fault circuit interrupters for workers' protection from electrical shock.

**Note:** A ground-fault circuit interrupter may be installed in the feeder to protect all branch circuits connected to that feeder.



Ground-Fault Circuit Interrupter

29 CFR 1926.404(b)(1)(ii)

c. Receptacles on a 2-wire, single-phase portable or vehicle-mounted generator rated at 5 kilowatt or below, in which the circuit conductors are insulated from the generator frame and all other grounded surfaces, need not be protected with a ground-fault circuit interrupter.

29 CFR 1926.404(b)(1)(ii)



d. When two or more receptacles are served by a branch circuit, the ampere rating shall meet the specifications in Table E-3.

**Table E-3. Receptacle Ratings for Various Size Circuits**

Circuit Rating Amperes	Receptacle Rating Amperes
15	Not over 15
20	15 or 20
30	30
40	40 to 50
50	50

29 CFR 1926.404(b)(2)(ii)

e. All electrical conductors and equipment shall be approved and free of hazards that may cause death or serious physical harm.

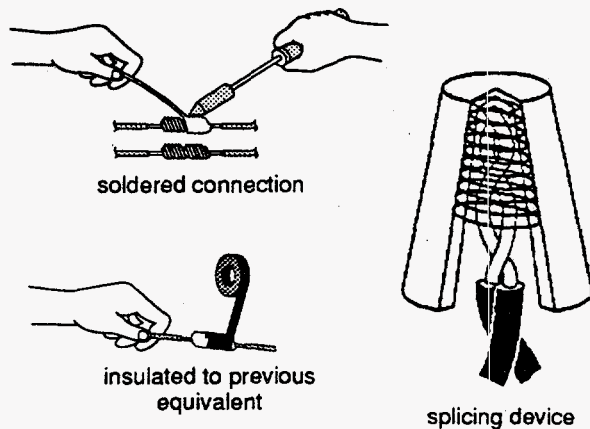
29 CFR 1926.403(a,b)

f. Circuit breakers, fuses, and other equipment intended to interrupt circuits shall have an interrupting rating sufficient for the current to be interrupted.

29 CFR 1926.403(c); NFPA 70,110-9

g. Conductors shall be spliced using approved splicing methods (welding, soldering, braising, or splicing devices).

29 CFR 1926.403(e)



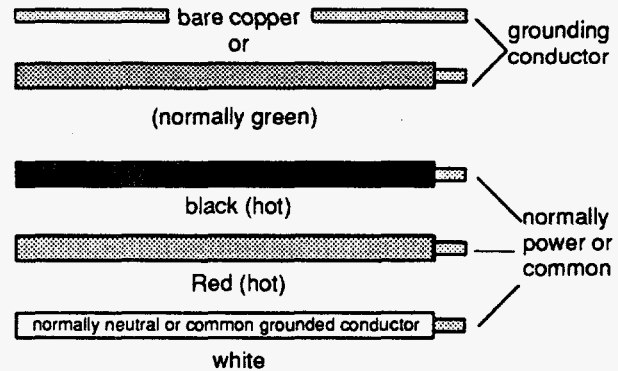
**Approved Splicing Methods**

h. All conductors used for general wiring shall be insulated for the voltage carried, unless otherwise specified.

29 CFR 1926.405(f)

i. Insulated grounded conductors, ungrounded conductors, and equipment-grounding conductors shall be distinguishable from each other by their colors.

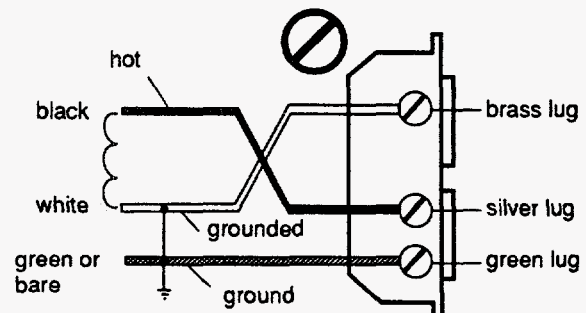
29 CFR 1926.405(f)



**Distinguishable Colored Wire**

j. No conductor shall be connected to a lead so as to reverse the designated polarity. Grounding terminals or grounding-type devices shall not be used for purposes other than grounding.

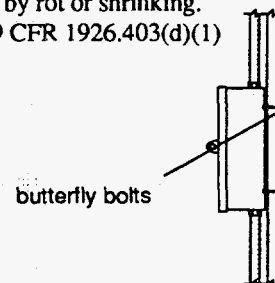
29 CFR 1926.404(a)(2,3)



**Reverse Polarity Wiring**

k. Equipment shall be firmly secured to its mounting surface. Equipment mounted on masonry, concrete, plaster, or similar material shall not be secured by wooden plugs because wooden plugs tend to loose anchoring ability by rot or shrinking.

29 CFR 1926.403(d)(1)

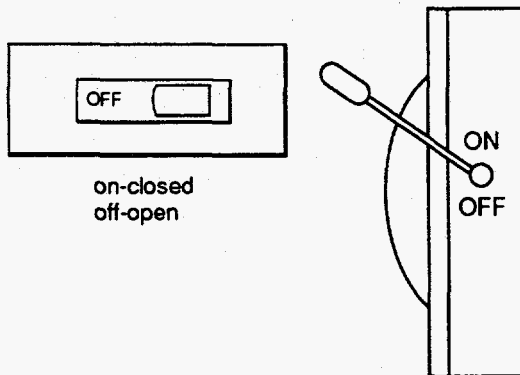


**Wall-Mounted Enclosure Method**



l. The disconnecting means shall indicate the open (off) or closed (on) position and shall simultaneously disconnect all ungrounded conductors. The "up" position will be the closed (on) position for circuit breaker handles that are operated vertically.

29 CFR 1926.404(e)(1)(vi)(A,B)



Disconnects

m. Circuit protection, including circuit breakers and fuses, shall not be bypassed or replaced with higher rated protective devices that would allow currents in excess of the load rating of the circuit wiring.

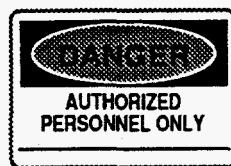
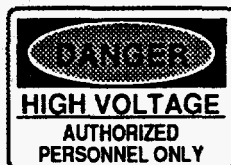
29 CFR 1926.416(c)

n. Overcurrent devices shall be kept readily accessible. They shall be located away from ignitable material and not exposed to damage by chemicals, equipment, or by other operations that can cause physical damage.

29 CFR 1926.404(e)(1)(iv)

o. Any room, vault, or other guarded location containing exposed live parts shall be posted with warning signs forbidding unqualified or unauthorized persons to enter. Installations of more than 600 volts, nominal, shall be kept locked or under the observation of a qualified person at all times.

29 CFR 1926.403(i)(2)(iii); 403(j)(2)



Warning Signs

p. When enclosed live parts are exposed for inspection or service and the workspace is in a passageway or open space, the space shall be guarded, and there shall be at least one unobstructed entrance to the area.

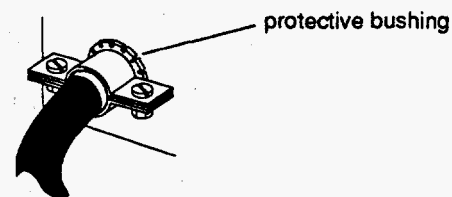
29 CFR 1926.403(i)(1)(ii,iii)

q. Live electrical equipment operating at 50 volts or more shall be guarded from accidental contact. Approved means of such guarding include cabinets or other enclosures; screens or partitions; placing the equipment in a room or vault; or locating the equipment on a balcony, gallery, or elevated platform (8 feet or more) and so arranged as to exclude unauthorized persons.

29 CFR 1926.403(i)(2)(i)(A-D)

r. Flexible cords shall be connected to devices and fittings so that, if strained, they will not pull on joints or terminal screws. Flexible cords shall be protected by bushings if they pass through holes in enclosures.

29 CFR 1926.405(g)(2)(iv,v)



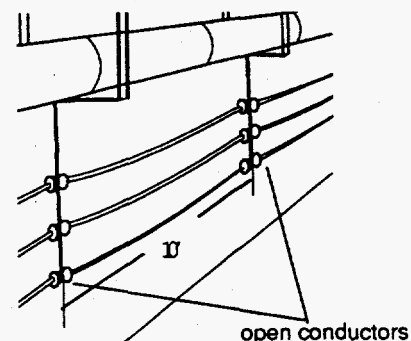
Enclosure Cord and Bushing

s. All requirements for permanent wiring shall apply to temporary wiring installations unless specifically modified according to paragraphs (1) through (9) below. Temporary wiring shall be removed as soon as the job for which the wiring was installed is completed.

29 CFR 1926.405(a)(2)(i)

(1) Feeders shall originate in a distribution center, and conductors shall be run as multiconductor cords or cable assemblies or within raceways. If conductors are not subject to damage or accidental contact, they may be run as open conductors on insulators spaced not more than 10 feet apart.

29 CFR 1926.405(a)(2)(ii)(A)

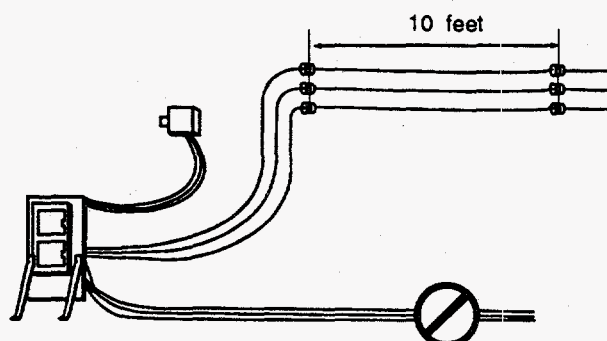






(2) Branch circuits shall originate in a power outlet or panel board. All conductors shall be protected by overcurrent devices at their ampacity; no branch-circuit conductors shall be laid on the floor.

29 CFR 1926.405(a)(2)(ii)(B)



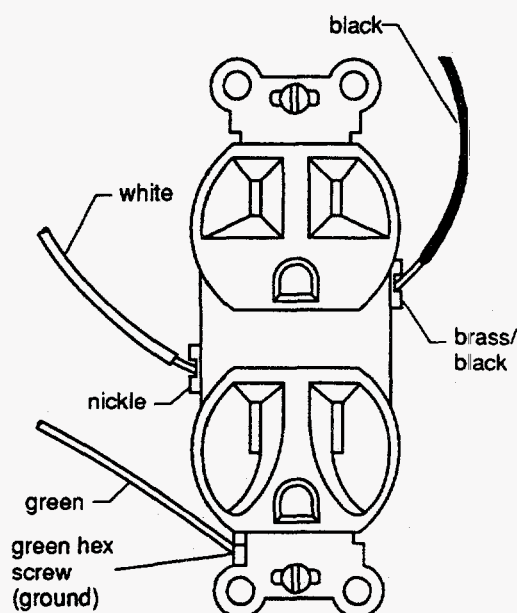
Branch Circuit on Ground

(3) Each branch circuit that supplies receptacles or fixed equipment and is run as an open conductor shall contain a separate equipment grounding conductor.

29 CFR 1926.405(a)(2)(ii)(B)

(4) All receptacles shall be a grounding type. Unless they are installed in a complete metallic conductive raceway providing a continuous path to ground, each branch circuit shall contain a separate equipment grounding conductor, and all receptacles shall be electrically connected to the grounding conductor.

29 CFR 1926.405(a)(2)(ii)(C)



Approved Receptacle

(5) Receptacles used for other than temporary lighting shall not be installed on branch circuits that supply temporary lighting. Receptacles shall not be connected to the same ungrounded conductor of multiwire circuits that supply temporary lighting.

29 CFR 1926.405(a)(2)(ii)(C)

(6) Disconnecting switches or plug connectors shall be installed to permit the ungrounded conductors of each temporary circuit to be disconnected.

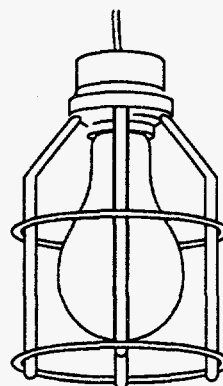
29 CFR 1926.405(a)(2)(ii)(D)

(7) Lamps for general illumination shall be protected from accidental contact or breakage. Metal-cased lamp sockets shall be grounded.

29 CFR 1926.405(a)(2)(ii)(E)

(8) Lampholders installed in wet or damp locations shall be of the waterproof type.

29 CFR 1926.405(j)(1)(iv)



Protected Lamp

(9) Temporary lights shall not be suspended by their electric cords, unless designed for such suspension.

29 CFR 1926.405(a)(2)(ii)(F)

(10) Portable electric lights used in wet and other conductive locations shall be operated at 12 volts or less. If they are protected by ground-fault circuit interrupters, 120-volt lights may be used.

29 CFR 1926.405(a)(2)(ii)(G)

t. Care must be taken to protect electric circuits from construction dust and fines, which could cause electrical explosion when power is switched on.

u. Equipment shall be installed according to listing, labeling, or certification found in instructions.

29 CFR 1926.403(b)(2); NFPA 70-110.3(g)



#### 4. General Wiring Design and Protection

*The requirements in this section do not apply to conductors that are integral parts of factory-assembled equipment such as motors and controllers.*

29 CFR 1926.405(a)

a. Metal raceways, cable armor, and other metal enclosures for conductors shall be electrically continuous and shall be connected to all boxes, fittings, and cabinets.

29 CFR 1926.405(a)(1)(i)

b. Wiring systems of any type shall not be installed in ducts or shafts used to transport dust, loose stock, or flammable vapors.

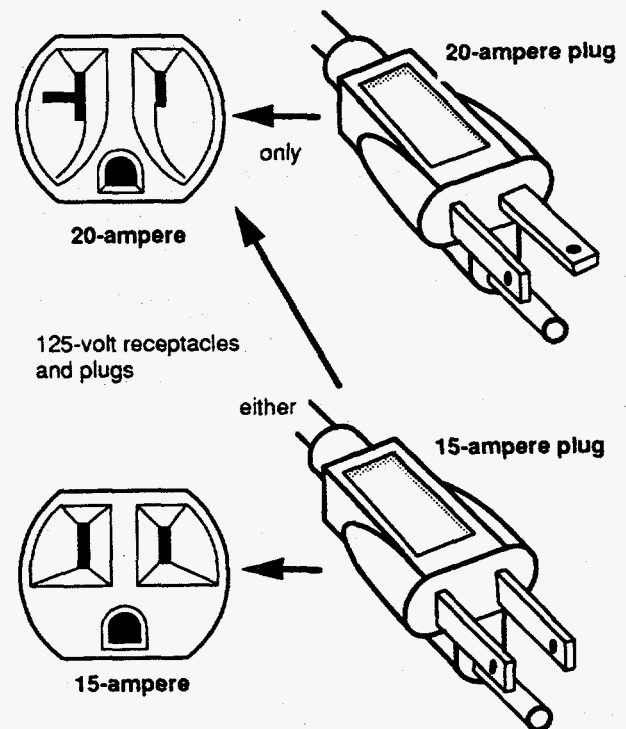
29 CFR 1926.405(a)(1)(ii)

c. A receptacle installed in a wet or damp location shall be designed for the location.

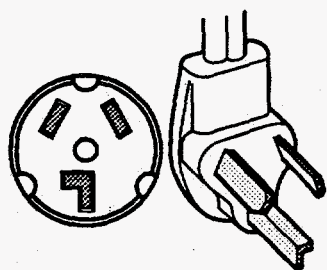
29 CFR 1926.405(j)(2)(ii)

d. Receptacles connected to circuits having different voltages, frequencies, or types of current (DC or AC) on the same premises shall be designed so that the attachment plugs used on the circuits may not be interchanged.

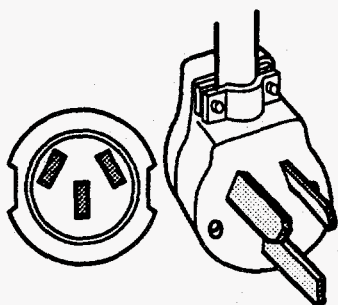
29 CFR 1926.405(j)(2)(i)



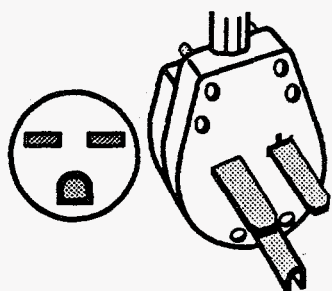




Plug and Cord Connectors



120/240-Volt, 50-Ampere Receptacle and Plug



240-Volt, 30-Ampere Receptacle and Plug

e. Control equipment and busways that are approved only for dry locations shall be protected during construction. All electrical equipment and accessories shall be suitable for the environment in which they are to be used.

29 CFR 1926.432(a)(2),(b)

f. Fixture wires shall be suitable for the voltage, temperature, and location of use and may be used for

- installation in lighting, fixtures, and similar equipment where enclosed or protected and not subject to bending or twisting and
- connecting light fixtures to the branch-circuit conductors.

29 CFR 1926.405(i)(1),(2)(i,ii)

g. Fixture wires may not be used as branch-circuit conductors except as permitted for Class 1 power-limited circuits.

29 CFR 1926.405(i)(3)

h. A means shall be provided for disconnecting appliances. Each appliance shall be marked with its rating in volts and amperes or volts and watts.

29 CFR 1926.405(j)(3)(ii)

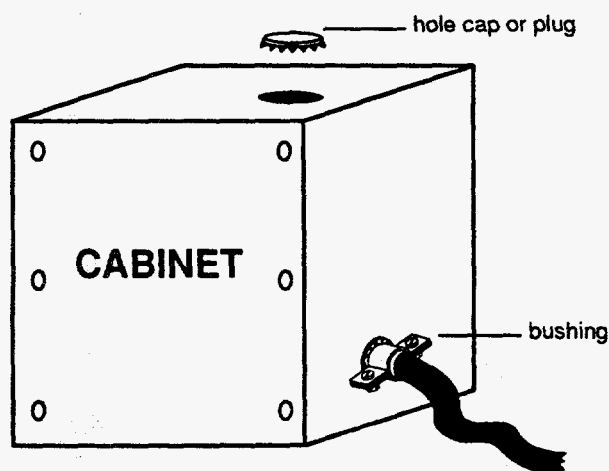
i. The grounding conductor of any cable or cord shall be distinguishable from all other conductors.

29 CFR 1926.405(g)(2)(i)

## 5. Cabinets, Boxes, and Switchboards

a. Conductors that enter boxes, cabinets, or fittings shall be protected from abrasion by bushings or fittings. Unused holes in the boxes shall be closed or plugged.

29 CFR 1926.405(b)(1)



Protected Cords/Covered Holes

b. Pull boxes, junction boxes, cabinets, or fittings shall have covers; if metal covers are used, they shall be grounded. In energized installations, each outlet box shall have a cover, faceplate, or fixture canopy.

29 CFR 1926.405(b)(2)



c. Covers for outlet boxes with holes through which flexible cord pendants pass shall have specially designed bushings or smooth, well-rounded surfaces on which the cord may rest to avoid insulation damage.

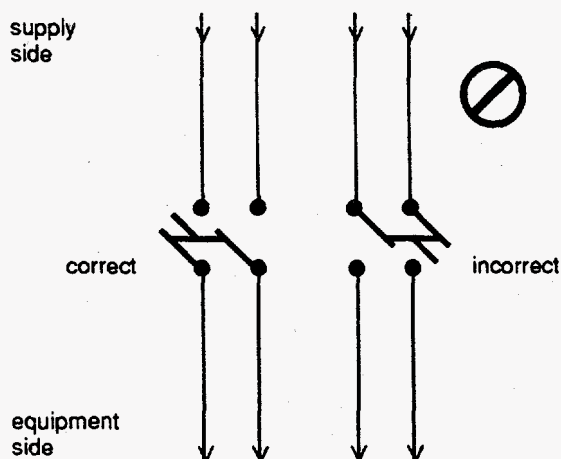
29 CFR 1926.405(b)(2)

d. For systems with more than 600 volts, nominal, pull and junction boxes shall have securely fastened covers and shall completely enclose conductors or cables. The covers shall be permanently marked, "High Voltage."

29 CFR 1926.405(b)(3)(i,ii)

e. Single-throw knife switches shall be connected so that the blades are dead when the switch is in the open position and placed so that gravity will not tend to close them. Single-throw knife switches approved for use in the inverted position shall be provided with a locking device to ensure that the blades remain in the open position when so set.

29 CFR 1926.405(c)



Connect knife switches properly.

f. Double-throw knife switches shall be mounted so that the throw will be either vertical or horizontal. If the throw is vertical, a locking device shall be provided to ensure that the blades remain in the open position when so set.

29 CFR 1926.405(c)

g. Switchboards with exposed live parts shall be installed in permanently dry locations and accessible only to qualified persons. Panel boards shall be mounted in cabinets, cutout boxes, or enclosures designed for the purpose and shall be dead front. Panel boards that are not dead front and are externally operated are permitted where accessible to qualified persons only.

29 CFR 1926.405(d)

h. Cabinets, cutout boxes, fittings, boxes, and panel board enclosures located in damp areas shall be installed so that moisture or water cannot enter or accumulate inside them. In wet locations, the enclosure shall be waterproof.

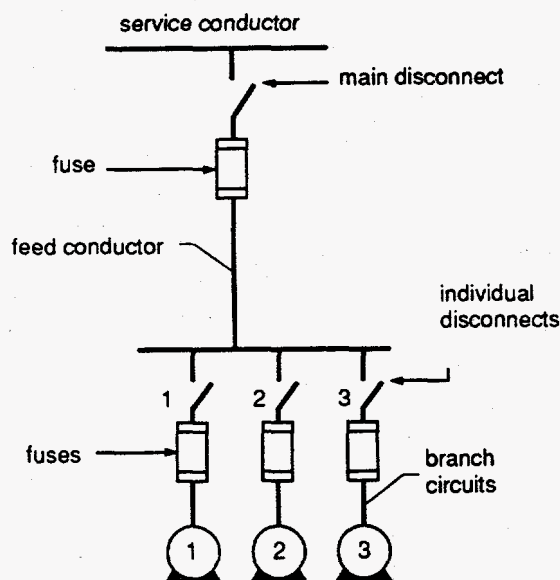
29 CFR 1926.405(e)(1)

i. A means to disconnect all conductors in a building from the service-entrance conductors shall be installed near the point where the service-entrance conductors enter the building.

29 CFR 1926.404(d)(1)(i)

j. Except for current-limiting devices on the supply side of the service disconnect means, all fuses and thermal cutouts on circuits over 150 volts to ground and all cartridge fuses accessible to other than qualified persons shall be provided with a disconnect means. The disconnect means shall be installed so that the fuse or thermal cutout can be disconnected from its supply without disrupting service to equipment and circuits unrelated to those protected by the overcurrent device.

29 CFR 1926.404(e)(1)(iii)



Disconnects for overcurrent devices

k. Open wire service-entrance conductors over 600 volts, nominal, shall be guarded and accessible only to qualified persons. Warning signs shall be posted in areas where unauthorized workers might contact live parts.

29 CFR 1926.404(d)(2)(i,ii)

l. Outside open conductors run as a branch circuit, feeder, or service conductors operating at 600 volts, nominal, or less shall have clearance requirements specified in Table E-4.

29 CFR 1926.404(c)(1)



Table E-4. Service Feeder Clearance, 600 Volts, Nominal, or Less

Activity and Location	Minimum Clearance
Horizontal Clearance for Pole Climbing	
Open power below communications conductors	30 in.
Open power alone or above communications conductors	
300 volts or less	24 in.
More than 300 volts	30 in.
Communications below open power conductors	
300 volts or less	24 in.
More than 300 volts	30 in.
Clearance Between Grounded Surface and Open Conductors	
Above grade sidewalks or platforms	10 ft
Over vehicles traffic	12 ft
Over truck traffic	15 ft
Over public streets, roads, alleys, and driveways	18 ft
Clearance from Buildings in Which Workers are Exposed	
Open conductor from windows, doors, fire escapes, or similar locations	3 ft
Over roofs (highest point of roof)	
Insulated conductor vertical clearance	8 ft
Covered conductor vertical or diagonal	10 ft
Bare conductor	15 ft
Other	
Open conductor - roof with vehicular traffic (vertical)	18 ft
Insulated conductor - roof not normally open to workers	3 ft
Roof slope not less than 4 inches in 12 inches with voltage between conductors	
300 volts or less	3 ft
300 volts or less between conductors that do not pass over more than 4 feet of a roof overhang, terminates in a through-the-roof raceway or support.	18 in.
29 CFR 1926.404(c)(1)(i-iv)	

## 6. Motors and Pendants

a. A disconnecting means shall be located in sight of the controller location. The controller means of disconnect for motor branch circuits of more than 600 volts, nominal, may be out of sight of the controller, if the controller is marked with a warning label giving the location and identification of the disconnecting means, which is to be locked in the open position.

29 CFR 1926.405(j)(4)(ii)(A)

*Note: If specified that one piece of motorized equipment shall be "in sight of" another piece of control equipment, one shall be visible from and not more than 50 feet from the other.*

29 CFR 1926.405(j)(4)(i)

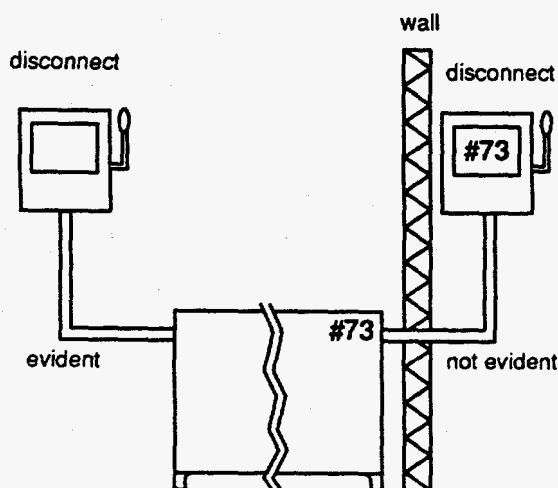
b. The disconnect means shall cut off the motor and controller from all ungrounded supply conductors; it shall be designed so that none of the poles can be operated independently.

29 CFR 1926.405(j)(4)(ii)(B)



c. Unless the disconnect is located so that the purpose or feed service is evident, each disconnect means shall be legibly marked to indicate its purpose or identify the equipment it feeds.

**NOTE:** To avoid any mistake, it is best to identify all disconnects to equipment.



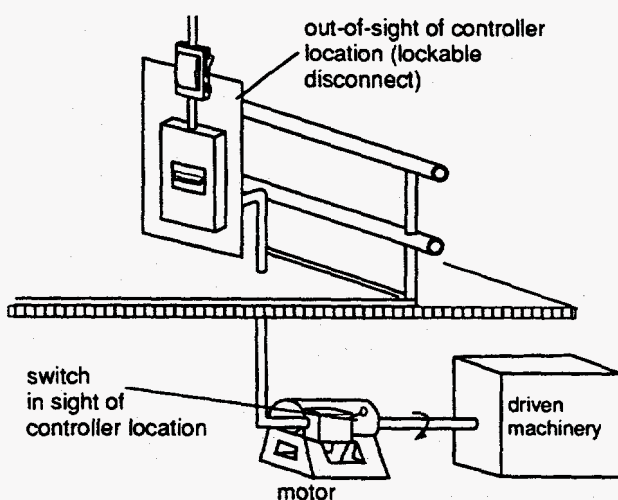
Equipment Disconnect Evident or Identified

29 CFR 1910.303(f)

d. If a motor and the machinery it drives are not visible from the controller's location, the installation shall

- be capable of being locked open or
- have a manually operated switch that will disconnect the motor from its supply source in sight of the motor location.

29 CFR 1926.405(j)(4)(ii)(C)(1,2)



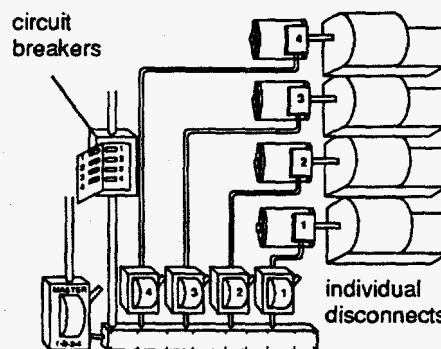
Out-of-Sight Disconnect to Motor

e. The means of disconnect shall be readily accessible. If more than one means of disconnect is provided for the same equipment, only one need be readily accessible.

29 CFR 1926.405(j)(4)(ii)(E)

f. Each motor shall be equipped with a means of disconnect; however, a single means of disconnect may be used for a group of motors, if they drive special parts of a single piece of equipment or are protected by one set of branch-circuit protection devices, or if they are in a single room in sight of the disconnect.

29 CFR 1926.405(j)(4)(ii)(F)(1-3)



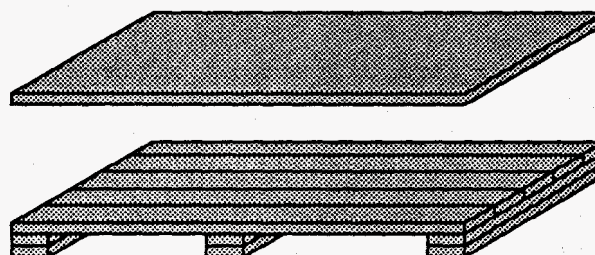
Various Means of Disconnect

g. To prevent accidental worker contact, exposed live parts of motors or controllers operating at 50 volts or more between terminals shall be installed in a room or enclosure that is accessible only to qualified persons; on a balcony, gallery, or platform elevated and arranged to exclude unqualified persons; or at an elevation of 8 feet or more above the floor.

29 CFR 1926.405(j)(4)(iv)(A)(1-3)

h. When live parts of motors or controllers operating at more than 150 volts to ground are protected as in paragraph g. above, and where adjustment or attendance may be necessary during the operation of the apparatus, insulating mats or a platform shall be provided so that a worker cannot touch live parts unless he or she is standing on the mats or platform.

29 CFR 1926.405(j)(4)(iv)(B)



Insulated Mat or Platform



- i. The rating of an attachment plug or receptacle used for connecting a motor, by cord or plug, to a branch circuit shall not exceed 15 amperes at 125 volts or 10 amperes at 250 volts, if individual overload protection is not provided.

29 CFR 1926.404(b)(2)(iii)

## 7. Transformers

- a. This section covers all transformers except current transformers; dry-type transformers installed as a component part of other apparatus; transformers that are an integral part of an x-ray, high-frequency, or electrostatic-coating apparatus; transformers used with Class 2 and Class 3 circuits; sign and outline lighting; and power-limited fire-protective signaling circuits.

29 CFR 1926.405(j)(5)(i)(A-D)

- b. The operating voltage of exposed live parts of transformers shall be indicated by warning signs on the equipment or structure.

29 CFR 1926.405(j)(5)(ii)

- c. Transformer vaults shall be constructed so that fire and combustible liquids are contained within the vault and unauthorized access is prevented. Locks and latches shall be installed so that the door can be easily opened from the inside.

29 CFR 1926.405(j)(5)(vi)

- d. Material shall not be stored in transformer vaults.

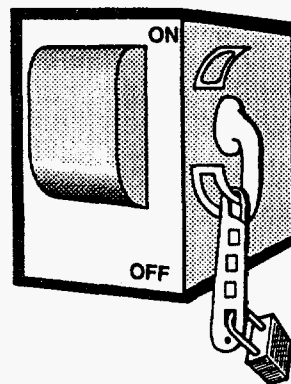
29 CFR 1926.405(j)(5)(viii)

## 8. Specific Purpose Equipment and Installations

### a. Cranes and Hoists

- (1) There shall be a switch, which can be locked open, to disconnect the power supply of any crane or monorail hoist.

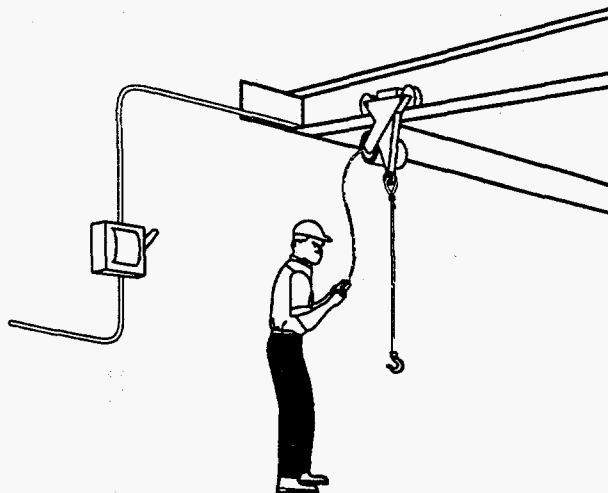
29 CFR 1926.406(a)(1)(i,ii)



Power Supply Switch

- (2) The switch to disconnect the runway conductor from its power supply shall be easy to find and operate.

29 CFR 1926.406(a)(1)(i)



Readily Accessible Disconnect Switch

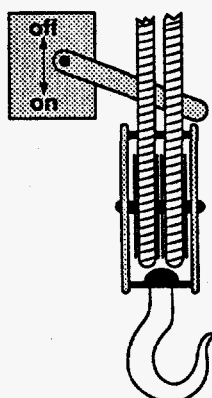
- (3) If the disconnecting switch is not in the crane or monorail operating station, it shall be possible to open the power circuits to all crane or monorail hoist motors from the operating station.

29 CFR 1926.406(a)(1)(ii)(A)



- (4) There shall be a limit switch to stop the load block from going higher than what is considered safe for each crane or a hoist.

29 CFR 1926.406(a)(2)



Block Limit Switch

*For additional crane information see Section H.1.i. and j of this guide.*

#### b. Elevators, Escalators, and Moving Walks

- (1) There shall be one switch to disconnect all ungrounded main power supply conductors for each elevator, escalator, or moving walk.

29 CFR 1926.406(b)(1)

- (2) If control panels are not in the same space as the drive machine, they shall be in cabinets with doors that can be locked closed.

29 CFR 1926.406(b)(2)

#### c. Electric Welding Equipment

- (1) The supply circuit shall have a switch that disconnects each arc-welding unit, unless there is a disconnect switch on the unit itself.

29 CFR 1926.406(c)(1)

- (2) There shall be a switch or circuit breaker to cut off each resistance welder from the supply circuit. The ampere rating of the switch or circuit breaker shall not be less than the current capacity of the supply conductor.

29 CFR 1926.406(c)(2)

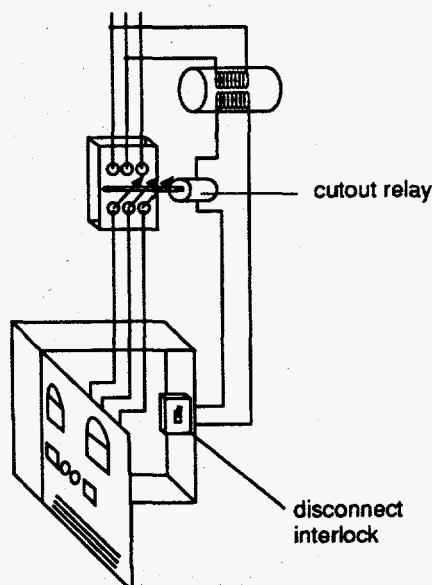
#### d. X-ray and Radiographic Equipment

- (1) There shall be a switch accessible from an x-ray control to disconnect the supply circuit.

29 CFR 1926.406(d)(1)(i)

- (2) To prevent workers from contacting live current-carrying parts, radiographic and fluoroscopic equipment shall always be enclosed or have interlocks that de-energize the equipment automatically.

29 CFR 1926.406(d)(2)



Radiographic and Fluoroscopic Equipment Interlock

- (3) If more than one piece of x-ray equipment is operated from the same high-voltage circuit, each piece of equipment or equipment group shall be provided with a high-voltage switch.

29 CFR 1926.406(d)(1)(ii)

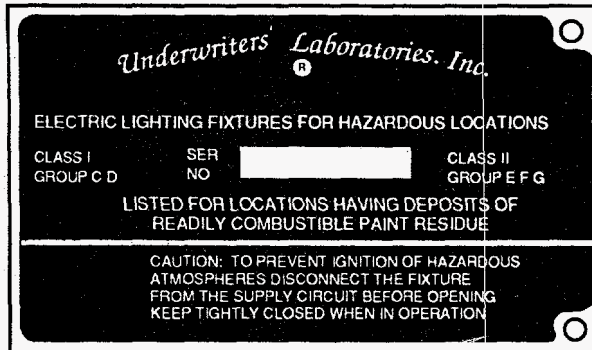




## 9. Hazardous Locations

a. Electrical equipment and wiring installed in hazardous locations shall be classified according to the kinds of flammable vapors, liquids, gases, or combustible dust or fibers present. Each room, section, or area shall be classified individually. See Table E-5 for basic hazard locations classifications. For detailed information refer to NFPA 70, Chapter 5, or 29 CFR 1926.449.

29 CFR 1926.407(a)



Underwriters' Label

b. Equipment and its associated wiring approved as intrinsically safe are permitted in the hazardous (classified) locations included in its listing or labeling.

29 CFR 1926.407(b)(1)

c. Equipment shall be approved both for class of location and type of ignitable or combustible gas, vapor, dust, or fiber that will be present.

29 CFR 1926.407(b)(2)(i)

d. Equipment shall not be used in a hazardous location unless it is marked to show the class, group, and operating temperature or temperature range.

29 CFR 1926.407(b)(2)(ii)

e. All conduits shall be threaded and shall be made wrench-tight. When it is impractical to make a threaded joint tight, a bonding jumper shall be used.

29 CFR 1926.407(c)

Table E-5. Basic Hazardous Location Classification

Classes	Division 1	Division 2	Groups
I. Flammable gases, vapors, or liquids.	Ignitable concentrations may exist under normal operating conditions or in the event of equipment failure or faulty operations.	Areas adjacent to Class I, Div. 1 areas; areas where flammable liquids or gas are present in closed containers but could be released in an accident, or areas where concentrations are controlled by mechanical ventilation the failure of which could result in ignitable concentrations.	A-Acetylene B-Hydrogen C-Ether, etc. D-Hydrocarbons
II. Combustible, ignitable or conductive dusts.	Ignitable or explosive concentrations may be in suspension under normal operating conditions or in the event equipment failure or faulty operations.	Not normally enough dust suspended to ignite but may infrequently exist in ignitable quantities due to malfunction of handling or processing equipment. Includes areas adjacent to Class II, Div. 1 locations and areas where accumulations of ignitable dust are on equipment or other surfaces.	E-Metal dust* F-Carbon black*, coke* or charcoal* G-Flour, grain, starch, combustible plastic, or chemical dust**
III. Ignitable fibers or flyings.	Areas where handled, used, or manufactured.	Areas where stored or handled (except in process of manufacturing).	Cotton, rayon, hemp, cocoa, other textiles
* Could have conductive qualities and be explosive with mixture and ignition source.			
** Could be explosive with mixture and ignition source.			

For further information see definitions in 29 CFR 1926.449 and NFPA Art. 500.

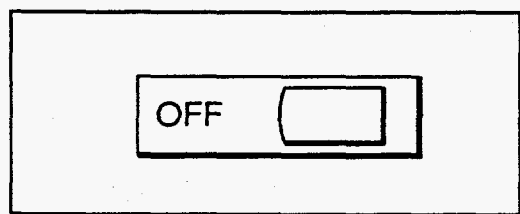


## 10. Special Systems

### a. Systems, Cables, and Installations of More than 600 Volts, Nominal

(1) Indoor circuit breakers shall be cell-mounted, metal-enclosed, or fire-resistant units. In areas where only qualified personnel are allowed, circuit breakers need not be enclosed. The open and closed positions of circuit breakers shall be clearly marked.

29 CFR 1926.408(a)(2)(i)



**Marked Circuit Breaker**

(2) Fused cutouts installed in buildings or transformer vaults shall be of a type identified by the manufacturer as suitable for this purpose. Fuse cutouts shall be designed to allow fuses to easily be changed.

29 CFR 1926.408(a)(2)(ii)

(3) A means shall be provided to completely isolate equipment for inspection or repair. If the isolating means are not designed to interrupt the load current of the circuit, they shall be interlocked with a circuit interrupter or be posted with a sign warning against opening under load.

29 CFR 1926.408(a)(2)(iii)

(4) Cable connectors that are connected to power cables on a mobile machine shall be enclosed in metal. The enclosure shall include a solid connection for the ground-wire terminal so that the machine frame is safely grounded. The enclosure shall be provided with a lock so that only authorized or qualified personnel may open the enclosure, and a sign warning of energized parts shall be posted.

29 CFR 1926.408(a)(3)(i)

(5) All energized switching and control equipment for mobile and portable equipment shall be enclosed in locked, grounded metal cabinets or enclosures. The means to operate circuit breakers and protective equipment shall project through the cabinets or enclosures so they can be reset without opening the locked doors. Enclosures shall be provided with a lock, so that only authorized or qualified personnel may open the enclosure; and signs shall be posted warning workers of energized parts.

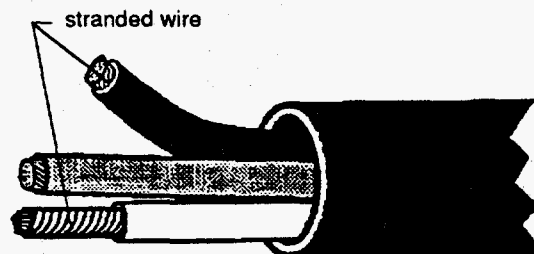
29 CFR 1926.408(a)(3)(ii)

(6) Collector ring assemblies on revolving-type machines, such as shovels and drag lines, shall be guarded.

29 CFR 1926.408(a)(3)(ii)

(7) Multiconductor portable cable used for supplying power to portable or mobile equipment at more than 600 volts, nominal, shall consist of No. 8 or larger flexible, stranded wire.

29 CFR 1926.405(h)



**Multiconductor Portable Cable**

(8) Portable cables operated at more than 2,000 volts shall be shielded so that voltage stress is confined to the insulation.

29 CFR 1926.405(h)

(9) Grounding conductors and locking-type connectors that cannot open or close while energized shall be used for portable cables of more than 600 volts, nominal. Strain relief shall be provided at the connections and terminations of these cables.

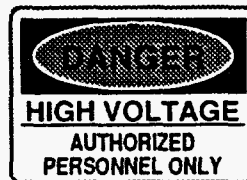
29 CFR 1926.405(h)

(10) Portable cables that have been spliced shall not be used unless the splices are permanently molded, vulcanized, or treated in an equivalent way.

29 CFR 1926.405(h)

(11) Termination enclosures for portable cables over 600 volts shall be marked with a high voltage hazard warning, and shall be accessible only to authorized and qualified workers.

29 CFR 1926.405(h)







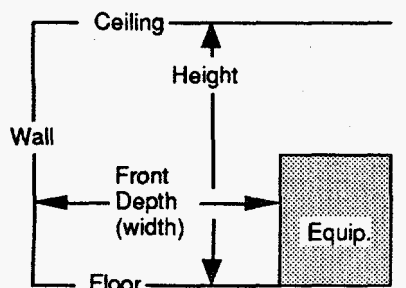
*Conductors and equipment used on circuits exceeding 600 volts, nominal, shall be used in accordance with requirements in the following paragraphs. The requirements do not apply to equipment on the supply side of the service conductors.*

(12) Electrical installations open to unqualified persons shall be enclosed in metal, vaults, or other enclosure with access limited by a lock; appropriate caution signs shall be posted.

29 CFR 1926.403(j)(2)(ii)

(13) The minimum clear workspace around exposed energized parts shall be at least 6 1/2 feet high and 3 feet wide. For higher voltage work depth (width) requirements, see Table E-2 of this section.

29 CFR 1926.403(j)(3)



**Live Equipment Work Clearance**

(14) When rear access is required to work on de-energized parts on the back of enclosed equipment, a minimum workspace of 30 inches horizontal shall be provided.

29 CFR 1926.403(j)(3)(i)

(15) Workspaces in which energized parts of electrical equipment may be exposed shall be barricaded or other means provided to ensure that these spaces are not used as passageways.

29 CFR 1926.416(b)(1)

(16) Lighting outlets and controls shall be located so that workers changing lights or repairing the lighting system will not be exposed to live parts or equipment.

29 CFR 1926.403(j)(3)(ii)

(17) Unguarded live parts of more than 600 volts, nominal, above a work surface shall be maintained at heights not less than 8' 6" for 601 to 7,500 volts, 9' 0" for 7,501 to 35,000 volts; 9' 0" plus 0.37 inches per 1,000 volts for more than 35,000 volts.

29 CFR 1926.403(j)(3)(iii)

*Capacitors rated more than 600 volts, nominal, shall comply with the following:*

(18) To prevent workers from switching load current, isolating or disconnecting switches that have no interrupting rating shall be interlocked with a load-interrupting device; or caution signs shall be prominently displayed.

29 CFR 1926.405(j)(6)(ii)(A)

(19) For series capacitors, at least one of the following shall be used to ensure proper switching: (1) mechanically sequenced isolating and by-pass switches, (2) interlocks, or (3) a switching procedure that is prominently displayed at the switching location.

29 CFR 1926.405(j)(6)(ii)(B)

#### b. Installations Inside Tunnels

(1) This section refers to installing and using portable and/or mobile, high-voltage power distribution equipment inside tunnels. Such equipment includes substations, trailers, cars, mobile shovels, drag lines, hoists, drills, dredges, compressors, pumps, conveyors, and underground excavators.

29 CFR 1926.408(a)(4)(i)

(2) Conductors inside tunnels shall be installed in metal conduit or raceways or in type MC cables or other suitable multiconductor cables and shall be placed in a safe location or guarded.

29 CFR 1926.408(a)(4)(ii)

(3) Nonenergized metal parts of electrical equipment, metal raceways, and cable sheaths shall be grounded and bonded to all metal pipes and rails at the entrance to the tunnel and at intervals of 1,000 feet or less.

29 CFR 1926.408(a)(4)(v)

(4) Bare terminals in transformers, switches, motor controllers, and other equipment shall be enclosed to prevent accidental worker contact with energized parts. Enclosures that are used in tunnels shall be drip-proof, weatherproof, or submersible, according to the environmental conditions in the tunnel.

29 CFR 1926.408(a)(4)(iii)

(5) There shall be a disconnecting means to simultaneously open all ungrounded conductors at each transformer and motor.

29 CFR 1926.408(a)(4)(iv)

#### c. Communication Systems

(1) Communication systems include central-station- and noncentral-station-connected telephone circuits, radio receivers and transmitters, outside wiring for fire and burglar alarms, and similar equipment.

29 CFR 1926.408(c)(1)



(2) Each communication system has specific wiring and installation requirements. NFPA 70-800 lists requirements for specific types of equipment.

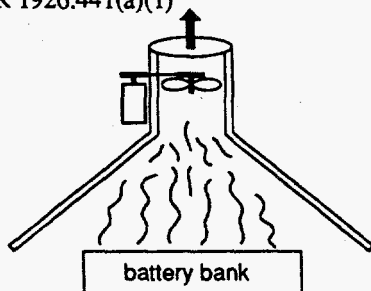
(3) Workers shall be protected from static discharge from outdoor radio transmission antenna lead-in conductors by an antenna discharge unit or other means that will drain static charges from the antenna system. For further information, see NFPA 70-800.

29 CFR 1926.408(c)(2)(ii)

#### d. Battery Servicing

(1) Unsealed batteries shall be located in enclosures with outside vents or in well-ventilated rooms. Batteries shall be arranged in such a way that fumes, gases, or electrolyte spray do not escape into the work area.

29 CFR 1926.441(a)(1)



**Forced Ventilation for Battery Charging**

(2) To prevent an explosion, ventilation shall be provided to diffuse the gases and fumes from batteries.

29 CFR 1926.441(a)(2)

(3) Battery racks and trays shall be substantial and treated to resist electrolytes.

29 CFR 1926.441(a)(3)

(4) Floors shall be constructed of an acid-resistant material or coating unless they are protected from acid build-up.

29 CFR 1926.441(a)(4)

(5) Protective equipment such as aprons, rubber gloves, safety-approved glasses, and/or face shields shall be used by workers handling batteries or acids. See Section A of this guide for more details on personal protective equipment (PPE).

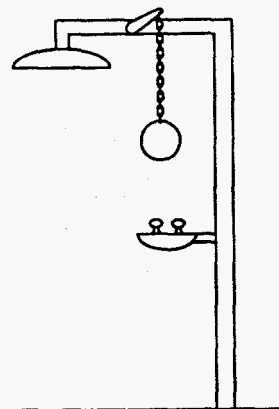
29 CFR 1926.441(a)(5)



**Use personal protective equipment (PPE).**

(6) Facilities for drenching the eyes and body shall be provided within 25 feet of an area in which batteries are handled or serviced.

29 CFR 1926.441(a)(6)



**Eye-Wash/Safety Shower**

(7) Facilities and supplies shall be provided for flushing and neutralizing spilled electrolyte and for fire protection.

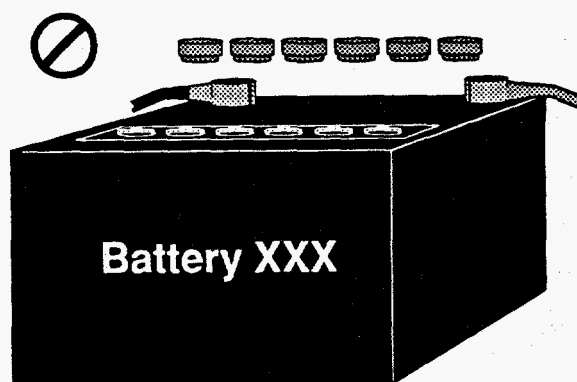
29 CFR 1926.441(a)(7)

(8) Batteries shall be charged in areas designed for this purpose, and the charging apparatus shall be protected from moving vehicles and equipment.

29 CFR 1926.441(b)(1,2)

(9) Battery caps shall be kept in place when batteries are charged; the caps shall be kept in good condition.

29 CFR 1926.441(b)(3)



**Do not remove battery caps during charging.**



## 11. Grounding

### a. General Requirements

(1) AC and DC wiring systems shall be appropriately grounded.

29 CFR 1926.404(f)

(2) AC systems between 50 and 1,000 volts shall be grounded under any of the following conditions, unless exempted under paragraph (3) below:

- if the system can be grounded so that the maximum voltage to ground on the ungrounded conductors does not exceed 150 volts;
- if the system is nominally rated 480Y/277-volt, 3-phase, 4-wire in which the neutral is used as a circuit conductor;
- if the system is nominally rated 240/120-volt, 3-phase, 4-wire in which the midpoint of one phase is used as a circuit conductor; or
- if a service conductor is not insulated.

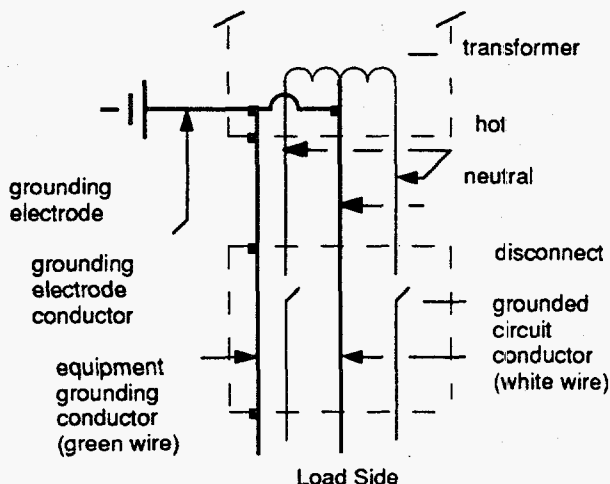
29 CFR 1926.404(f)(1)(iv)(A-D)

(3) AC systems between 50 and 1,000 volts do not require grounding if the system is separately derived, is supplied by a transformer that has a primary voltage rating of less than 1,000 volts, and meets the following requirements:

- The system is used exclusively for control circuits.
- Only qualified workers service the system.
- Continuity of control power to the control circuits is required.
- Ground detectors are installed on the control system.

29 CFR 1926.404(f)(1)(v)(A-D)

(4) For a grounded system, a grounding-electrode conductor shall be used to connect both the equipment-grounding conductor and the grounded-circuit conductor to the grounding electrode. Both the equipment-grounding conductor and the grounding-electrode conductor shall be



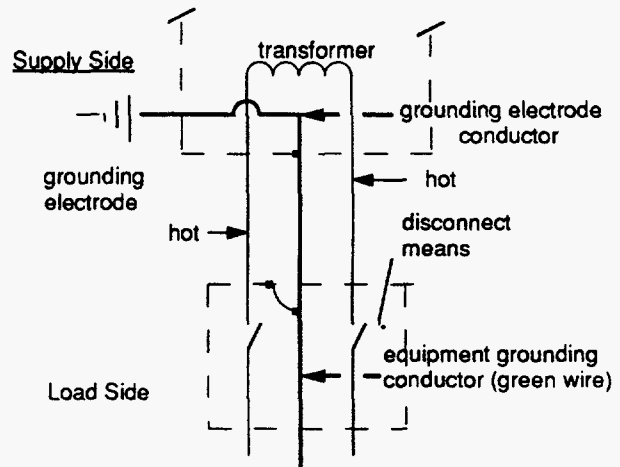
Grounded System - Service Supplied

connected to the grounded-circuit conductor on the supply side of the service disconnect, or on the supply side of the system disconnect or overcurrent device if the system is separately derived.

29 CFR 1926.404(f)(5)(i)

(5) In ungrounded, service-supplied systems, the equipment-grounding conductor shall be connected to the grounding-electrode conductor at the service equipment.

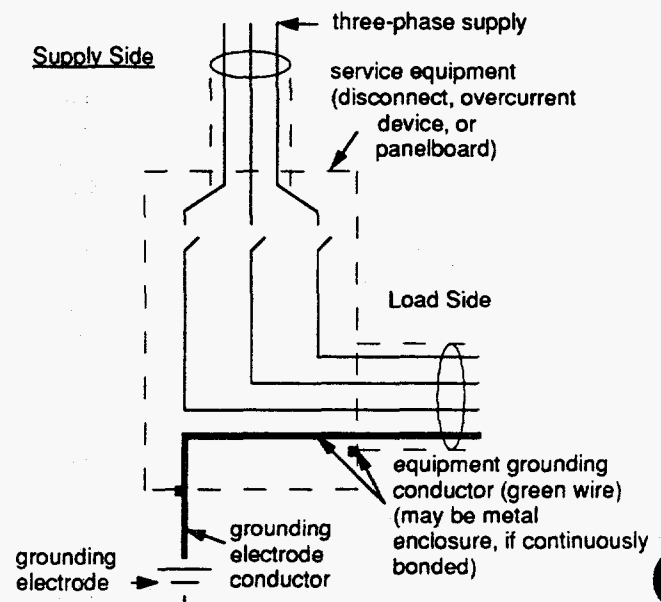
29 CFR 1926.404(f)(5)(ii)



Ungrounded System - Separately Derived

(6) In ungrounded, separately derived systems, the equipment-grounding conductor shall be connected to the grounding-electrode conductor at or ahead of the system disconnecting means or overcurrent devices.

29 CFR 1926.404(f)(5)(ii)



Ungrounded Service - Supplied System



- (7) All grounds shall be permanent and continuous.  
29 CFR 1926.404(f)(6)

**b. Requirements for Portable and Vehicle-Mounted Generators**

(1) The frame of portable or vehicle-mounted generators need not be grounded if the following conditions are met:

- the generator supplies only equipment powered by and mounted on the generator including cord- and/or plug-connected equipment connected to receptacles mounted on the generator, and
- the noncurrent-carrying parts of equipment and receptacles are bonded to the generator frame.

29 CFR 1926.404(f)(3)(i)(A-B)

(2) The vehicle frame may serve as the ground for a system supplied by a generator and located on the vehicle, if the generator and vehicle frames are bonded together and meet the conditions of paragraph (1) above.

29 CFR 1926.404(f)(3)(ii)(A-B)

**c. Grounding of Supports, Enclosures, and Equipment**

(1) All metal cable trays, raceways, and enclosures for conductors shall be grounded, except for the following:

- metal enclosures that protect cables or conductors added to existing installations of open-wire knobs and tubes and
- metal enclosures that protect nonmetallic-sheathed cable with runs of less than 25 feet, in which enclosures are free from probable contact with ground or grounded metal and are guarded against accidental contacts.

29 CFR 1926.404(f)(7)(i)(A-D)

(2) Metal enclosures around service equipment shall be grounded.

29 CFR 1926.404(f)(7)(ii)

(3) Exposed noncurrent-carrying metal parts of fixed equipment that may become energized shall be grounded if they are

- subject to worker contact;
- within 8 feet vertically or 5 feet horizontally of ground or grounded objects;
- in damp or wet locations;
- in electrical contact with metal;
- in a hazardous (classified) location; or
- supplied by a metal-clad, metal-sheathed, or grounded-metal raceway.

29 CFR 1926.404(f)(7)(iii)(A-E)

(4) Equipment operating with any terminal rated at more than 150 volts to ground shall be grounded, except for the following:

- enclosures for switches or circuit breakers used for other than service equipment that are accessible only to qualified workers;
- metal frames of electrically heated appliances that are effectively insulated from ground; and
- distribution apparatus (transformers and capacitors) mounted on wooden poles more than 8 feet above the ground.

29 CFR 1926.404(f)(7)(iii)(F)(1-3)

**d. Requirements for Plug- and Cord-Connected Equipment**

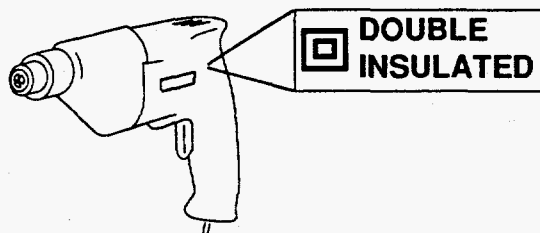
(1) Exposed noncurrent-carrying metal parts of equipment shall be grounded if they are in hazardous (classified) locations or operated at more than 150 volts to ground.

The following equipment shall also be grounded: hand-held, motor-operated tools; portable x-ray equipment; and portable hand lamps, tools, or equipment likely to be used in wet locations or by workers standing on the ground, on metal floors, or in metal tanks or boilers.

29 CFR 1926.404(f)(7)(iv)(A-C)

(2) Tools likely to be used in wet and/or conductive locations need not be grounded if they are supplied through an isolating transformer with an ungrounded secondary of not more than 50 volts. Listed or labeled portable double-insulated tools (or equivalent tools) and appliances need not be grounded. Double-insulated equipment shall be distinctively marked.

29 CFR 1926.404(f)(7)(iv)(C)(6)



(3) Nonelectrical metal parts of the following shall be grounded:

- frames and tracks of electrically driven cranes;
- frames of nonelectrically driven elevator cars with electric conductors attached;
- hand-operated metal shifting ropes and cables of electric elevators; and
- metal partitions, grill work, and metal enclosures around equipment of more than 1,000 volts between conductors.

29 CFR 1926.404(f)(7)(v)



e. Grounding Methods

(1) If noncurrent-carrying metal parts of fixed equipment must be grounded, they shall be grounded by an equipment-grounding conductor contained within the same raceway, cable, or cord; or run with or enclosed in the circuit conductors.

29 CFR 1926.404(f)(8)(i)

(2) A conductor used for grounding fixed or moveable equipment shall have the capacity to safely conduct any fault current imposed on it.

29 CFR 1926.404(f)(8)(ii)

(3) Electrical equipment is considered to be properly grounded when it is secured to and in electrical contact with a metal rack or structure provided for its support. The metal rack or structure shall be grounded using the method specified in paragraph (1) above.

29 CFR 1926.404(f)(8)(iii)

(4) Bonding conductors used to ensure electrical continuity shall have the capacity to conduct any fault current that may be imposed on them.

29 CFR 1926.404(f)(9)

(5) Made electrodes shall be free of nonconductive coatings and, if practicable, shall be embedded below the permanent moisture level. A single electrode that has a resistance to ground greater than 25 ohms shall have an additional electrode installed at least 6 feet from the first electrode.

29 CFR 1926.404(f)(10)

f. Grounding 1,000-Volt Supply or Greater

**Note:** Systems operating at 1000 volts or higher shall be grounded in accordance with the requirements discussed in paragraphs 11.a.-e. on preceeding pages of this guide as supplemented or modified below.

(1) Systems supplying portable or mobile high-voltage equipment, other than substations installed on a temporary basis, shall comply with the following:

(a) Portable or mobile equipment shall be supplied from a system having its neutral grounded through an impedance. If a delta-connected, high-voltage system is used to supply the equipment, a system neutral shall be derived.

29 CFR 1926.404(f)(11)(ii)(A)

(b) Exposed noncurrent-carrying metal parts of portable or mobile equipment shall be connected by an equipment-grounding conductor to the point at which the system-neutral impedance is grounded.

29 CFR 1926.404(f)(11)(ii)(B)

(c) Ground-fault detection and relaying shall be provided to automatically de-energize any high-voltage system component that has developed a ground fault. The continuity of an equipment-grounding conductor shall be continuously monitored so as to automatically de-energize the high-voltage feeder to portable equipment if continuity of the equipment-grounding conductor is lost.

29 CFR 1926.404(f)(11)(ii)(C)

(d) The grounding electrode to which a portable or mobile-equipment-system neutral impedance is connected shall be isolated from and separated in the ground by at least 20 feet from any other system or equipment-grounding electrode. There shall be no direct connection between grounding electrodes, such as buried pipe, fence, or similar objects.

29 CFR 1926.404(f)(11)(ii)(D)

(e) All noncurrent-carrying metal parts of portable or fixed equipment including their associated fences, housings, enclosures, and supporting structures shall be grounded. Equipment that is guarded because of its location and isolated from the ground need not be grounded.

29 CFR 1926.404(f)(11)(iii)



## 12. Power Transmission and Distribution

*This section applies to the construction of new transmission and distribution lines and equipment and to the alteration, conversion, and improvement of existing lines and equipment.*

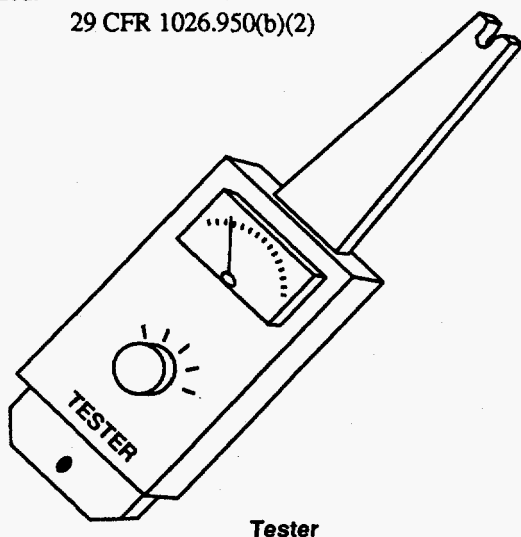
### a. General Requirements

(1) Before work begins, energized lines and equipment, including utility poles, circuits, power and communication lines, cable television (CATV) lines, and fire alarm circuits shall be inspected or tested for existing conditions.

29 CFR 1926.950(b)(1)

(2) Electric equipment and lines shall be considered energized until they are tested and found not to be energized.

29 CFR 1026.950(b)(2)



Tester

*Note: Caution should be maintained in making immediate direct contact with live lines when using any type of testing device.*

(3) The operating voltage of lines or equipment shall be determined before workers may work on them or near their energized parts.

29 CFR 1926.950(b)(3)

# ?VOLTAGE?

Always check the voltage!

(4) When workers approach or touch exposed energized parts of a conductive object, they must

- use an approved insulating handle no closer than the minimum distances given in Table E-6; or
- be insulated or guarded from energized parts (gloves or sleeves rated for the voltage may be considered as insulated); or
- have the energized part insulated or guarded from the worker and from any other conductive object at a different potential; or
- have the energized part isolated, insulated, or guarded from any other conductive objectives as it would be during live-line, bare-hand work.

29 CFR 1926.950(c)(1)(i-iii)

(5) Conductor-support tools, such as link sticks, strain carriers, and insulator cradles, may be used, provided that the clear insulation is at least as long as the insulator string or is the minimum distance specified in Table E-6 for the operating voltage.

29 CFR 1926.950(c)(2)(ii)

**Table E-6. Alternating Current—Minimum Distances**

Voltage Range (Phase-to-Phase) Kilovolts(kV)	Minimum Working and Clear Hot-Stick Distance
2.1 to 15	2' 0"
15.1 to 35	2' 4"
35.1 to 46	2' 6"
46.1 to 72.5	3' 0"
72.6 to 121	3' 4"
138 to 145	3' 6"
161 to 169	3' 8"
230 to 242	5' 0"
345 to 362	7' 0" <sup>1</sup>
500 to 552	11' 0" <sup>1</sup>
700 to 765	15' 0" <sup>1</sup>

<sup>1</sup> NOTE: For 345–362 kV, 500–552 kV, and 700–765 kV, the minimum working distance and the minimum clear hot-stick distance may be reduced, provided that such distances are not less than the shortest distance between the energized part and a grounded surface.



- (6) When lines and equipment rated higher than 600 volts are de-energized, and the means of disconnect are not visibly open or locked-out, steps shall be taken according to (6)(a-g) below.

29 CFR 1926.950(d)(1)



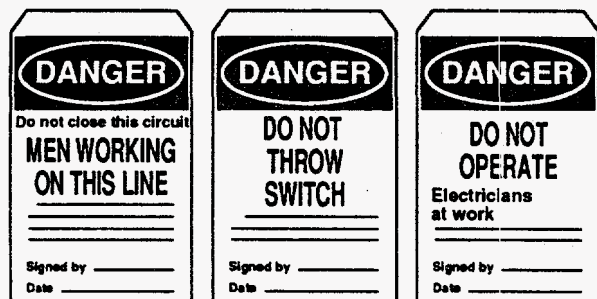
*Note: Although the use of locks to lockout electrical equipment and circuits is not required by 29 CFR 1926, the practice provides a greater degree of protection and is strongly recommended.*

- (a) The section of line or equipment to be de-energized shall be clearly identified and isolated from all sources of power.

29 CFR 1926.950(d)(1)(i)

- (b) A designated worker shall ensure that all switches and disconnectors for the line or equipment have been de-energized, tagged, and locked out and, when design permits, have been made inoperative.

29 CFR 1926.950(d)(1)(ii)(a-c)



**Danger Tags**

- (c) Lines and equipment shall be visually inspected and tested to ensure that they have been de-energized.

29 CFR 1926.950(d)(1)(iii)

- (d) Protective grounds shall be applied to the disconnected lines or equipment.

29 CFR 1926.950(d)(1)(iv)

- (e) Guards or barriers shall be erected next to adjacent energized lines as necessary.

29 CFR 1926.950(d)(1)(v)

- (f) When more than one independent crew requires the same line or equipment to be de-energized, a designated worker shall place a prominent tag and lock for each crew on the line or equipment.

29 CFR 1926.950(d)(1)(vi)

- (g) Upon completion of work on de-energized lines or equipment, a designated worker shall ensure that all workers in the crew are away from the line and the crew's protective grounds are removed. The designated worker shall then report to the designated authority that all tags and locks protecting his or her crew may be removed.

29 CFR 1926.950(d)(1)(vii)

- (7) When a crew working on lines or equipment rated over 600 volts can observe that the means of disconnect are visibly open or locked-out, the requirements in paragraphs (6)(c-g) above shall apply.

29 CFR 1926.950(d)(2)



- (8) All workers on energized lines shall be proficient in procedures involving emergency situations and first aid fundamentals including resuscitation unless there is a first-aid trainer available on site to render first aid or the worksite is within 3 to 4 minutes of an infirmary, clinic, hospital, or physician.

29 CFR 1926.950(e)(1)(i,ii), (e)(2)

- (9) Nighttime operations shall be carried out under spotlights or portable lights.

29 CFR 1926.950(f)

- (10) Hydraulic fluids used for the insulated sections of derricks, trucks, aerial lifts, and hydraulic tools used on/or around energized lines and equipment shall be an insulating type. (The requirements for fire-resistant fluids do not apply to hydraulic tools covered by this paragraph.)

29 CFR 1926.950(i)

## b. PPE and Tools

### (1) PPE

- (a) Rubber PPE shall meet the provisions of the American National Standard Institute as follows:

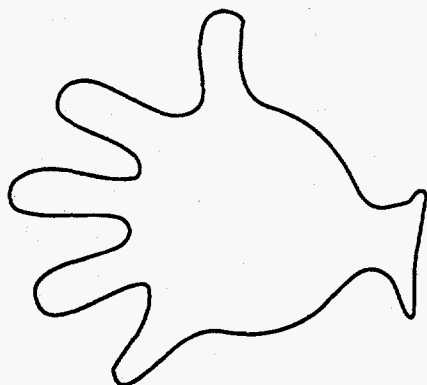
- rubber insulating gloves—ANSI/ASTM D 120-1984,
- rubber matting for use around electrical apparatus—ANSI /ASTM D 178-1981,
- rubber insulating blankets—ANSI/ASTM D 1048-1981, and
- rubber insulating line hose—ANSI/ASTM D-1050-1985.

29 CFR 1926.951(a)(1)(i)

- (b) Rubber PPE shall be visually inspected before use, and rubber gloves shall be "air tested" before use, and at least annually according to ANSI/ASTM D 120-1984.

29 CFR 1926.951(a)(1)(ii-iii)





Air-Leak Test of Lineman's Rubber Glove

(c) Protective helmets (hard hats) shall meet the provisions of ANSI Z.89.2-1971 "Head Protection." See Section A.2 of this guide for more information.

29 CFR 1926.951(a)(2)

## (2) Tools

(a) Metal or conductive ladders shall not be used near energized electric lines or equipment except under special conditions, such as in high-voltage substations where nonconductive ladders might present a greater hazard than conductive ladders. Metal or conductive ladders shall be marked "CONDUCTIVE," and all necessary precautions shall be taken when they are used.

29 CFR 1926.951(c)(1)

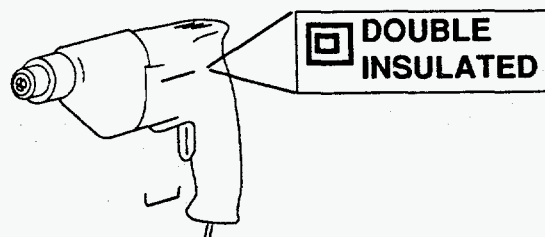
(b) Tools shall be wiped clean and inspected each day before use. If any hazardous defects are noted, the tool shall be removed from service.

29 CFR 1926.951(d)(2)

(c) Portable electric hand tools shall either be equipped with a three-wire cord having the ground wire permanently connected to the tool frame and a means for grounding the other end; or shall be double-insulated and permanently labeled "DOUBLE-INSULATED"; or shall be connected

to the power supply by means of an isolating transformer or other isolated power supply.

29 CFR 1926.951(f)(1),(f)(2)(i-iii)



(d) Measuring tapes or ropes that are metal or contain conductive metal strands shall not be used on or near energized parts.

29 CFR 1926.951(e)

(e) Hydraulic tools used on or around energized lines or equipment shall use nonconductive hoses having adequate strength for normal operating pressures.

29 CFR 1926.951(f)(3)

(f) Pneumatic tools used on or around energized lines or equipment shall have nonconducting hoses that are strong enough for normal operating pressures and shall have an accumulator on the compressor to collect moisture.

29 CFR 1926.951(f)(4)(i,ii)

## c. Mechanical Equipment

(1) All mechanical equipment used on the construction site (including vehicles in Section N of this guide) shall be visually inspected each time it is used.

29 CFR 1926.952(a)(1)

(2) Aerial-lift trucks working near energized lines shall be grounded, barricaded, and considered as energized equipment or shall be insulated from work being performed.

29 CFR 1926.952(b)(2)





(3) Line clearance from cranes, derricks, and other lifting and mechanical equipment are as follows:

(a) Equipment or materials that are being operated or handled near power lines shall maintain a clearance between lines. Any part of the crane or load shall be

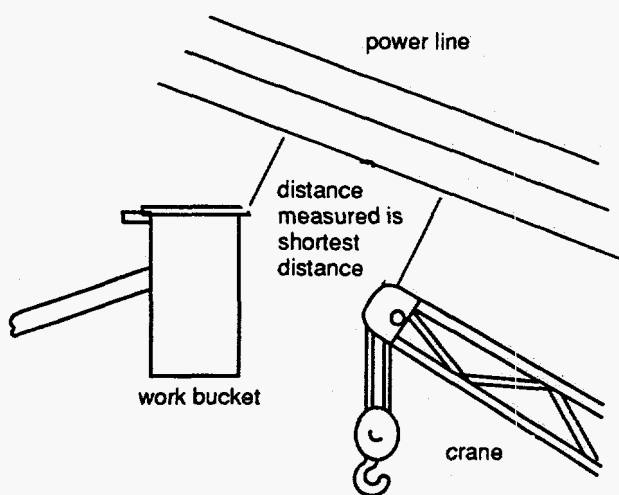
- 10 feet for lines rated 50 kV or less;
- 10 feet plus 0.4 inches for each 1 kV over 50 kV for lines rated 50 kV or more; except,
- where electrical distribution or transmission lines have been de-energized and visibly grounded at the point of work; or
- where insulating barriers (not part of an attachment to the equipment or machinery) have been erected to prevent physical contact with the lines.

29 CFR 1926.550(a)(15)(i-ii)

(b) With the exception of equipment certified for work on the proper voltage, mechanical equipment used in electrical distribution and transmission line work shall not be operated closer to any energized lines or equipment than the clearances set forth in Table E-6, unless

- an insulated barrier is installed between the energized part and the mechanical equipment,
- the mechanical equipment is grounded,
- the mechanical equipment is insulated, or
- the mechanical equipment is considered as energized.

29 CFR 1926.952(c)(2)(i-iv)



**Power Line Clearances**

(4) Equipment or material shall not be passed between the aerial-lift basket and utility poles or structures or on aerial lifts while a worker in the basket is within reaching distance of energized conductors or equipment that is not covered with insulation protective equipment.

29 CFR 1926.952(b)(3)

#### d. Material Handling

(1) Before unloading steel poles, cross arms, or similar materials, the load shall be inspected to determine if it has shifted or become otherwise dangerous to workers.

CFR 1926.953(a)

(2) When poles are transported, all loads shall be secured well, and a red flag shall be attached to the end of the longest pole. Precautions shall be taken to prevent blocking roadways or endangering other traffic.

CFR 1926.953(b)(1,2)

(3) Materials shall not be stored under energized buses or conductors or near energized equipment, if it is practical to store the material elsewhere.

29 CFR 1926.953(c)(1)

(4) When material or equipment is stored under energized lines or equipment, appropriate clearances, as found in Table E-6, shall be maintained. Extraordinary caution shall be taken when moving materials near any energized sources.

29 CFR 1926.953(c)(2)

(5) Tag lines or other suitable devices shall be used when material is hoisted and when workers may be endangered. Tag lines or other devices shall be nonconductive when used near energized sources or lines.

29 CFR 1926.953(d); 955(a)(8)

(6) During framing operations, employees shall not work under a pole or a structure that is suspended by a crane or by other hoisting equipment unless the pole or structure is adequately supported.

29 CFR 1926.953(f)

#### e. Grounding for Employee Protection

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

29 CFR 1926.954(a)

(2) New lines or equipment may be considered de-energized when the lines or equipment are grounded or the hazard of induced voltage is not present and adequate clearances or other means are implemented to prevent contact between energized lines or equipment and the new lines or equipment.

29 CFR 1926.954(b)(1-2)

(3) Bare-wire communications conductors on power poles or structures shall be treated as energized lines unless protected by insulating materials.

29 CFR 1926.954(c)



(4) De-energized conductors or equipment to be grounded shall be voltage-tested; the results of the test shall determine the subsequent procedures, as noted in paragraphs 12.a.(3) and 12.a.(7) of this section.

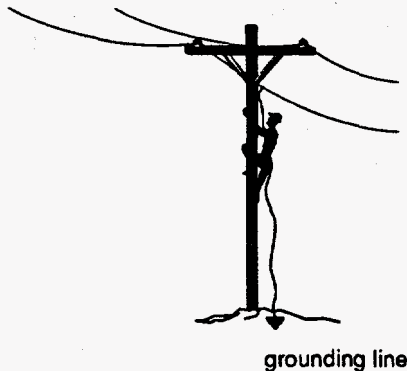
29 CFR 1926.954(d)

(5) When grounds are attached, the grounded end shall be attached first, and the other end shall be attached and removed with insulated tools or other suitable devices. When removing, remove the equipment end of the ground first, using insulated tools.

29 CFR 1926.954(e)

(6) Requirements for placement of grounds are as follows:

(a) Grounds shall be placed at the work locations or between the work location and all sources of energy and as close as practicable to the work location.



(b) 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, and the conductor to be worked shall be grounded at each work location.

(c) The minimum distances in Table E-6 shall be maintained from ungrounded conductors at the work location.

(d) When making a ground is impracticable or the conditions resulting therefrom would be more hazardous than working on the line or equipment without grounding, the grounds may be omitted and the line or equipment worked as energized.

29 CFR 1926.954(f)

(7) Grounds may be temporarily removed only when necessary for testing purposes, and extreme caution shall be exercised during testing procedures.

29 CFR 1926.954(g)

(8) When grounding electrodes are used, they shall have a resistance to ground low enough (25 ohms maximum is generally accepted resistance) so that workers will not be harmed or to permit prompt operation of protective devices.

29 CFR 1926.954(h)

(9) Grounding to towers shall be made with a tower clamp capable of conducting the anticipated fault current.

29 CFR 1926.954(i)

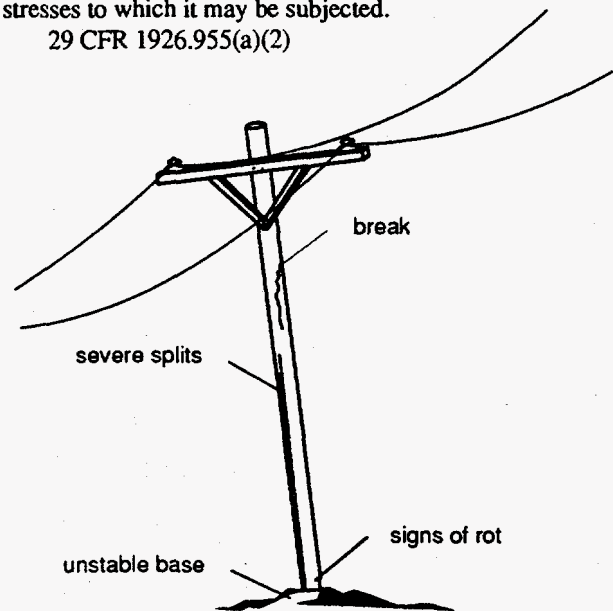
(10) A ground lead, which will be attached to either a tower ground or driven ground, shall be capable of conducting the anticipated fault current and shall have a minimum conductance of No. 2 AWG copper.

29 CFR 1926.954(j)

#### f. Overhead Lines

(1) Before workers climb poles, ladders, or other elevated structures, the structure shall be inspected to determine if it is capable of sustaining the additional or unbalanced stresses to which it may be subjected.

29 CFR 1926.955(a)(2)



Safety Inspection of Poles

(2) Poles or structures that are considered unsafe for climbing shall not be climbed until they are guyed, braced, or made safe in an equivalent way.

29 CFR 1926.955(a)(3)

(3) Before wire or cable is installed or removed, strains to which poles and structures will be subjected shall be considered, and action shall be taken to prevent failure of such supporting structures.

29 CFR 1926.955(a)(4)

(4) When poles are set, moved, or removed using hoists or other mechanical equipment near energized lines or equipment, precautions shall be taken to avoid contact with energized lines or equipment. This is not necessary in bare-hand live-line work or when barriers or protective devices are used.

29 CFR 1926.955(a)(5)(i)

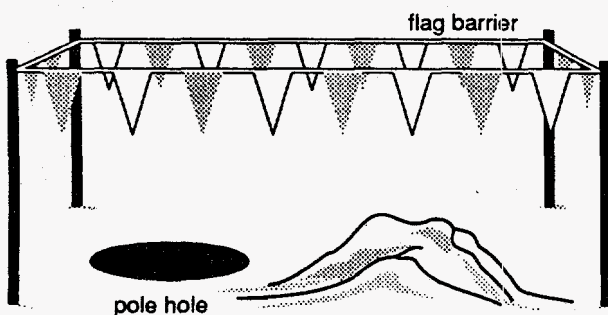


(5) Equipment and machinery operating adjacent to energized lines or equipment shall comply, as applicable, with paragraph 12.c.(3) (a,b) of this guide and Table E-6.  
29 CFR 1926.955(a)(5)(ii)

(6) Unless suitable protective equipment for the voltage involved is used, workers standing on the ground shall avoid touching equipment or machinery that is adjacent to energized lines or equipment.  
29 CFR 1926.955(a)(6)(i)

(7) Equipment for lifting shall be bonded to an effective ground or shall be considered energized and barricaded when used near energized equipment or lines.  
29 CFR 1926.955(a)(6)(ii)

(8) Pole holes shall not be left unattended or unguarded in areas where employees are currently working.  
29 CFR 1926.955(a)(7)



(9) When excavating or augering in unstable material, pad- or pile-type footings more than 5 feet deep shall be sloped to the angle of repose or shored if worker entry is required. Ladders shall be provided when footings in excavations are more than 4 feet deep. See Section C, "Excavations," of this guide.  
29 CFR 1926.955(b)(1,2)

(10) When towers are erected near energized lines, the lines shall be de-energized or appropriate clearances listed in Table E-6 shall be maintained. During lifts, a spotter shall determine the required clearances.  
29 CFR 1926.955(b)(5)(iii)

(11) Traffic shall be controlled in accordance with Sections G, "Signs, Signals, and Barricades," and N, "Demolition," of this guide.  
29 CFR 1926.955(b)(7)

(12) No one shall be permitted to remain in a footing while equipment is being spotted or moved for placement.  
29 CFR 1926.955(b)(3)(ii)

#### g. Stringing or Removing De-Energized Conductors

(1) Before stringing operations begin, all workers shall receive prephase training to include review of work assignments, equipment required, and precautions to be taken for the operation.

29 CFR 1926.955(c)(2) **T**

(2) When there is a possibility of a conductor accidentally contacting an energized circuit, the conductor being installed or removed shall be grounded; or workers shall be insulated or isolated.

29 CFR 1926.955(c)(3)

(3) If the existing line is de-energized, proper clearance authorization shall be secured and the line shall be grounded on both sides of the crossover; or the strung line shall be considered and worked as if it were energized.

29 CFR 1926.955(c)(4)(i)

(4) When crossing over energized conductors of more than 600 volts, rope nets or guard structures shall be installed unless provisions are made to insulate or isolate the live conductor or worker. Where practical, the automatic reclosing feature of the circuit-interrupting device shall be made inoperative. In addition, the line being strung shall be grounded either side of the crossover or worked as energized.

29 CFR 1926.955(c)(4)(ii)

(5) Conductors being strung or removed shall be controlled with tension reels, guard structures, tielines, or other equivalent means to prevent contact with energized lines.

29 CFR 1926.955(c)(5)

(6) Conductor grips shall not be used on wire rope, unless the conductor grips are designed for this application.

29 CFR 1926.955(c)(8)

(7) Clipping crews shall have a minimum of two structures clipped in between the crew and the conductor being sagged. When working on bare conductors, crews shall work between grounds at all times; and grounds shall remain intact until work is completed.

29 CFR 1926.955(c)(10)

(8) Reliable communications between the reel tender and the pulling-rig operator shall be provided.

29 CFR 1926.955(c)(12)(ii)

(9) Each pull shall be snubbed or dead-ended at both ends before subsequent pulls.

29 CFR 1926.955(c)(12)(iii)



## h. Stringing Next to Energized Lines

(1) Before stringing parallel to an existing live line, it shall be determined if dangerous induced-voltage build-ups will occur, especially during switching and ground-fault conditions. When there is a possibility of dangerous induced voltages, the requirements in this section shall be followed unless the lines are worked as energized.

29 CFR 1926.955(d)(1)



(2) All pulling and tension equipment shall be isolated, insulated, or effectively grounded. A ground shall be installed between the tensioning reel and the first structure in order to ground each bare conductor, subconductor, or overhead ground during stringing operations.

29 CFR 1926.955(d)(3,4)

(3) During stringing operations, each of the conductors in paragraph (2) above shall be grounded at the first tower adjacent to both the tension and pulling setup and in increments so that no point is more than 2 miles from the ground. Grounds shall be left in place until work is completed, removed as a last phase of aerial cleanup, or removed with a hot stick. Such conductors shall be grounded at all dead-end or catch-off points.

29 CFR 1926.955(d)(5)(i-iii), (6)

(4) A ground shall be located on each side and within 10 feet from the working area where conductors, subconductors, or overhead ground conductors are being spliced. The two ends of the conductors to be spliced together shall be bonded together. It is recommended that splicing be carried out on an insulated platform or metallic grounding mat that is bonded to both grounds.

29 CFR 1926.955(d)(7)

(5) All conductors, subconductors, and ground conductors shall be bonded to the tower at any isolated tower when necessary to complete work on the transmission line. When deadend towers are worked, all de-energized lines shall be grounded.

29 CFR 1926.955(d)(8)(i-ii)

(6) When performing work from structures, all workers on conductors shall be protected by individual grounds at every work location.

29 CFR 1926.955(d)(9)

## i. Live-Line, Bare-hand Work

(1) Workers shall be instructed and trained in live-line, bare-hand techniques and safety requirements before beginning such work.

29 CFR 1926.955(e)(1)



(2) Handlines shall not be used between buckets, booms, or ground, and there shall be no conductive objects over 36 inches long in a bucket (except for appropriate length jumpers, armor rods, and tools).

29 CFR 1926.955(e)(18)(i,ii)

(3) Workers shall know the voltage rating of the circuit, clearances to ground and other energized parts, and the voltage limitations of the aerial-lift equipment before they begin live-line, bare-hand work.

29 CFR 1926.955(e)(2)(i-iii)

(4) Only equipment and tools designed, tested, and intended for live-line, bare-hand work shall be used. Tools and equipment shall be maintained clean and dry. All work shall be personally supervised by a trained and qualified worker in live-line, bare-hand work.

29 CFR 1926.955(e)(3,4,8)



(5) When practical, the automatic reclosing feature of an interrupting device shall be made inoperative before working on any energized line or equipment.

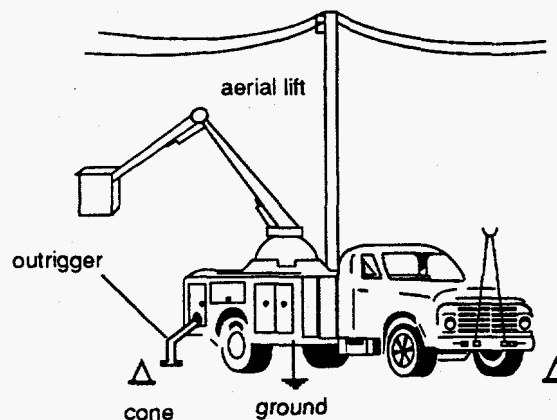
29 CFR 1926.955(e)(5)

(6) A conductive bucket liner or other conductive device shall be used for bonding the insulated aerial device to the live line or equipment. Workers shall be connected to the bucket liner with conductive shoes, leg clips, or other equivalent means. When necessary for electrostatic protections, appropriate electrostatic shielding or conductive clothing shall be provided.

29 CFR 1926.955(e)(7)(i,ii)

(7) Before the boom is elevated, the outriggers on the aerial truck shall be extended and adjusted to stabilize the truck, and the body of the truck shall be bonded to an effective ground or barricaded and considered as energized equipment. The controls of the aerial lift shall be inspected and tested (ground level and bucket) before it is moved into the work position.

29 CFR 1926.955(e)(9,10)



Aerial Lift Truck



(8) Arm current tests shall be made before starting work each day and any time a new higher voltage is to be worked. See the below noted CFR for test requirements.

29 CFR 1926.955(e)(11)

(9) Aerial lifts shall have upper and lower controls; lower controls shall have override capabilities. Bucket controls shall be within easy reach of workers; lower controls shall be located near the base of the boom. Controls shall be overriding, and the lower control shall not be used without approval of the worker in the bucket except in the event of an emergency.

29 CFR 1926.955(e)(12,13)

(10) The minimum clearance distances for live-line, bare-hand work are specified in Table E-7. These distances shall be maintained from all grounded objects; from lines and equipment, including the grounded frame of the lift truck; and from lines of a different potential to those bonded to the insulated aerial device, unless these objects are covered by insulated guards. The clearance distances shall be maintained when live circuits are approached, or left, or when bonded to live circuits.

29 CFR 1926.955(e)(15)

**Table E-7. Minimum Clearance Distances for Live-Line Bare-Hand Work (Alternating Current)**

Voltage Range (Phase-to-Phase) Kilovolts (kV)	Distance in Feet and Inches for Maximum Voltage	
	Phase to Ground	Phase to Phase
2.1 to 15	2' 0"	2' 0"
15.1 to 35	2' 4"	2' 4"
35.1 to 46	2' 6"	2' 6"
46.1 to 72.5	3' 0"	3' 0"
72.6 to 121	3' 4"	4' 6"
138 to 145	3' 6"	5' 0"
161 to 169	3' 8"	5' 6"
230 to 242	5' 0"	8' 4"
345 to 362*	7' 0"*	13' 4"*
500 to 552*	11' 0"*	20' 0"*
700 to 765*	15' 0"*	31' 0"*

\*For noted kVs, the minimum clearance distance may be reduced, provided the distances are not made less than the shortest distance between the energized part and a grounded surface.

(11) Before workers contact the energized parts to be worked, the conductive bucket liner shall be bonded to the energized conductor and remain so until work is completed.

29 CFR 1926.955(e)(14)

(12) The minimum clearances as stated in Table E-7 shall be printed on durable, nonconductive material and posted inside the bucket where it may easily be seen by workers inside the bucket.

29 CFR 1926.955(e)(20)(i)

#### j. Underground Lines

##### (1) Requirements for Guarding and Ventilation

(a) Warnings signs shall be posted when the cover of a manhole, handhole, or vault is removed; the type of warning sign will depend on the location and hazard involved.

29 CFR 1926.956(a)(1)

(b) A street opening or vault shall be protected by barriers, temporary covers, or other suitable guards before workers enter.

29 CFR 1926.956(a)(2)

(c) Workers shall not be permitted to enter manholes or unvented vaults until forced ventilation is provided and the atmosphere is tested for oxygen deficiency and presence of explosive gases or fumes and found safe. When unsafe conditions are found, the work area shall be ventilated, retested, and made safe before entry; and provisions shall be made for adequate exchange of air.

29 CFR 1926.956(a)(3)(i-iii)

##### (2) Requirements for Work in Holes

(a) When workers are in a manhole, a safety watch shall be in the immediate vicinity to render emergency assistance; safety watch may occasionally enter the manhole to give other than emergency assistance. Although not recommended, the CFR does allow specific exemptions to this requirement. For information of specific exemptions, see the below noted CFR.

29 CFR 1926.956(b)(1)



(b) When open flames must be used in manholes, extra precautions shall be taken to provide adequate ventilation.

29 CFR 1926.956(b)(2)

(c) Before open flames are used in a manhole or excavation in which combustible gases or liquids may be present (for example, in areas near gasoline stations), the atmosphere shall be tested and found safe or cleared of combustible gases or liquids. Adequate ventilation must be provided during use of open flame work.

29 CFR 1926.956(b)(3)



## (3) Requirements for Trenching and Excavating

(a) Trenching and excavating requirements are outlined in Section C of this guide to include directing of mobile equipment next to excavations.

29 CFR 1926.956(c)(2)



(b) To prevent worker exposure to underground hazards during excavating or trenching operations, efforts shall be made to locate dangerous underground facilities and to prevent their damage.

29 CFR 1926.956(c)(1)

(c) When any underground facilities are exposed (electric, gas, water, telephone, and others), the facilities shall be protected as necessary to avoid damage.

29 CFR 1926.956(c)(3)

(d) When multiple cables are found in an excavation, all cables not being worked shall be protected.

29 CFR 1926.956(c)(4)

(e) When multiple cables are found in an excavation, the cable to be worked on shall be identified electrically, unless it has a distinctive appearance.

29 CFR 1926.956(c)(5)

(f) When working on buried cable or cable in manholes, metallic sheath continuity of a cable shall be maintained by bonding across the sheath opening or by equivalent means.

29 CFR 1026.956(c)(7)

## k. Construction in Energized Substations

## (1) General Requirements

(a) Only an authorized person may approve the start of construction in an energized substation.

29 CFR 1926.957(a)(1)



(b) Before construction begins, energized facilities shall be identified, and appropriate PPE shall be selected. The precautions necessary for worker safety shall also be determined.

29 CFR 1926.957(a)(2)(i,ii)

(c) Extraordinary caution shall be exercised when busbars and steel for towers and equipment are handled in the vicinity of the energized facilities. Specific guidance on appropriate precautionary measures is provided in Section E.12.a(4-5) "Power Transmission and Distribution" of this guide.

29 CFR 1926.957(a)(3)

(d) When it is necessary to de-energize equipment or lines for protection of workers, refer to the guidelines outlined in Section E.12.a.(6-8) "Power Transmission and Distribution," of this guide.

(e) Barricades and barriers shall be installed to prevent accidental worker contact with energized lines and equipment. Signs indicating the hazard shall be posted near the barricade or barrier.

29 CFR 1926.957(c)(1,2)

(f) Work on or near energized control panels shall be performed only by designated, qualified workers.

29 CFR 1926.957(d)(1)



(g) Precautions shall be taken to prevent jarring, vibration, or improper wiring from causing accidental operation of relays or other protective devices.

29 CFR 1926.957(d)(2)

## (2) Using Mechanical Equipment

(a) Use of vehicles, gin poles, cranes, and other equipment in restricted or hazardous areas shall be controlled by designated workers at all times.

29 CFR 1926.957(e)(1)



(b) All mobile cranes and derricks shall be effectively grounded when being moved or operated in close proximity to energized lines or equipment, or the equipment shall be considered energized.

29 CFR 1926.957(e)(2)

## (3) Substation Fences

(a) When a substation fence must be expanded or removed for construction purposes, a temporary fence affording similar protection (at least 8 feet in height) shall be provided when the site is unattended. Adequate interconnection with ground shall be maintained between the temporary fence and the permanent fence.

29 CFR 1926.957(g)(1)

(b) All gates to unattended substations shall be locked.

29 CFR 1926.957(g)(2)

## (4) Excavating Footings

(a) Excavation for auger-, pad- and piling-type footings for structures and towers shall require the same precautions as metal tower construction. See Section E.12.f.(9) "Power Transmission and Distribution. Overhead Lines." of this guide.

29 CFR 1926.957(h)(1)





(b) No worker shall enter an unsupported auger-type excavation made in unstable material for any purpose. Cleanout shall be done without workers entering.

29 CFR 1926.957(h)(2)

1. Lineman's Body Belts

(1) Lineman's belts, safety straps, and lanyards shall meet the requirements of the American Society of Testing Materials (ASTM) Standard B117-64. See Section A.9. of this guide for more details.

29 CFR 1926.951(b)(4)(i); 959(a)(1)

(2) PPE (body belts with straps and lanyards) shall be worn by those working at elevated locations, except in operations in which use of these items may create a greater hazard; then other safeguards shall be used.

29 CFR 1926.951(b)(1)

(3) Before each use, body belts and straps shall be inspected for a deformed buckle; cracked or broken "D" ring; failure of the snap hook; parted, torn, or cracked fabric or leather; and other damaged items. Specific inspection requirements can be found in the CFR noted below.

29 CFR 1926.951(b)(3), 959(a)(2-4), (b)(1)(i-ii)



(4) Safety lines are not intended for shock-loading; they are used to lower workers during an emergency rescue. Defective lines shall be replaced.

29 CFR 1926.951(b)(4,5)

(5) The cushion support of a body belt shall contain no exposed rivets on the inside.

29 CFR 1926.959(b)(2)(i)



## DEFINITIONS

**Acceptable** — Has been accepted, certified, listed, labeled, or otherwise specified as being safe by a nationally recognized testing laboratory, such as Underwriters' Laboratories (UL); or has been inspected or tested by a controlling authority and found to be in compliance with the provisions of the National Electrical Code (NEC)/or other regulatory requirements.

**Accessible** — Can be easily entered or reached; not guarded, locked away, placed at a high elevation, or in any way obstructed.

**Ampacity** — Current-carrying capacity measured in amperes.

**Approved** — Accepted by a controlling authority; or approved for a specific use in accordance with standard or code.

**Attachment Plug** — A fitting that can be inserted into an electric receptacle to establish a connection with the power supply.

**Bonding** — Using low-resistance material to electrically join metallic parts to form a permanent electrical connection or continuity.

**Branch Circuit** — The section of wiring that extends between the final overload protective device and the plug receptacle.

**Certified** — Acceptable (See "Acceptable" above).

**Circuit Breaker** — An automatic switch, which can also be manually opened or closed, that stops the flow of electric current in an overloaded circuit.

**Clearance Authorization** — The portion of an electrical line-stringing plan that includes permission from the power company to string across or near an existing line.

**Conductors** — Wires capable of and intended to conduct electricity.

**Bare** — Uncovered or uninsulated wires.

**Covered** — Wires encased in materials that do not meet the electrical insulation standard.

**Insulated** — Wires encased in materials that meet the electrical insulation standard.

**Open** — A condition or location of circuit wiring, for example, the physical location of wiring or circuit, i.e., wiring run in the open, across poles, etc.

**Disconnect Means** — A device or group of devices that can be used to disconnect circuits from their power source.

**Enclosed** — Surrounded by a case, housing, fence, wall, or other device that prevents individuals from accidentally contacting energized parts and that protects equipment from damage.

**Explosion-Proof Enclosure** — An equipment-enclosing case that can withstand an internal explosion of a specified gas or vapor without propagating the explosion to the environment outside the enclosure.





**Exposed** — Unprotected from individuals' inadvertent contact or approach; or not suitably guarded, isolated, or insulated.

**Feeder** — Power supplied to service equipment.

**Grounding Conductor** — A conductor used to connect equipment or the grounded circuit of a wiring system to the grounding electrode or electrode.

**Grounded Conductor** — A system or circuit conductor that is intentionally grounded. This conductor is white or gray and will normally have circuit flow.

**Ground (Grounding)** — A conducting path, either intentional or accidental, between an electric circuit or a piece of equipment and the earth or a conducting body that serves in place of the earth.

**Ground Fault Circuit Interrupter (GFCI)** — A sensitive, fast-acting circuit breaker that can sense and interrupt very small ground-fault currents (usually 5 milliamperes [mA] difference between hot and neutral).

**Guarded** — Covered, shielded, enclosed within fences or walls, or otherwise protected.

**Hot Stick** — A long, insulated tool used to hold or attach live power lines.

**Isolated** — Separated or removed; set apart.

**Locations** —

**Damp** — Partially protected areas, under canopies, porch roofs, or other coverings, that are subject to moderate amounts of moisture.

**Dry** — Locations that are not normally subject to dampness or wetness.

**Wet** — Underground areas, surrounded by concrete or masonry or in direct contact with the earth; or locations that are exposed to weather.

**Outlet** — A termination point on the wiring system from which electric power is taken to operate equipment.

**Premises-Wiring System** — Permanent or temporary interior and exterior wiring that extends from the lead end of a service drop to the outlets.

**Qualified Person** — A person who is familiar with the construction and operation of the equipment and who understands the hazards involved.

**Service-Entrance Conductors** — The supply conductors that extend to the service equipment from the street main or from transformers.

**Voltage, Nominal** — A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (for example, 120/240, 480Y/277, or 600).

**Watertight** — Constructed so that moisture cannot enter the enclosure.

**Weatherproof** — Constructed or protected so that exposure to the weather will not interfere with operations; or rainproof and watertight.

**KEY ITEMS CHECK LIST**  
**SECTION E. ELECTRICAL SAFETY**

Item	Paragraph	Notes
1. REQUIREMENTS FOR ALL SITE WORKERS	E.1	
Is the worksite surveyed for electrical hazards; are signs posted and workers advised?	E.1.a	
Are workers near electrical circuits? If so, is equipment guarded or power de-energized and grounded?	E.1.b	
Are tools inspected for hazardous defects?	E.1.i	
Are tools grounded or double insulated?	E.1.k	
Are double-insulated tools so labeled?	E.1.k	
Are flexible extension cords the correct size and type?	E.1.n	
Are flexible extension cords protected from damage?	E.1.n(5)	
Are cabinet clearances maintained?	E.1.e	
Is the location of underground electric power known prior to use of jack hammer or bar?	E.1.m	
Are signs posted and observed?	E.1.c	
2. REQUIREMENTS FOR ELECTRICAL WORKERS	E.2	
Are workers trained in electrical safety-related work practices and hazard recognition?	E.2.a	
Are only qualified workers inspecting and using electrical test equipment?	E.2.c E.2.d	
Are lockout/tagout procedures for electric work carried out?	E.2.f	
Are proper space requirements met for work near exposed live parts?	E.2.j	
3. ON-SITE ELECTRICAL SAFETY REQUIREMENTS	E.3	
Are ground-fault circuit interrupters (GFCIs) installed and used?	E.3.a	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
Where GFCIs are not installed, is an assured grounding program in effect?	E.3.a	
Are splices as strong and as well insulated as new cord?	E.3.g	
Are equipment and cords secured and installed correctly?	E.3.j E.3.k	
Is temporary wiring removed as soon as its purpose is served?	E.3.s	
Are listing and labeling instructions followed?	E.3.u	
Are new installations protected from accumulation of construction dust or fines that could cause fire or an explosion?	E.3.t	
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4. GENERAL WIRING DESIGN AND PROTECTION	E.4	
Are metal raceways, cable armor, and other metal enclosures continuous and connected to boxes, fittings, or cabinets?	E.4.a	
Are wiring systems protected from damage, dampness, and flammable vapors?	E.4.b E.4.c	
Are receptacles and connectors the correct type?	E.4.d	
Are means for disconnecting appliances provided and correctly marked?	E.4.h	
Is the grounded conductor of every cable distinguishable?	E.4.i	
<hr/>		
5. CABINETS, BOXES, AND SWITCHBOARDS	E.5	
Are cabinets and boxes fitted with bushings to prevent conductor damage?	E.5.a	
Are pull boxes, junction boxes, or fittings covered and grounded?	E.5.b	
Are all switches installed according to instructions?	E.5.d E.5.e	
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## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
6. MOTORS AND PENDANTS	E.6	
Are disconnects within sight of controller location?	E.6.a	
	E.6.e	
Are all disconnects identified according to the equipment or motors they serve?	E.6.c	
	E.6.d	
Are the correct plugs, cords, and pendants used?	E.6.i	
7. TRANSFORMERS	E.7	
Are transformers correctly posted with operating voltage?	E.7.b	
Is access by workers and storage of material in transformer vaults prohibited?	E.7.c	
	E.7.d	
8. SPECIFIC PURPOSE EQUIPMENT AND INSTALLATIONS	E.8	
a. <i>Cranes and Hoists</i>	E.8.a	
Can the required switches be locked open?	E.8.a (1)	
Are the required limit switches installed?	E.8.a (4)	
Are disconnects and switches correctly located?	E.8.a (2)	
	E.8.a (3)	
b. <i>Elevators, Escalators, and Moving Walks</i>	E.8.b	
Are switches and disconnects correctly located?	E.8.b (1)	
	E.8.b (2)	
c. <i>Electric Welding Equipment</i>	E.8.c	
Are the required disconnects and switches provided?	E.8.c (1)	
Is the amperage rating of switches adequate?	E.8.c (2)	
d. <i>X-Ray and Radiographic Equipment</i>	E.8.d	
Are all the required interlocks and disconnects installed?	E.8.d (1)	
	E.8.d (2)	
9. HAZARDOUS LOCATIONS	E.9	
Is the type of wiring appropriate for the hazard?	E.9.a	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
10. SPECIAL SYSTEMS	E.10	
a. <i>Systems, Cables, and Installations over 600 Volts, Nominal</i>	E.10.a	
Are circuit breakers enclosed and clearly marked?	E.10.a (1)	
Is there an equipment isolating means or warning on circuits when inspections or repairs are required?	E.10.a (3) E.10.a (5)	
Are the correct cables and conductors for the machinery in use?	E.10.a	
Are allowed splices molded or otherwise prepared to be as strong and as well insulated as new cable?	E.10.a (10)	
Are the required clearances maintained?	E.10.a (13) E.10.a (14)	
b. <i>Installations inside Tunnels</i>	E.10.b	
Are proper electrical safety procedures followed during the installation of mobile shovels, trailers, cars, draglines, hoists, drills, dredges, compressors, pumps, conveyors, and underground excavators?	E.10.b (1)	
c. <i>Communication Systems</i>	E.10.c	
Are the specific requirements for each system followed?	E.10.c	
d. <i>Battery Servicing</i>	E.10.d	
Are battery areas ventilated?	E.10.d (1)	
Are battery caps in place during charging?	E.10.d (9)	
11. GROUNDING	E.11	
a. <i>General Requirements</i>	E.11.a	
Are systems grounded when it is required?	E.11.a	
b. <i>Requirements for Portable and Vehicle-Mounted Generators</i>	E.11.b	
Are noncurrent-carrying metal parts bonded to the frame?	E.11.b (1)	
c. <i>Grounding of Supports, Enclosures, and Equipment</i>	E.11.c	
Are all noncurrent-carrying metal parts grounded?	E.11.c (3)	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
<i>d. Requirements for Plug and Cord Equipment</i>	<i>E.11.d</i>	
Are all noncurrent-carrying metal parts grounded?	E.11.d (1)	
Are double-insulated tools so labeled?	E.11.d (2)	
<i>e. Grounding Methods</i>	<i>E.11.e</i>	
Are grounding conductors contained within the raceway, cable, or cord that contains the circuit conductor?	E.11.e (1)	
Are grounding or bonding conductors adequate?	E.11.e (2) E.11.e (4)	
Are made grounding electrodes conductive and driven below soil moisture level?	E.11.e (5)	
<i>f. Grounding 1,000-Volt Supply or Greater</i>	<i>E.11.f</i>	
Are the special grounding requirements for higher-voltage equipment considered?	E.11.f	
<b>12. POWER TRANSMISSION AND DISTRIBUTION</b>	<b>E.12</b>	
<i>a. General Requirements</i>	<i>E.12.a</i>	
Are lines considered to be energized until they are tested?	E.12.a (2)	
Are power and communication lines, poles, television cables, and fire alarm circuits tested before work begins?	E.12.a (1)	
Are minimum safe distances maintained for conductor-support tool work?	E.12.a (5)	
Are lines and equipment to be worked on clearly identified?	E.12.a (6)(a)	
Are lockout/tagout procedures established and followed?	E.12.a (6)	
Are workers on energized lines adequately trained in the hazards of high voltage?	E.12.a (8)	
Have workers received proper first-aid training?	E.12.a (8)	
Has medical liaison been established?	E.12.a (8)	
<i>b. PPE and Tools</i>	<i>E.12.b</i>	
Do rubberized gloves, insulating blankets, and rubber matting meet ANSI standards?	E.12.b (1)	
Are gloves tested for air leaks?	E.12.b (1) (b)	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
Are metal ladders prohibited?	E.12.b (2) (a)	
Are tools clean?	E.12.b (2) (b)	
Are metal tape measures or ropes or such items containing conductive metal strands prohibited?	E.12.b (2) (d)	
Are the conductive properties of hand tools offset by double insulation or isolating circuits, or otherwise prepared for worker protection?	E.12.b (2) (c)	
<i>c. Mechanical Equipment</i>	<i>E.12.c</i>	
Are aerial-lift trucks, cranes, derricks, and other mechanical equipment inspected?	E.12.c (1)	
Are the correct clearances maintained for equipment near energized lines?	E.12.c (3) (a)	
Are the correct clearances maintained for equipment servicing energized lines?	E.12.c (3) (b)	
Is equipment that is operated closer to energized lines than the approved clearances certified for such use?	E.12.c (3) (b)	
<i>d. Material Handling</i>	<i>E.12.d</i>	
Are loads of poles, cross arms, or similar materials inspected for stability?	E.12.d (1)	
Is storage of materials near energized buses or conductors discouraged?	E.12.d (3)	
Are extraordinary precautions taken when conductive materials are handled near energized lines?	E.12.d (4)	
Are workers prohibited from working under inadequately supported structures during framing operations?	E.12.d (6)	
<i>e. Grounding for Employee Protection</i>	<i>E.12.e</i>	
Are the requirements for ground placement met?	E.12.e (6)	
Is extreme caution used when grounds are removed for testing?	E.12.e (7)	
Are grounding leads adequate?	E.12.e (10)	
<i>f. Overhead Lines</i>	<i>E.12.f</i>	
Are poles inspected for strength before they are climbed?	E.12.f (1)	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
Are auguring and excavation requirements met?	E.12.f (9)	
Are precautions taken to avoid energized lines or parts?	E.12.f (4)	
g. <i>Stringing or Removing De-Energized Conductors</i> Have workers received prephase training?	E.12.g E.12.g (1)	
Is the potential for contacting live lines accounted for?	E.12.g (2) E.12.g (3)	
Is reliable communication provided?	E.12.g (8)	
h. <i>Stringing Next to Energized Lines</i> Are the hazards of induced current accounted for?	E.12.h E.12.h (1)	
Are all conductors being strung bonded and grounded?	E.12.h (2) E.12.h (3)	
i. <i>Live-Line, Bare-Hand Work</i> Are workers trained?	E.12.i E.12.i (1)	
Are long conductive objects prohibited in the bucket?	E.12.i (2)	
Are workers aware of voltage compared with the limitations of their equipment?	E.12.i (3)	
Is a bonded conductive bucket liner used?	E.12.2 (6)	
Are proper clearances maintained for the grounded parts of equipment?	E.12.i (10)	
Are lift controls located correctly, and do they have the required overrides?	E.12.i (9)	
Does the worker in the bucket have approval concerning use of the lower controls?	E.12.i (9)	
j. <i>Underground Lines</i> Do street openings have proper signs and barricades?	E.12.j E.12.j (1) (a) E.12.j (1) (b)	
Have workers met requirements before entering confined spaces?	E.12.j (1) (c)	
Are workers observing excavation procedures?	E.12.j (3)	



## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
<i>k. Construction in Energized Substations</i>	<i>E.12.k</i>	
Is construction in energized substations under the control of an authorized person?	E.12.k (1) (a)	
Are extraordinary precautions taken in handling conductive materials near energized facilities?	E.12.k (1) (c)	
Are signs posted and barricades erected to protect workers?	E.12.k (1) (d) E.12.k (1) (e)	
Are precautions taken against accidental relay activation?	E.12.k (1) (g)	
Is the use of vehicles, gin poles, cranes, and other equipment controlled by an authorized person?	E.12.k (2) (a) E.12.k (2) (b)	
Are fence openings guarded and gates locked?	E.12.k (3) (a) E.12.k (3) (b)	
Are proper precautions taken for excavations and footings?	E.12.k (4) (a) E.12.k (4) (b)	
<i>l. Lifelines and Body Belts</i>	<i>E.12.l</i>	
Are the types of lifelines, belts, safety straps, and lanyards approved by the ASTM?	E.12.l (1)	
Is equipment inspected?	E.12.l (3)	
Are belts used in electrical work free of exposed rivets?	E.12.l (5)	



## Section F. Fire Protection and Prevention



*A large variety of construction material, which ranges from combustible wood, cardboard, and paper to flammable gas and fuel, is present at the worksite. It is most important that supervisors and workers be aware of the potential danger of this material and be familiar with ways to prevent, suppress, or report any fires that occur. Frequent fire protection surveys and assessments are a vital part of construction safety because of the changing nature of a construction site. Likewise, escape routes change; these changes should be noted and site workers should be alerted.*

*The DOE recognizes National Fire Protection Association (NFPA) 241, "Standard for Safeguarding Construction, Alterations, and Demolition." Occupational Safety and Health Administration (OSHA) most generally reflects NFPA in fire safety requirements, although there are instances where OSHA and NFPA may differ. In such cases the most stringent differences will be reflected in the text and will be identified by an asterisk (\*). Further guidance regarding construction-site fire protection can be found in DOE Orders 5480.7 and 6430.1A.*

### 1. General Requirements

a. A fire-protection program shall be established and used throughout all phases of construction or demolition.

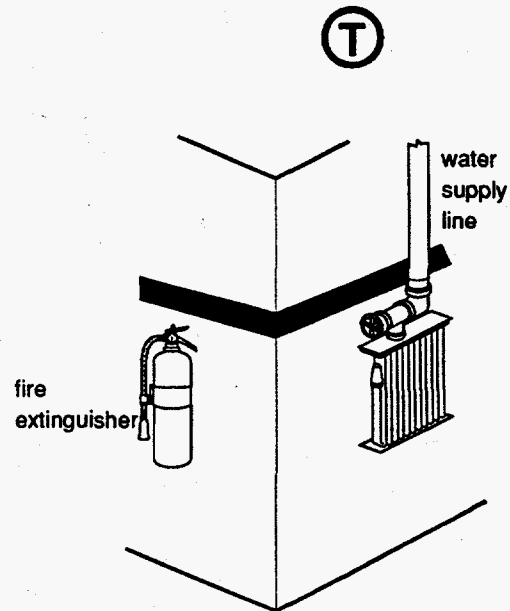
29 Code of Federal Regulations (CFR) 1926.150(a)(1)

b. If required by site contract or warranted by site operations, a trained fire-fighting organization shall be provided unless a DOE or other fire-fighting organization is readily available to the construction site.

29 CFR 1926.150(a)(5)

c. Fire-fighting equipment for the worksite shall be provided, maintained, conspicuously located, and periodically inspected.

29 CFR 1926.150(a)(2-4)



d. Workers shall be trained to use fire-fighting equipment and know the location of the equipment.

29 CFR 1926.21

e. If a fire extinguisher is used, its use and reason for use shall be reported immediately to the site supervisor.

29 CFR 1926.150(a)(4)

f. Fire walls and exit stairways, if required for the completed building, shall be given priority. Fire doors with approved closing devices and hardware shall be installed as soon as practical and before combustible material is introduced.

NFPA 241, 6-7



g. Hot-work permit procedures and prefire plans shall be coordinated with local authority having jurisdiction where applicable.

NFPA 241, 3-1

h. The site shall be accessible to fire department apparatus by way of access roadways with all-weather driving surface of not less than 20 feet of unobstructed width, able to withstand equipment loading, and having a minimum of 13 feet 6 inches of vertical clearance. If access road exceeds a 150-foot dead end, then appropriate turnarounds are necessary.

NFPA 241, 5-4.3

i. Where security fencing is applied around the site, the fencing shall either be noncombustible or flame resistant and shall be fastened securely so it can not be blown against heaters or other sources of ignition.

NFPA 241, 2-2

j. All buildings over one story in height shall have at least one stairway provided in useable condition at all times. Such stairway shall be extended upward as each floor is installed in new construction and maintained for each floor remaining during demolition. The stairway should be lighted and enclosed if the building's exterior walls are in place. Additional stairway exits should be provided based on fire hazard analysis, especially for large structures.

NFPA 241, 5-4.8

k. An alarm system (telephone, siren, pull box) shall be established at the worksite. Instructions on how to report a fire and emergency telephone numbers shall be conspicuously posted at all telephones, bulletin boards, and other locations where workers pass or gather.

29 CFR 1926.150(e)(1,2)



local emergency  
number



telephone



fire alarm box with  
pull handle



bell

#### Emergency Notification Devices

## 2. Water Supply

As soon as combustible materials accumulate on the worksite, a temporary or permanent water supply sufficient in volume, duration, and pressure to operate fire-fighting equipment shall be available. When underground water mains are to be provided, they shall be installed, completed, and made available as soon as practicable.

29 CFR 1926.150(b)(1,2)

## 3. Portable Fire Extinguishers

a. At least one 2A-rated fire extinguisher shall be provided for each 1,500\* square feet of a protected building area or major part thereof, and a fire extinguisher shall be within 75\* feet of each worker. One 55-gallon water drum and 2 fire pails may be used instead of each 2A-rated fire extinguisher.

29 CFR 1926.150(c)(1)(i,ii); NFPA 10\*

b. A 1/2-inch garden-type hose (equipped with a nozzle) no more than 100 feet long with a discharge rate of 5 gallons per minute at a horizontal range of 30 feet may also be used instead of a 2A-rated fire extinguisher. These hoses shall be located so that their streams can reach all points in the area.

29 CFR 1926.150(c)(1)(iii)

c. At least one 2A-rated fire extinguisher shall be provided on each floor of a structure. In multistory structures, an extinguisher shall be located adjacent to the stairway.

29 CFR 1926.150(c)(2)(iv)

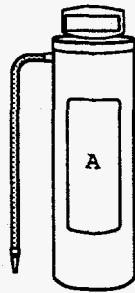
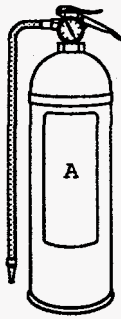
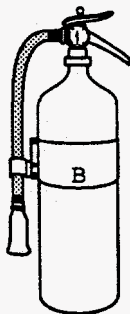
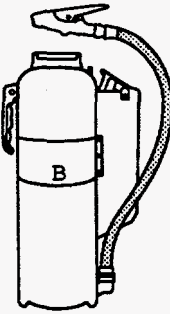
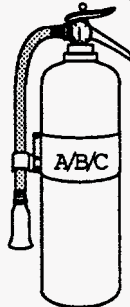
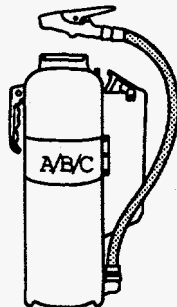
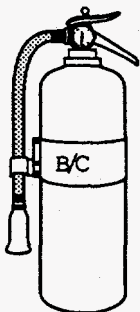
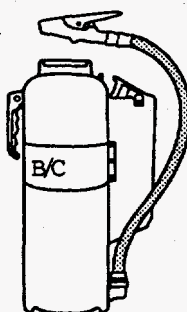
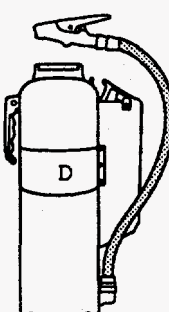
d. If 5 gallons of combustible or flammable liquid or 5 pounds of flammable gas is used for an operation, a 10-B:C-rated fire extinguisher shall be provided within 50 feet of the operation.

29 CFR 1926.150(c)(1)(vi)

e. Fire extinguishers shall have monthly visual inspections, annual maintenance inspections, and hydrostatic testing as required. Records shall be kept of all test and inspection results.

29 CFR 1926.150(c)(1)(viii)



water extinguisher  
pump tank**Class A Fire Extinguishers**dry chemical  
stored pressuredry chemical  
cartridge operated**Class B Fire Extinguishers**multipurpose dry chemical  
stored pressuremultipurpose dry chemical  
cartridge operated**Class A/B/C- Rated Fire Extinguishers**dry chemical  
stored pressuredry chemical  
cartridge operateddry powder  
cartridge operated**Class B/C Fire Extinguisher    Class D Fire Extinguisher**

f. Only fire extinguishers that are listed or approved by nationally recognized laboratories shall be used at the construction site.

29 CFR 1926.150(c)(1)(ix)

g. Water-type fire extinguishers and water drums shall be protected from freezing.

29 CFR 1926.150(c)(1)(v)

h. There are a variety of types and classes of fire extinguishers that may be used to meet the construction-site fire prevention requirements. The most common types and sizes used on construction sites are as follows:

- 2 1/2-gallon pressurized water Class A fire extinguisher *for emergency use on combustible materials (wood, paper, trash);*
- 2 1/2-to-5-gallon pump-type water Class A fire extinguisher *for emergency use and protective wetting in or around hot work on combustible material (wood, paper, trash); and*
- 5-to-30-pound pressurized multipurpose dry chemical Class A/B/C fire extinguisher *for emergency use on combustible material, flammable liquid and gas, and electrical fires.*

29 CFR 1929.150(c)(1)(ix,x)

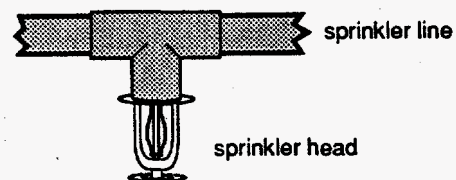
i. Carbon tetrachloride, soda acid, methyl bromide, halon, and other toxic vaporizing-type fire extinguishers shall not be used on the worksite.

29 CFR 1926.150(c)(1)(vii)

**4. Fixed Fire-Fighting Equipment**

a. During new construction, automatic sprinkler systems included in the construction plans shall be installed and put into operation following completion of each story or before occupancy. Installation shall be in accordance with NFPA 13 requirements.

29 CFR 1926.150(d)(1)(i)



b. During demolition or alteration, existing automatic sprinkler systems shall be retained as long as possible. Sprinkler control valves shall be operated by a properly authorized person. Control valves shall be checked at the end of each work day to ensure that they are in an *open* position.

29 CFR 1926.150(d)(1)(ii)

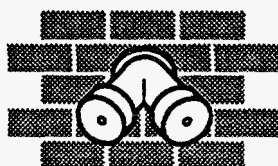


c. New standpipes shall be installed and be put into operation as soon as possible. When existing structures are demolished or altered, standpipes shall be retained as long as possible.

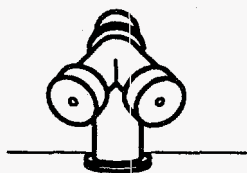
29 CFR 1926.150(d)(2)

d. All standpipes shall have a clearly marked fire department connection at street level. Fire department connections shall not be blocked.

29 CFR 1926.150(d)(2)



building-faced  
connection



free-standing  
connection

e. A fire hose with a discharge rate of 25 gallons per minute may be used instead of a 2A-rated fire extinguisher if the fire hose is 1 1/2" in diameter, at least 100 feet long, and can reach the specified areas.

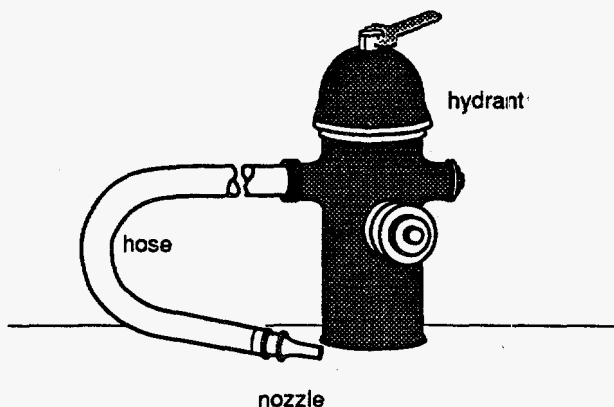
29 CFR 1926.150(c)(2)(i)

f. All fire hose connections shall be made compatible with local fire-fighting equipment. Temporary fire hoses may be provided with adaptors, if necessary.

29 CFR 1926.150(c)(2)(ii)

g. When demolition operations involve combustible materials, charged fire-hose lines that are supplied with water from hydrants or a water-tank truck with a pump or equivalent shall be available.

29 CFR 1926.150(c)(2)(iii)



## 5. Fire Prevention

a. Hazardous ignition sources such as lit cigarettes, open flames, and electrical arcs shall be eliminated or controlled in areas where there is a high probability of flammable or combustible material (either stored or in use) being ignited.

29 CFR 1926.151(a)

b. Electrical wiring and equipment shall be installed in accordance with structural load requirements and existing hazards.

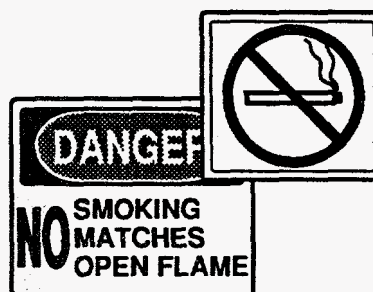
29 CFR 1926.151(a)

c. Inside a structure, the exhaust of internal combustion engines shall be kept away from combustible materials. When engine exhaust is piped outside a building, the piping shall be kept at least 9\* inches away from any combustible material.

29 CFR 1926.151(a)(2); NFPA 241, 2-3.1\*

d. Smoking is prohibited near any building or operation that may constitute a fire hazard. Placards with the words "NO SMOKING OR OPEN FLAME" shall be posted at all areas where smoking or open flames are prohibited (for example, wood structures, areas where flammable or combustible materials are stored or used, fueling stations, or any area where flammable dust or mist is produced). Where smoking is permitted, safe receptacles shall be provided for smoking materials.

29 CFR 1926.151(a)(3-5); NFPA 241, 3-3.2



e. Battery-powered lighting equipment used in flammable liquid or gas areas shall be of the type approved for the location.

29 CFR 1926.151(a)(4)

f. Air, inert gas, or steam hoses used to clean or ventilate tanks with flammable atmospheres shall have their nozzles continuously bonded to the tank or vessel to ensure that the static discharge will not ignite and cause a fire.

29 CFR 1926.151(a)(5)





## 6. Temporary Buildings

a. Temporary buildings shall not block any means of exit from the worksite.

29 CFR 1926.151(b)(1)

b. If a temporary building is erected or located within another building or structure, the temporary building shall be made of noncombustible material or have a fire-resistance rating of 1 hour or greater.

29 CFR 1926.151(b)(2)

c. A temporary building that is not located inside another building; used for storing, handling, or applying flammable or combustible liquid; or used for storing gases or explosives or similar hazardous material shall not be located within 30\* feet of other buildings or structures. A group of temporary buildings not exceeding 2,000 square feet shall be considered a single temporary building.

29 CFR 1926.151(b)(3); NFPA 241, 6.3.3.

## 7. Open-Yard Storage

a. Combustible material stored in open yards shall be stable and in piles no higher than 20 feet.

29 CFR 1926.151(c)(1)

b. Driveways around and between piles of stored combustible materials shall be so spaced that a maximum grid system of 50 x 150 feet is produced. Piles shall be at least 30\* feet from any structure.

29 CFR 1926.151(c)(2), (c)(5); NFPA 241, 6.3.3

c. Open yards shall be free of unnecessary combustible material such as paper, cardboard, weeds, grass, and rubbish.

29 CFR 1926.151(c)(3)

d. If danger of underground fire is present in the construction site, open yards for storing combustible or flammable material may not be established.

29 CFR 1926.151(c)(4)

e. In an open yard that has combustible storage, portable fire extinguishers with a 2A rating or greater shall be conspicuously located so that the distance of travel to a unit will not exceed 100 feet.

29 CFR 1926.151(c)(6)

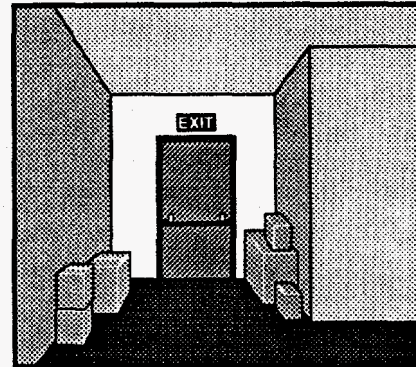
f. Yard storage of combustible construction material or equipment to be installed shall not be closer than 30 feet from the installed structure.

NFPA 241, 6.3.3

## 8. Indoor Storage

a. Material stored indoors shall not block exits. Aisles shall be maintained wide enough to allow for the widest vehicle that may be used within the building for fire fighting purposes. Stored material must be stably maintained.

29 CFR 1926.151(d)(1,4)



Unobstructed Exitway Access

b. Material shall be stored, handled, and stacked according to its fire characteristics, and stable piling shall be maintained. The material shall be stored so that it is not in contact with lights, heating units, or other ignition sources.

29 CFR 1926.151(d)(4,6)

c. Incompatible materials shall be segregated by a barrier with a fire rating of at least 1 hour.

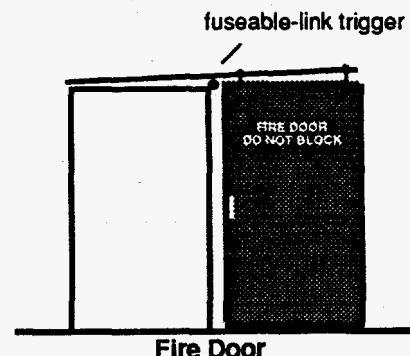
29 CFR 1926.151(d)(3)

d. Materials shall be piled so that the spread of fire is minimized.

29 CFR 1926.151(d)(4)

e. Materials shall be stored at least 3 feet from the deflector of a fire sprinkler head, at least 3 feet from a fire door opening, and at least 2 feet from the travel path of a fire door, unless a barrier is provided to prevent the fire door from being blocked.

29 CFR 1926.151(d)(5,7)



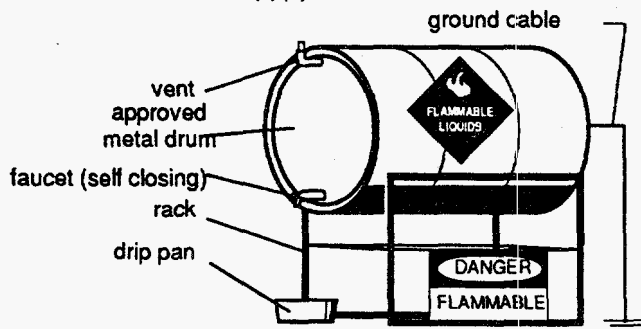
Fire Door



## 9. Indoor Storage of Flammable and Combustible Liquids

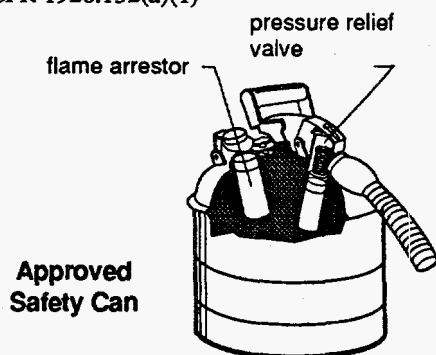
- a. Approved containers or portable tanks shall be used to store, move, and dispense flammable and combustible liquids.

29 CFR 1926.152(a)(1)



- b. Approved safety cans shall be used to store, handle, and dispense flammable liquid in quantities greater than 1 gallon. Highly viscous (hard-to-pour) material may be kept in its original container.

29 CFR 1926.152(a)(1)



- c. Flammable and combustible liquids shall not be stored in or near entryways, stairways, passageways, or exits.

29 CFR 1926.152(a)(2)

- d. Flammable or combustible liquids shall not be stored in quantities greater than 25 gallons unless they are in approved cabinets.

29 CFR 1926.152(b)(1)

- e. No more than 60 gallons of flammable liquid nor more than 120 gallons of combustible liquid shall be stored together in an approved storage cabinet. No more than three storage cabinets shall be located in one area.

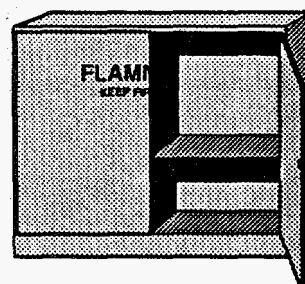
29 CFR 1926.152(b)(3)

- f. Approved storage cabinets for flammable liquids shall be free of combustible material (wood, paper, or cloth) ignitable material, oxidizers, chemicals, or other incompatible materials.

29 CFR 1926.152(b)(2)(iii)

- g. Approved storage cabinets for flammable liquid shall be conspicuously labeled "FLAMMABLE—KEEP FIRE AWAY."

29 CFR 1926.152(b)(2)(iii)



Storage Cabinet for Flammable Liquids

- h. Rooms specifically constructed for storing flammable materials are not usually found on construction sites. If this type of storage room is built, it shall meet the specific design, material, wiring, fire-protection, and storage requirements in 29 CFR Subpart F.

29 CFR 1926.152(b)(4)(i-viii)

- i. No more than 60 gallons of Class I and Class II flammable liquids shall be stored within 50 feet of the structure under construction.

NFPA 241, 3-5.1.2

- j. Class I flammable liquids shall not be taken, stored, or used underground, nor within 100 feet of a tunnel portal or shaft opening.

NFPA 241, 8-4.1

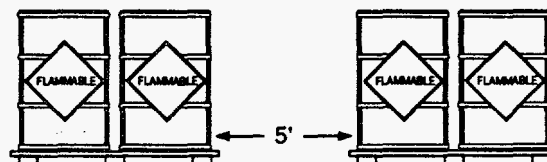
## 10. Outdoor Storage of Flammable and Combustible Liquids

- a. The quantity of flammable or combustible liquid shall not exceed 1,100 gallons in any pile or area. No more than 60 gallons shall be stored in containers.

29 CFR 1926.152(c)(4)(i)

- b. There shall be a 5-foot separation between each group or pile of containers of flammable or combustible liquid.

29 CFR 1926.152(c)(4)(i)



- c. Each storage area or pile of flammable or combustible liquid shall have an access path at least 12 feet wide by 200 feet long.

29 CFR 1926.152(c)(4)(ii)



d. Flammable or combustible liquids shall not be stored within 30\* feet of any structure or pile of combustible material or within a distance of 100 feet of an access shaft, hoistway, or other underground entrance.

29 CFR 1926.152(c)(4)(i); NFPA 241, 8-4.8\*

e. The storage area shall be graded so that a spill will be diverted from any structures.

29 CFR 1926.152(c)(3)

f. The storage area shall have at least a 12-inch dike or curb surrounding each pile and a means to drain rain water or spills. Drainage shall terminate at a safe location that is accessible to fire-fighting equipment.

29 CFR 1926.152(c)(3,4)

### 11. Outdoor Storage of Portable Tanks

a. Portable tanks of flammable or combustible materials stored outdoors shall meet the requirements of paragraphs 10.c. through 10.e. in "Outdoor Storage of Flammable and Combustible Liquids."

29 CFR 1926.152(c)(3,4)

b. If two or more portable tanks have a combined capacity of over 2,200 gallons, they shall be separated by a cleared area 5 feet wide.

29 CFR 1926.152(c)(4)(i)

c. All portable tanks over 660 gallons shall have emergency venting and all other required devices as stated in NFPA 30, "Flammable and Combustible Liquids Code," or current local fire ordinances.

29 CFR 1926.152(c)(6,7)

### 12. Transfer of Flammable and Combustible Liquids

a. All operations in which 5 or more gallons of flammable or combustible liquids are transferred shall be located at least 25 feet from other operations and have spill controls or drains and adequate natural or mechanical ventilation to control vapors or fumes to below 10% of the lower flammable limit of the liquid. See paragraph 14.e. for required bonding and grounding during transfer of flammable or combustible liquids.

29 CFR 1926.152(e)(1)

b. Equipment that is used for free-flowing transfer of flammable or combustible liquids (indoors or outdoors) shall be equipped with a self-closing valve or faucet to automatically stop the flow. Applying air pressure to a tank or container to transfer flammable or combustible liquids is prohibited.

29 CFR 1926.152(e)(3)

### 13. Liquid-Fuel Dispensing Areas

a. Liquid fuel shall be stored in above- or below-ground tanks.

29 CFR 1926.152(g)(1)

b. Underground liquid-fuel tanks shall never be abandoned.

29 CFR 1926.152(g)(5)

c. When electrical pumps are used to transfer liquid fuel, there shall be a clearly identified switch located away from the transfer area. The switch will be used to shut off power in an emergency.

29 CFR 1926.152(g)(6)

d. Equipment motors shall be turned off before refueling.

29 CFR 1926.152(g)(10)

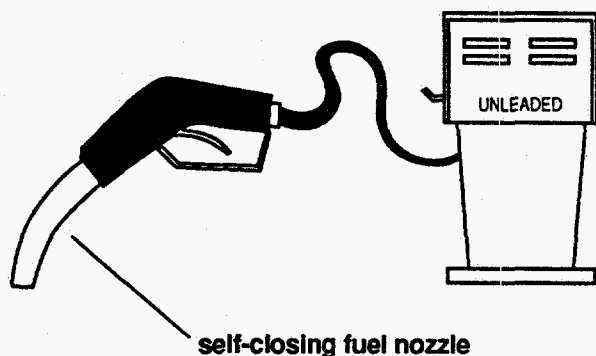
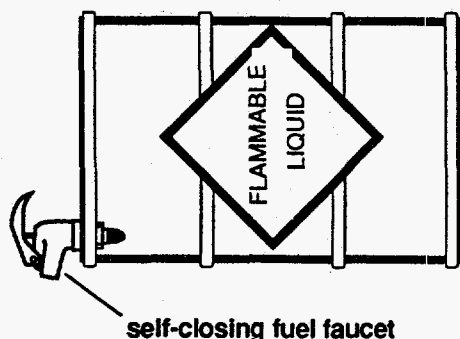
e. In lubrication or service areas where no liquid fuel is dispensed or transferred, an approved heater may be installed at least 18 inches above the floor. In liquid-fuel dispensing areas, an approved heater may be installed at least 8 feet above the floor. In either case, the heater shall be approved for the specific location and shall be protected.

29 CFR 1926.152(f)(7)(i-ii)



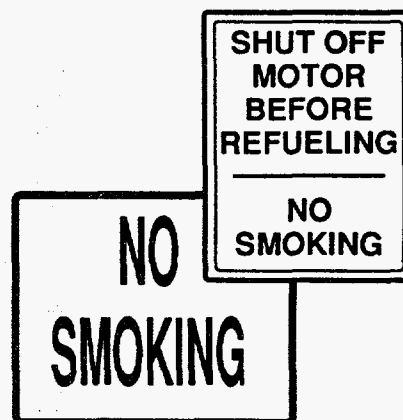


- f. All hoses, pipes, and nozzles through which flammable or combustible liquid is transferred shall have an approved self-closing valve without an open-latch device.  
29 CFR 1926.152(e)(5), (f)(3)



- g. The liquid-fuel dispensing area shall be free of trash, debris, combustible material, oxidizers, weeds, grass, and ignition sources.  
29 CFR 1926.152(c)(5)

- h. A liquid-fuel dispensing area shall be posted with conspicuous signs prohibiting smoking or open flame.  
29 CFR 1926.152(g)(9)



- i. Flammable liquid shall not be used within 50 feet of an ignition source or open flame. Some operations may require a distance greater than 50 feet.  
29 CFR 1926.152(f)(3)
- j. All spills or leaks shall be cleaned up *immediately*, and the fuel shall be disposed of safely.  
29 CFR 1926.152(f)(2)

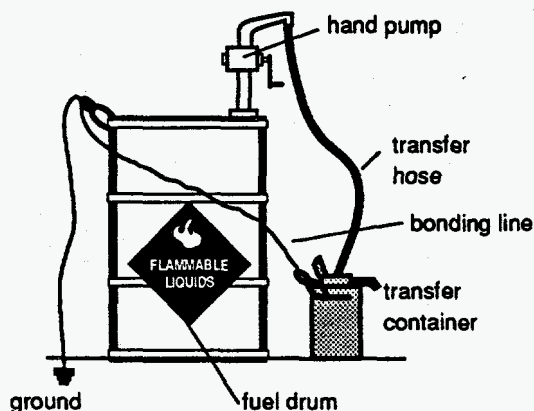
#### 14. Fire Control and Protection for Flammable and Combustible Liquids

- a. At least one 20-B:C-rated fire extinguisher shall be located outside the doorway (but not more than 10 feet from the door) of a room in which 60 gallons or more of combustible or flammable liquids are stored.  
29 CFR 1926.152(d)(1)
- b. At least one fire extinguisher rated not less than 40-B:C\* shall be located between 25 and 75 feet from an outside storage area in which flammable or combustible liquids are stored.  
29 CFR 1926.152(d)(2)
- c. At least one fire extinguisher rated not less than 40-B:C\* shall be on all tank trucks or vehicles that transport or dispense liquid fuel.  
29 CFR 1926.152(d)(4); NFPA 241, 5-6.4\*
- d. At least one 4A-40-B:C\*-rated fire extinguisher shall be located at each liquid-fuel dispensing area. It shall be within 75 feet of each pump, dispenser, underground fill-pipe opening, and service or lubrication area.  
29 CFR 1926.152(g)(11); NFPA 241, 6-4.4.1\*



e. The container used in transfer of flammable or combustible liquids shall be ground bonded together whether transfer is by approved displacement pump or gravity flow. Ground bonding is achieved by grounding the supply container and receiving containers with an electrical wire equipped with alligator clips. See illustrations with paragraphs 9.a. and below.

29CFR 1926.152 (e)(2); NFPA 30, 5-4



Procedure for Grounding Containers

## 15. Fire Safety for Hot Work (Welding, Cutting, or Heating Operations)

### a. General Requirements for Hot Work

To prevent fires from welding, cutting, or heating operations (i.e., hot work), the following precautions shall be taken:

- (1) If possible, before welding or cutting begins, move the work to a designated safe location.  
29 CFR 1926.352(a)
- (2) If the work cannot be moved, any movable combustible or flammable material shall be taken to a safe location or be adequately protected from flames, sparks, arcs, or slag.  
29 CFR 1926.352(b)
- (3) When hot-work operations are such that normal or suitable fire prevention methods cannot be taken, additional workers (fire watchers) shall be assigned to the hot-work area to reduce the risk of fire. The assigned workers shall be instructed in how to identify probable fire hazards and in how to use fire-fighting equipment.  
29 CFR 1926.352(e,f)



- (4) When hot-work operations are performed on walls, floors, or ceilings where there is a possibility of sparks, flame, or hot slag penetrating an adjacent area, additional fire watchers shall be assigned to the adjacent area. They shall be provided with fire-fighting equipment and instructed in the use of that equipment. They shall be assigned for the duration of the work and shall stay after the work is completed for at least 1/2 hour to make certain no fire hazards remain.

29 CFR 1926.352(e,f)



- (5) Appropriate fire-fighting equipment shall be available for immediate use in areas of hot-work operations.

29 CFR 1926.352(d)

- (6) Hot-work operations shall not take place in areas where flammable paints are applied nor where flammable liquids, flammable compounds, or heavy dust concentrations that may create a fire or explosion are present.

29 CFR 1926.352(c)

- (7) Should hot-work permits or procedures be required on the worksite for welding and cutting, workers involved shall satisfy all requirements of the permit.

NFPA 241,3-1

### b. Hot Work in Enclosed Spaces

To prevent possible fire in enclosed spaces as a result of gas escaping through leaking or improperly closed torch valves, the procedures below shall be followed:

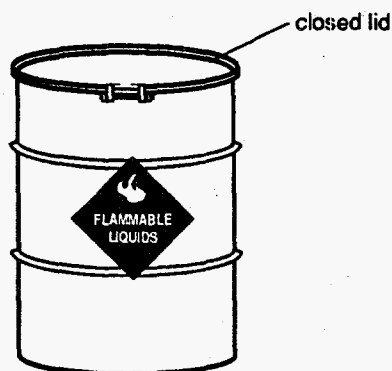
- (1) The gas supply to the torch shall be shut off at a point outside the enclosed space whenever the torch is unattended.
- (2) Overnight and during shift changes, the torch and hose shall be removed from the confined space.
- (3) Hoses shall be immediately removed from the enclosed space whenever they are disconnected from the torch or other gas-consuming devices.
- (4) At the beginning of each working shift, hoses, torches, and other gas-consuming devices shall be fully inspected before they are used in an enclosed space.

29 CFR 1926.350(f)(3); .352(g)

**c. Welding on Drums and Other Containers**

To eliminate fire hazards from drums and other containers, the following procedures shall be followed:

- (1) Empty drums, pails, or other containers that held flammable or toxic materials shall be kept closed. Empty containers shall be removed to a safe area away from any hot-work operations.  
29 CFR 1926.352(h)



- (2) Drums, containers, or hollow structures that have held flammable or toxic materials shall be filled with water or fully cleaned and ventilated and shall be properly tested for existing hazards before any welding, cutting, or heating is permitted.  
29 CFR 1926.352(i)

**16. Temporary Heating Devices**

- a. Special precautions shall be taken when using flame-producing heating devices that may endanger workers or property.

29 CFR 1926.154(a)(2)

- b. Fresh air shall be provided in sufficient quantities to maintain the health and safety of workers. When heaters are used in confined spaces, special care shall be taken to provide sufficient ventilation to ensure proper combustion, maintain the health and safety of workers, and limit the temperature rise in the area.

29 CFR 1926.154(a)(1,2)

- c. When natural ventilation (fresh air supply) is inadequate, mechanical ventilation shall be provided.

29 CFR 1926.154(a)(1)

- d. When heating devices are used near combustible materials, a minimum clearance between the device and the combustible material shall be provided as follows:

**Table F-1. Appliance Clearance**

Heating Appliance	Minimum Clearance in Inches		
	Sides	Rear	Chimney Connector
Room heater, circulating type	12	12	18
Room heater, radiant type	36	36	18

29 CFR 1926.154(b)(2)

- e. Temporary heating devices with less clearance than specified in the table above may be installed in accordance with the manufacturer's specifications.

29 CFR 1926.154(b)(2)

- f. Heaters not suitable for use on wood floors shall be set on an insulating material or on at least 1 inch of concrete or the equivalent. Insulating material shall extend beyond the heater a minimum of 2 feet or more in all directions.

29 CFR 1926.154(b)(3)

- g. Heaters used near combustible tarpaulins, canvas, or similar coverings shall be located at least 10 feet from such coverings. The coverings shall be securely fastened to prevent igniting or upsetting the heaters during adverse weather conditions.

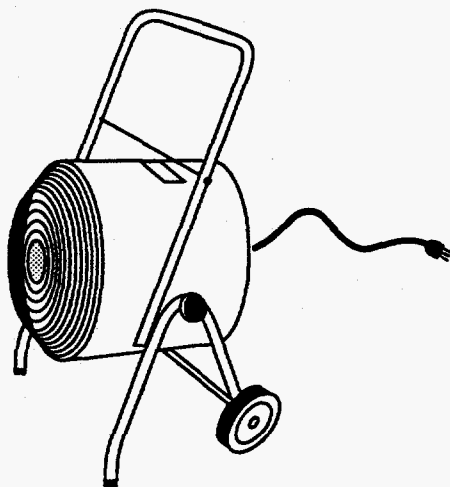
29 CFR 1926.154(b)(4)

- h. When in use, heaters shall be set horizontally level unless otherwise permitted by the manufacturer's markings.

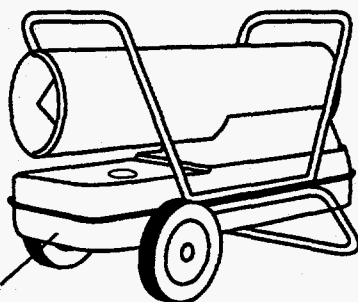
29 CFR 1926.154(c)

- i. Flammable liquid-fired heaters shall have a primary safety control to stop the flow of fuel in the event of flame failure. Barometric or gravity oil feeds are not considered primary safety controls, and heaters using these feeds must have integral tanks. Heaters designed and approved for use with separate supply tanks may be directly connected for gravity feed or connected to an automatic pump.

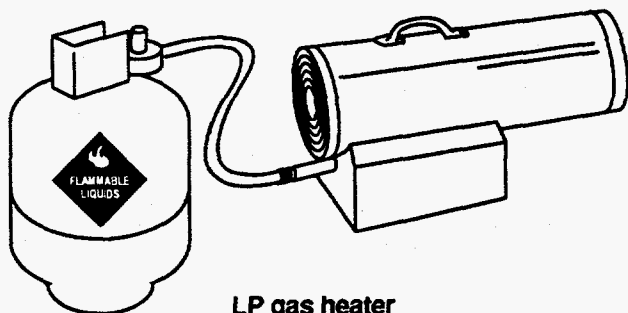
29 CFR 1926.154(e)(1-4)



electric heater



kerosene heater



LP gas heater

## 17. Liquid Petroleum Gas (LP Gas)

### a. General Requirements

(1) All parts of a liquid petroleum (LP) gas system including cylinders, containers, valves, connectors, manifolds, vaporizers, and regulators shall be of approved types.

29 CFR 1926.153(a)

(2) Welding or burning is prohibited on LP gas containers or cylinders. No aluminum piping or tubing shall be used for LP gas installations.

29 CFR 1926.153(b), (h)(6)

(3) Primary valves, fittings, and accessories connected to LP gas containers shall have a rated minimum working pressure of 250 pounds per square inch gravity (psig) and be of a material and design suitable to LP gas service. Connections to containers (except safety-relief connections, liquid-gauging devices, and plugged openings) shall have shutoff valves located as close to the container as practicable.

29 CFR 1926.153(c)(1,2)

(4) Every container and vaporizer shall have one or more safety-relief valves. These valves shall be arranged to afford free venting to the outside with the discharge at least 5 feet horizontally away from any building opening. Container safety-relief devices and regulator-relief vents shall be located at least 5 feet away in any direction from openings into sealed combustion systems, appliances, or mechanical ventilation air intakes.

29 CFR 1926.153(d)(1,3)

(5) Shutoff valves shall not be installed between the container and the safety-relief device except where the full-capacity flow of liquid through the safety-relief device is required.

29 CFR 1926.153(d)(2)

(6) Filling of vehicle fuel containers from bulk storage containers shall be performed at least 10 feet from the nearest masonry-walled building or at least 25 feet from any other building or construction. Portable containers or containers mounted on skids shall be filled at least 50 feet from the nearest building.

29 CFR 1926.153(e)(1,2)

(7) LP gas appliances shall be of approved types. Appliances in good condition that were originally designed to be used with other gaseous fuel may be used with LP gas only after it is converted, adapted, and tested with LP gas.

29 CFR 1926.153(f)(1,2)

*LP gas containers shall be filled by weight to avoid over-filling.*



(8) Containers and regulating equipment installed outside of buildings shall be upright and on a firm foundation. Where there is a possibility of the foundations settling, outlet piping shall be protected by a flexible connection or special fitting.

29 CFR 1926.153(g)

(9) No combustible material shall be allowed to accumulate where temporary LP-gas-fired heaters are used. No flammable liquid shall be stored or used near a temporary LP-gas-fired heater.

29 CFR 1926.150(a)(1)

(10) At least one 20-B:C fire extinguisher shall be provided at each LP gas storage area.

29 CFR 1926.153(l)

(11) Fire extinguishers and other appropriate fire-protection equipment shall be located near LP gas heating devices.

29 CFR 1926.150(a)(1)

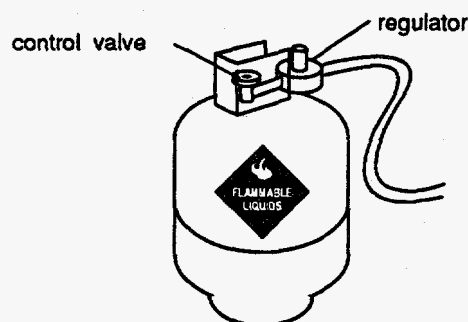
#### b. LP Gas Containers Used Indoors

(1) LP gas containers used indoors having a water capacity of 2 1/2 pounds (nominal 1 pound LP gas) shall be equipped with excess-flow valves that are an integral part of or connected to the container valve.

29 CFR 1926.153(h)(3)

(2) Regulators shall be directly connected to the container valves or to manifolds connected to the container valves.

29 CFR 1926.153(h)(4)



(3) Valves on LP gas containers having a water capacity of greater than 50 pounds (nominal 20 pounds LP gas) shall be protected from damage at all times.

29 CFR 1926.153(h)(5)

(4) Hoses and all fittings for LP gas containers shall be designed for a minimum working pressure of 250 psig. The hose length shall be as short as is practicable while reaching the container without kinking, straining, or being so close to a burner as to be damaged by heat.

29 CFR 1926.153(h)(7)

(5) LP gas containers having a water capacity greater than 2 1/2 pounds shall stand on a firm, level surface and be protected from heat or physical damage. They shall not be used to support temporary heaters. When necessary, containers shall be secured in an upright position.

29 CFR 1926.153(h)(10,11)

(6) The maximum water capacity of individual LP gas containers shall be 245 pounds (nominal 100 pounds LP gas capacity).

29 CFR 1926.153(h)(12)

#### c. Temporary or Portable LP Gas Heating Units

(1) Temporary or portable heating units without attached LP gas containers shall be at least 6 feet from any LP gas container.

29 CFR 1926.153(h)(13)

(2) When two or more heater-container units (integral or nonintegral) are located in an unpartitioned area on the same floor, they shall be at least 20 feet from each other and from any other heating unit.

29 CFR 1926.153(h)(14)

(3) When two or more heater-container units are located in an unpartitioned area on the same floor, the total water capacity of the containers, manifolded together for connection to a heater or heaters, shall be no more than 735 pounds (nominal 300 pounds LP gas), and the connecting manifolds shall be at least 20 feet apart.

29 CFR 1926.153(h)(15)

(4) Portable LP gas-fired heaters shall have an automatic device to shut off the main burner fuel supply if the pilot light fails. LP gas-fired heaters of greater than 50,000 Btu per hour shall be equipped with an electronic ignition system or a pilot, which must be lighted and proved to be lit before the main burner is turned on.

29 CFR 1926.153(h)(8)



#### d. Multiple-Container LP Gas Systems

(1) Valves in multiple-container LP gas systems shall be arranged so that they can be replaced (either by a mechanical method or an automatic device) without stopping the flow of gas in the system.

29 CFR 1926.153(i)(1)

(2) The system shall be equipped with a supply-line regulator between the container and heater unit and an excess-flow valve to minimize gas flow if the line ruptures.

29 CFR 1926.153(i)(2)

(3) The system shall have regulators and low-pressure relief devices rigidly attached to the container valves, containers, supporting standards, building walls, or other secure structures and shall be protected from adverse weather conditions.

29 CFR 1926.153(i)(3)

#### e. Storage of LP Gas

(1) LP gas containers shall not be stored in buildings.

29 CFR 1926.153(j)

(2) LP gas containers awaiting use shall be stored outdoors and at specific distances from buildings or other enclosures. (See Table F-2 below.)

29 CFR 1926.153(k)(1,2)

**Table F-2. Quantity and Distance for LP Gas Storage**

Quantity of LP Gas Stored (in cubic meters)	Distance from the Building (in feet)
500 or less	0
501 to 6,000	10
6,001 to 10,000	20
Over 10,000	25

#### 18. Asphalt, Tar Kettles, and Roofing

a. Asphalt and tar kettles shall be located in a safe place outside of a building or on a noncombustible roof at a point avoiding danger of ignition of combustible materials. Kettles shall be constantly attended during operation.

NFPA 241, 6-4.2.1

b. Kettle lids shall be gravity closed.

NFPA 241, 6-4.2.2

c. A minimum of one 20-B fire extinguisher shall be

available within 30 feet horizontal travel distance at all times during kettle operation.

NFPA 241, 6-4.4.1

d. Torches or heat guns used to secure roof membranes shall be used in accordance with manufacturer's instructions. Roof membranes shall not be overheated.

NFPA 241, 6-4.3.1

e. Caution shall be maintained when using torches around openings of combustibles to avoid overheating or direct contact with the flame.

NFPA 241, 6-4.3.2

f. A fire watch shall be provided for at least 1/2 hour after torches have been extinguished.

NFPA 241, 6-4.3.11



g. A minimum of one multipurpose 2A-20-B:C portable fire extinguisher shall be provided within 20 feet horizontal travel distance of torch-applied roofing equipment.

NFPA 241, 6-4.4.3

#### 19. Two-Pound, Torch-Type LP Gas Cylinders

a. Extreme care shall be maintained when using lighted, portable torch LP gas units to avoid personal injury burns and fire hazards; such units are lightweight and easily knocked over.

b. Portable torch units shall not be used near combustibles or flammables. Be sure that lighted torch tips are always directed away from any probable fire hazard or condition.

c. The following is offered as guidance for storage and care of cylinders.

- Do not store with torch tip connected.
- Do not store under the seat of a vehicle.
- Do not store in a flammable storage cabinet.
- Ensure that cylinders are always stored in an upright position, preferably in a secured rack to prevent physical damage.
- Do not store in tool boxes where cylinders could be damaged.
- Do not store in enclosed areas or cabinets. The storage of over six cylinders should bare a "CAUTION—FLAMMABLE GAS" label or sign at or near the storage location. Store in an open, well-ventilated area free of combustibles and flammables.



## DEFINITIONS

**Approved** — Meets the requirements of a code, regulation, law, standard or ordinance; or is accepted by a controlling agency, testing laboratory, or person responsible for the construction site.

**Approved Storage Cabinet** — Cabinet for storage of flammable or combustible liquids that meets specific structural standards.

**Barrier** — An object that temporarily or permanently separates two or more areas or enclosures.

**Combustible** — A solid or liquid with a flash point greater than 100°F.

**Compatible** — The ability of a material to exist unchanged under certain temperature conditions when in the presence of some other specific material.

**Fire Door** — A specially constructed door that has been tested by Underwriters Laboratories/Factory Mutual (UL/FM) and is certified to withstand fire for a prescribed length of time. This door is equipped with a self-closing mechanism that causes it to close in case of fire.

**Fire Extinguisher** — A portable device used to extinguish a fire by ejecting a fire-inhibiting substance such as water, carbon dioxide, dry chemical, or chemical foam. Fire extinguishers are representative in four basic classifications directed toward the general fire classification or combination thereof:

Class A — Ordinary combustible material (wood, paper, cloth)

Class B — Combustible or flammable liquids (oil, grease, gasoline, alcohol)

Class C — Electrical (electric motors, transformers, wiring)

Class D — Combustible metals (magnesium, titanium, sodium)

**Flammable** — Capable of being easily ignited, burning intensely, or having a rapid rate of flame spread.

**Flammable Liquid** — A liquid with a flash point of less than 100°F (and a vapor pressure less than 40 pounds per square inch.)

**Hot Work** — Work that produces heat and flames such as welding and cutting; in some areas a permit is required before such work may be undertaken.

**Ignition Source** — A potential cause of a fire such as a spark, arc, ember, flame, lit cigarette, or high temperature.

**LP Gas** — Liquid petroleum gas such as butane and propane.

**On-Site Fire Vehicle** — A vehicle permanently assigned to the construction site and used for transportation of fire-fighting equipment.

**Safety Can** — A can or other container approved for storage of flammable liquids.

**Sprinkler System** — A fire-protection system of pipes and outlets in a building or other enclosure for delivering a fire extinguishing liquid or gas, usually automatically when heat is sensed by the sprinkler head.

**Standpipe** — A piping system that is installed in a building or enclosure and used only for fire protection.

**KEY ITEMS CHECK LIST**  
**SECTION F. FIRE PROTECTION AND PREVENTION**

Item	Paragraph	Notes
1. GENERAL REQUIREMENTS	F.1	
Is there an adequate fire protection program?	F.1.a	
Are required hot-work permits obtained and pre-fire plans coordinated?	F.1.g	
Are fire prevention and control systems given construction priority?	F.1.j F.1.k	
2. WATER SUPPLY	F.2	
Is the water supply on site before combustible building materials arrive?	F.2	
3. PORTABLE FIRE-FIGHTING EQUIPMENT	F.3	
Is fire extinguishing equipment available?	F.3.a-c	
Are fire extinguishers inspected?	F.3.e	
4. FIXED FIRE-FIGHTING EQUIPMENT	F.4	
Are sprinkler systems, hoses, standpipes, and connections given the proper construction or demolition priority?	F.4	
5. FIRE PREVENTION	F.5	
Are cigarettes, open flames, electric arcs, etc., controlled or eliminated?	F.5.a	
Are electrical fire hazards eliminated?	F.5.b	
Are engine exhausts kept away from combustible materials?	F.5.c	
Are no-smoking signs posted?	F.5.d	
6. TEMPORARY BUILDINGS	F.6	
Are temporary buildings placed so that access and egress to the construction project remain unblocked?	F.6.a	
Are temporary buildings located so that they do not increase the risk of fire?	F.6.b F.6.c	



## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
7. OPEN YARD STORAGE	F.7	
Are the fire characteristics of materials stored in open yards considered?	F.7.a F.7.b F.7.d	
Are storage areas free of weeds, cardboard, rubbish, and other combustible debris?	F.7.c	
8. INDOOR STORAGE	F.8	
Are the fire exits open?	F.8.a	
Are combustible materials stored away from egress routes, heaters, and lights?	F.8.b F.8.c	
Are the characteristics of fire spread and control considered for material storage?	F.8.e	
9. INDOOR STORAGE OF FLAMMABLE AND COMBUSTIBLE LIQUIDS	F.9	
Are only approved containers or cans used?	F.9.a F.9.b	
Is the amount of storage limited?	F.9.d F.9.e F.9.i	
10. OUTDOOR STORAGE OF FLAMMABLE AND COMBUSTIBLE LIQUIDS	F.10	
Are quantities limited to 1,100 gallons per pile?	F.10.a	
Are space, distance, and spill considerations met?	F.10.a F.10.d F.10.e F.10.f	
11. OUTDOOR STORAGE OF PORTABLE TANKS	F.11	
Are space, separation, and housekeeping requirements met?	F.11.b F.11.c	
12. TRANSFER OF FLAMMABLE AND COMBUSTIBLE LIQUIDS	F.12	
Do transfer operations have adequate spill control, drains, and ventilation?	F.12.a	
Does transfer equipment have self-closing valves?	F.12.b	

## KEY ITEMS CHECK LIST (continued)

	Item	Paragraph	Notes
13.	LIQUID-FUEL DISPENSING AREAS	F.13	
	Is fuel stored in tanks?	F.13.a	
	Are engines turned off during fueling?	F.13.d	
	Are dispensing areas free of weeds, trash, oxidizers, ignition sources, and rubbish?	F.13.g	
	Is area adequately posted?	F.13.h	
14.	FIRE CONTROL AND PROTECTION FOR FLAMMABLE AND COMBUSTIBLE LIQUIDS	F.14	
	Are adequate fire extinguishers placed near storerooms, on tank trucks, and in service areas?	F.14.a F.14.b F.14.d	
	Are bonding and grounding requirements met?	F.14.e	
15.	FIRE SAFETY IN HOT WORK (WELDING, CUTTING, OR HEATING OPERATIONS)	F.15	
a.	<i>General Requirements for Hot Work</i>	F.15.a	
	Is a hot-work permit required and are the conditions met?	F.15.a (7)	
	Are alternate locations for hazardous welding considered?	F.15.a (1)	
b.	<i>Hot Work in Enclosed Spaces</i>	F.15.b	
	Are welding gases prevented from causing an explosion or asphyxiation hazard?	F.15.b (1) F.15.b (2) F.15.b (3)	
c.	<i>Welding on Drums and Other Containers</i>	F.15.c	
	Are empty drums cleaned, tested, or filled with water before any cutting or welding is done?	F.15.c (2)	
16.	TEMPORARY HEATING DEVICES	F.16	
	Are flame-producing heating devices controlled?	F.16.a	
	Is adequate ventilation provided?	F.16.b F.16.c	
	Are proper clearances maintained between heating devices and combustibles?	F.16.d F.16.e	
	Are manufacturers' specifications observed?	F.16.e	
17.	LIQUID PETROLEUM GAS (LP GAS)	F.17	
a.	<i>General Requirements</i>	F.17.a	
	Are only approved types of heaters used?	F.17.a (1)	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
Is aluminum piping prohibited?	F.17.a (2)	
Are the correct valves and containers used?	F.17.a (3)	
	F.17.a (4)	
Are the proper clearances from buildings maintained for vehicle fuel containers?	F.17.a (6)	
Is proper clearance maintained between heaters and combustibles?	F.17.a (9)	
Are the correct fire extinguishers nearby?	F.17.a (10)	
	F.17.a (11)	
<i>b. LP Gas Containers Used Indoors</i>	<i>F.17.b</i>	
Are the correct valves, regulators, fittings, and hoses used?	F.17.b	
<i>c. Temporary and Portable LP Gas Heating Units</i>	<i>F.17.c</i>	
Are heaters and LP gas containers separated by at least 6 feet?	F.17.c (1)	
Are heaters properly spaced?	F.17.c (2)	
	F.17.c (3)	
Do heaters have shut-off devices in case of pilot-light failure?	F.17.c (4)	
<i>d. Multiple-Container LP Gas Systems</i>	<i>F.17.d</i>	
Are the correct valves and regulators used?	F.17.d	
<i>e. Storage of LP Gas</i>	<i>F.17.e</i>	
Is LP gas stored out of doors beyond the specified distances from buildings?	F.17.e	
<hr/>		
18. ASPHALT, TAR KETTLE, AND ROOFING	F.18	
Are kettles located at a safe outdoor location?	F.18.a	
Are kettle lids self closing?	F.18.b	
Are torches and heat guns used according to the manufacturers' specifications?	F.18.d	
Are the correct fire extinguishers provided?	F.18.c	
	F.18.g	
<hr/>		
19. TWO-POUND TORCH-TYPE LP GAS CYLINDERS	F.19	
Is care taken to avoid knocking over lightweight cylinders?	F.19.a	
Are lightweight cylinders protected from heat and flames?	F.19.b	
Are lightweight cylinders stored properly?	F.19.c	



## Section G. Signs, Signals, and Barricades



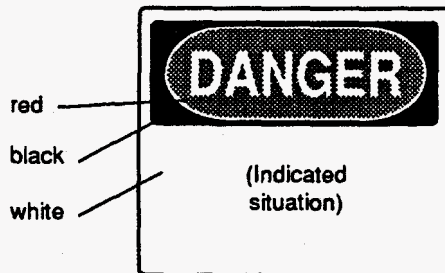
### 1. Accident-Prevention Signs and Tags

a. Accident-prevention signs shall be visible when work is being performed and shall be removed or covered promptly when hazards no longer exist.

29 Code of Federal Regulations (CFR) 1926.200(a)

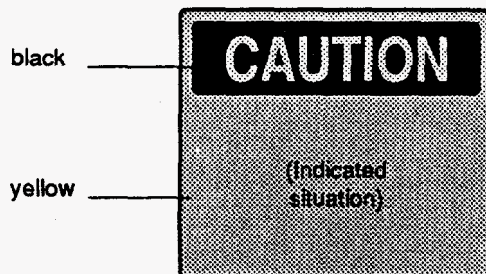
b. Danger signs shall be used only when an immediate hazard is present.

29 CFR 1926.200(b)



c. Caution signs such as "HARD HAT AREA," "SLIPPERY SURFACE," or "CAUTION-WELDING ARC" shall be used *only* to warn against potential hazards or to caution against unsafe practices.

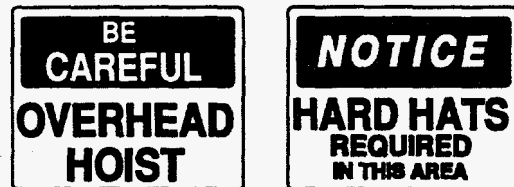
29 CFR 1926.200(c)



d. Safety instruction signs (green upper panel with white letters to convey the principal message and a white message background below the panel with black letters) shall be used for additional messages. Safety notice signs (blue upper panel with white letters and a white message background below with black letters) shall be used as necessary to convey other safety information messages,

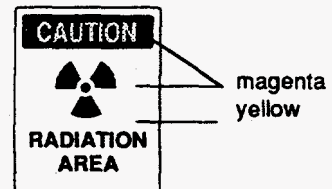
such as notice to wear hard hats and safety glasses or other instructions.

29 CFR 1926.200(e)



e. Radiation signs (yellow background with a three-blade radiation symbol and magenta heading) are used only for warning or instructing of radiation hazards. For specific use requirements, refer to below noted OSHA standard.

29 CFR 1910.96(e)



f. To protect workers, traffic signs shall be appropriately placed to control vehicle traffic on roadways in or near construction sites. Traffic control signs or devices shall conform with ANSI D6.1

29 CFR 1926.200(g)

g. Accident-prevention tags shall be used as a temporary means of warning workers of existing hazards such as defective tools or equipment. Where applicable, such tags shall be used in conjunction with a lock as specified in the lockout/tagout program. The tag shall be removed only by an authorized person when the condition of the hazard has been corrected or removed. See Section B.8., "Lockout/Tagout Program."

29 CFR 1926.200(h)



Accident Prevention Tag



## 2. Traffic Control Systems and Signs

a. Traffic control signs, signals, and applications, including design and dimensions, shall conform with ANSI D6.1, "Manual on Uniform Traffic Control Devices for Streets and Highways."

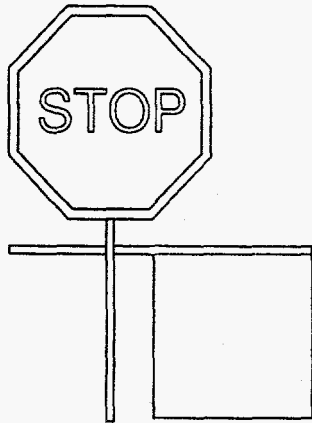
29 CFR 1926.200(g)(2)

b. Flaggers shall be used to control traffic when signs, signals, or barricades do not provide the necessary protection for workers from traffic.

29 CFR 1926.201(a)(1)

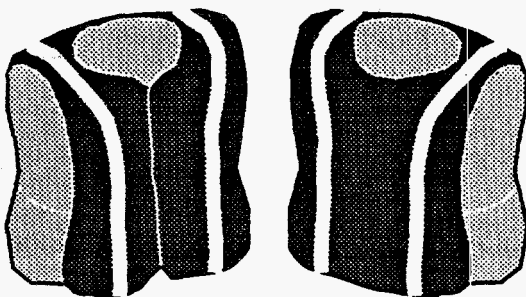
c. Hand signals by a flagger shall be made with a hand-signal device, 18-inch red flag, or signal paddle during daylight hours and with red lights or a flashlight with a red cone attached during periods of darkness.

29 CFR 1926.201(a)(3)



d. Flaggers and workers exposed to vehicle traffic shall wear a Department of Transportation (DOT) orange vest or orange clothing. During periods of darkness, the vest or clothing shall have reflective material.

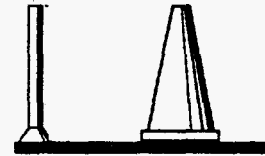
29 CFR 1926.201(a)(4)



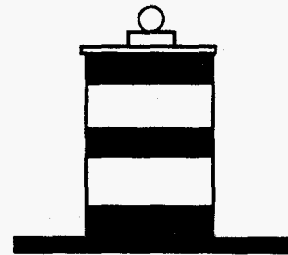
DOT Orange Vests

e. Flaggers shall not stand in the path of approaching vehicles nor shall they turn their backs to approaching vehicles. Flaggers shall be instructed in these procedures.

f. Traffic control devices such as barricades, cones, and drums shall be used to guide or channel traffic as desired through roadway construction. See ANSI D6.1 for appropriate dimensions.



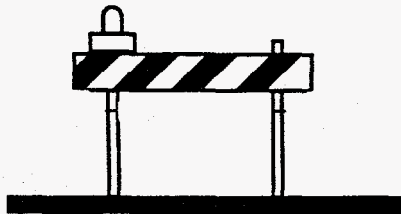
Cones



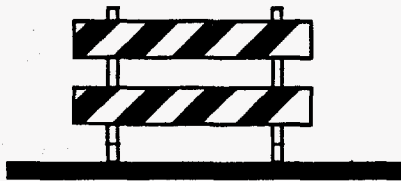
Drum



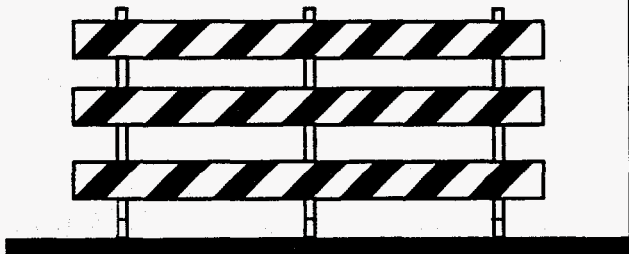
g. Three types of barricades are used to stop or control traffic. Type I and II are used for traffic control in a construction area while Type III is used as an indicator that the road is closed. See ANSI D6.1 for appropriate dimensions.



Type I Barricade



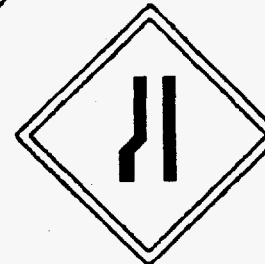
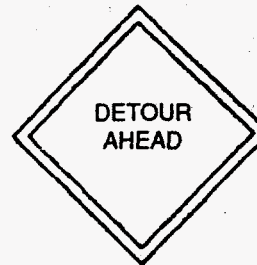
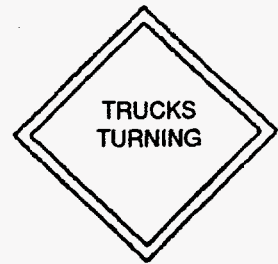
Type II Barricade



Type III Barricade

h. Flashing warning lights shall be placed on barricades during hours of darkness. Nonflashing warning lights shall be placed on groups of barricades used in a series to channel nighttime traffic.

i. Caution, warning, and construction information traffic signs shall be displayed as appropriate to warn or inform vehicle traffic of roadway construction activities and conditions.



Traffic Signs and Notices Examples



j. Construction vehicles or equipment left or parked near a roadway shall have appropriate warnings displayed or barricades positioned.

k. Disabled vehicles parked near roadways will display reflective triangles, warning lights, flags, or flares to warn traffic of their position.

l. The arrangement of traffic-control devices used to stop or channel traffic (barricades, drums, cones) shall be inspected periodically to ensure that the devices are in good condition and positioned correctly.

m. Barricades shall be weighted or supported to prevent displacement.

### 3. Training Requirements

a. Workers who are responsible for maintaining traffic control signs, warning lights, and devices in the construction zone shall be trained to make decisions concerning placement of these devices. (T)

b. Only those workers who are trained in safe traffic-control practices shall supervise the selection, placement, and maintenance of traffic control devices at construction sites. (T)



## DEFINITIONS

**Barricade** — A means of obstruction such as appropriately colored traffic-control drums, cones, and barriers used to deter passage or to channel vehicle traffic or persons.

**Cone** — An appropriately colored cylindrical, tubular, or cone-shaped device with a minimum height of 18" used to channel traffic or warn of a traffic hazard or obstacle.

**DOT Orange Vest** — An orange-colored vest approved by DOT and worn by workers to ensure that they are noticeable by traffic. (Vests worn during hours of darkness should have reflective material.)

**Drum** — An appropriately colored (orange with white) cylindrical device approximately 36" high and with a minimum diameter of 18" used to channel or control traffic flow.

**Flag** — A red cloth, at least 18" square, attached to a handle or staff and used for traffic warning by a flagger.

**Flagger** — A worker who uses a flag, signal paddle, or light to direct or warn traffic.

**Sign** — A permanent or temporary warning that informs or directs traffic before entering and when traveling through a construction area.

**Signal** — A motion of direction given by a flagger.

**Signal Paddle** — A flagger's hand-held device used to signal or direct traffic. The paddle sign is 18" in diameter with SLOW on one side and STOP on the other and has a handle or shaft.

**Tag** — A temporary warning sign or notice attached to equipment, equipment controls, or tools.



**KEY ITEMS CHECK LIST**  
**SECTION G. SIGNS, SIGNALS, AND BARRICADES**

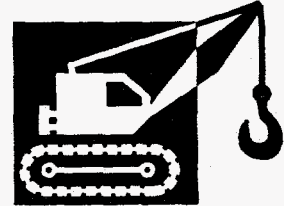
Item	Paragraph	Notes
1. ACCIDENT-PREVENTION SIGNS AND TAGS	G.1	
Is defective equipment tagged with visible accident-prevention signs and symbols?	G.1.g	
Are tags removed only by authorized persons after equipment is repaired or removed from service?	G.1.g	
Are legible traffic signs posted at all hazardous construction areas?	G.1.f	
Are appropriate radiation warning symbols used in radiation areas?	G.1.e	
2. TRAFFIC CONTROL SYSTEMS AND SIGNS	G.2	
Are flaggers trained to stand out of the path of, and to face, approaching traffic?	G.2.e	
Are flaggers provided with flashlights during night work?	G.2.c	
Are flaggers and workers provided with orange vests?	G.2.d	
Are flaggers and workers provided with reflective clothing or vests for night work?	G.2.d	
Does the traffic sign placement and spacing meet requirements?	G.2.a G.2.f G.2.l	
Are appropriate types of barricades used to control or stop traffic?	G.2.g	
Are construction vehicles that are parked near highways properly signed and marked?	G.2.j M.1.a	
Are disabled vehicles that are parked near roadways properly signed and marked?	G.2.k	
Are traffic-control devices observed intermittently to ensure that they are positioned correctly?	G.2.l	
Are flashing warning lights properly used to channel nighttime traffic?	G.2.h	

KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
Are barricades supported to prevent displacement?	G.2.m	
3. TRAINING REQUIREMENTS	G.3	
Are only those employees who are trained in safe traffic control allowed to select and place devices?	G.3.a G.3.b	



## Section H. Cranes, Hoists, and Conveyors



When "ANSI B30\*" follows the text under "General Requirements for All Cranes and Hoists," it indicates that the information is from current American Society of Mechanical Engineers/ American National Standards Institute (ASME/ ANSI) Standards. ANSI B30 is applicable to all cranes and hoists in this text representing each of the following unless otherwise specified.

B30.2 - Overhead and Gantry Cranes

B30.3 - Hammerhead Tower Cranes

B30.4 - Portal, Tower, and Pillar Cranes

B30.5 - Mobile and Locomotive Cranes

B30.7 - Base-Mounted Drum Hoist

Individual or specific requirements are noted under applicable headings.

### 1. General Requirements for All Cranes and Hoists

#### a. Design, Construction, Inspection, and Testing

(1) All cranes and hoists shall be designed, constructed, erected, inspected, tested, and operated in accordance with the applicable ANSI B30 standard and as prescribed by the manufacturer's instructions and the characteristics of the crane or hoist.

29 Code of Federal Regulations (CFR) 1926.550(a)(1); ANSI B30\*



(2) Inspection shall be both frequent and periodic as noted in paragraphs (a-e).

ANSI B30\*

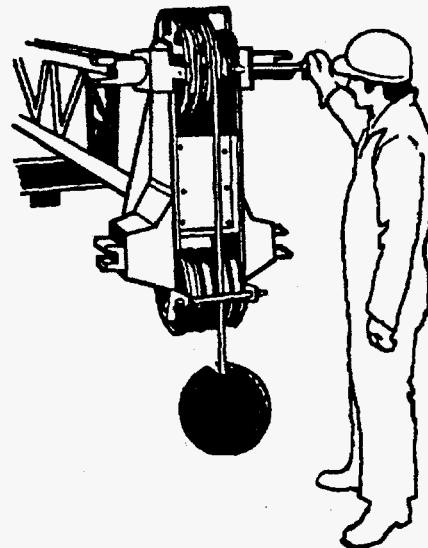
(a) All new and altered cranes or hoists shall have an initial inspection by a qualified person. Thereafter, cranes and hoists shall have regular inspections classified as frequent or periodic. Inspections of these classifications shall be made at intervals dependent upon the critical components of the crane or hoist and the degree of exposure to wear, depreciation, or malfunctions.

ANSI B30\*



(b) Frequent inspections shall be daily to monthly (dependent upon use and condition) and shall be performed by a designated person. The inspections include (but are not limited to) checking control mechanisms for maladjustment and excessive wear, checking safety devices for proper function, and checking hydraulic hoses and systems, hooks and latches, ropes and rope reeving, and electrical and mobile parts as applicable and as recommended by the manufacturer.

29 CFR 1926.550(a)(5); ANSI B30\*



Inspect, test, and maintain cranes for safety.

(c) Periodic inspections of cranes and hoists shall be made by a qualified person at intervals of 1 to 12 months depending on the severity of equipment use and the environment. Inspections shall be in-depth; all structures and mechanisms shall be inspected for wear, deterioration, leaks, damage, and operation. Any deficiency shall be examined, and it shall be determined whether or not it constitutes a hazard.

29 CFR 1916.550(a)(6); ANSI B30\*



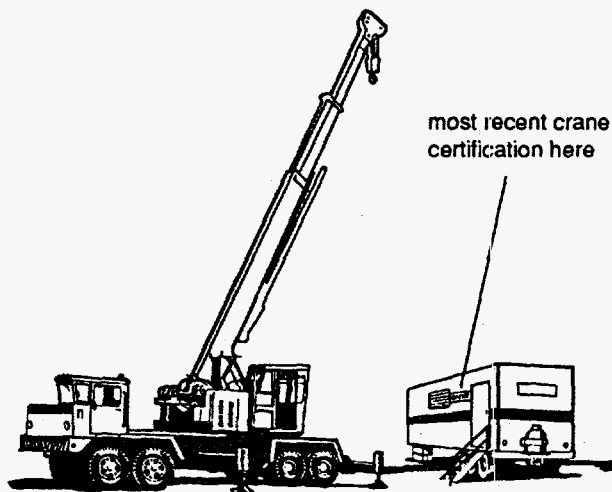


(d) Cranes and hoists not in regular use for periods of more than one month and not more than one year shall be thoroughly inspected before use.

ANSI B30\*

(e) Dated inspection reports, especially those of periodic inspections, shall be maintained and be readily available for review.

29 CFR 1926.550(a)(6); ANSI B30\*



(3) Before initial use, all new, altered, reinstalled, excessively repaired, or modified cranes and hoists shall be operationally tested to include (but not be limited to) the following as applicable to the specific crane or hoist:

- hoisting and lowering,
- trolley travel,
- bridge travel,
- swing motion,
- brakes and clutches,
- limit-locking and safety devices,
- assembly, foundation, and erection,
- control operations,
- running gear and drives, and
- all other mechanisms pertinent to the safe, operation of the equipment.

ANSI B30\*

(4) Before initial use, all new, altered, reinstalled, and excessively repaired or modified cranes or hoists shall be rate-load tested according to the weight percentage specified by the manufacturer or the appropriate ASME/ANSI standard.

ANSI B30\*

(5) All inspections and tests shall be by, or under the direction of, a designated or authorized person, and records of the test methods and results shall be maintained and made readily available for review.

29 CFR 1926.550(a)(5,6); ANSI B30\*



(6) When the manufacturer's specifications are not available, the assigned limitations of the equipment shall be determined by a qualified engineer.

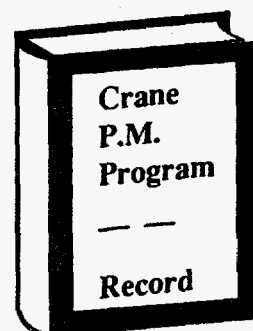
29 CFR 1926.550(a)(1); ANSI B30\*



b. Adjustments, Maintenance, and Repair

(1) A preventive maintenance program shall be established based on the crane or hoist manufacturer's recommendations, and a maintenance record shall be maintained.

ANSI B30\*



(2) Replacement parts shall be at least equivalent to the original manufacturer's specifications.

ANSI B30\*



(3) Before any major adjustments or repairs are made to a crane or hoist, every precaution shall be taken to ensure that the crane is in a safe location, has stops applied, has power in the "OFF" position, is properly tagged "Out of Order," and is locked out as applicable to ensure safe worker conditions.

ANSI B30\*



(4) Following adjustments, repairs, or maintenance work, the crane or hoist shall not be returned to service until all guards are replaced, safety devices are reactivated, tools and work equipment are removed, and warning tags or signs are removed.

ANSI B30\*

(5) Any defects found in inspections shall be repaired before the crane or hoist is used, except when a qualified person certifies that it may be operated without undue hazard. All repairs shall be made by a designated person.

ANSI B30\*



(6) Equipment shall be maintained and adjusted to ensure correct functioning of components, as applicable to the crane type or hoist mechanism.

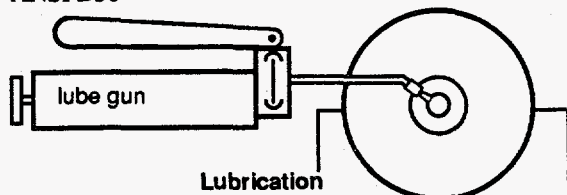
(a) Cranes – all items as noted in paragraph 1.a.(5) above.

(b) Hoists – all functional and operating mechanisms; limit switches; control systems; brakes and clutches; power plant; pawls; foundation or anchorage; critical parts that may be cracked, worn, or bent; and electrical contacts.

ANSI B30\*

(7) Moving parts for which lubrication is specified by the manufacturer should be lubricated regularly. A check should be made for proper delivery of lubricant. The equipment shall be stopped during a worker-performed lubrication process.

ANSI B30\*

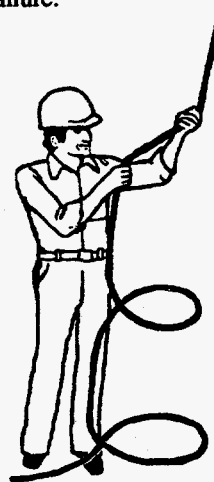


### c. Wire Rope Inspection and Maintenance

(1) All running ropes (wire ropes) that are in continuous service should be visually inspected once each day for

- distortion such as kinking, crushing, unstranding;
- birdcaging, main-strand displacement, or core protrusion;
- general corrosion;
- broken or cut strands;
- number and type of visible broken wires;
- core failure in rotation-resistant ropes; and
- any other condition relative to the rope that may cause rope failure.

ANSI B30\*



Do safety inspections on all ropes.

(2) A periodic inspection of running ropes (wire ropes) shall be made by a qualified person and shall take into account expected rope life for particular or similar installations, severity of the environment, percentage of capacity lifts, frequency rates of operation, and exposure to shock loads. Inspections shall be made at least annually or more often as the rope approaches the end of its usual life. Ropes shall be inspected for

- all items in c.(1) above;
- reduction of rope diameter below minimal diameter;
- severely corroded, cracked, bent, worn, or improperly applied end connections; and
- sections in contact with saddles, equalizer sheaves, and other sheaves where rope travel is limited.

29 CFR 1910.180(g); ANSI B30\*





(3) Wire ropes shall be taken out of service when any of the following exist:

- in running ropes, six randomly distributed broken wires in one lay;
- wear of 1/3 the original diameter of the 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;
- significant reduction in the nominal diameter of the rope per 29 CFR 1926.550(a)(7)(iv); or
- in standing ropes, more than two broken wires in one lay in sections beyond end connections or more than one broken wire at an end connection.

29 CFR 1926.550(a)(7)(i-v); ANSI B30.5

(4) Replacement rope shall have the strength rating of the original ropes. Any change in rope size, grade, or construction shall be specified by the rope manufacturer, crane or hoist manufacturer, or qualified person.

ANSI B30\*

(5) Rope shall be stored in a manner to avoid damage and shall be unreeled or uncoiled with care to avoid kinking or twisting.

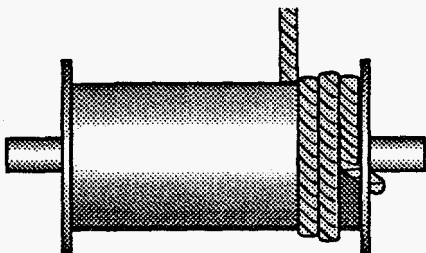
ANSI B30\*

(6) Rope shall be maintained in a well-lubricated condition with a lubricant equal to that of the original.

ANSI B30\*

(7) At least two wraps of rope shall remain on the drum. The end attachment shall be by a clamp securely attached to the drum or a wedge/socket arrangement that is approved by the equipment or rope manufacturers.

ANSI B30\*

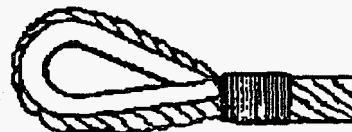


(8) Nonrotating (rotation-resistant) rope and fiber core rope shall not be used for boom-hoist reeving on cranes. When nonrotating rope is used for other purposes, special care shall be taken during installation to avoid damage.

ANSI B30\*

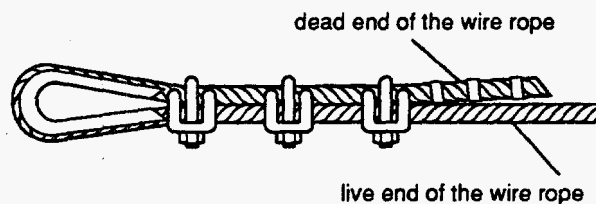
(9) Eye splices shall be made as recommended by the rope manufacturer, and rope thimbles should be used in the eye splice.

ANSI B30\*



(10) Wire rope clips shall be drop-forged steel of the single-saddle U-bolt or double-saddle type. Spacing, number of clips, and torque shall be determined according to manufacturer's recommendations. Wire rope clips shall have the U-bolt over the dead end and the saddle over the live end of the wire rope.

ANSI B30\*



Correct Application of Wire Rope Clips

(11) Rope with an independent wire-rope, wire strand core, or other temperature-resistant core shall be used when wire is exposed to temperatures in excess of 180°F at the rope.

ANSI B30\*

#### d. Operator Qualifications and Practices

(Cab-, Station-, or Pulpit-Operated Cranes and Hoists)

(1) Cranes and hoists shall be operated by designated persons, trainees under the direct supervision of designated persons, maintenance and test personnel in duty performance, and crane and hoist inspectors.

ANSI B30\*



(2) Operators of cranes and hoists shall pass a written or oral practical operating examination or furnish satisfactory evidence of qualification and experience. Examination shall be limited to the type of equipment for which the operator is qualified.

ANSI B30\*





*Operators must demonstrate the ability to read and understand load and lift charts and other instructions.*

(3) Operators and operator trainees of cranes or hoists shall meet the following physical qualifications:

- Snellen vision test 20/30 in one eye and 20/50 in the other (corrected or uncorrected), normal depth perception, field of vision, and color vision (if required by the operation);
- sufficient strength, endurance, agility, coordination, and responsiveness to meet the demands of the equipment operation;
- adequate hearing (with or without hearing aid) for specific operations;
- no physical defects or emotional disorders that could cause hazard to the operator or others; and
- no evidence of seizures or loss of physical control.

**Note:** Medical or special clinical judgements may be required in determining physical or emotional conditions.

ANSI B30\*

(4) Operators shall not engage in any practices that might interfere with operating the crane or hoist, and they shall be responsible for those operations under their control.

ANSI B30\*

(5) Operators shall respond to signals from an appointed signal person but shall respond to a stop signal no matter who may give the signal.

ANSI B30\*

(6) Before starting a crane or hoist, the operator shall see that all controls are in "OFF" or "NEUTRAL" position and that all personnel are clear of machinery.

ANSI B30\*

(7) If power fails during the operation, the operator shall set all brakes and locking devices, move all clutches or other power controls to "OFF" or "NEUTRAL" position, and, if practical, land the suspended load under mechanical brake control.

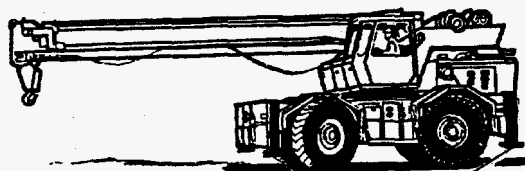
ANSI B30\*

(8) Before leaving a crane or hoist unattended, the operator shall

- land the load,
- set brakes or locking devices,
- bring hook to highest position,
- lower the boom to rest or cradle position,
- put controls in "OFF" or "NEUTRAL" position,
- secure the equipment from any accidental movement by setting brakes or other locking devices, and
- shut off power.

Exceptions include those cranes and hoists that are securely blocked, dogged, pawled, rocket locked, or secured by other equivalent means. Operators shall follow any specific equipment's manufacturer's instruction for shutdown procedures.

ANSI B30\*



Clear area before starting crane.

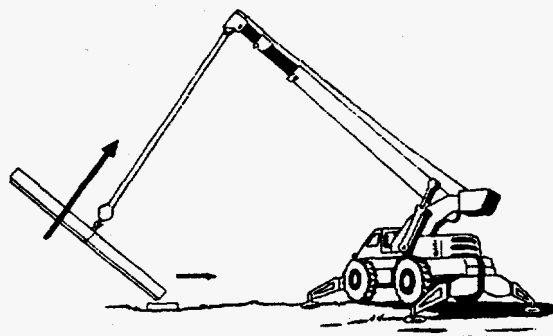
(9) No crane or hoist shall be loaded beyond the specifications of the load-rating chart, except for test purposes. The load to be lifted is to be within the rated capacity of the existing configuration. When the load is not accurately known, the person responsible for the lift shall determine that the weight of the load does not exceed the capacity of the crane at the configuration at which the load is to be lifted.

ANSI B30\*



(10) Prior to initiating a lift, the hook shall be positioned over the load in such a manner as to prevent the load from swinging.

ANSI B30\*



Incorrect hoisting causes load to swing.

(11) The hoisting rope shall not be wrapped around the load. The load shall be attached to the hook with a sling or other device of sufficient capacity.

ANSI B30\*

(12) The crane shall not be operated if a worker is on the load or hook.

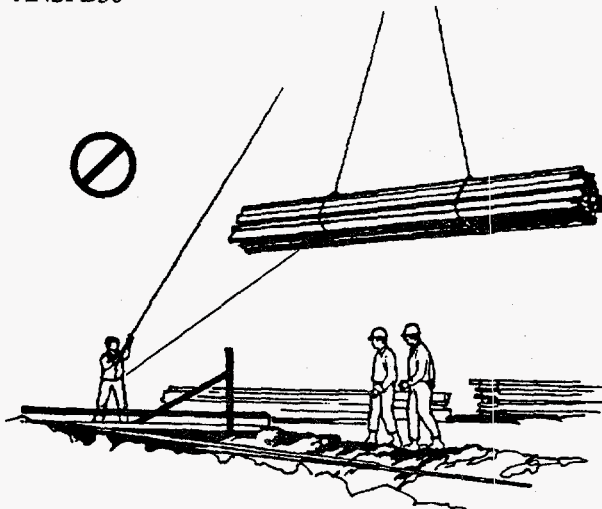
ANSI B30\*





- (13) The operator shall not move a load over an area where workers or other persons are located.

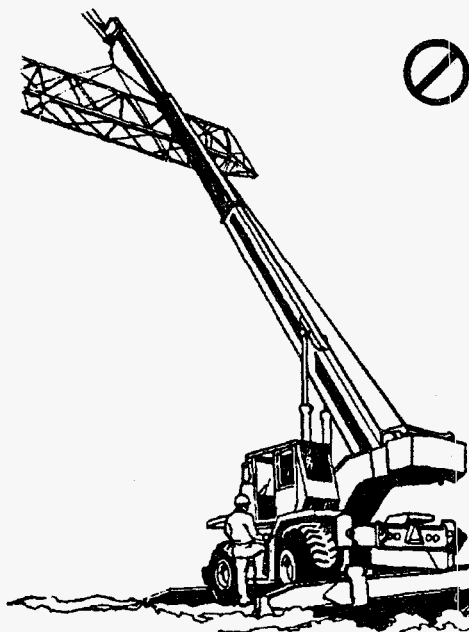
ANSI B30\*



Keep personnel from under the load.

- (14) The operator shall not leave the cab or operating controls while a load is suspended, except under circumstances in which a load is to be suspended for a period of time exceeding normal lift operations. The operator may then leave the controls provided that prior to that time, the appointed individual and operator shall establish the requirements for retraining the boom hoist, telescoping, load, swing, and outrigger functions, and provide notice, barricades, or whatever other precautions may be necessary.

B 30-5.3.2.1(d)



Never leave the controls when the load is on hook.

- (15) When it is difficult for the crane operator to judge any clearance distance, a designated worker shall observe the clearance distance and give timely warnings or signals to the operator.

ANSI B30\*

#### e. Operator Qualifications (Floor and Remote)

- (1) Operators shall be required to pass a practical examination for cranes and hoists that have remotes or floor controls. Operator examinations shall be limited to the specific equipment.

ANSI B30\*



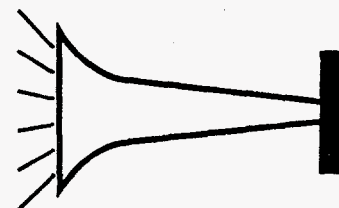
- (2) Because remote-control equipment involves a wide variety of requirements and conditions, installations shall be carefully analyzed and reviewed monthly for the first 6 months of operation to determine if specific operator qualifications noted in paragraphs d.(3) or e.(1) should apply to the operators.

ANSI B30\*

#### f. Other Equipment, Conditions, and Operations

- (1) Warning devices or audible alarms shall be provided and routinely tested for the specific crane or hoist. The workers and operators shall understand the purpose and use of the alarm, warning, and directional signals.

ANSI B30\*



Bell or Horn

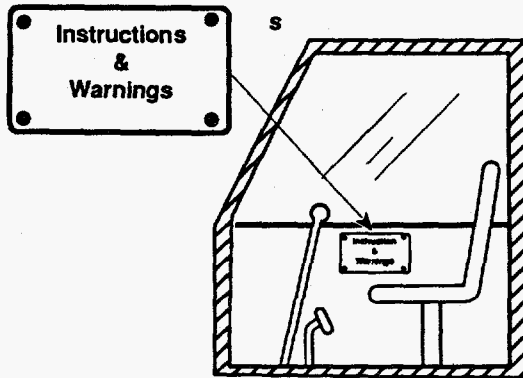
- (2) Standard crane operational signals shall be used when communicating with the equipment operator. Special operations may require special signals that shall be agreed upon and understood by the operator and signal person before their use.

ANSI B30\*



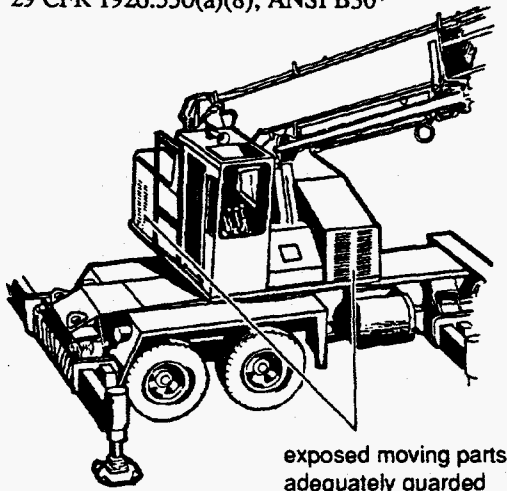


- (3) Rated load capacities, recommended operating speeds, and special warnings shall be conspicuously posted on all equipment. Instructions and warnings shall be visible to the operator at the control station or cab.  
29 CFR 1926.550(a)(2); ANSI B30\*



Instructions and Warnings Posted in Cab

- (4) Exposed moving parts that may constitute a hazard under normal operating conditions shall be guarded, such as gears, shafts, and chain sprockets.  
29 CFR 1926.550(a)(8); ANSI B30\*



- (5) The load hoisting unit of a crane or hoist shall be equipped with

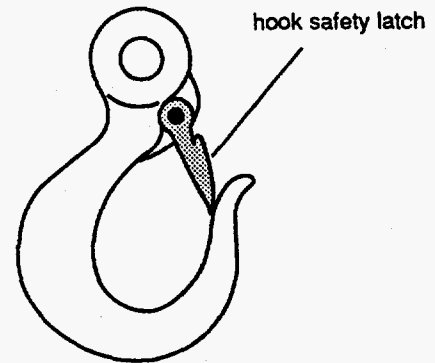
- at least one braking means capable of holding a full-rated load (100% to 125% of the rated load depending on the crane or hoist type and design) at the point where the brake is applied;
- a braking means capable of providing a controlled lowering speed in the event of loss of power or pressure;
- an automatic means to stop and hold the rated load in the event of brake actuating power.

Refer to the appropriate ANSI B30 crane or hoist standard for any load hoist holding exceptions or additional requirements.

B30\*

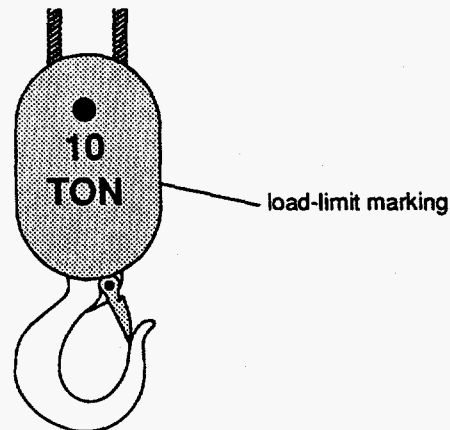
- (6) Hooks shall not be overloaded and shall meet the manufacturer's recommendations. Swiveling hooks shall rotate freely. All hooks shall have a safety latch and a functional spring except when application makes the latch impractical or unnecessary.

ANSI B30\*



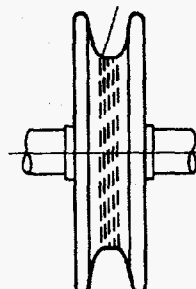
- (7) Load hooks and hook blocks shall be weighted to overhaul the line for the highest hook position. All hook ball assemblies and load blocks shall be permanently labeled with their rated capacity and weight.

ANSI B30\*



- (8) Sheave grooves shall be smooth and free from surface defects that could damage the rope.

ANSI B30\*

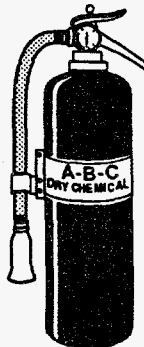


If there is a rope track worn in sheave groove, it must be resurfaced or replaced.



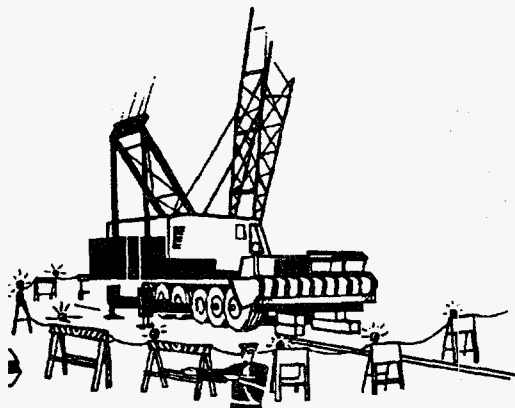
- (9) There shall be at least one fire extinguisher with a rating of 10-B:C installed in the cab or in a convenient location near the operator's station.

ANSI B30\*



- (10) When the cab of the crane is rotating, workers shall not be permitted in the swing radius of the rear of the rotating structure. Such danger areas shall be barricaded.

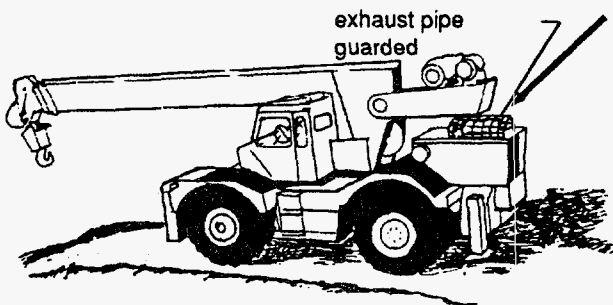
29 CFR 1926.550(a)(9); ANSI B30\*



Barricade workers and public from crane.

- (11) Exhaust pipes of internal combustion engines shall be guarded or insulated when contact with workers is possible.

29 CFR 1926.550(a)(10); ANSI B30\*



- (12) Fuel tank filler pipes shall be located to prevent fuel overflow or spill from running onto the engine, exhaust, or electrical equipment.

29 CFR 1926.550(a)(14); ANSI B30\*

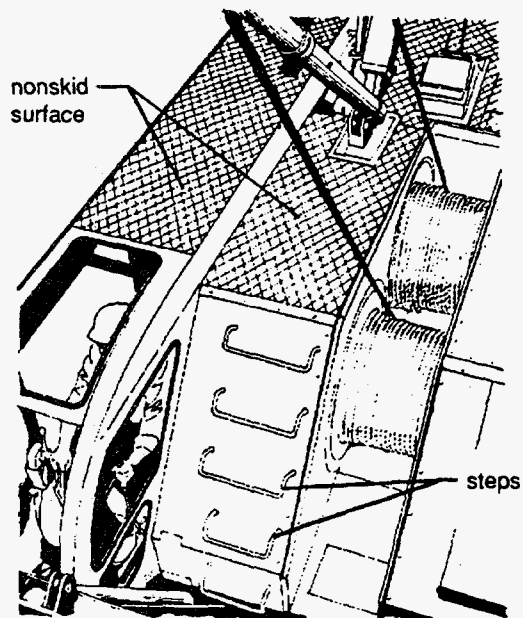
- (13) Portable containers used in refueling shall be of an approved safety-can type. During the refueling process, the engine must be turned off, and no smoking or open flame shall be allowed.

ANSI B30\*

#### g. Walking, Climbing, and Working Surfaces

- (1) Footwalks providing access to the car and cab shall be rigidly constructed, capable of supporting a worker, and have a standard handrail and toeboard. Footwalks are to be slip-resistant (anti-slip surfacing).

29 CFR 1926.550(a)(13)(i-iii)





- (2) A ladder or steps shall be provided for access to the cab roof when such access is required for maintenance or rigging purposes. Such ladders or steps shall meet the applicable design and construction standards.

29 CFR 1926.550(a)(13)(i)

#### h. Controls and Controllers

- (1) Basic crane or hoist operation controls shall be located within reach of the operator at the operator's station.

ANSI B30\*

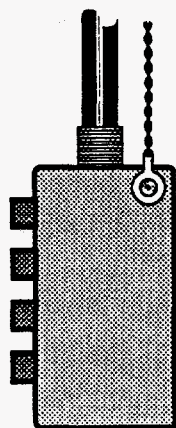
- (2) Crane action and operating controls for load hoist, boom hoist, swing, bridge travel, trolley travel, and boom telescope (when applicable) shall be provided with a means for holding the control in the "OFF" or "NEUTRAL" position, without the use of positive latches.

ANSI B30\*

#### i. Electrically Powered Cranes

- (1) All electrical wiring, circuits, equipment, and installations shall comply with the requirements of the National Electric Code.

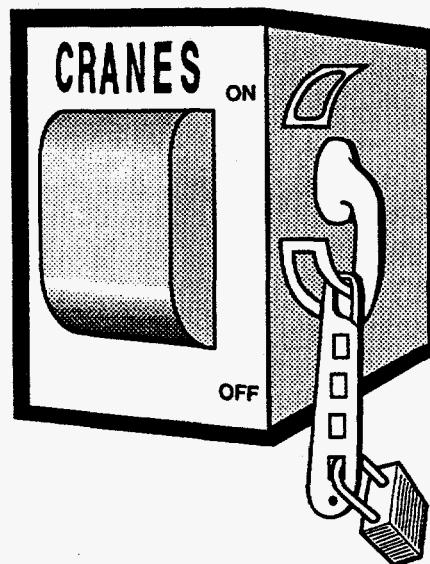
National Fire Protection Association (NFPA) 70-610



Chain (or cable) Strain Control

- (2) The circuit breaker shall have a main electric power disconnect located on a fixed structure, be accessible from the floor or ground, and have the capability of being locked in the "OPEN" position.

ANSI B30\*



Crane Circuit Breaker Control

- (3) Live electrical equipment parts shall be enclosed or located to avoid accidental contact with personnel and to protect the parts from oil, grease, moisture, dirt, and weather conditions.

ANSI B30\*

- (4) The operator shall be provided with a means to interrupt the main power supply from either the cab or remote station.

ANSI B30\*

- (5) When required, provisions shall be made to automatically set the load holding brakes (hoist, trolley, and other brakes) in the event of power failure.

ANSI B30\*



## j. Work Near Electric Power Lines

(1) Equipment and machines shall be operated near power lines only in accordance with the requirements in Tables H-1 and H-2. Exceptions include electric distribution and transmission lines that have been de-energized and visibly grounded at the point of work or insulating barriers (not part of an attachment to the equipment or machinery) that have been erected to prevent physical contact with the lines.

29 CFR 1926.550(a)(15)

**Table H-1. Required Clearance - Loaded Working Cranes**

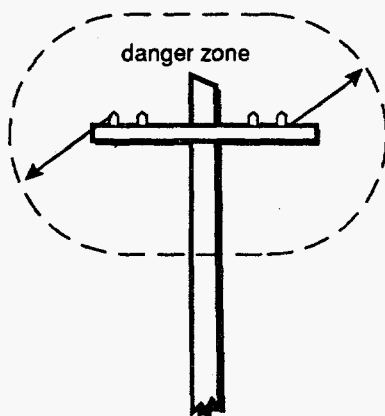
Line Rating kV*	Clearance Feet
to 50	10
50 to 200	15
200 to 350	20
350 to 500	25
500 to 750	35
750 to 1000	45

\*Kilovolt

**Table H-2. Required Clearance - Unloaded Crane in Transit**

Line Rating kV	Clearance Feet
to 0.75	4
0.75 to 50	6
50 to 345	10
345 to 750	16
750 to 1000	20

ANSI B30.5-3.4.5 Table #1



**Danger Zone (Distance vs Voltage)**

(2) A worker shall be designated to observe equipment clearance and to give timely warning of all operations when it is difficult for the operator to see.

29 CFR 1926.550(a)(15)(iv)

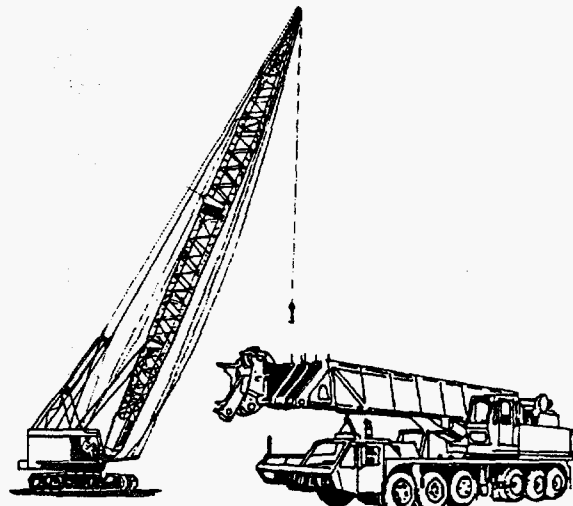


(3) Overhead lines shall be considered energized unless and until the owner of the line or utility authority indicates that the line is not energized and it has been visibly grounded.

29 CFR 1926.550(a)(15)(vi)

*The following information is specific to the listed cranes and hoists and is beyond that of general information and requirements.*

## 2. Mobile and Locomotive Cranes



crawler crane

truck crane

a. All jibs on conventional boom cranes shall have positive stops so that the jib can move no more than 5 degrees above the straight line of the jib and boom.

29 CFR 1926.550(b)(1)

b. Boom stops shall be provided to prevent the boom from falling backward and should be one of the following types:

- a fixed or telescoping bumper,
- a shock absorbing bumper, or
- a hydraulic boom elevation cylinder(s).

ANSI B30.5-1.9.1(a)

c. Jibs shall be restrained from backward overturning.

ANSI B30.5-1.9.1(b)

d. A boom angle indicator readable from the operator's station shall be provided.

ANSI B30.5-1.9.1(c)

e. A boom hoist disconnect, shutoff, or hydraulic relief shall be provided to automatically stop the boom hoist when the boom reaches a predetermined high angle.

ANSI B30.5-1.9.1.(d)

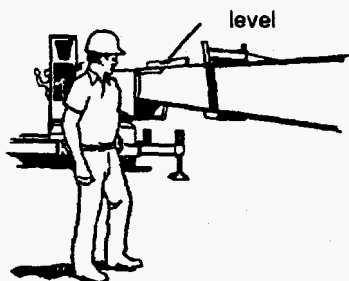
f. A boom-length indicator, readable from the operator's station, shall be provided for all telescoping booms.

ANSI B30.5-1.9.1.(e)



g. A means shall be provided for the operator to visually determine from the operator's seat the levelness of the crane. (The accuracy of the boom-level indicator shall be checked during periodic inspections.)

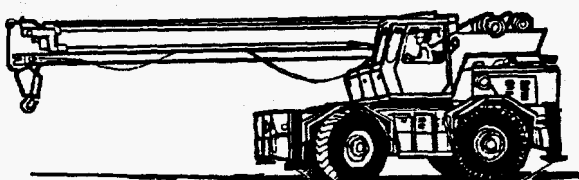
ANSI B30.5-1.9.11(d)



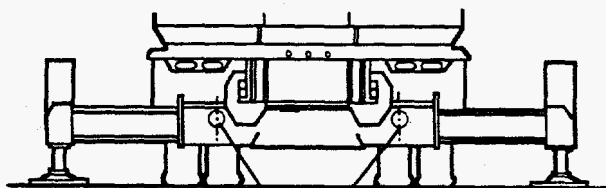
Use level to check accuracy of boom angle indicator.

h. A means shall be provided to hold outriggers in the retracted position during travel and in the extended position when in use. A means shall be provided for fastening outrigger floats to the outriggers when in use.

ANSI B30.5-1.9.3.(a)



outriggers in retracted position



locking pins

i. When in use, the crane shall be supported by a firm surface, level within 1% grade. Substantial timbers, cribbing, or other structural members may be used for this purpose.

ANSI B30.5-1.2.2(e)

j. A device or boom support shall be provided to prevent the boom and superstructure from rotating when the crane is in transit; this device or boom support shall be constructed to minimize inadvertent engagement or disengagement.

ANSI B30.5-1.4.2(b)

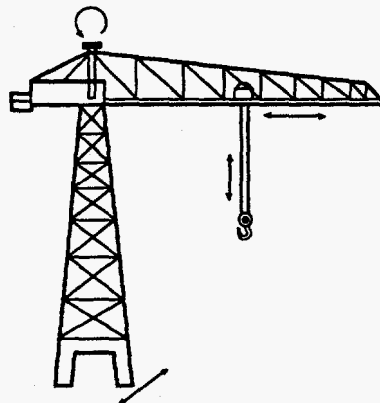
k. Travel brakes on crawler, locomotive, and wheel-mounted cranes shall be capable of holding the crane in position during working cycles on level ground and capable of stopping the crane when it is descending the maximum grade recommended for travel. Commercial truck, vehicle-mounted cranes shall meet the braking requirements of the Department of Transportation (DOT).

ANSI B30.5-1.5.3.(c)

l. Telescopic boom cranes shall have either an anti-two-block device or a two-block damage prevention feature at all points of two-blocking. Those cranes manufactured before the effective date of ANSI B30.5 should have those features retrofitted or equipped with a two-blocking warning device.

ANSI B30.5-1.9.9(a)

### 3. Hammerhead Tower Cranes



a. Hammerhead tower cranes shall be erected in accordance with the manufacturer's recommendations and supervised by a qualified person.

ANSI B30.3-1.1.2(b)



b. Adequate clearance shall be maintained between moving or rotating parts of the crane and fixed objects to allow workers to pass and to prevent damage to structures.  
29 CFR 1926.550(c)(1)

c. Limit switches shall be provided to

- limit trolley travel,
- limit block upper motion to prevent two-blocking, and
- limit the load being lifted to no more than 110% of the rated load at each radius and prevent running the trolley out to more than the maximum operating radius for 110% of the rated load.

Limit switches shall be sealed against unauthorized tampering after testing is completed and final setting is made.

ANSI B30.3-1.11.1



d. The hoisting unit shall be equipped with a self-setting brake capable of holding the load as specified in paragraph 1.f.(5).

ANSI B30.3-1.5.3(e)

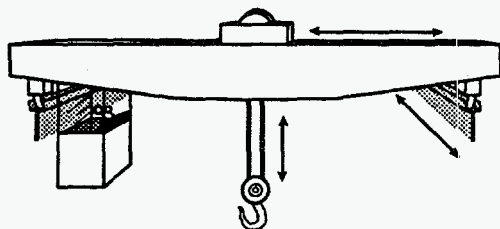
e. The swing and trolley both shall have a braking system capable of stopping movement in either direction and capable of holding the position without further operator attention. Trolley brakes shall be equipped with an automatic device to stop the outward movement of the trolley if the trolley rope breaks.

ANSI B30.3-1.9.3.4.

f. A wind-indicating device shall be provided that will give a visible or audible alarm to the crane operator at a predetermined wind velocity.

ANSI B30.3-1.18.7

#### 4. Overhead and Gantry Cranes



Overhead-Traveling Crane

a. Clearance shall be maintained between the crane, building or structure, and any parallel running cranes at the same or different levels.

ANSI B30.2-1.2.1(a)

b. The rated load of the crane shall be marked on each side of the bridge. If the crane has more than one hoisting unit, the rated load shall be marked on each load block.

ANSI B30.2-1.1.1



c. Every outdoor crane shall have secure fasteners, such as rail clamps, that are convenient to apply and will hold the crane against wind conditions. Parking brakes shall be considered minimum compliance with this rule.

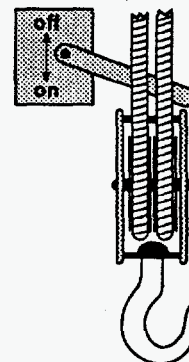
ANSI B30.2-1.3.1(b)

d. Outdoor storage gantry cranes shall be provided with remotely operated rail clamps or other equivalent device. A parking brake may be considered minimum compliance with this rule. In addition, these cranes shall be provided with wind indicating devices.

ANSI B30.2-1.3.1(d)

e. Each hoisting unit shall be provided with an upper movement limit switch that shall be tested at the start of each shift by slow or inching contact.

29 CFR 1910.179(n)(4)(i,ii)



Block Limit Switch

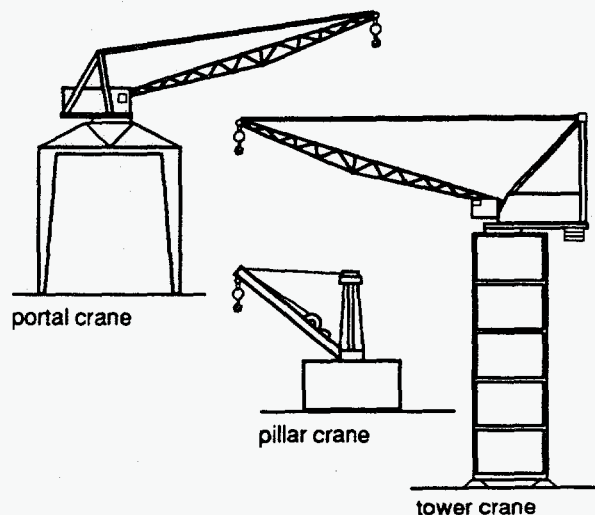
f. Each hoisting unit shall be equipped with a self-setting brake capable of holding the load as specified in paragraph 1.g.(5).

29 CFR 1910.179(f)(1)(i)

g. Trolleys and bridges shall have stops and bumpers (buffers) at the end of the travel. Stops and bumpers shall be designed, constructed, and installed according to ANSI B30.2-1.8.

ANSI B30.2; 29 CFR 1910.179(e)(1,2)

#### 5. Portal, Tower, and Pillar Cranes





a. All cranes shall be assembled or erected in accordance with the crane manufacturer's or a qualified person's recommendations and performed under the supervision of a qualified person.

ANSI B30.4-1.1.2(b)



b. The ends of tracks shall be equipped with rail stops, or buffers, designed to minimize the possibility of derailment. The trolley shall be provided with rail sweeps that extend to the top of the rail and project in front of the leading wheels in either direction.

ANSI B30.4-1.1.1(b,g)

c. The boom hoist (luffing hoist) mechanism shall be equipped with at least one brake that has 125% of the maximum full-load torque at the point where the brake is applied. The boom hoist mechanism shall be capable of raising and lowering the boom only when coupled to its prime mover or suitable retarder.

ANSI B30.4-1.5.1

d. The boom hoist drum shall be controllable from the operator's station; have an auxiliary ratchet and pawl or other positive locking device to hold the drum from rotating in the lowering direction; and be capable of holding the rated load indefinitely.

ANSI B30.4-1.5.2(a)

e. The load hoist mechanism shall be equipped with at least one brake that has 125% of the maximum full-load hoisting torque at the point where the brake is applied.

ANSI B30.4-1.4.3(b)

f. A positive means, controllable from the operator's station, shall be provided to hold the boom hoist drum from rotating in the lowering direction and to hold the rated load indefinitely without further attention from the operator.

ANSI B30.4-1.4.3(b)

g. A brake with holding power in both directions shall be provided to prevent movement of the rotating upper structure during operation; the brake shall be capable of being set and remaining set in the holding position without further action of the operator.

ANSI B30.4-1.6.2(a)

h. The load hoist of all cranes shall be provided with an over-travel limiting device or a two-blocking warning feature, and when the hook enters areas not visible to the operator, the load hoist should be provided with a lower over-travel limiting device.

ANSI B30.4-1.9.1,1.9.2

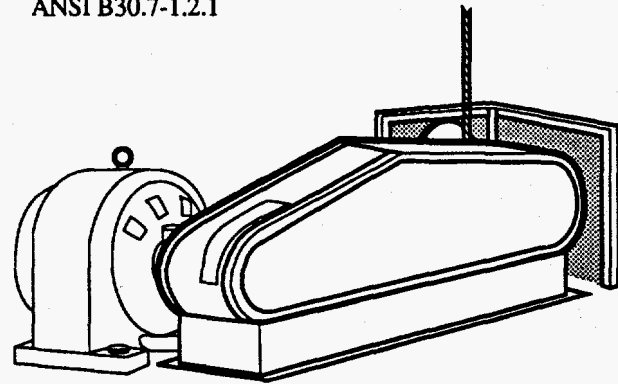
i. A wind-indicating device shall be provided that will give a visible or audible alarm at a predetermined wind velocity to the crane operator.

ANSI B30.4-1.16.6

## 6. Base Mounted Drum Hoists

a. Hoists shall be designed and constructed to meet all stresses imposed upon their frames and components under normal operating conditions when properly installed and when loads do not exceed the manufacturer's load rating.

ANSI B30.7-1.2.1



Guarded Moving Parts

b. Hoists are to be marked with the following for each drum:

- load rating;
- drum size consisting of barrel diameter, flange diameter, and barrel length;
- rope size;
- rope speed in feet per minute (fpm); and
- power supplied.

ANSI B30.7-1.1.3

c. Load rating shall be the manufacturer's recommended single-rope pull in pounds or kilograms, at a specified rate of speed, on a given drum size, and for a prescribed number of layers of rope.

ANSI B30.7-1.1.2

d. Drum assemblies shall be provided with power and operational characteristics to perform all lifting, lowering, and swinging functions when operated at rated load.

ANSI B30.7-1.2.2(a)

e. Drums that hold suspended loads and booms shall be provided with a ratchet or pawl. The pawl shall be operable from the operator's station.

ANSI B30.7-1.2.2(e)



f. Each load hoist mechanism shall be equipped with at least one brake that has 125% of maximum-rated line pull at the point where the brake is applied. (The maximum-rated line pull at each rope layer on the drum shall be considered in determining this rating.)

ANSI B30.7-1.2.3(a)

g. When the prime mover is an electric motor, it shall be provided with a self-setting motor brake or other device to prevent drum rotation in the event of power failure.

ANSI B30.7-1.2.3(b,c)

h. Swinger brakes shall have holding power in both directions and have the capability of being set and remaining set in the holding position without further attention from the operator.

ANSI B30.7-1.2.3(e)

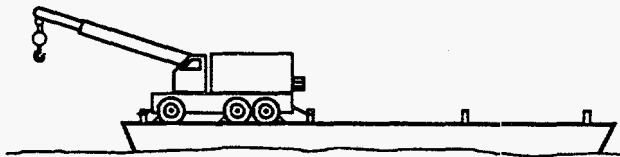
i. A means of power control braking shall be provided and be capable of maintaining controlled lowering speeds.

ANSI B30.7-1.2.3(f)

## 7. Barge-Mounted Cranes

a. Mobile cranes mounted on a barge shall be positively secured.

29 CFR 1926.550(f)(1)(iv)



Mobile Crane on Barge

b. If a crane mounted on a barge has its load reduced to stay within the load limits of the barge, a new load-limit chart for the crane shall be provided and affixed according to paragraph 1.f.(3).

29 CFR 1926.550(f)(1)(iii)

c. When a crane is permanently mounted on a barge, the capacity and limitations for use shall be based on competent design criteria.

29 CFR 1926.550(f)(2)(i)

d. Barge-mounted cranes shall meet the applicable requirements for design, construction, installation, testing, maintenance, and operation as prescribed by the manufacturer.

29 CFR 1926.550(f)(2)(iii)

e. Workers' safety on floating cranes shall comply with applicable requirements specified for work on marine vessels according to 29 CFR 1926.605 and Section M.5 of this guide, as applicable.

29 CFR 1926.550(f)(3)

## 8. Derricks

*Because derricks are not generally used for construction operations, only the basic requirements will be covered. Additional information can be found in the current American National Standards Institute (ANSI) B30.6, "Safety Code for Derricks."*

a. This section covers A-frame, basket, breast, Chicago boom, gin-pole, guy, shearleg, and stiffleg derricks.

b. For permanently installed derricks, a load-rating chart shall be provided and affixed where it is visible to the operator of the derrick. For nonpermanent installations, the manufacturer shall provide sufficient information from which capacity charts can be prepared for the particular installation. The capacity chart shall be located at the derrick or at the job site office.

29 CFR 1910.181(c)(1,2)

c. Daily inspection shall be performed on

- control mechanisms for wear and lubrication;
- all cords and lacing;
- tension on guys;
- deterioration or leakage in air or hydraulic systems; and
- hoists, brakes, and operating levers.

29 CFR 1910.181(d)(2)(i-iii,v,viii)

d. Ropes shall not be handled on the winch head without the knowledge of the operator. While the winch head is in use, the operator shall be within convenient reach of the power unit control lever.

29 CFR 1910.181(h)(5)(i,ii)

e. Dog, pawls, or other positive holding mechanisms on the hoist shall be engaged. When the boom is not in use, the boom shall

- be laid down;
- be secured to a stationary member, as close under the head as possible, by attachment of a sling to the load block; or
- be hoisted to a vertical position and secured to the mast.

29 CFR 1910.181(h)(6)(i-iii)





## 9. Crane- or Derrick-Suspended Personnel Platforms

### a. Hoisting a Personnel Platform

(1) Use of cranes or derricks to hoist workers on personnel platforms is prohibited except when it is not possible (or is more hazardous) to erect a conventional means to reach the worksite.

29 CFR 1926.550(g)(2)

(2) The personnel platform shall be hoisted in a slow, controlled, cautious manner. Load lines shall be capable of supporting at least seven times the maximum intended load; when rotation resistant rope is used, the line shall be capable of supporting ten times the maximum intended load.

29 CFR 1926.550(g)(3)(i)(A-B)

(3) Load- and boom-hoist drum brakes, swing brakes, and locking devices, such as pawls or dogs, shall be engaged when an occupied personnel platform is in a stationary working position.

29 CFR 1926.550(g)(3)(i)(C)

(4) The crane shall be uniformly level to within 1% of grade and located on a firm footing. All outriggers shall be fully extended.

29 CFR 1926.550(g)(3)(i)(D)

(5) The total weight of the loaded personnel platform and related rigging shall not exceed 50% of the rated capacity for the radius and configuration of the crane or derrick.

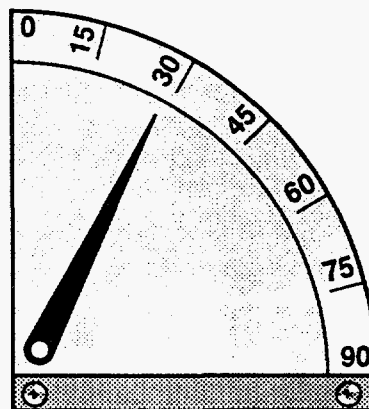
29 CFR 1926.550(g)(3)(i)(E)

(6) Machines equipped with booms in which lowering is controlled only by a brake are prohibited.

29 CFR 1926.550(g)(3)(i)(F)

(7) Cranes and derricks with variable-angle booms shall be equipped with a boom-angle indicator that is visible to the operator.

29 CFR 1926.550(g)(3)(ii)(A)



Boom Angle Indicator

(8) Cranes with telescoping booms shall be equipped with a device to indicate at all times the boom's extended length, or the load radius to be used during the lift shall be determined prior to hoisting personnel.

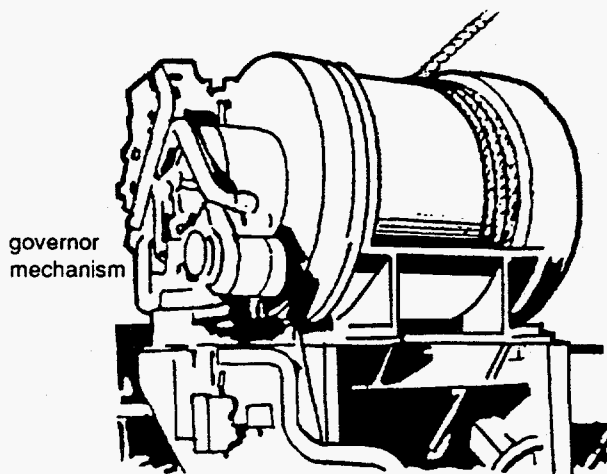
29 CFR 1926.550(g)(3)(ii)(B)

(9) An anti-two-blocking device or means to deactivate the hoist shall be used to prevent contact between the load block or overhaul ball and the boom tip.

29 CFR 1926.550(g)(3)(ii)(C)

(10) The loading hoist drum shall have a governor (or equivalent device other than the load hoist brake) on the power train to regulate the lowering rate of speed of the hoist mechanism. Free fall of the hoist is prohibited.

29 CFR 1926.550(g)(3)(ii)(D)





b. Design and Use of Personnel Platforms

- (1) Each personnel platform shall be equipped with a guardrail system and shall be enclosed from the toeboard to the midrail with solid or expanded metal that has openings no greater than 1/2 inch.

29 CFR 1926.550(g)(4)(ii)(A)



Suspended Personnel Platform

- (2) The personnel platform and suspension system shall be designed by a qualified engineer or a qualified person competent in structural design.

29 CFR 1926.550(g)(4)(i)(A)



- (3) The personnel platform suspension system shall be designed to minimize tipping caused by workers moving on the platform.

29 CFR 1926.550(g)(4)(i)(B)

- (4) Personnel platforms shall be capable of supporting their own weight and at least five times the maximum intended load.

29 CFR 1926.550(g)(4)(i)(C)

- (5) A grab rail shall be installed inside the entire perimeter of the personnel platform.

29 CFR 1926.550(g)(4)(ii)(B)

- (6) Access gates, including those that slide or fold, shall be equipped with restraining devices to prevent them from being opened accidentally.

29 CFR 1926.550(g)(4)(ii)(D)

- (7) Sufficient space shall be provided so that workers can stand upright on the personnel platform.

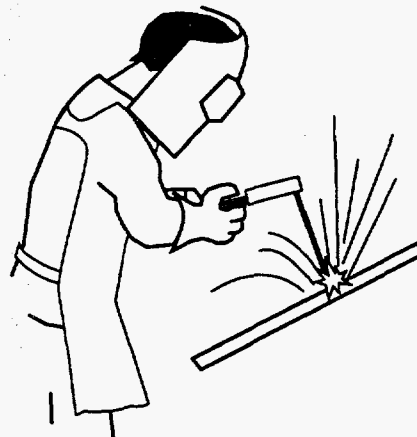
29 CFR 1926.550(g)(4)(ii)(E)

- (8) The personnel platform shall have overhead protection in situations where workers might be exposed to falling objects.

29 CFR 1926.550(g)(4)(ii)(F)

- (9) A qualified welder shall perform all welding on the personnel platform and its components.

29 CFR 1926.550(g)(4)(ii)(H)



Qualified Welder

- (10) The number of workers occupying the personnel platform shall not be more than required for the work being performed.

29 CFR 1926.550(g)(4)(iii)(B)

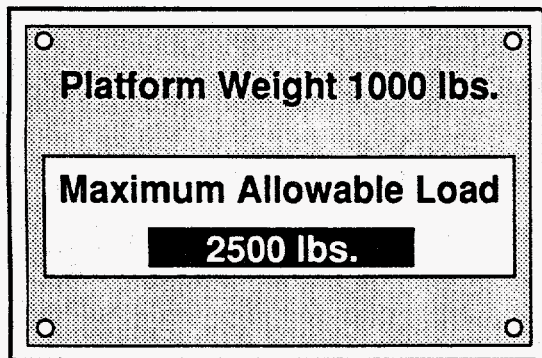
- (11) Personnel platforms shall be used only for workers, their tools, and the materials necessary to do their work and shall not be used to hoist only materials and tools.

29 CFR 1926.550(g)(4)(iii)(C)



- (12) The personnel platform's weight and load rating or maximum intended load shall be conspicuously posted on a plate or other permanent marking on the platform.

29 CFR 1926.550(g)(4)(ii)(I)



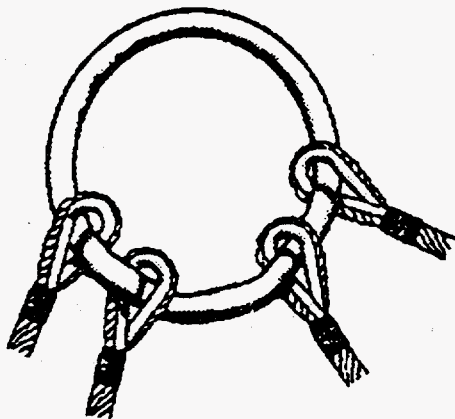
Load Tag for Personnel Platform

- (13) Materials and tools hoisted during a personnel lift shall be secured to prevent displacement.

29 CFR 1926.550(g)(4)(iii)(D)

- (14) When a wire-rope bridle is used to connect the personnel platform to the load line, each bridle leg shall be connected to a master link or shackle to ensure that the load is evenly divided among the bridle legs.

29 CFR 1926.550(g)(4)(iv)(A)



Wire-Rope Bridle Master Link

- (15) Hooks on overhaul ball assemblies, lower load blocks, or other attachment assemblies shall be of a type that can be closed and locked. An alloy anchor shackle with a bolt, nut, and retaining pin may also be used.

29 CFR 1926.550(g)(4)(iv)(B)

- (16) Bridles and associated rigging used for personnel lifting shall not be used for any other purpose.

29 CFR 1926.550(g)(4)(iv)(E)

#### c. Trial Lifts

- (1) Before the trial lift, a meeting shall be held at each new location to review all appropriate regulations with the crane or derrick operator, signal person, workers to be lifted, and the person responsible for the task to be performed. These meetings shall be repeated for workers who are assigned to the operation after the trial lift takes place.

29 CFR 1926.550(g)(8)(i-ii)

- (2) A trial lift shall be made from ground level, or any other location where workers will enter the platform, to each location where the personnel platform is to be hoisted and positioned. The personnel platform shall be unoccupied and loaded to the anticipated lift weight.

29 CFR 1926.550(g)(5)(i)

- (3) The trial lift shall be repeated before hoisting workers or whenever the crane or derrick is moved and set up in a new location.

29 CFR 1926.550(g)(5)(ii)

- (4) Between the trial lift and the time workers are first hoisted, the platform shall be hoisted a few inches above the ground and inspected to ensure that it is secure and properly balanced.

29 CFR 1926.550(g)(5)(iii)

- (5) Workers shall not be hoisted unless the hoist ropes are free of kinks, multiple-part lines are not twisted around each other, the primary attachment is centered over the platform, and the hoisting system is inspected to ensure that all ropes are properly set on drums and in sheaves.

29 CFR 1926.550(g)(5)(iii)

- (6) Platforms must be proof tested at 125% of the rated capacity at each job site prior to hoisting personnel or after any repair or modification.

29 CFR 550(g)(5)(vi)

- (7) A visual inspection of the crane or derrick, rigging, personnel platform, and the crane or derrick base support or ground shall be conducted by a competent person immediately after the trial lift or proof test to determine if the test has exposed any defect or adversely affected any component or structure.

29 CFR 1926.550(g)(5)(iv)



#### d. Hoisting Workers

- (1) Any defects found during inspections that create a safety hazard shall be corrected before workers are hoisted.

29 CFR 1926.550(g)(5)(v)



(2) Workers shall be instructed to keep all parts of the body inside the platform during raising, lowering, and positioning.

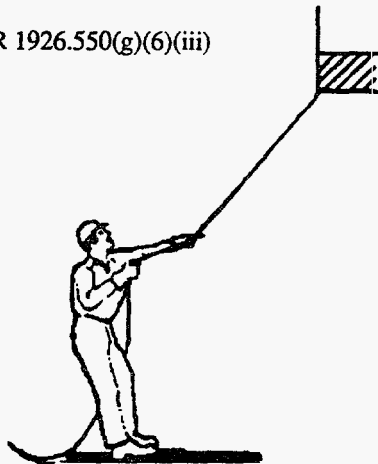
29 CFR 1926.550(g)(6)(i)

(3) Before workers exit or enter a hoisted personnel platform that has not landed, the platform shall come to a complete stop and be secured to the structure on which the work is to be performed unless such securing creates an unsafe condition.

29 CFR 1926.550(g)(6)(ii)

(4) Tag lines shall be used unless they create an unsafe condition.

29 CFR 1926.550(g)(6)(iii)



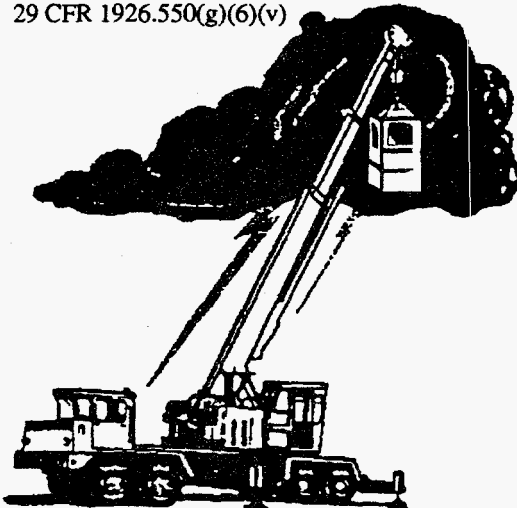
Use of Tag Line

(5) The crane or derrick operator shall remain at the controls at all times if the crane engine is running and if the platform is occupied.

29 CFR 1926.550(g)(6)(iv)

(6) When dangerous weather conditions or any other danger is imminent, hoisting of workers shall be stopped.

29 CFR 1926.550(g)(6)(v)



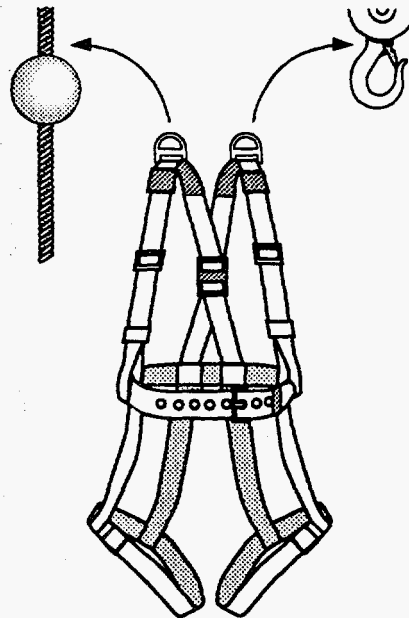
Dangerous Weather

(7) Workers being hoisted shall remain in continuous sight of, and in direct communication with, the hoist operator or signal person. When direct visual contact with the operator is not feasible, direct communication alone may be used.

29 CFR 1926.550(g)(6)(vi)

(8) Each worker on the personnel platform shall use a body belt or safety harness with a lanyard attached to the lower load block or overhaul ball or to a structural member on the platform that can support an impact from a fall.

29 CFR 1926.550(g)(6)(vii)



Safety Harness

(9) Lifts shall not be made with one of the crane's or derrick's remaining load lines if workers are suspended on a platform.

29 CFR 1926.550(g)(6)(viii)

(10) The employer shall implement the following procedures for all circumstances in which a crane might travel while it is hoisting workers:

- Crane travel shall be restricted to a fixed track or runway.
- Travel shall be limited to the load radius of the boom used during the lift.
- The boom shall be parallel to the direction of travel.
- A complete trial run shall be performed to test the route of travel before workers are allowed to occupy the platform.
- If travel is done with a rubber-tired carrier, the overall condition and air pressure of the tires shall be checked.

29 CFR 1926.550(g)(7)(ii)



## 10. Material and Personnel Hoists

### a. General Requirements

(1) The employer shall comply with the equipment manufacturer's specifications. When the manufacturer's specifications are not available, a professional engineer who is competent in the field shall determine any limitations of the equipment.

29 CFR 1926.552(a)(1)



(2) The installation of energized booms on hoists shall be prohibited.

29 CFR 1926.552(a)(5)

(3) The use of endless belt-type manlifts on construction sites shall be prohibited.

29 CFR 1926.552(a)(6)

### b. Material Hoists

(1) Operating rules for material hoists shall be established and posted at the hoist operator's station.

29 CFR 1926.552(b)(1)(i)

(2) Rules and notices shall be posted on the car frame or crosshead in a conspicuous location. A sign stating "NO RIDERS" shall be conspicuously posted on the car frame or crosshead.

29 CFR 1926.552(b)(1)(i)



Posted "NO RIDERS"

(3) No person shall be permitted to ride on material hoists except for the purpose of inspection or maintenance.

29 CFR 1926.552(b)(1)(ii)

(4) All entrances to hoistways shall be protected by substantial gates or bars that are painted with diagonal, colored stripes (for example, black and yellow stripes) across the full width of the landing entrance.

29 CFR 1926.552(b)(2)

(5) Bars shall be between 36 and 42 inches above the hoistway floor. Entrances to the hoistway floor shall be equipped with a latching device.

29 CFR 1926.552(b)(2)(i,ii)

(6) The operator's station of a hoisting machine shall have overhead protection equivalent to tight planking at least 2 inches thick.

29 CFR 1926.552(b)(4)

(7) In case of rope failure, car-arresting devices shall be installed.

29 CFR 1926.552(b)(6)

(8) All material hoist towers shall be designed by a licensed professional engineer.

29 CFR 1926.552(b)(7)



### c. Personnel Hoists

(1) Personnel hoist towers outside a structure shall be enclosed for the full height of the structure on the side or sides used for entrance to and exit from the structure.

29 CFR 1926.552(c)(1)

(2) Personnel hoist towers inside a structure shall be enclosed on all four sides for the entire height of the structure.

29 CFR 1926.552(c)(2)

(3) Personnel hoist towers shall be anchored to a structure at intervals of 25 feet and guyed to ensure stability. Where ties are not practical, the tower shall be anchored by guys made of 1/2-inch-diameter wire rope.

29 CFR 1926.552(c)(3)

(4) Hoistway doors or gates shall be at least 6 1/2 feet high; they shall be provided with mechanical locks that cannot be operated from the landing side and are accessible only to persons on the car.

29 CFR 1926.552(c)(4)

(5) Doors or gates shall protect the full width and height of the car entrance.

29 CFR 1926.552(c)(6)

(6) An overhead protective covering of 2-inch planking, 3/4-inch plywood, or solid material of equivalent strength shall be installed on the top of every personnel hoist.

29 CFR 1926.552(c)(7)

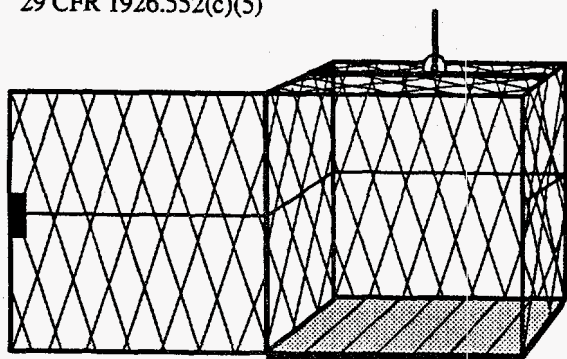
(7) The capacity of the car and other relevant data shall be posted on a secured plate located in a conspicuous place on the car or crosshead.

29 CFR 1926.552(c)(10)



(8) Cars shall be permanently enclosed on the top and all sides except for those sides equipped with car gates or entry doors.

29 CFR 1926.552(c)(5)



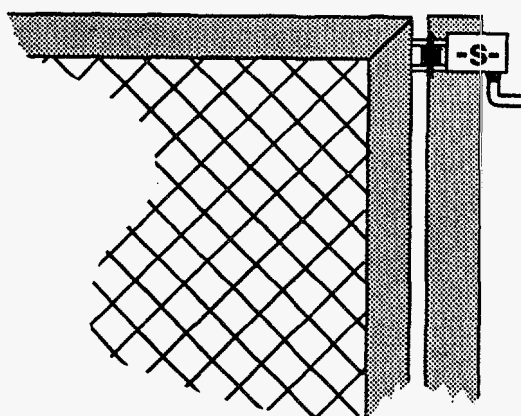
Car with All Sides Enclosed

(9) Safeties (brakes) shall be capable of stopping and holding the car and its rated load when the car is traveling at governor-tripping speed.

29 CFR 1926.552(c)(9)

(10) Doors or gates on personnel hoists shall have electric contacts that do not allow movement of the hoist when the door or gate is open.

29 CFR 1926.552(c)(8)



Gate Cut-Out Switch

(11) All aspects of safety devices, including how they function, shall be inspected and tested under the supervision of a competent person between the time personnel hoists are erected and assembled and the time they are put into service. A similar inspection and test shall be required after major alteration of an existing installation. All hoists shall be inspected and tested at least every 3 months. Records, including the dates and results of inspections and signature of the inspector, shall be prepared and the most recent certification record shall be kept on file.

29 CFR 1926.552(c)(15)

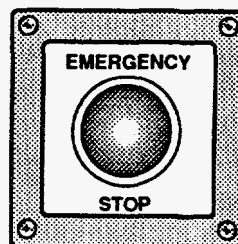


(12) Internal combustion engines shall not be permitted for direct drive for personnel hoists.

29 CFR 1926.552(c)(11)

(13) An emergency stop switch marked "STOP" shall be provided in a conspicuous location in the car.

29 CFR 1926.552(c)(13)

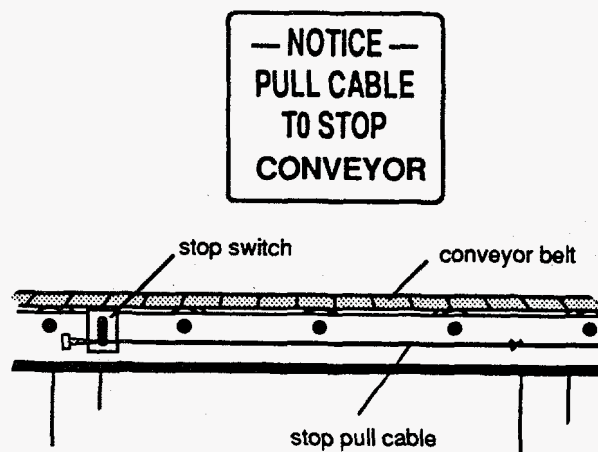


Emergency-Stop Switch

## 11. Conveyors

a. The operator's station shall be equipped with a means for stopping the motor or engine.

29 CFR 1926.555(a)(1)

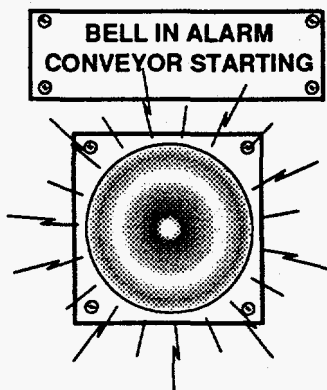


Remote Stop Method



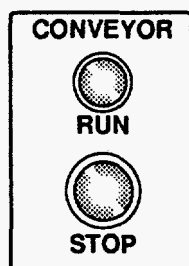
- b. Conveyor systems shall be equipped with an audible warning signal that sounds immediately before the conveyor is started.

29 CFR 1926.555(a)(1)



- c. If the operator's station is at a remote point, provisions for stopping the motor or engine shall be provided at the motor or engine location.

29 CFR 1926.555(a)(2)



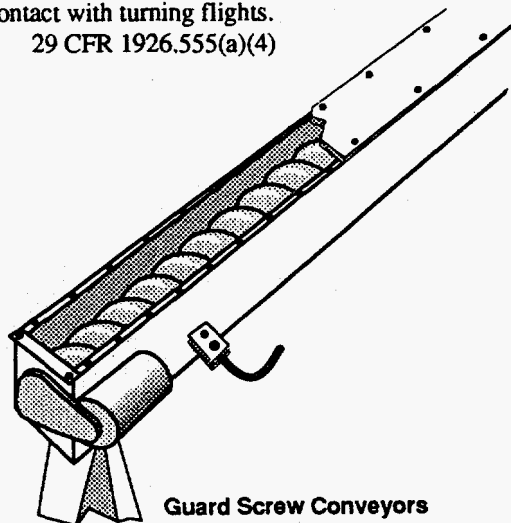
Conveyor Motor Control

- d. Emergency stop switches shall be arranged so that the conveyor cannot be restarted until the actuating stop switch has been reset to the running or "ON" position.

29 CFR 1926.555(a)(3)

- e. Screw conveyors shall be guarded to prevent worker contact with turning flights.

29 CFR 1926.555(a)(4)



Guard Screw Conveyors

- f. When conveyors pass over work areas, aisles, or thoroughfares, suitable guards such as catch nets or side panels shall be provided to protect workers below.

29 CFR 1926.555(a)(5)

- g. All crossovers, aisles, and passageways shall be conspicuously marked with suitable "WARNING" and "DANGER" signs.

29 CFR 1926.555(a)(6)



Danger and Warning Signs

- h. Conveyors shall be locked out or otherwise rendered inoperable and tagged "DO NOT OPERATE" when operation of a conveyor may be hazardous to workers performing maintenance work or repairs.

29 CFR 1926.555(a)(7)

- i. Conveyor equipment shall be used to carry only specific materials that are within the rated capacity and the rated speed of the conveyor.

ANSI/ASME B20.1b.5.1

- j. Maintenance work such as lubrication and adjustment of the conveyor shall be performed by trained, qualified workers.

ANSI/ASME B20.1b.5.2a



- k. Maintenance shall not be performed when a conveyor is in operation unless

- lubrication points are easily accessible and it is safe to lubricate them and
- workers have been trained in how to deal with hazards of a moving conveyor.

ANSI/ASME B20.1b.5.2c





l. When lubricants or process liquids drip on the floor of a conveyor and constitute a hazard, drip pans or other means of eliminating the hazard shall be provided.

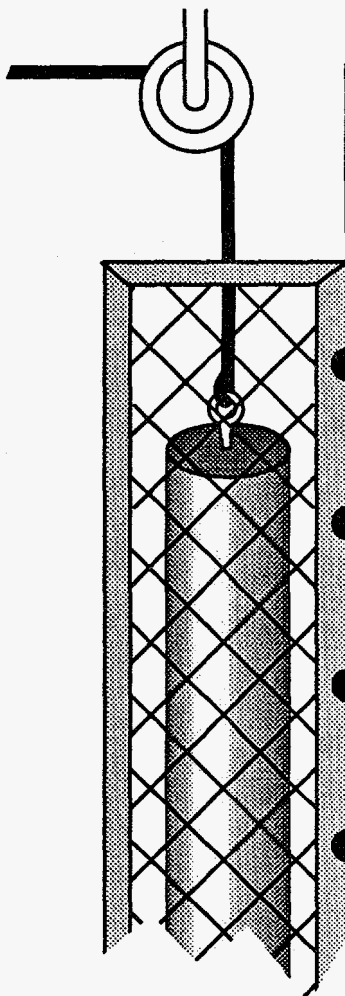
ANSI/ASME B20.1b.5.3b

m. Anti-runaway, brake, or backstop devices shall be provided on all incline, decline, or vertical conveyors if gravity could cause an uncontrolled lowering of the load.

ANSI/ASME B20.1b.5.5

n. Counterweights supported by belts, cables, chains, and similar means shall be confined in an enclosure to prevent workers from passing beneath.

ANSI/ASME B20.1b.5.8



Counterweight Guard

o. All exposed moving machinery parts shall be positioned, or mechanically or electrically guarded, so they are not a hazard to workers.

ANSI/ASME B20.1b.5.9.2

p. Only trained workers shall be permitted to operate a conveyor. Workers shall be trained for normal work conditions and for emergency conditions.

ANSI/ASME B20.1b.5.12.



q. Workers who work at or near conveyors shall not wear jewelry, exposed long hair, loose clothing or sleeves, or other items that could get caught in the conveyor.

## 12. Aerial Lifts

a. Before an aerial-lift truck is moved onto a highway, the ladders shall be secured in the lower traveling position with the locking device on top of the truck cab and the manually operated locking device at the base of the ladder.

29 CFR 1926.556(b)(1)

b. Lift controls on extensible and articulating-boom platforms shall be tested before used to determine if they are in a safe working condition.

29 CFR 1926.556(b)(2)

c. Only authorized persons shall be permitted to operate an aerial lift.

29 CFR 1926.556(b)(2)(ii)

d. Tying off to an adjacent pole, structure, or equipment shall not be permitted by those working from an aerial lift. A safety harness and a lanyard that is attached to the boom or basket shall be worn by all workers on an aerial lift.

29 CFR 1926.556(b)(2)(iii,v)



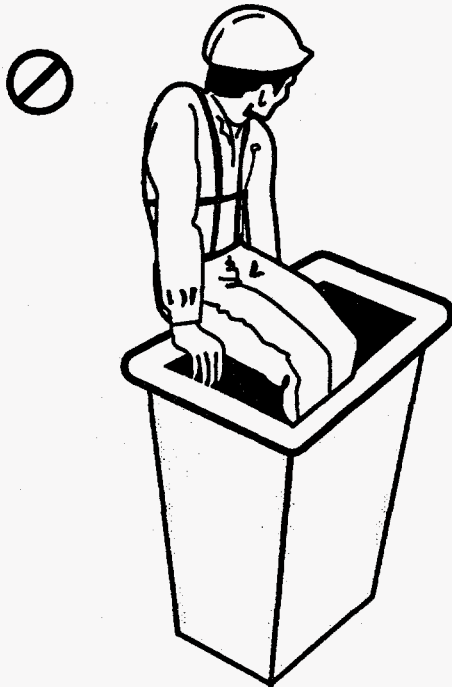
Do not tie off on structures.





e. Workers shall always stand firmly on the floor of the basket. They shall not sit or climb on the edge of the basket or use planks, ladders, or other devices to reach their work positions.

29 CFR 1926.556(b)(2)(iv)



Do not sit or stand on edge.

f. Boom and basket load limits shall not exceed manufacturer's specifications.

29 CFR 1926.556(b)(2)(vi)

g. 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.

29 CFR 1926.556(b)(2)(vii)

h. An aerial-lift truck with workers in the basket shall not be moved when the boom is elevated in a working position unless the equipment is specifically designed to be moved during this type of operation.

29 CFR 1926.556(b)(2)(viii)

i. Workers shall not wear climbers when working from an aerial lift.

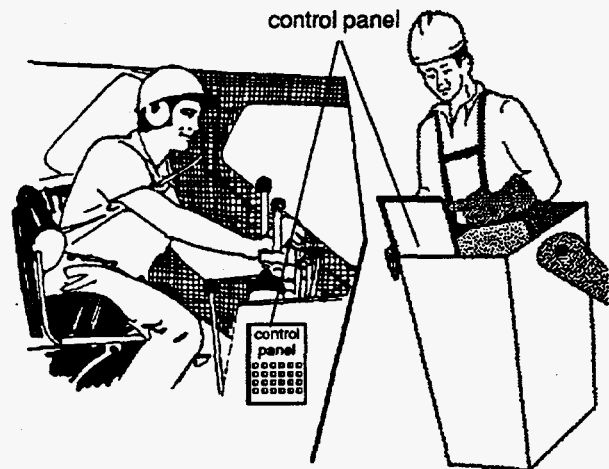
29 CFR 1926.556(b)(2)(x)

j. Before an aerial lift is moved, the boom shall be inspected to ensure that it is properly cradled and that outriggers are in a stowed position.

29 CFR 1926.556(b)(2)(xii)

k. Aerial devices designed primarily as personnel carriers shall have both upper and lower controls. Upper controls shall be in or beside the platform, readily accessible to the operator, and be protected from damage and inadvertent actuation. Lower controls shall be easily accessible and shall be capable of overriding the upper controls but shall not be used except in the event of an emergency or with the consent of the worker in the bucket.

29 CFR 1926.556(b)(2)(ix); ANSI A92.2.4.3.1



Upper and Lower Controls

l. Mechanical ladders, which are counterbalanced for ease of raising to and lowering from an operating position, shall be equipped with a locking device to secure the ladder in the lower travel position.

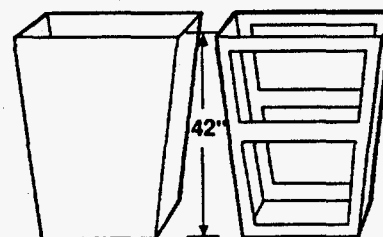
ANSI A92.2.4.5.3

m. Hydraulically operated aerial lifts shall be equipped so that if a hydraulic line fails, the lift will not fly free. Electrically operated aerial devices shall be designed so that free and unrestricted motion is prevented if the power fails.

ANSI A92.2.4.8

n. Buckets or baskets shall have 42 inch walls or handrail with midrail and toeboard or equivalent protection.

ANSI A92.2.4.9



Closed and Open Baskets



- o. Steps on all platforms shall have nonskid surfaces.

ANSI A92.2.4.9

- p. Platforms with folding-type floors and steps or rungs may be used without rails and kick plates if a method is provided to allow workers equipped with a body belt and safety strap or lanyard to attach themselves to the platform or boom.

ANSI A92.2.4.9.2

- q. Markings shall be determined by either the manufacturer, or both the manufacturer and user, to indicate hazards inherent in the operation of an aerial device and hazards for which the aerial device does not provide protection.

ANSI A92.2.4.10.6

- r. Before initial use, all new or modified mobile units shall be inspected and tested to comply with all applicable requirements.

ANSI A92.2.6.3.1.1

- s. A check list of items to be inspected shall be provided to the operator or other authorized person for use in making frequent inspections.

- When safety hazards are found, they shall be reported in writing to a person responsible for the corrective action, and that report and a record of the correction shall be maintained.
- Written reports of periodic inspections and tests shall be dated, signed, and filed on the construction site.
- Records shall be readily available.

ANSI A92.2.6.3.1.4

- t. No modifications or additions that affect the mechanical, hydraulic, or electrical integrity or the safe operation of the aerial device shall be made without the written approval of the manufacturer or an equivalent entity.

ANSI A92.2.6.3.3

- u. The employer shall select and authorize only those persons qualified by training or experience, or both, to operate the aerial lift.

ANSI A92.2.7.1



- v. Each operator shall be instructed in the safe and proper operation of the aerial device according to the manufacturer's operator's manual, the employer's work instructions, and the appropriate standards.

ANSI A92.2.7.2



*We wish to acknowledge the Construction Safety Association of Ontario, Canada, for the use of their illustrations from the "Crane Handbook."*



## DEFINITIONS

**Aerial Ladder** — An aerial device consisting of a single- or multiple-section ladder with a platform at the top.

**Articulating-Boom Aerial Device** — An aerial device with two or more hinged boom sections.

**Base** — The hoist's mounting flange or feet. It is used to attach the hoist to its supporting structure or foundation.

**Boom Angle** — The angle above or below the horizontal on the longitudinal axis of the base boom section of a hoist.

**Boom-Angle Indicator** — An accessory that indicates the angle of a hoist's boom base section relative to the horizontal plane.

**Certified Welder** — A welder who has met the certification requirements set forth by the American Welding Society (AWS).

### Crane Types —

- Crawler Crane** — A rotating superstructure powered by an internal combustion engine, having operating machinery and a boom mounted on a base and equipped with crawler treads for travel. Its function is to hoist, lower, and swing loads at various radii.
- Gantry Crane** — Similar to an overhead crane. A gantry crane includes a bridge for carrying the trolley(s), and it is rigidly supported on two or more legs running on fixed rails or other runway.
- Overhead Crane** — A crane with a moveable bridge carrying a moveable or fixed hoisting mechanism and traveling on an overhead fixed runway structure.
- Truck Crane** — A rotating superstructure powered by an internal combustion engine, having operating machinery and a boom on an independently powered truck. Its function is to hoist, lower, and swing loads at various radii. Variations include a single engine in the truck, which also serves as the power source for the superstructure, or a single engine in the superstructure, which also serves as the power source for the truck.

**Derrick** — A mast or equivalent member held by guys or braces, with or without a boom, for use with a hoisting mechanism and operating ropes.

**Drum** — A cylinder on a crane or hoist around which rope is wound for lifting or lowering the load or boom or for swinging the boom supporting structure.

**Extensible-Boom Aerial Device** — An aerial device with a telescopic or extensible boom.

**Eye or Eye Splice** — A loop with or without a thimble formed in the end of a wire rope.

**Latch-Type Hook** — A hook incorporating a device that bridges the hook opening and that requires manual movement to release the load from the hook.

**Jib** — An extension attached to the boom point to provide added boom length for lifting specified loads. The jib may be in line with the boom or offset to various angles.

**Lay** — The lengthwise distance on a wire rope in which a strand makes one complete turn around the rope.



**Maximum Intended Load** — The total load of all workers, tools, materials, and other loads reasonably anticipated to be applied to a platform or personnel platform component or hoist at any one time.

**Nonrotating Rope** — Wire rope (18 by 7 strands) consisting of a left-lang-lay, inner core covered by an outer core of seven strands of right-regular-lay.

**Outrigger** — Extendable or fixed metal arm that is attached to the two sides of the mounting base of a crane and on supports at the outer ends of the crane.

**Qualified Person** — A person who by possession of a recognized degree, certificate, or professional standing or who by extensive knowledge, training, and experience has successfully demonstrated an ability to solve problems relating to the subject matter or work.

**Qualified Welder** — A welder who meets the qualifications necessary to adequately perform safe welding operations. The welder may or may not be certified.

**Reeving** — A rope system in which the rope travels around drums and sheaves.

**Tag Line** — A rope used to guide and prevent rotating and swinging of a load.

**Trolley** — The unit that travels on the bridge rails and carries the hoisting mechanism.

**Two-Blocking** — A situation in which the lower load block comes in contact with the upper load block or boom point.

**KEY ITEMS CHECK LIST**  
**SECTION H. CRANES, HOISTS, AND CONVEYORS**

Item	Paragraph	Notes
1. GENERAL REQUIREMENTS	H.1	
a. <i>Design, Construction, Inspection, and Testing</i>	H.1.a	
Are all cranes and hoists designed, constructed, erected, inspected, tested, and operated according to the manufacturers' instructions?	H.1.a (1)	
Are the required tests and inspections conducted and documented?	H.1.a (2)	
Are the inspection, testing, and operation done by qualified persons?	H.1.a (5) H.1.a (6)	
b. <i>Adjustments, Maintenance, and Repair</i>	H.1.b	
Is a prescribed maintenance program followed and recorded?	H.1.b (1)	
Are all defects that are found in inspections repaired?	H.1.b (5)	
Are repairs made only by a designated person?	H.1.b (5)	
Do the replacement parts meet the manufacturers' specifications?	H.1.b (2)	
Are repairs done in safe locations, and are stops applied, the power turned off, and lockout/tagout procedures followed?	H.1.b (3)	
Are the required adjustments made to functional parts and critical mechanisms?	H.1.b (6)	
Is the equipment stopped before the required lubrication?	H.1.b (7)	
c. <i>Wire Rope Inspection and Maintenance</i>	H.1.c	
Are daily visual inspections done?	H.1.c (1)	
Are periodic inspections performed?	H.1.c (2) H.1.c (3)	
Are the replacements correct?	H.1.c (4)	
Are the ropes stored correctly?	H.1.c (5)	
Are the ropes lubricated?	H.1.c (6)	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
Are the ropes correctly attached to the drum and, when they are fully extended, are they left with two wraps on the drum?	H.1.c (7)	
Is the use of fiber core rope restricted?	H.1.c (8)	
	H.1.c (11)	
Are the eye splices and wire rope clips used correctly?	H.1.c (9)	
	H.1.c (10)	
<i>d. Operator Qualification and Practices (Cab-, Station-, or Pulpit-Operated)</i>	<i>H.1.d</i>	
Are the operators tested and qualified to operate the specific equipment?	H.1.d (1)	
	H.1.d (2)	
	H.1.d (3)	
Are the operators physically qualified?	H.1.d (3)	
Do the operators respond to stop signals from anyone and to other signals from only one person?	H.1.d (5)	
Are the cranes started only in "NEUTRAL" or "OFF" positions?	H.1.d (6)	
Is the correct procedure followed for a power failure?	H.1.d (7)	
Are the correct procedures for shutdown followed?	H.1.d (8)	
Are the load limits known and observed?	H.1.d (9)	
Is load swing avoided?	H.1.d (10)	
Are only slings, and never the hoisting line, used around loads?	H.1.d (11)	
Is the operator trained never to operate the crane over workers or when workers are on the hook?	H.1.d (12)	
	H.1.d (13)	
Does the operator remain at the controls when loads are suspended or per approved exception?	H.1.d (14)	
Are signals used?	H.1.d (15)	
<i>e. Operator Qualification (Floor and Remote)</i>	<i>H.1.e</i>	
Are the operators tested and qualified to operate the specific equipment?	H.1.e (1)	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
<p><i>f. Other Equipment, Conditions, and Operations</i>  Are the warning signals and alarms known, posted, and observed; are standard crane operational signals used?</p>	<p><i>H.1.f</i>  H.1.f (1)  H.1.f (2)  H.1.f (3)</p>	
<p>Are the gears, shafts, sprockets, chains, and other hazardous parts covered or guarded?</p>	<p>H.1.f (4)</p>	
<p>Are the load hoisting brakes installed and capable of holding the required rated load?</p>	<p>H.1.f (5)</p>	
<p>Are the hooks and blocks swiveled, fitted with a latch, and marked with load capacity?</p>	<p>H.1.f (6)  H.1.f (7)</p>	
<p>Are the sheave grooves smooth?</p>	<p>H.1.f (8)</p>	
<p>Is a proper fire extinguisher handy to the operator?</p>	<p>H.1.f (9)</p>	
<p>Is the swing radius barricaded to exclude workers?</p>	<p>H.1.f (10)</p>	
<p>Is worker contact with hot exhaust pipes prevented?</p>	<p>H.1.f (11)</p>	
<p>Are the fuel tanks safely and correctly located?</p>	<p>H.1.f (12)</p>	
<p>Are refueling precautions observed?</p>	<p>H.1.f (13)</p>	
<p><i>g. Walking, Climbing, and Working Surfaces</i>  Are the walkways sturdy, and do they have standard guardrails and slip-resistant surfaces?</p>	<p><i>H.1.g</i>  H.1.g (1)</p>	
<p>Are the ladders or steps properly designed?</p>	<p>H.1.g (2)</p>	
<p><i>h. Controls and Controllers</i>  Are the controls easy to reach and clearly marked, and will they stay in neutral?</p>	<p><i>H.1.h</i>  H.1.h (2)</p>	
<p><i>i. Electrically Powered Cranes</i>  Can the power source be locked out?</p>	<p><i>H.1.i</i>  H.1.i (2)</p>	
<p>Is worker contact with exposed live parts prevented?</p>	<p>H.1.i (3)</p>	
<p>Is there a means of disconnect both in the cab and at a remote location?</p>	<p>H.1.i (4)</p>	
<p>Do the brakes set when there is a power failure?</p>	<p>H.1.i (5)</p>	
<p><i>j. Work Near Electric Power Lines</i>  Are line clearances maintained?</p>	<p><i>H.1.j</i>  H.1.j (1)</p>	

## KEY ITEMS CHECK LIST (continued)

	Item	Paragraph	Notes
2.	MOBILE AND LOCOMOTIVE CRANES	H.2	
	Do the jibs have a stop to prevent a rise of over 5 degrees above "straight"?	H.2.a	
	Are boom stops provided?	H.2.b	
	Are jibs restrained?	H.2.c	
	Is the boom angle indicator readable by the operator?	H.2.d	
	Is there an automatic stop for the boom hoist?	H.2.e	
	Can the operator of a telescoping boom see a boom-length indicator?	H.2.f	
	Can the operator see a boom-level indicator?	H.2.g	
	Are the outriggers held retracted during travel?	H.2.h	
	Is the crane on firm surface, level within 1% grade, and are timbers and other structural members used to ensure stable outrigger footing?	H.2.i	
	Are the booms supported to prevent rotation during travel?	H.2.j	
	Are the travel brakes adequate to hold during working cycles?	H.2.k	
	Do the telescoping boom cranes have an anti-two-blocking device or equivalent protection?	H.2.l	
3.	HAMMERHEAD TOWER CRANES	H.3	
	Does a qualified person supervise the erection and are manufacturers' recommendations followed?	H.3.a	
	Are the required limit switches installed?	H.3.c	
	Does the hoisting unit have adequate self-setting brakes?	H.3.d	
	Does the trolley brake set if the trolley rope breaks?	H.3.e	
	Is a wind indicator with a visible and audible alarm provided?	H.3.f	



## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
4. OVERHEAD AND GANTRY CRANES	H.4	
Are the required building clearances and other crane clearances maintained?	H.4.a	
Are the load ratings marked on the crane sides and on the load blocks?	H.4.b	
Are remotely operated rail clamps, or other fasteners provided for the outdoor gantry cranes?	H.4.c H.4.d	
Does the hoisting unit have adequate self-setting brakes?	H.4.f	
Are the required limit switches installed and tested before each shift?	H.4.e	
Do trolleys and bridges have stop bumpers?	H.4.g	
5. PORTAL, TOWER, AND PILLAR CRANES	H.5	
Does a qualified and experienced person supervise the erection according to instructions and manufacturers' recommendations?	H.5.a	
Are rail stops (buffers) and rail sweeps installed?	H.5.b	
Are boom-hoist brakes installed, and are they capable of holding 125% of the maximum load?	H.5.c	
Does the boom-hoist drum have a positive locking device?	H.5.d	
Are load-hoist brakes installed, and are they capable of holding 125% of the maximum load?	H.5.e	
Is there an adequate boom hoist drum lock?	H.5.f	
Is there an adequate brake to keep the superstructure from rotating?	H.5.g	
Are limit devices provided for the boom and load hoists?	H.5.h	
Is a wind indicator provided with an alarm that is both visible and audible?	H.5.i	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
6. BASE-MOUNTED DRUM HOISTS	H.6	
Are the loads within the manufacturer's rating?	H.6.a	
Is the hoist marked with the load rating, drum size, rope size, rope speed, and power supply?	H.6.b	
Is there an adequate drum lock?	H.6.e H.6.g	
Are load-hoist brakes installed, and are they capable of holding 125% of the maximum load?	H.6.f H.6.i	
Does the brake keep the hoist from swinging?	H.6.h	
7. BARGE-MOUNTED CRANES	H.7	
Are the mobile cranes positively secured when they are on a barge?	H.7.a	
Is the barge load limit accounted for?	H.7.b H.7.c	
8. DERRICKS	H.8	
Are inspection, maintenance, and operation in accordance with the current guidelines?	H.8.a H.8.c	
Are load charts provided and maintained or posted?	H.8.b	
Does the operator remain at his/her station?	H.8.d	
Is there an adequate drum lock?	H.8.e	
Are the booms secured when they are not in use?	H.8.e	
9. CRANE- OR DERRICK-SUSPENDED PERSONNEL PLATFORMS	H.9	
a. <i>Hoisting a Personnel Platform</i>	H.9.a	
Is the use of cranes or derricks to hoist personnel discouraged?	H.9.a (1)	
Are the personnel platforms hoisted slowly and cautiously?	H.9.a (2)	
Are the hoisting lines rated at 7 times the personnel load?	H.9.a (2)	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
Do the brakes, dogs, and locking devices engage when the platform load is stationary?	H.9.a (3)	
Is the crane level with the outriggers extended?	H.9.a (4)	
Is the total weight of a loaded personnel platform not more than 50% of the rated capacity for the crane or derrick?	H.9.a (5)	
Is the use of machines that have only boom brakes prohibited for lifting personnel?	H.9.a (6)	
Can the operator see the boom-angle indicators?	H.9.a (7)	
Can the operator see a boom-length indicator for telescoping booms?	H.9.a (8)	
Is an anti-two-blocking device installed?	H.9.a (9)	
<i>b. Design and Use of Personnel Platforms</i>	<i>H.9.b</i>	
Are the platforms correctly designed?	H.9.b (2)	
	H.9.b (3)	
Is a standard guardrail installed with steel mesh between the toe board and mid-rail?	H.9.b (1)	
Are grab rails installed?	H.9.b (5)	
Are the gates properly latched?	H.9.b (6)	
Are space to stand erect and overhead protection provided?	H.9.b (7)	
	H.9.b (8)	
Did a qualified welder do the welding on the platforms?	H.9.b (9)	
Are the platforms used only by essential workers and their tools?	H.9.b (10)	
	H.9.b (11)	
Are the load limits posted?	H.9.b (12)	
Are the tools and materials secured?	H.9.b (13)	
Where wire ropes are used, does a shackle or a master link balance the platform?	H.9.b (14)	
Are the hooks and shackles locked and bolted?	H.9.b (15)	
Is the bridle rigging used only for personnel?	H.9.b (16)	
<i>c. Trial Lifts</i>	<i>H.9.c</i>	
Do the operator, signal person, and the persons to be lifted hold a prelift meeting?	H.9.c (1)	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
Are trial lifts made with a weight equal to that of the people to be lifted?	H.9.c (2) H.9.c (3)	
Is there a final inspection to ensure proper balance security, correct rigging, and rated capacity?	H.9.c (4) H.9.c (5) H.5.c (6) H.9.c (7)	
<i>d. Hoisting Workers</i>	<i>H.9.d</i>	
Are all lifts and platforms inspected and are defects corrected?	H.9.d (1)	
If the structure is stable, are the work platforms secured to it before work is started?	H.9.d (3)	
Is the operator instructed to stay at the controls as long as the platform is occupied?	H.9.d (5)	
Is work involving personnel on platforms stopped in dangerous weather?	H.9.d (6)	
Do the workers and the operator or signal person remain in sight and communicate directly?	H.9.d (7)	
Does each worker wear a safety harness with a lanyard attached to the load block or overhaul ball?	H.9.d (8)	
Are the correct procedures followed when a crane travels?	H.9.d (10)	
<b>10. MATERIAL AND PERSONNEL HOISTS</b>	<b>H.10</b>	
<i>a. General Requirements</i>	<i>H.10.a</i>	
Are energized booms prohibited?	H.10.a (2)	
Are endless belt-type lifts prohibited for hoisting personnel?	H.10.a (3)	
<i>b. Material Hoists</i>	<i>H.10.b</i>	
Are the hoist rules posted at the operator's station?	H.10.b (1)	
Is a "NO RIDERS" sign posted?	H.10.b (2)	
Does the entrance to the hoist have a standard guardrail?	H.10.b (5)	
Are the material-hoist towers designed by a licensed professional engineer?	H.10.b (8)	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
c. <i>Personnel Hoists</i>	<i>H.10.c</i>	
Is an outside tower enclosed for the full height?	H.10.c (1)	
Is an inside lift enclosed for the full height?	H.10.c (2)	
Are towers anchored or guyed?	H.10.c (3)	
Are the hoist gate latches inaccessible from the landing?	H.10.c (4)	
Do the doors protect the full height and width of the car opening?	H.10.c (5)	
Is overhead protection provided?	H.10.c (6)	
Is the capacity posted?	H.10.c (7)	
Is the car enclosed on all sides?	H.10.c (8)	
Can the safety brake stop the loaded car?	H.10.c (9)	
Are the doors or gates equipped with a switch that prevents operation of the hoist if they are open?	H.10.c (10)	
Are the hoists fully inspected and are records kept?	H.10.c (11)	
Are internal combustion engines prohibited for use in driving the hoists?	H.10.c (12)	
Does the car have an effective emergency stop switch; is the stop switch clearly marked?	H.10.c (13)	
11. CONVEYORS	H.11	
Are the conveyor operators trained?	H.11.p	
Is there a motor-stop control at the operator's station or along the conveyor if the station is at a remote point?	H.11.a H.11.c	
Does an audible alarm sound just before operation?	H.11.b	
Do the stop switches require resetting?	H.11.c H.11.d	
Are the screw-type conveyors covered or guarded?	H.11.e	

## KEY ITEMS CHECK LIST (continued)

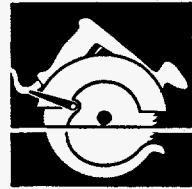
Item	Paragraph	Notes
Are guards provided where conveyors pass over aisles or work areas?	H.11.f	
Are the required warning signs posted?	H.11.g	
Are the lockout procedures followed for maintenance?	H.11.h	
Are materials moved within the rated speed and capacity of the conveyor?	H.11.i	
Are the maintenance personnel trained to deal with the specific hazards?	H.11.j H.11.k	
Are backstop or anti-runaway devices installed?	H.11.m	
Are the counterweights enclosed?	H.11.n	
Are the requirements met for machine guards?	H.11.o	
12. AERIAL LIFTS	H.12	
Are only authorized and properly instructed employees permitted to use the lifts?	H.12.c H.12.u	
Are the ladders or booms secured before they travel onto a highway?	H.12.a	
Are the lift controls tested each day?	H.12.b	
Are the harnesses and lanyards tied to the boom and never to a structure?	H.12.d H.12.p	
Does the bucket or platform give fall protection equivalent to that of a standard guardrail?	H.12.n	
Are the workers instructed to always stand on the floor?	H.12.e	
Do platform (bucket or basket) floors have nonskid surfaces?	H.12.o	
Are the boom and basket load limits known and not exceeded?	H.12.f	
Are the outriggers extended to solid footing, and are the brakes set and the wheels chocked?	H.12.g	
Are the aerial lifts prohibited from moving with workers in the basket?	H.12.h	

# KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
Are climbers removed for work in the basket?	H.12.i	
Are the outriggers stowed and is the boom cradled before the lift is moved?	H.12.j	
Are both the lower and upper controls correctly installed?	H.12.k	
Are the mechanical ladders equipped with a lower-position locking device?	H.12.l	
Are the lifts designed not to fall or fly free if the electrical or hydraulic power fails?	H.12.m	
Is a written, comprehensive check list used to inspect lifts, and are the results reported and retained?	H.12.s	
Are unauthorized modifications prohibited and identified by inspection?	H.12.r H.12.s H.12.t	



## Section I. Hand and Power Tools



### 1. General Requirements

a. All contractor and/or personal hand and power tools shall be in a safe condition.

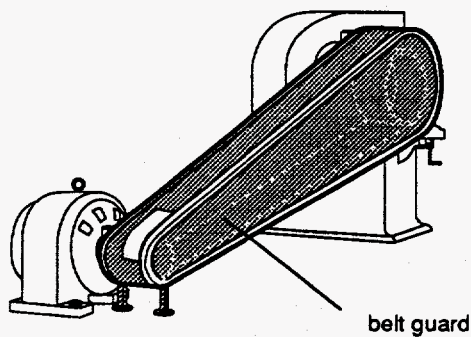
29 Code of Federal Regulations (CFR) 1926.300(a)

b. When power-operated tools are designed to accommodate guards, the guards shall be in place as intended and shall not be removed when the tool is in use.

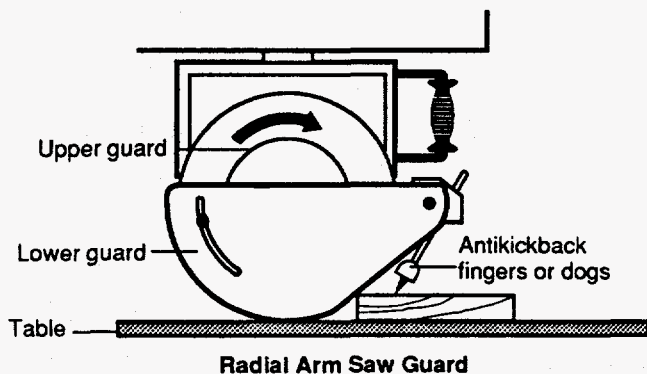
29 CFR 1926.300(b)(1)

c. Moving parts of equipment (for example, belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or moving parts) to which workers may be exposed shall have guards and shall meet requirements of ANSI B15.1.

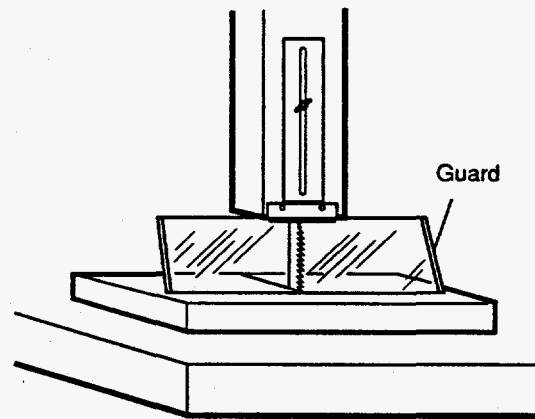
29 CFR 1926.300(b)(2)



Drive Train Guard



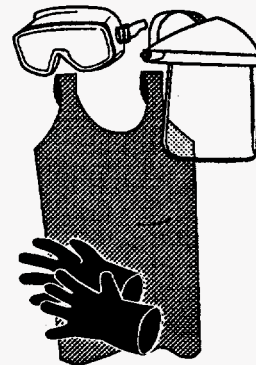
Radial Arm Saw Guard



Band Saw Point of Operation Saw

d. Workers who are exposed to falling, flying, abrasive, or splashing objects or dust, fumes, mist, vapors, or gases when using hand and power tools shall be provided with the appropriate personal protective equipment (PPE). See Section III.A.2 for PPE.

29 CFR 1926.300(c)



Use Personal Protective Equipment (PPE)





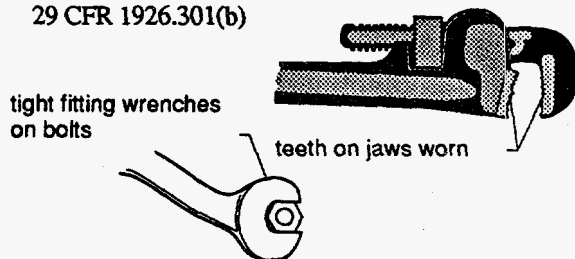
## 2. Hand Tools

- a. Workers shall not be issued nor permitted to use unsafe hand tools.

29 CFR 1926.301(a)

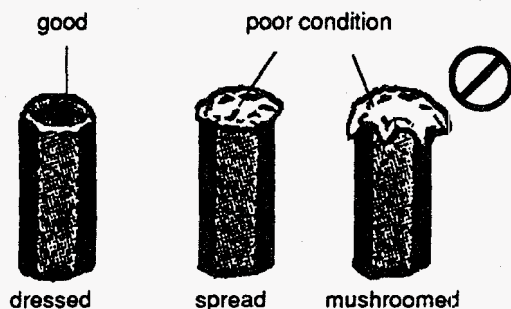
- b. Wrenches, including adjustable pipe, end and socket wrenches, shall be repaired or removed from the construction site when jaws are sprung or worn to the point that slippage occurs.

29 CFR 1926.301(b)



- c. Mushroomed heads on impact tools (for example, drift pins, wedges, or chisels) shall be repaired or removed from the construction site.

29 CFR 1926.301(c)



- d. Wooden tool handles shall be free of splinters and cracks and be tight in the tool.

29 CFR 1926.301(d)

## 3. Power-Operated Hand Tools (Electric, Pneumatic, or Gasoline)

- a. Electric hand tools shall be double-insulated (approved and labeled) or properly grounded (connected to a grounding pin on the plug) and protected by a ground-fault circuit interrupter (GFCI) or assured grounding program.

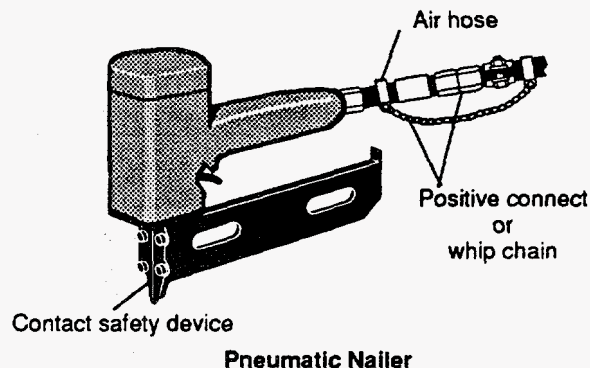
29 CFR 1926.302(a)(1); .404(b)(1)(i)

- b. Compressed air shall not be used for cleaning unless the pressure is reduced to less than 30 pounds per square inch (psi) and chip guards and PPE (goggles or safety glasses with side shields) are used. Compressed air shall not be used for personal cleaning.

29 CFR 1926.302(b)(4)

- c. All pneumatic hand tools (for example, nailers or staplers) shall be equipped with a safety device on the muzzle to prevent accidental ejection of fasteners and be secured to the hose or whip end with a safety chain or other positive means to prevent accidental disconnect.

29 CFR 1926.302(b)(1)(3)



- d. On pneumatic tools, hoses with an inside diameter greater than 1/2 inch shall have a safety device at the source of supply or branch line to reduce pressure in case of hose failure.

29 CFR 1926.302(b)(7)

- e. Fuel-powered hand tools shall be turned off when they are being refueled or serviced.

29 CFR 1926.302(c)(1)

## 4. Powder-Actuated Tools

- a. To ensure that safety devices are in proper working condition, powder-actuated tools shall be tested or inspected each day before they are loaded. Manufacturer's instructions shall be followed exactly.

29 CFR 1926.302(e)(2)

- b. Only workers who have been trained in the operation of a particular tool shall be allowed to operate that tool.

29 CFR 1926.302(e)(1)



- c. Driving into easily penetrable materials shall be avoided unless the materials are backed so as to prevent the fastener or pin from passing completely through and becoming a flying missile.

29 CFR 1926.302 (e)(8)

- d. Neither loaded nor empty powder-actuated tools shall be pointed at any worker. These tools shall not be loaded until just before use.

29 CFR 1926.302(e)(5)

- e. Fasteners shall not be driven into very hard or brittle materials such as (but not limited to) cast iron, glazed tile, surface-hardened steel, glass block, live rock, face brick, or hollow tile.

29 CFR 1926.302(e)(7)



f. Workers using powder-actuated tools shall be provided with and use appropriate PPE, that is, eye, face, and hearing protection. See Section III.A.2 of this guide for more information on appropriate PPE.

29 CFR 1926.302(e)(4)

g. Any tool that is not in proper working order shall be immediately removed from service and repaired or discarded.

29 CFR 1926.302(e)(3)

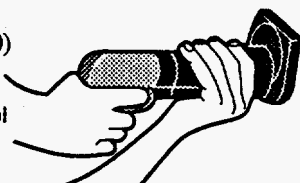
h. All tools shall be used with the correct shield, guard, or attachment specified by the manufacturer.

29 CFR 1926.302(e)(11)

i. Powder-actuated tools shall not be used in explosive or flammable atmospheres.

29 CFR 1926.302(e)(10)

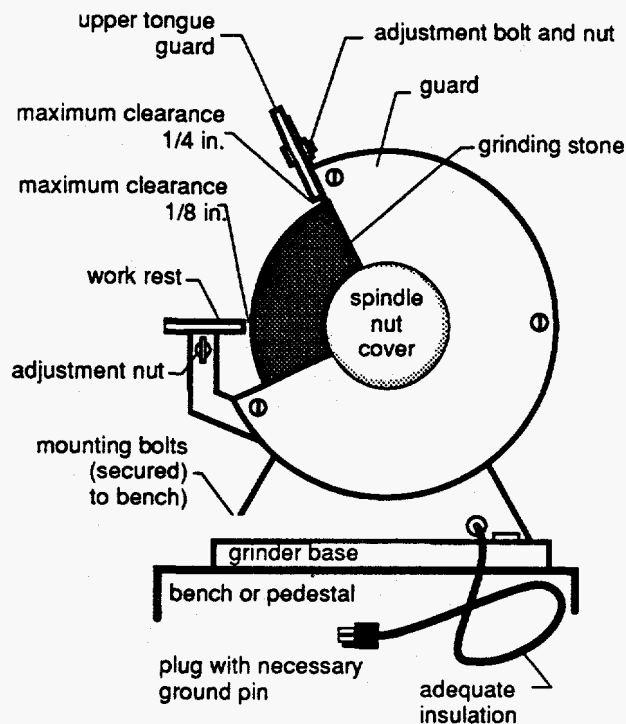
Powder-Actuated Tool



## 5. Abrasive Wheels (Grinders)

a. Grinding machines shall be guarded to conform to American National Institute (ANSI) B 7.1-1970.

29 CFR 1926.303(b)



Abrasive-Wheel Grinder

b. Floor- or bench-mounted abrasive wheels shall be equipped with guards on the spindle, nut, and wheel. Maximum wheel exposure shall be 90°. The guards shall be strong enough to withstand the effects of and contain a bursting wheel.

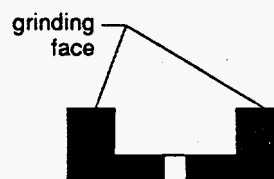
29 CFR 1926.303(c)(2)

c. Floor- or bench-mounted abrasive wheels shall be equipped with work rests that are rigidly supported and easily adjusted. Work rests shall be adjusted to within 1/8 inch of the surface of the abrasive wheel.

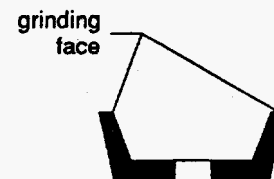
29 CFR 1926.303(c)(2)

d. Cup-type wheels used for external grinding shall be protected by either a revolving cup guard or a band-type guard, per ANSI B7.1-1970. Guards shall be set so that the worker is protected from wheel contact.

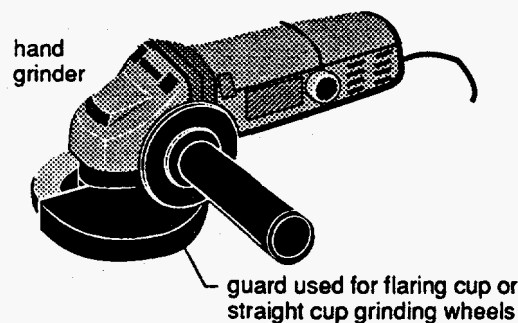
29 CFR 1926.303(c)(3)



straight cup wheel



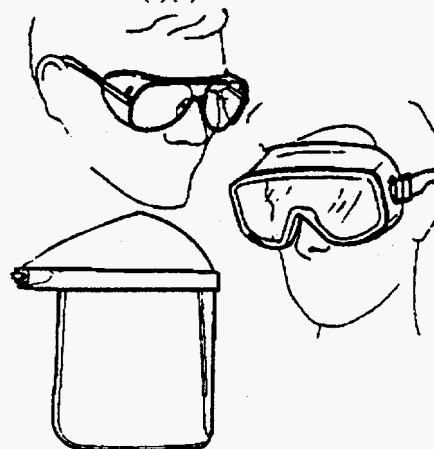
flaring cup wheel



Cup-Type Wheel Grinder

e. All workers using abrasive wheels shall be provided with and use safety-approved eye wear, safety glasses with side shields, goggles, or face shield. See Section III.A.2.b. for more details on eye and face protection.

29 CFR 1926.303(c)(9)





f. Abrasive wheels shall be inspected and ring tested before they are mounted.

29 CFR 1926.303(c)(9)

## 6. Electric Woodworking Tools

### a. General Requirements

(1) Woodworking tools and machinery shall meet the requirements of ANSI 01.1-1961, "Safety Code for Woodworking Machinery."

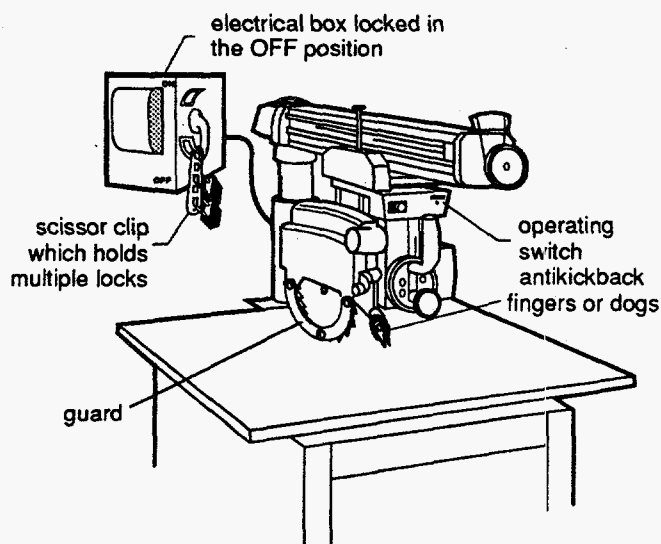
29 CFR 1926.304(f); ANSI 01.1

(2) Workers who are allowed to operate woodworking machines shall be instructed in the machine hazards and safe use of the machine.

29 CFR 1926.304(f); ANSI 01.1

(3) All fixed electric woodworking tools shall be equipped with a disconnect switch that can be locked or tagged in the off position.

29 CFR 1926.304(a)



Disconnect and Tool

(4) A manual restart switch or button shall be installed on all woodworking machines to prevent them from automatically starting when power is restored following a power failure.

29 CFR 1926.304(f)

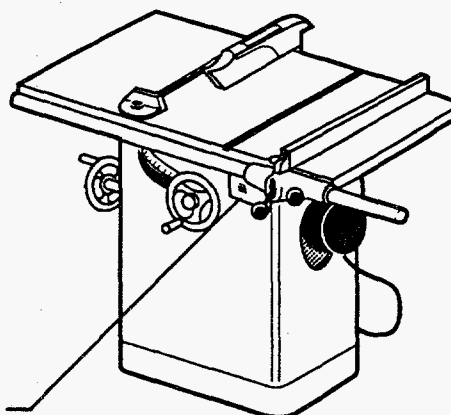
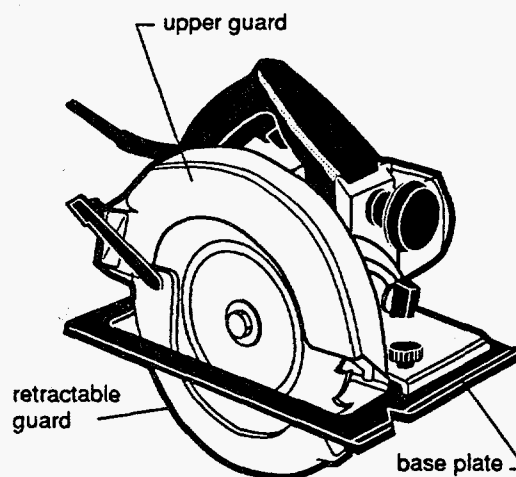


table saw

### b. Portable Circular Saws

(1) Portable, electric circular saws shall be equipped with guards above and below the base plates or shoes.

29 CFR 1926.304(d)

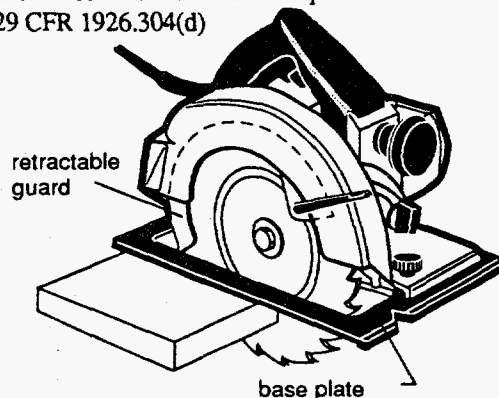


(2) The lower guard on portable, electric circular saws shall automatically and instantly return to the covered position when the saw is withdrawn from the material.

29 CFR 1926.304(d)

(3) The upper and lower guards on portable electric circular saws shall cover the saw to the depth of the teeth.

29 CFR 1926.304(d)



Portable Electric Circular Saw



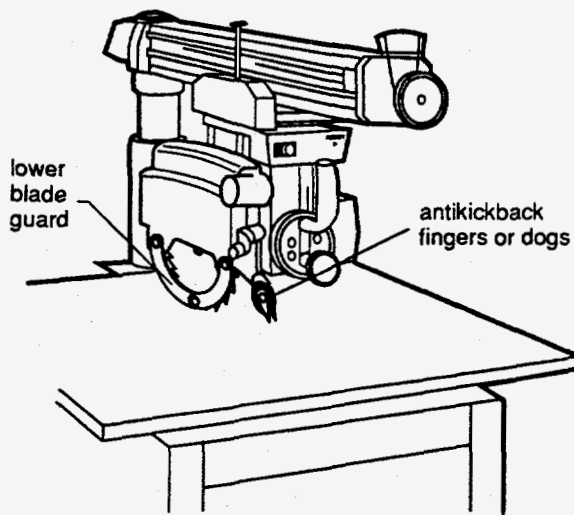
### c. Radial Arm Saws

(1) The sides of the lower exposed portion of radial arm saw blades shall have guards that cover the entire blade.

29 CFR 1926.304(f); ANSI 01.1

(2) Radial arm saws used for ripping shall have antikickback fingers or dogs located on the out-feed side.

29 CFR 1926.304(f); ANSI 01.1



Radial Arm Saw

(3) In repetitive operations, to prevent the blade from traveling beyond the position necessary to complete the cut, radial arm saws shall have adjustable stops.

29 CFR 1926.304(f); ANSI 01.1

(4) Radial arm saws shall be installed so that the cutting head of the blade returns to the starting position when it is released by the operator.

29 CFR 1926.304(f); ANSI 01.1

### d. Hand-Fed Rip Saws (Table Saws)

(1) Circular hand-fed rip saws shall have guards that automatically adjust and completely enclose the portion of the saw that is above the table. The blade shall also be guarded below the table.

29 CFR 1926.304(f); ANSI 01.1

(2) Circular hand-fed rip saws shall have spreaders to prevent the stock from squeezing the saw blade or being thrown back on the operator.

29 CFR 1926.304(f); ANSI 01.1

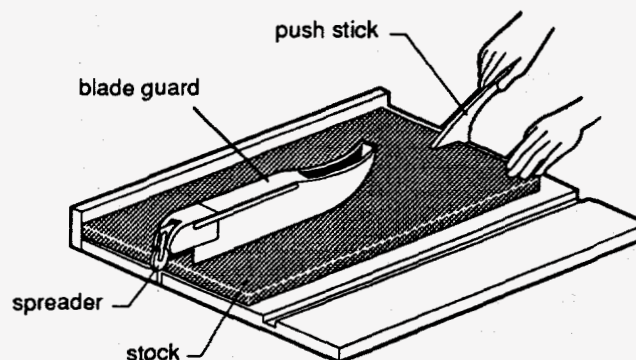


Table Saw

(3) Circular hand-fed rip saws shall have antikickback fingers or dogs located to prevent the blade from throwing stock back at the operator.

29 CFR 1926.304(f); ANSI 01.1

### 7. Jacks

a. The manufacturer's capacity rating shall be marked on each jack and that rating shall not be exceeded.

29 CFR 1926.305(a)(1)

b. The operator shall ensure that jacks have a rating sufficient to lift and sustain the load to be lifted.

29 CFR 1910.244(a)(2)(i); ANSI B30.1

c. All jacks shall have a positive stop to prevent overtravel.

29 CFR 1926.305(a)(2)

d. Hydraulic jacks used in lift-slab construction shall have safety devices that support the load in any position if the jack malfunctions.

29 CFR 1926.305(b)(1)

e. When a firm foundation is required, the base of the jack shall be blocked or cribbed.

29 CFR 1926.305(c)



f. As soon as the load has been raised by the jack, the load shall be cribbed, blocked, or otherwise secured.

29 CFR 1910.244(a)(2)(iii); ANSI B30.1

g. Hydraulic jacks exposed to freezing temperatures shall have an adequate supply of antifreeze added to the jack oil.

29 CFR 1910.244(a)(2)(iv); ANSI B30.1

h. Each jack that is used constantly or intermittently shall be thoroughly inspected every 6 months. Jacks used for

special work or subjected to abnormal loads or shocks shall be inspected before they are used and immediately after use.

29 CFR 1910.244(a)(2)(vi)

i. Jacks that are not functioning properly shall be tagged with "DO NOT USE" signs and not used again until they are repaired.

29 CFR 1910.244(a)(2)(viii); ANSI B30.1



## DEFINITIONS

**Abrasive Wheel (Grinder)** — A circular cutting tool made of bonded organic or inorganic abrasive grains.

**Band Saw** — A saw equipped with a power-driven endless belt or ribbon-type blade that has a cutting edge. There are three basic types of band saws: table, cut-off, and hand portable.

**Cup-Type Abrasive Wheels** — Bowl-shaped abrasive wheels used for grinding on their rim faces.

**Double-Insulated Tools** — Tools designed so that their inner electrical parts are isolated physically and electrically from their outer housing. (Double insulation does not protect against defects in cords, plugs, or outlets.)

**Fuel-Powered Tool** — A tool that is powered by a gasoline-fired internal combustion engine.

**Hand Tool** — A hand-held implement (for example, a hammer, saw, or drill) used to cut, form, drive, twist, or bend materials.

**Hydraulic Tool** — A tool in which force is transmitted by fluid under pressure.

**Mushroomed Head** — The top of a chisel, wedge, or driving pin that is formed, by severe impact, into the shape of a mushroom. This mushroom-shaped part can fly free and strike a worker when being hammered.

**Antikickback Fingers or Dogs** — A device with fingers or dogs located at the operator side of the saw blade that grips the work piece to prevent it from being thrust in the direction of the operator.

**Overtravel** — The blade continues traveling beyond the position necessary to complete the cut.

**Pneumatic Power Tool** — A compressed-air powered tool.

**Portable Circular Saw** — A power-driven circular blade saw that is hand held and operated.

**Powder-Actuated Tool** — A tool, activated by an explosive powder, that moves a piston to drive a nail, pin, or fastener into wood or other materials.

**Radial Arm Saw** — An electric saw that has a circular blade suspended from a transverse head mounted on a rotatable arm. Wood is clamped in position before being cut.

**Safety Guard** — An attachment or covering that protects the operator from contact with a harmful source.

**Table Saw** — A table mounted power-driven circular saw that has the cutting blade mounted beneath the table with the blade cutting edge exposed through the top of the table.

**KEY ITEMS CHECK LIST**  
**SECTION I. HAND AND POWER TOOLS**

Item	Paragraph	Notes
1. GENERAL REQUIREMENTS	I.1	
Are tools in good condition?	I.1.a	
Are guards attached to all tools equipped for them?	I.1.b	
Is PPE available and in use?	I.1.d	
2. HAND TOOLS	I.2	
Are all tools inspected for hazardous defects?	I.2	
3. POWER-OPERATED HAND TOOLS (ELECTRIC, PNEUMATIC, OR GASOLINE)	I.3	
Is a GFCI used?	I.3.a	
Are pneumatic hoses secured?	I.3.c	
Are fuel-powered tools turned off before they are refueled?	I.3.e	
4. POWDER-ACTUATED TOOLS	I.4	
Is the operator trained?	I.4.b	
Are the tools inspected daily?	I.4.a	
No "horse play" or careless use?	I.4.d	
Are powder tools prohibited in explosive atmospheres?	I.4.i	
5. ABRASIVE WHEELS (GRINDERS)	I.5	
Are guards and shields in place and properly adjusted?	I.5.a	
Are wheels checked for cracks?	I.5.f	

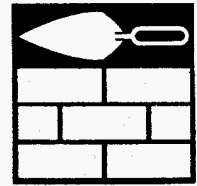
## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
6. ELECTRIC WOODWORKING TOOLS	I.6	
Can the power source be locked out for fixed tools?	I.6.a(3)	
Do fixed electric tools have manual restart switches?	I.6.a(4)	
Portable circular saws' lower blade guard operational?	I.6.b(2)	
Radial arm saws used for ripping have properly installed and adjusted antikickback device?	I.6.c(2)	
Radial arm saws automatically return to starting position when released?	I.6.c(4)	
Hand-fed rip (table saw) equipped with blade guard and spreader?	I.6.d(1)(2)	
7. JACKS	I.7	
Are correct-capacity jacks used?	I.7.a	
	I.7.b	
Are hydraulic jacks protected from freezing?	I.7.g	
Are jacks maintained in safe condition?	I.7.h	
	I.7.i	
Is overtravel prevented?	I.7.c	





## Section J. Concrete and Masonry



### 1. General Requirements

a. A construction load shall not be placed on an uncured concrete structure or portion of a concrete structure, unless it is determined by a person qualified in structural design that the structure can support the load.

29 Code of Federal Regulations (CFR)  
1926.701(a)



b. All projecting reinforcing steel that workers might hit or fall on shall be guarded to prevent accidents.

29 CFR 1926.701(b)

c. During post-tensioning operations, only workers essential to the operations shall be allowed behind the jack. To limit worker access, signs and barriers shall be placed around the tensioning area.

29 CFR 1926.701(c)(1,2)

d. Workers shall not be allowed to ride on concrete buckets. While concrete buckets are being lifted or lowered into position, workers shall not be allowed to work underneath them. An elevated concrete bucket shall be routed so that if it falls, it will not fall on a worker.

29 CFR 1926.701(d),(e)(1,2)

e. Workers shall not apply a cement, sand, and water mixture through a pneumatic hose unless workers are wearing personal protective equipment (PPE) for the head and face.

29 CFR 1926.701(f)(1)

f. Workers shall wear a safety harness or other fall-protection device while they are placing or tying reinforcing steel more than 6 feet above any adjacent work area.

29 CFR 1926.701(f)(2)

### 2. Equipment and Tools

a. Containers, silos, and bulk storage bins shall be equipped with cone-shaped or tapered bottoms with mechanical or pneumatic controls to start the flow of material.

29 CFR 1926.702(a)(1)(i,ii)

b. Workers shall not enter cement storage facilities unless the ejection system has been shut down, locked out, and tagged. Workers who enter the cement storage facility through an opening at the top must comply with confined-space entry requirements in Section III.B.5 of this guide.

29 CFR 1926.702(a)(2)

c. Concrete mixers that have loading skips of one cubic yard or more shall have guardrails on each side of the skips and a mechanical device to clear the skip material.

29 CFR 1926.702(b)(1,2)

d. Powered and rotation-type concrete troweling machines that are manually guided shall be equipped with a control switch that automatically shuts off power whenever the operator's hands are removed from the equipment handles.

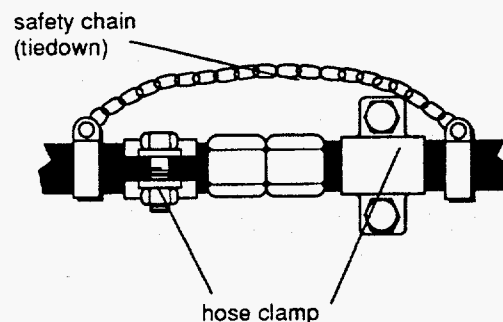
29 CFR 1926.702(c)

e. Concrete pumping systems that use discharge pipes shall have pipe supports designed for 100% overload.

29 CFR 1926.702(e)(1)

f. Compressed-air hoses used on concrete pumping systems shall be provided with positive fail-safe joint connectors to prevent separation when pressurized.

29 CFR 1926.702(e)(2)



High-Pressure Hose Connection



g. To prevent early or accidental dumping, concrete buckets shall have positive safety latches or similar safety devices. Concrete buckets shall also be designed to prevent concrete from hanging up on the top and sides of the bucket.

29 CFR 1926.702(f)(1,2)

h. In addition to regular couplings or connections, sections of tremies and similar devices shall be secured with wire rope or equivalent material.

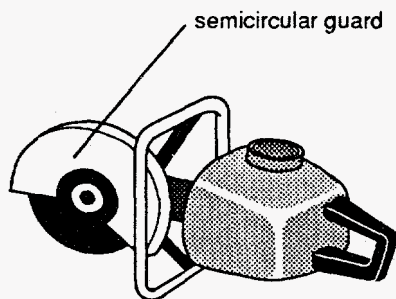
29 CFR 1926.702(g)

i. Bull-float handles used near energized electrical conductors shall be constructed of nonconductive material or insulated with a nonconductive material.

29 CFR 1926.702(h)

j. Masonry saws shall be equipped with a semicircular guard over the blade. The guard shall be capable of retaining fragments in the event of blade failure.

29 CFR 1926.702(i)



Handheld Abrasive Masonry Saw

k. Workers shall not service or repair equipment until all potentially dangerous power sources have been locked out and tagged out.

29 CFR 1926.702(j)

### 3. Cast-in-Place Concrete

a. Formwork shall be designed, made, erected, supported, braced, and maintained so that it can support all reasonably expected loads.

29 CFR 1926.703(a)(1)

b. Drawings or plans, including all revisions for the layout, formwork, shoring equipment, working decks, and scaffolds, shall be available at the construction site.

29 CFR 1926.703(a)(2)

c. All shoring equipment shall be inspected before it is erected to ensure that it meets the requirements in the formwork drawings.

29 CFR 1926.703(b)(1)

d. Damaged shoring equipment shall not be used.

29 CFR 1926.703(b)(2)

e. Shoring equipment shall be inspected immediately before, during, and immediately after concrete placement. Shoring equipment that is found to be damaged or weakened after it is erected shall be reinforced.

29 CFR 1926.703(b)(3,4)

f. Sills used for shoring shall be sound, rigid, and able to carry the maximum intended load.

29 CFR 1926.703(b)(5)

g. All base plates, shore heads, extension devices, and adjustment screws shall be in firm contact with the foundation and the form.

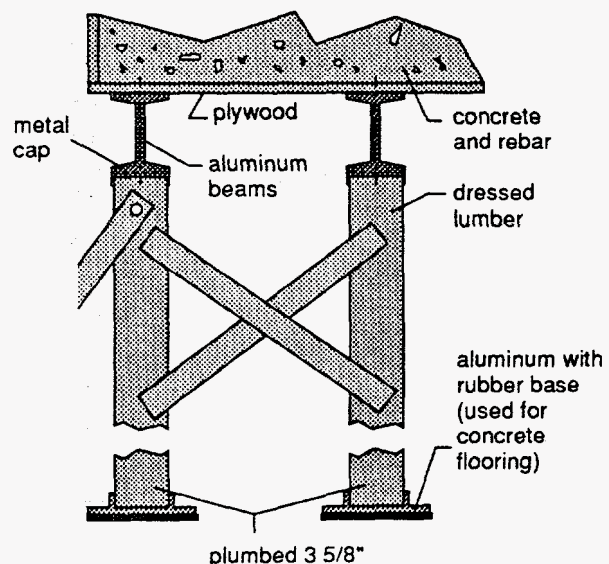
29 CFR 1926.703(b)(6)

h. Off-center loads on shore heads and similar members shall be prohibited unless these members have been designed for such loads.

29 CFR 1926.703(b)(7)

i. When single-post shores are built one on top of another, the shoring shall be prepared by a qualified designer and inspected by a structural design engineer. Single posts shall be vertically aligned, spliced to prevent misalignment, and diagonally braced in two mutually perpendicular directions at the splice level.

29 CFR 1926.703(b)(8)(iii-iv)



Dressed-Lumber Kiln-Dried Single-Posted Shores



- j. Single-post shores shall not be adjusted to raise formwork after the concrete has been placed.

29 CFR 1926.703(b)(9)

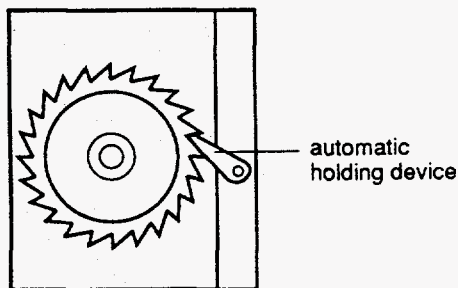
*Note: Single-post shores are very dangerous unless properly designed and installed.*

- k. When concrete must support loads heavier than its capacity, reshoring shall be erected as the original shores or forms are removed.

29 CFR 1926.703(b)(10)

- l. Jacks and other lifting devices on slip forms shall be equipped with mechanical dogs or other automatic holding devices to support the slip forms in case the power supply or lifting mechanism fails.

29 CFR 1926.703(c)(5)



- m. Steel rods or pipes on which jacks climb or by which the forms are lifted shall be specifically designed for that purpose and adequately braced when not enclosed in concrete.

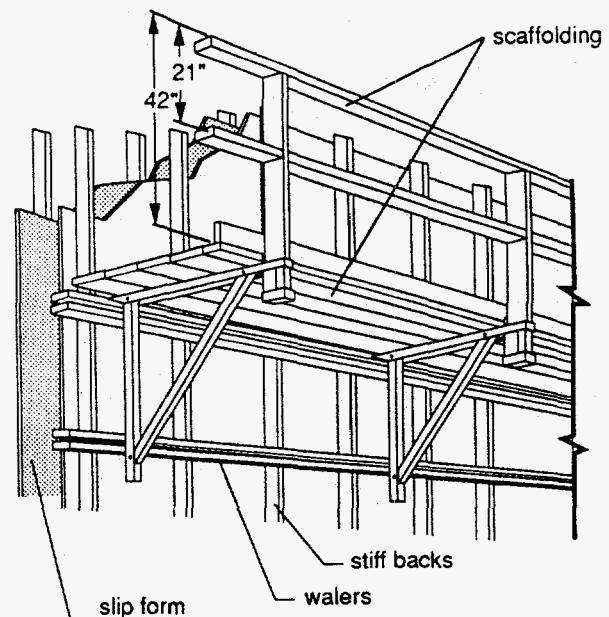
29 CFR 1926.703(c)(1)(i,ii)

- n. Forms shall be designed to prevent distortion of the structure during jacking operations.

29 CFR 1926.703(c)(2)

- o. All vertical slip forms shall have scaffolds or work platforms in areas where workers are required to work or pass.

29 CFR 1926.703(c)(3)



Vertical Slip Form with Scaffolding

- p. Jacks and vertical supports shall be placed so that the loads are not heavier than the rated capacity of the jacks.

29 CFR 1926.703(c)(4)

- q. During jacking operations, the form shall be kept within all design tolerances specified for alignment with true vertical.

29 CFR 1926.703(c)(6)

- r. The predetermined safe rate of lift shall not be exceeded.

29 CFR 1926.703(c)(7)

- s. Reinforcing steel for walls, piers, columns, and similar vertical structures shall be adequately supported to prevent overturning or collapse.

29 CFR 1926.703(d)(1)

- t. To prevent unrolled wire mesh from re-coiling, each end of the roll shall be secured or the roll shall be turned over.

29 CFR 1926.703(d)(2)



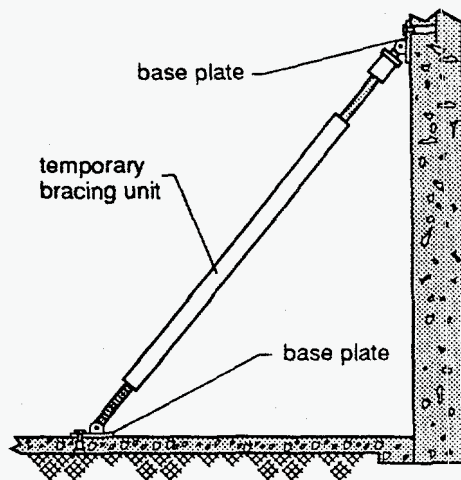
- u. Except for those used for slabs on grade and slip forms, forms and shores shall remain in place until the engineer determines that the concrete has set up sufficiently.

29 CFR 1926.703(e)(1)

#### 4. Precast Concrete

- a. To prevent overturning or collapse, precast concrete wall units, structural framing, and tilt-up wall panels shall be supported until permanently connected.

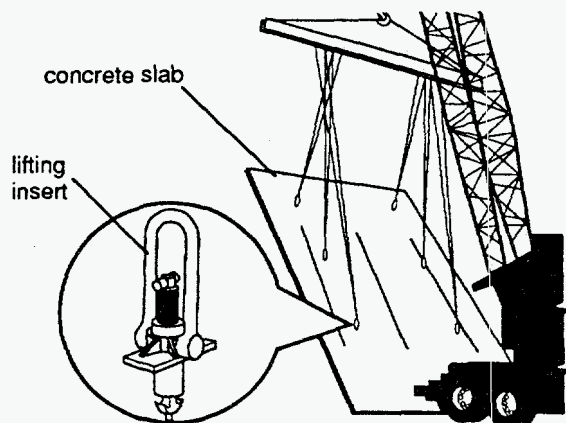
29 CFR 1926.704(a)



Precast Concrete Wall

- b. Lifting inserts embedded or otherwise attached to tilt-up precast concrete members shall be capable of supporting at least two times their maximum intended load.

29 CFR 1926.704(b)



Lifting Inserts in Precast Concrete Slabs

- c. Lifting inserts embedded or otherwise attached to precast concrete members other than the tilt-up members shall be capable of supporting at least four times their maximum intended load.

29 CFR 1926.704(c)

- d. Lifting hardware (chains, turnbuckles, or wire cables) shall be capable of supporting at least five times the maximum intended load.

29 CFR 1926.704(d)

- e. Workers shall not walk or work under concrete members being lifted or tilted into position unless their presence under the slab is required for the lifting operations.

29 CFR 1926.704(e)

#### 5. Lift-Slab Operations

- a. Lift-slab operations shall be designed and planned by a registered professional engineer who is competent in lift-slab construction. The plans and designs shall include detailed instructions and sketches of each operation as well as provisions for ensuring lateral stability during construction.

29 CFR 1926.705(a)



- b. Jacking equipment shall not be loaded beyond its safe working capacity. Threaded rods and other devices that transport loads to the jacks shall have a minimum safety factor of 2.5. All equipment components, such as jacks, threaded rods, lifting nuts, lifting angles, shearheads, columns, and footings, shall also have the safety factor of 2.5.

29 CFR 1926.705(c,d)

- c. Jacks shall be designed and installed to stop lifting when overloaded.

29 CFR 1926.705(e)

- d. Jacks shall be equipped with a safety device that, in case of a malfunction, enables the jacks to support loads in any position.

29 CFR 1926.705(f)

- e. Jacking operations shall be synchronized to ensure even and uniform lifting of the slab. All points of the slab support shall be kept within 1/2 inch of what is needed to maintain a level position during lifting.

29 CFR 1926.705(g)

- f. If leveling is controlled automatically, a device shall be installed to stop the operation when the 1/2-inch tolerance is exceeded or the jacking system malfunctions. If leveling is controlled manually, the controls shall be placed in a central location. When lifting is in progress, a



trained operator shall attend the manual controls.

29 CFR 1926.705(h,i)

g. During jacking operations, only essential workers shall be allowed in the immediate area of the building or structure being jacked up.

29 CFR 1926.705(k)(1)

h. No more than 14 manually controlled jacks shall be used on a single slab. The number of manually controlled jacks shall never be too large for the operator to keep the slab level within specified tolerances.

29 CFR 1926.705(j)

i. The manufacturer's rated capacity shall be legibly marked on all jacks and shall not be exceeded.

29 CFR 1926.705(b)

j. All jacks shall have a positive stop to prevent overtravel.

29 CFR 1926.305(a)(2)

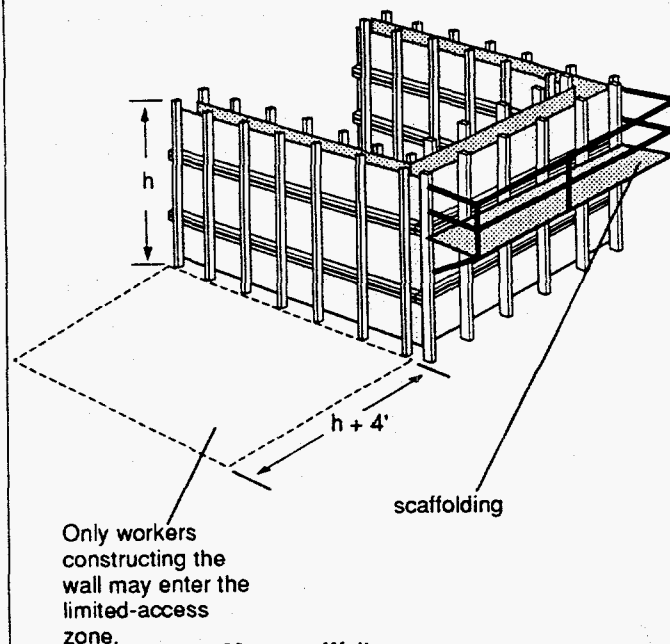
## 6. Masonry Construction

a. Whenever a masonry wall is being constructed, a *limited-access zone* shall be established according to the following requirements:

- The zone shall be established before the wall construction begins.
- The zone shall be equal to the wall height plus four feet and shall run the entire length of the wall.
- The zone shall be placed on the side of the wall that will not be scaffolded.
- Only workers actively engaged in constructing or inspecting the wall shall enter the zone.

- The zone shall remain in place until the wall is adequately supported. If the wall is more than 8 feet high, the limited-access zone shall be maintained until the requirement of paragraph b below has been met.

29 CFR 1926.706(a)(1-5)



**Masonry Walls**

b. All masonry walls greater than 8 feet high shall be braced, unless adequately supported to prevent overturning or collapse. The bracing shall remain in place until permanent supporting structure elements are in place.

29 CFR 1926.706(b)



## DEFINITIONS

**Bull Float** — A long-handled tool used to spread out and smooth concrete.

**Formwork** — The total support system for freshly placed or partially cured concrete (including the mold or sheeting that is in contact with the concrete and including all supporting members such as shores, reshores, hardware, braces, and related equipment).

**Limited-Access Zone** — At a masonry-wall construction site, a clearly marked area in which access is limited to required workers to protect workers in the event that the masonry wall falls.

**Load Skip** — A container which is used to transport mixed concrete to the form by hoist or chain.

**Precast Concrete** — Concrete members (such as walls, panels, slabs, columns, and beams) that are formed, cast, and cured before being lifted into their positions in a structure.

**Reshoring** — The placement of new shoring equipment as the original, inadequate forms and shores are removed; providing additional support for partially cured concrete and construction loads that surpass the concrete's load capacity.

**Shore** — A supporting member that resists the compressive force of a load.

**Tremie** — A concrete-transporting apparatus, consisting of a sheet-metal hopper connected at the bottom to a large metal pipe.

**Vertical Slip Forms** — Forms that are jacked vertically during placement of concrete (used to cast single-piece structures).

**KEY ITEMS CHECK LIST**  
**SECTION J. CONCRETE AND MASONRY**

Item	Paragraph	Notes
1. GENERAL REQUIREMENTS	J.1	
Are loads placed only on structures that can support them?	J.1.a	
Are workers protected from puncture by protective guards on vertical reinforcing bars?	J.1.b	
Are workers prohibited from riding concrete buckets and from working under loads?	J.1.d	
Are safety harnesses used by workers placing reinforcing bar at heights over 6 feet?	J.1.f	
2. EQUIPMENT AND TOOLS	J.2	
Are workers protected from being crushed in the ejection system of cement storage by lockout procedures?	J.2.b J.2.k	
Are concrete mixers with loading skips of more than 1 cubic yard equipped with clearing devices and guard rails on the skip?	J.2.c	
Are guided-rotation concrete pumps equipped with a switch that turns off when the operator releases the handle?	J.2.d	
Do high-pressure hoses have fail-safe joints and safety chains?	J.2.f	
Are buckets designed to dump correctly and to prevent concrete from hanging up on the top and sides?	J.2.g	
Are bull-float handles nonconductive?	J.2.i	
3. CAST-IN-PLACE CONCRETE	J.3	
Will forms support the load?	J.3.a	
Are forms and shores inspected before use?	J.3.c J.3.e	
Are jacks adequate to lift vertical-slip forms?	J.3.p	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
4. PRECAST CONCRETE	J.4	
Are precast sections supported until they are permanently connected?	J.4.a	
Are lift inserts adequate?	J.4.c	
Is lifting hardware adequate?	J.4.d	
Are workers restricted from working under sections not yet permanently connected?	J.4.e	
5. LIFT-SLAB OPERATIONS	J.5	
Did a registered professional engineer design the lift-slab operations?	J.5.a	
Is the need for additional lateral stability accounted for during construction?	J.5.a	
Is jacking equipment adequate to hold loads?	J.5.c	
	J.5.d	
6. MASONRY CONSTRUCTION	J.6	
Are limited access zones established?	J.6.a	
Are masonry walls braced?	J.6.b	





## Section K. Stairways and Ladders



### 1. Stairways

a. Stairways or ladders shall be provided for access to all areas where there is a break in elevation of 19 inches or greater, and no ramp, slope, or other means are provided.

29 Code of Federal Regulations (CFR) 1926.1051(a)

b. Temporary stairways shall have landings at least every 12 feet of vertical rise. These landings shall measure at least 30 inches in direction of travel and 22 inches wide.

29 CFR 1926.1052(a)(1)

c. All points of access to stairways shall be clear of construction materials.

29 CFR 1926.25(a); .1051(a)(3)

d. Where doors or gates swing directly onto a stairway, a platform shall be provided, and the swing of the door or gate shall not reduce the effective width of the platform to less than 20 inches.

29 CFR 1926.1052(a)(4)

e. Stairways shall be free of hazardous projections, such as protruding nails.

29 CFR 1926.1052(a)(6)

f. If stairway steps are slippery, they shall not be used until materials causing the slippery conditions have been removed.

29 CFR 1926.1052(a)(7)

g. Stairways with 4 or more stairs or stairs that rise more than 30 inches shall have handrails installed on all unprotected sides.

29 CFR 1926.1052(c)(1)

h. Guardrails on stairways shall be at least 36 inches high. Midrails, screens, mesh, or equivalent intermediate vertical members shall be provided.

29 CFR 1926.1052(c)(3)(i), (c)(4)

i. Handrails shall be surfaced to prevent injury to the hands from punctures or lacerations.

29 CFR 1926.1052(c)(8)

j. A permanent metal stairway or a landing with hollow pan-type treads (which will be permanently filled with concrete or other material) shall be temporarily filled to the level of the nosing with wood or other solid material. This material shall be installed for the entire width and depth of each panned step.

29 CFR 1926.1052(b)(1)

k. To prevent falls, handrails shall be an appropriate size and shape for workers' hands. All handrail supports shall be capable of withstanding a lateral force of 200 pounds.

29 CFR 1926.1052(c)(5)

l. Temporary handrails shall have a minimum of 3 inches of clearance between the handrail and the wall.

29 CFR 1926.1052(c)(11)

### 2. Ladders

a. Self-supporting and nonself-supporting portable ladders shall be rated to support 4 times the maximum intended load.

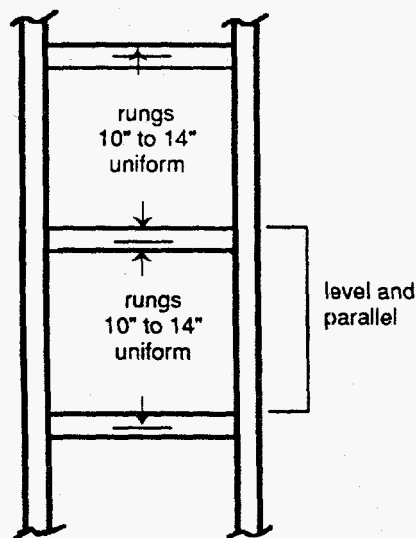
29 CFR 1926.1053(a)(1)(i,ii)

b. Two or more ladders or a double-cleated ladder shall be provided for access to or egress from a structure on which more than 25 people are working.

29 CFR 1926.1051(a)(2)

c. Ladder rungs and cleats shall be parallel, level, and spaced uniformly. The rungs shall be uniformly set at an interval between 10 and 14 inches.

29 CFR 1926.1053(a)(2), (3)(i)

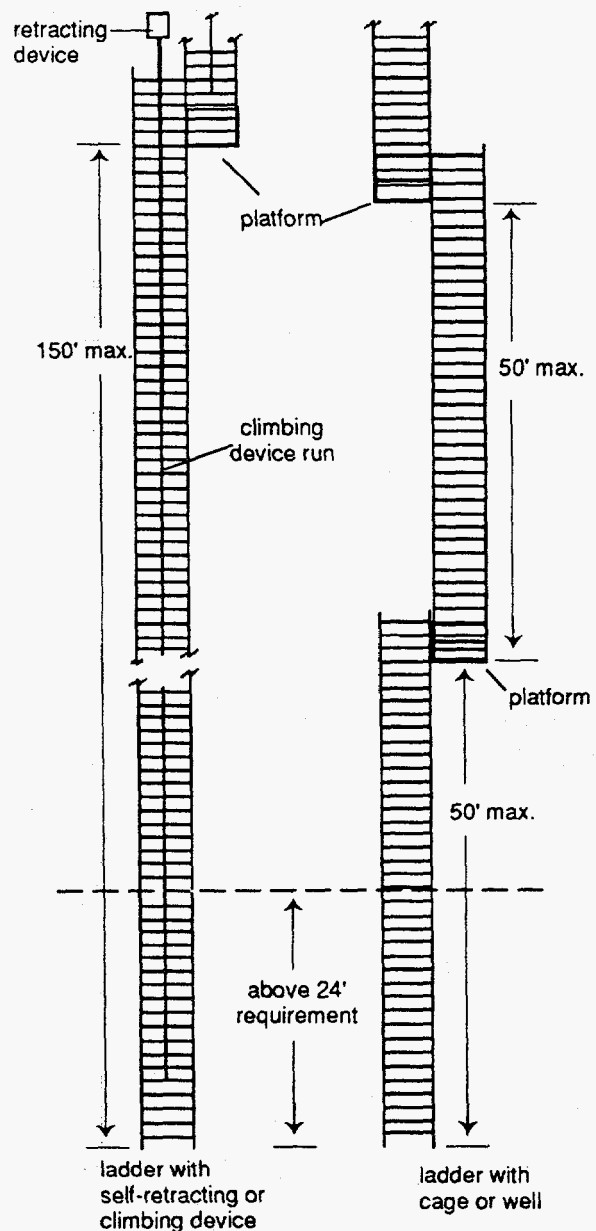


Ladder Rungs

d. Fixed ladders with a rise of 24 feet or more shall be equipped with one of the following:

- a ladder climbing safety device;
- a self-retracting life line and a rest platform at intervals not to exceed 150 feet; or
- a cage or well and multiple ladder sections each not exceeding 50 feet in length with each ladder section offset from adjacent sections and provided with a platform at maximum intervals of 50 feet.

29 CFR 1926.1053(a)(19)(i,ii,iii)



Ladder Climbing Protection



e. The minimum distance between the 2 side rails of a fixed ladder and individual rung stepladders shall be 16 inches.

29 CFR 1926.1053(a)(4)(i)

f. The rungs of portable and fixed metal ladders shall be corrugated, knurled, dimpled, or coated with skid-resistant material.

29 CFR 1926.1053(a)(6)(i,ii)

g. Ladders shall not be tied or fastened together vertically unless they are specifically designed for that purpose.

29 CFR 1926.1053(a)(7)

h. When two or more separate fixed ladders are used to reach an elevated work area, they shall be offset and include a platform, guardrails, overhead protection, and toeboards.

29 CFR 1926.1053(a)(10)

i. Permanently attached ladders shall have a back clearance of 7 inches or more. Ladders used in elevator pits shall have a minimum perpendicular clearance of 4 1/2 inches.

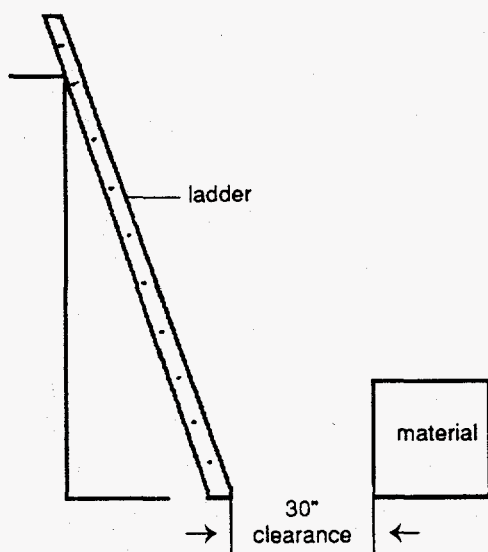
29 CFR 1926.1053(a)(13)

j. A landing platform shall be provided if the access/egress step-across distance from a structure is greater than 12 inches.

29 CFR 1926.1053(a)(16)

k. There shall be at least a 30-inch clearance at the base of the climbing side of a ladder. This may be reduced to 24 inches provided that a deflection device is installed to guide workers.

29 CFR 1926.1053(a)(14,15)



Climbing Clearance

### 3. Use Requirements for Ladders

a. A worker who ascends or descends a ladder shall face the ladder and not hand-carry objects or loads that could affect stability.

29 CFR 1926.1053(b)(20,22)

b. All points of access to ladders shall be clear of construction materials.

29 CFR 1926.25(a); .1051(a)(3)

c. If used in an area where it can be displaced by activity or traffic, a ladder shall be secured to prevent its accidental displacement.

29 CFR 1926.1053(b)(8)

d. All ladders shall be periodically inspected for defects (for example, broken or missing rungs) by a competent person. If a ladder has been damaged in any way, it shall be thoroughly inspected; if any defects are found, the ladder shall be tagged "DO NOT USE" and removed from service. Do not paint wooden ladders as painting will hide defects.

29 CFR 1926.1053(b)(15,16)

e. Portable ladders used to reach an upper landing of a structure shall have side rails that extend at least 3 feet above the landing.

29 CFR 1926.1053(b)(1)

f. Ladders shall be free of oil, grease, and other hazards that may cause a worker to slip.

29 CFR 1926.1053(b)(2)

g. Ladders shall be used only for the purpose for which they were designed. Ladder bases shall have slip-resistant feet (unless secured) and be used on a surface that is stable and level.

29 CFR 1926.1053(b)(7)

h. Ladders shall not be moved, shifted, or extended when workers are on them.

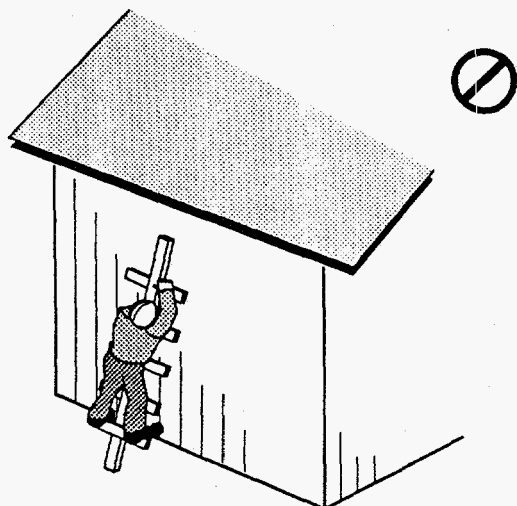
29 CFR 1926.1053(b)(11)

i. Ladders that may come in contact with exposed energized electrical equipment shall have nonconductive side rails.

29 CFR 1926.1053(b)(12)

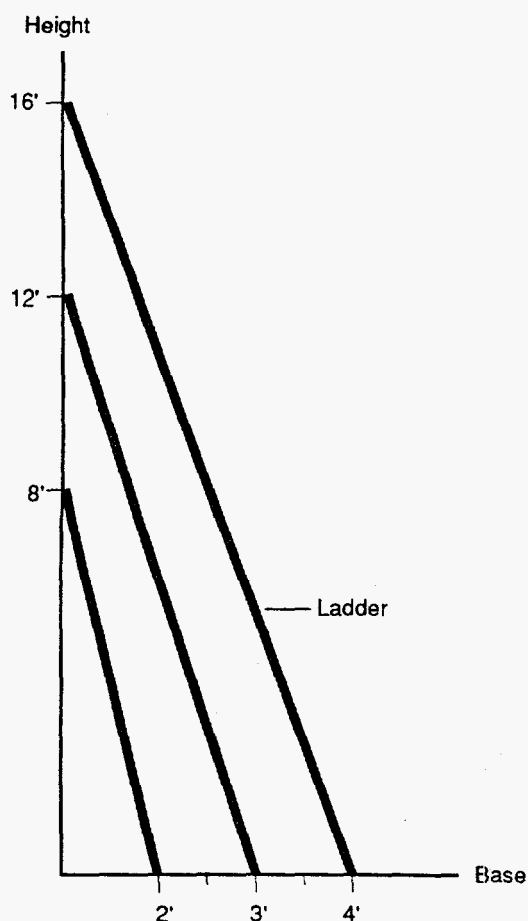


- j. Single-rail ladders shall not be used.  
29 CFR 1926.1053(b)(19)



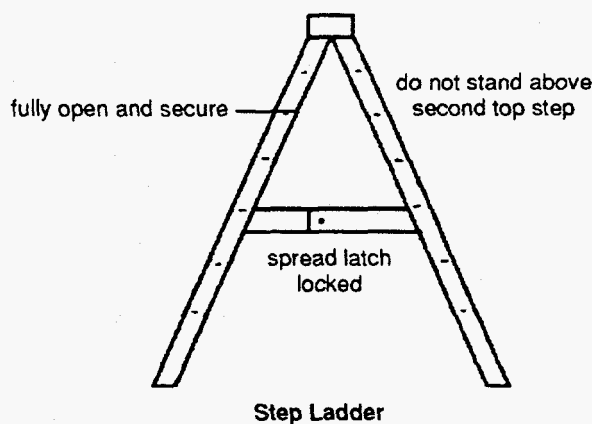
- k. Extension ladders shall be placed at a 4 to 1 ratio, height over distance, from the wall to the bottom of the ladder.

29 CFR 1926.1053(b)(5)(i)



Extension Ladder Stand 1b to 4h

- l. Stepladders should only be used fully unfolded, and workers shall not stand above the second from the top step.  
29 CFR 1926.1053(b)(13)



#### 4. Training Requirements for Workers Using Ladders and Stairways

- a. A training program shall be provided for workers who use ladders and stairways at the construction site. As necessary, such a program may be integrated into the general employee orientation.

29 CFR 1926.1060(a)



- b. The employer shall ensure that each employee is trained in the following:

1. the nature of fall hazards in the work area;
2. correct procedures for erecting, maintaining, and disassembling fall protection;



3. proper construction, use, placement, and care of a stairway and ladder; and
  4. the maximum load for each ladder.
- 29 CFR 1926.1060(a)(1)(i-v)



- c. Retraining in ladder safety shall be provided as necessary.

29 CFR 1926.1060(b)

### **5. Use of Ladders and Stairways During Demolition Operations**

- a. During demolition operations, only designated stairways and ladders shall be used to gain access to a structure. All other access ways shall be sealed at all times.

29 CFR 1926.851(a)

- b. During demolition operations, each stairway and ladder in use shall be periodically inspected and maintained in a clean and safe condition.

29 CFR 1926.851(b)

- c. During demolition of a multistory building, stairwells in use shall be properly illuminated by either natural or artificial light and completely covered at least two floors below the floor on which work is being performed.

**Note:** As floors are removed fall protection may be necessary. Refer to Section III.A.2 of this guide for information regarding fall protection.

29 CFR 1926.851(c)



## DEFINITIONS

**Double-Cleated Ladder** — A ladder that consists of three parallel, vertical support pieces connected by a series of rungs and crosspieces.

**Handrail** — A narrow metal or wooden railing to be grasped by a person for protection and support when walking on a stairway or ramp.

**Hollow Pan-Type Treads** — In the hollow steps of a permanent metal stairway, cavities that will be filled with concrete or another similar material.

**Platform** — A horizontal wooden or metal surface that is provided at regular intervals along a lengthy ladder and at points of access and egress, when needed, for the safety of the workers.

**Rise** — The vertical distance from the top of a stairway tread to the top of the tread located above it; or the vertical height from the ground to the top of any tread of a stairway.

**Single-Rail Ladder** — A ladder that consists of one vertical support piece to which the rungs or crosspieces are affixed.

**KEY ITEMS CHECK LIST**  
**SECTION K. STAIRWAYS AND LADDERS**

Item	Paragraph	Notes
1. STAIRWAYS	K.1	
Are the required stairs provided?	K.1.a	
Do temporary stairs have landings every 12 feet?	K.1.b	
Are handrails installed?	K.1.i K.1.k K.1.l	
2. LADDERS	K.2	
Are ladders provided?	K.2.b	
Are safety cages, landings, or climbing-safety devices provided for high ladders?	K.2.d K.2.h	
Are ladder rungs parallel, level, and evenly spaced?	K.2.c	
3. USE REQUIREMENTS FOR LADDERS	K.3	
Are workers trained to set up and climb ladders (facing it, 4 rise to 1 run)?	K.3.k K.3.a	
Are ladders inspected?	K.3.d	
Are step ladders set correctly, and are workers instructed not to use the top step?	K.3.l	
4. TRAINING REQUIREMENTS FOR WORKERS USING LADDERS AND STAIRWAYS	K.4	
Are workers instructed in fall hazards; fall protection; and placement, use, and care of ladders and stairs?	K.4.b	
5. REQUIREMENTS FOR USING LADDERS AND STAIRWAYS DURING DEMOLITION OPERATIONS	K.5	
Is a single access designated and used exclusively?	K.5.a	



## Section L. Welding and Cutting



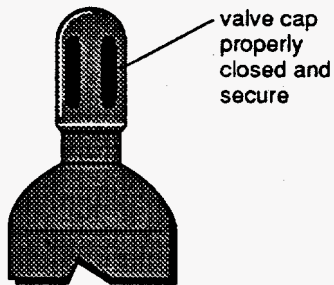
### 1. Gas Welding and Cutting

#### a. Moving Compressed-Gas Cylinders

The following procedures shall be followed when compressed-gas cylinders are moved.

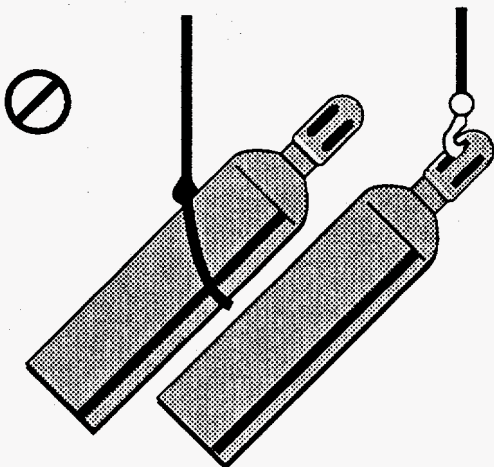
(1) Valves shall be closed and protective caps in place and secured.

29 Code of Federal Regulations (CFR) 1926.350(a)(1)



(2) Cylinders shall be hoisted only when secured on a cradle, pallet, or sling board. Cylinders shall never be hoisted by magnets or choker slings or be lifted by their valve protection caps.

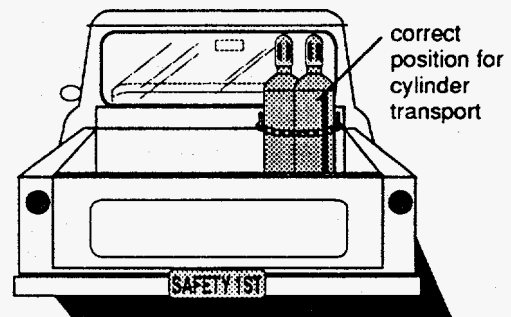
29 CFR 1926.350(a)(2,5)



Improper Hoisting of Cylinders

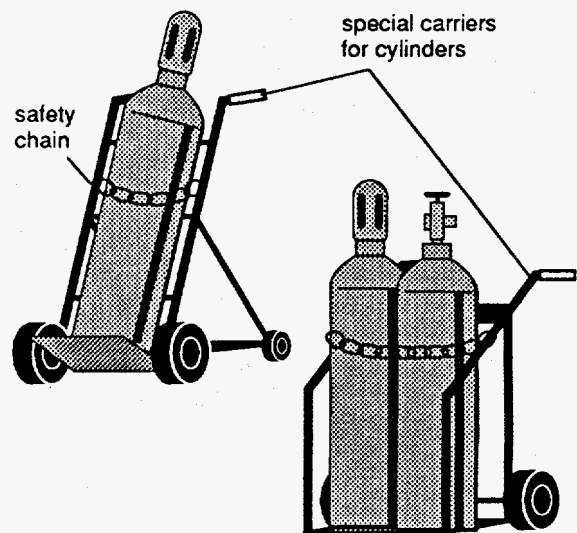
(3) When transported by vehicle, cylinders shall be secured in a vertical position with the valve always in the "up" position.

29 CFR 1926.350(a)(4)



(4) Unless cylinders are secured in a special carrier intended for moving them, regulators shall be removed and valve protection caps put in place before the cylinders are moved. When being moved by hand, cylinders shall be tilted and rolled on their bottom edges.

29 CFR 1926.350(a)(3,6)

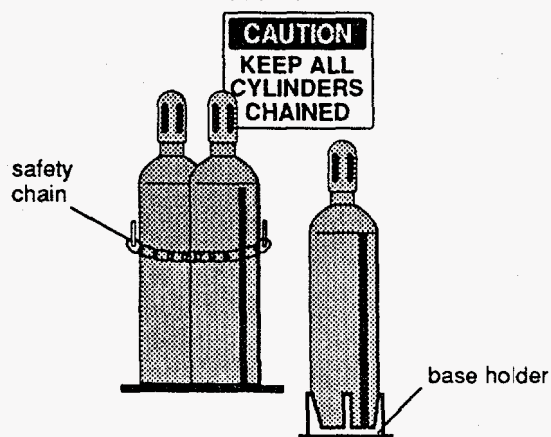






(5) Cylinders shall be secured in an upright position, except while being hoisted or carried. A suitable cylinder truck, chain, and/or other steadying device shall be used to keep cylinders from being knocked over while in storage or in use.

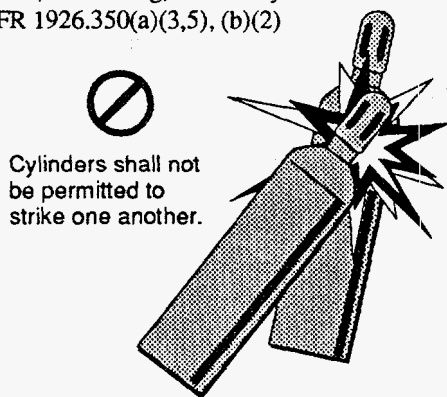
29 CFR 1926.350(a)(7-9)



#### b. Safety Procedures for Compressed-Gas Cylinders

(1) Cylinders shall never be intentionally dropped, struck, or permitted to strike each other in a violent manner. Cylinders shall never be placed where they can become part of an electrical circuit. If cylinders are frozen, do not use bars under valves or valve caps to pry them loose. Use warm water, not boiling, to thaw cylinder.

29 CFR 1926.350(a)(3,5), (b)(2)



(2) Cylinders shall be kept away from hot slag, sparks, or flame; or cylinders shall be protected by fire resistant shields. Electrodes shall not be struck against a cylinder to strike an arc. Fuel-gas cylinders shall not be placed where they would be subject to open flame, hot metal, or other sources of artificial heat. Damaged cylinders shall not be used.

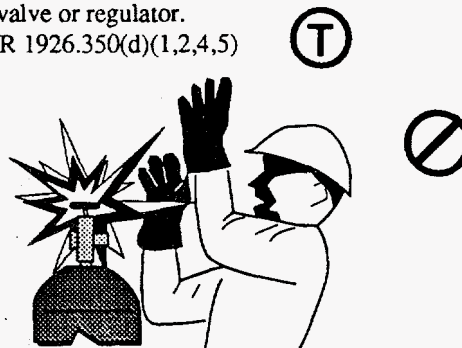
29 CFR 1926.350(b)(1-3), (c)(3)

(3) No one except the owner of the cylinder or person authorized by the owner shall refill a cylinder. The gas in a cylinder shall be used only for the purposes intended by the supplier.

29 CFR 1926.350(c)(2)

(4) Workers shall be taught how to safely "crack" a cylinder valve (clear it of dust or dirt). They shall also be taught how to attach and detach regulators safely, how to test for leaks, and what to do in case of leakage at the cylinder valve or regulator.

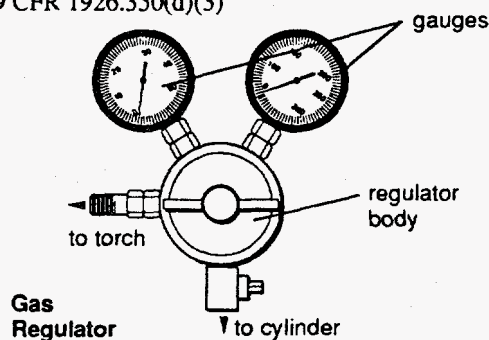
29 CFR 1926.350(d)(1,2,4,5)



Improper Method for Cracking a Cylinder

(5) Gas shall not be drawn from a cylinder through a torch or other device that has a shutoff valve unless the pressure is reduced through a suitable regulator attached to the cylinder valve or manifold.

29 CFR 1926.350(d)(3)



(6) Gas torch workers are to be instructed that should a leak develop in a fuse plug or other safety device, the cylinder shall be removed from the work area.

29 CFR 1926.350(d)(6)

(7) When a special wrench is required to open a cylinder or manifold valve, associated workers shall be instructed that the wrench shall be left in place on the valve stem when in use; that this precaution is taken so the fuel-gas supply can be shut off quickly in case of an emergency; and that nothing shall be placed on top of a cylinder that may damage the safety device or interfere with the quick closing of the valve.

29 CFR 1926.350(d)(2)

(8) Cylinder valves shall be closed when empty, when moved, or when work is completed.

29 CFR 1926.350(a)(8)

(9) When in use, gas cylinders shall be placed standing with the valve end up.

29 CFR 1926.350(b)(3)



c. Fuel-Gas and Oxygen Manifold Systems

(1) Fuel-gas and oxygen manifolds shall be located in well-ventilated accessible areas and shall bear the name of the substance they contain in letters at least 1-inch high, painted on or permanently attached to the manifolds.

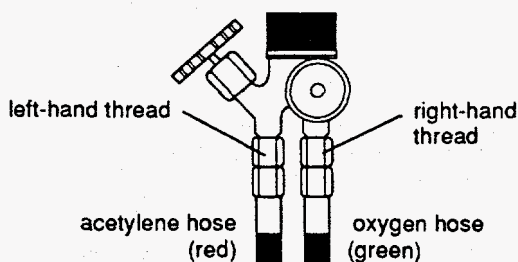
29 CFR 1926.350(e)(1,2)

(2) Both ends of the supply hose that lead to the manifold shall be such that hoses cannot be interchanged between fuel-gas manifolds, oxygen manifolds, and supply header connections. Adapters shall not be used to make hoses interchangeable.

29 CFR 1926.350(e)(3)

(3) Fuel-gas and oxygen hoses shall not be interchangeable and shall be distinguished from each other by their color or by their surface characteristics. Hose couplings shall require a rotary motion to be unlocked or pulled free.

29 CFR 1926.350(f)(1,5)



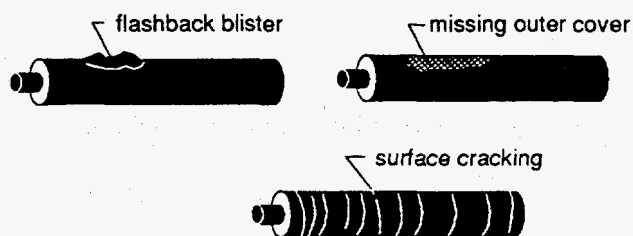
Hose and Couplings

(4) When parallel sections of an oxygen and fuel-gas hose are taped together, no more than 4 inches of each 12-inch section shall be covered by tape.

29 CFR 1926.350(f)(2)

(5) All hoses shall be inspected each day before they are used. Any hose that has been subject to flashback or that shows evidence of severe wear or damage shall be tested to twice its normal pressure, but in no case less than 300 pounds per square inch (psi); and, if found defective, the hose shall be removed from use.

29 CFR 1926.350(f)(3,4)



Damaged Hoses

d. Torches and Regulators

(1) Torches shall be inspected daily to ensure that valves, hose couplings, and tip connections are not leaking. Defective torches shall not be used. Clogged torch tips shall be cleaned with suitable cleaning wires, drills, or other cleaning devices. Torches shall be lighted with friction lighters or other approved devices and not with matches or hot slag.

29 CFR 1926.350(g)(1-3)

(2) All gas regulators shall be kept in good working condition.

29 CFR 1926.350(h)

(3) Regulators and lines shall be bled and cylinder valves closed before regulators are removed.

29 CFR 1926.350(d)(4)

*Recently manufactured regulators and torches have backflash and backflow devices or controls built into the equipment. Older equipment without these features shall not be used unless such protective devices are installed.*

*National Fire Protection Association (NFPA) 51, Chapter 5, paragraphs 5-3 and 5-4.*

e. Oxygen Gas

(1) Oxygen-gas cylinders and fittings shall be kept free of oil or grease. Cylinders, caps, cap threads, hoses, hose connections, regulators, and associated apparatus shall be kept free from oil or greasy substances and shall not be handled with oily hands or gloves.

29 CFR 1926.350(i)

(2) Oxygen shall never be directed at oily or greasy surfaces, flammable liquids, or clothing or into a fuel-oil storage tank or vessel.

29 CFR 1926.350(i)

(3) When in storage, oxygen cylinders shall be separated from fuel-gas cylinders or combustible material (oil, grease, petroleum products) by a minimum of 20 feet. Alternatively, oxygen cylinders shall be separated from these combustibles by a noncombustible barrier that is at least 5 feet high and has a fire-resistant rating of at least 1/2 hour.

29 CFR 1910.253(b)(4)(iii)

(4) Oxygen cylinders or fuel-gas cylinders shall not be taken into a confined space.

29 CFR 1926.350(b)(4)



## 2. Arc Welding and Cutting

### a. Holders and Cables

(1) Only manual electrode (welding rod) holders that are specifically designed for arc welding and cutting shall be used for arc welding and cutting. They shall be capable of safely handling the maximum current load required for the electrode. The current-carrying parts, such as hand grips, outer surfaces, and jaw backs, shall be insulated against maximum ground voltage.

29 CFR 1926.351(a)(1,2)

(2) Cables shall be insulated, flexible, and capable of handling the maximum current required. They shall be free of repairs or splices for a minimum of 10 feet from the cable end to which the electrode holder is connected. Cables with standard insulated connectors or cables with splices that have insulating quality equal to that of the cable are permitted.

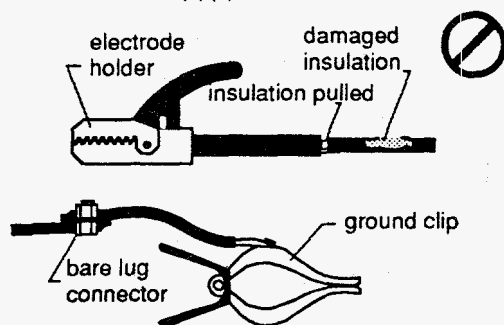
29 CFR 1926.351(b)(1,2)

(3) When cables are connected or spliced, the connector shall be insulated to a capacity equal to that of the cable. When lugs are used to connect cables, the lugs shall be securely fastened; and insulation on the exposed metal shall be equivalent to that of the cable. When a cable becomes worn and bare conductors are exposed, the conductors shall be repaired with rubber and friction tapes or other equivalent insulation, except as indicated in 2.a.(2) above.

29 CFR 1926.351(b)(3,4)

(4) Torn or damaged cables in which there is cut insulation, exposed wire, bare metal lugs, or insulation pulled back at the ends shall be repaired before use.

29 CFR 1926.351(b)(4)



### b. Grounding

(1) Ground-return cables servicing one or more units shall have safe current-carrying capacities equal to or exceeding the maximum output capacities of all the units they serve.

29 CFR 1926.351(c)(1)

(2) A structure or pipeline used as a ground circuit shall be such that all joints and contacts are bonded securely. The structure or pipeline shall be inspected periodically to ensure that there are no fire hazards.

29 CFR 1926.351(c)(3,4)

(3) Arc welding and cutting machine frames shall be grounded by a third wire in the cable containing the circuit conductor or by a separate wire grounded at the source of the current. Grounding circuits shall be periodically inspected to ensure that the circuit between the ground and the grounded power conductor has a resistance low enough to trigger the fuse or circuit breaker, if necessary.

29 CFR 1926.351(c)(5,6)

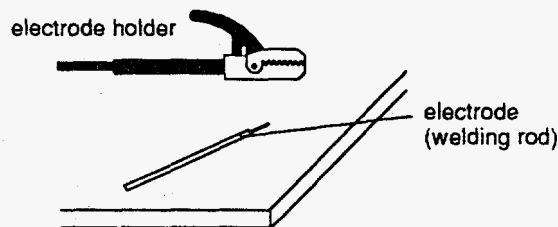
(4) Pipelines containing gases or flammable liquids or conduits containing electrical circuits shall not be used as ground returns in arc welding or cutting operations.

29 CFR 1926.351(c)(2)

### c. Operating Instructions

(1) Workers shall be instructed in overall safety procedures for arc welding and cutting. **T**

- When electrode holders are unattended, the electrode (welding rod) shall be removed and the holder shall be prevented from coming into contact with workers or objects.



- When workers leave for an extended period of time or when the welding/cutting machine is to be moved, the power supply switch shall be open.
- Hot electrode holders shall not be dipped into water.
- Any faulty or unsafe equipment shall be removed from service and reported to the supervisor immediately.

29 CFR 1926.351(d)(1,4)

(2) Additional safety training in welding and cutting may be found in American National Standard Institute (ANSI) Z49.1.

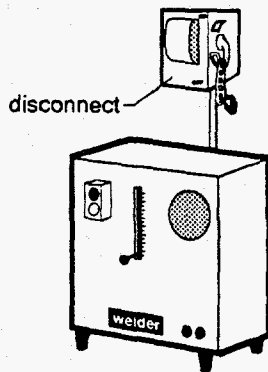
29 CFR 1926.350(j)



## d. Electric Arc Welder Disconnects

(1) If a disconnect is not an integral part of a motor-generator, DC rectifier, AC transformer, or arc welding machine, a disconnect means shall be provided.

29 CFR 1926.406(c)(1)



(2) A resistance welder shall be equipped with a switch or circuit breaker for the welder and its control equipment. The rating of the disconnect means shall not be less than the ampacity of the supply conductor.

29 CFR 1926.406(c)(2)

## e. Shielding

Fire-retardant or noncombustible barriers or curtains shall be used to protect workers and others nearby from direct rays of an arc.

29 CFR 1926.351(e)



## f. Special Precautions

For welding on natural gas pipelines, the technical portions of regulations issued by the US Department of Transportation, Office of Pipeline Safety, 49 CFR 192, "Minimum Federal Safety Standards for Gas Pipelines," shall apply.

29 CFR 1926.351(c)(2)

## 3. Welding, Cutting, and Heating on Preservative Coatings

a. Before any welding, cutting, or heating is performed on surfaces with preservative coatings in which the level of flammability is unknown, a competent person shall test the coating to determine if there is a fire hazard. The coating shall be considered highly flammable when scrapings burn extremely rapidly.

29 CFR 1926.354(a)

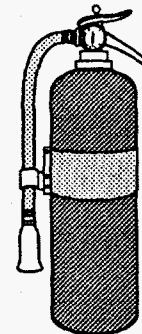


b. Every precaution shall be taken to avoid fire and to avoid exposing workers to toxic fumes.

29 CFR 1926.354(b,c)

(1) Appropriate fire extinguishers shall be furnished and made ready in the area of operations.

29 CFR 1926.352(d)



(2) To prevent ignition, flammable coatings shall be stripped from the areas to be welded or heated. Surfaces shall be stripped of all toxic coatings at least 4 inches from the area where heat will be applied, or workers shall be provided with appropriate respirators. See Section III.A.2.i and III.B.9 for details on appropriate respiratory protection.

29 CFR 1926.354(c)(1)



#### 4. Ventilation for Welding and Cutting

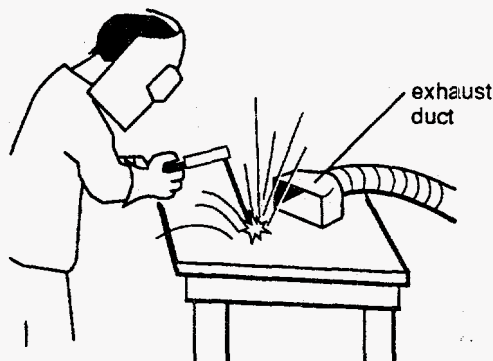
a. The general-mechanical or local-exhaust ventilation system used for welding and cutting shall be capable of exchanging enough air to keep welding fumes and smoke within safe limits. (See 29 CFR 1910.1000, Subpart Z for "Threshold Limit Values of Air Contaminants.")

29 CFR 1926.55; 353(a)(1,2)

b. To keep exposures within safe limits and to remove fumes and smoke at the source, local-exhaust ventilation systems shall be designed so that the worker can place a duct or hood close to the material being welded.

**Note:** See Section III.B.6 "Ventilation," of this guide for additional information reference to ventilation.

29 CFR 1926.353(a)(3)



Removing Welding Fumes

c. Exhaust from welding or cutting operations shall be discharged into the open air (away from the source of intake air systems). Sufficient make-up air shall be provided, and that air shall be clean and respirable.

29 CFR 1926.353(4,5)

d. Oxygen shall not be used for ventilating, personal cooling, blowing dust from clothing, or cleaning the work area.

29 CFR 1926.353(a)(6)

e. General-mechanical or local-exhaust ventilation system shall be provided when welding, cutting, or heating is done in a confined space. When sufficient ventilation cannot be supplied to a confined space, workers shall be provided with air-supplied respirators, and an additional worker (safety watch) shall be stationed outside the confined space to communicate with workers inside and to provide emergency assistance. (See Section III.B.5, "Confined Spaces")

29 CFR 1926.353(b)(1,2)

f. General-mechanical or local-exhaust ventilation systems shall be provided for welding, cutting, and heating operations in enclosed spaces when the following metals are used:

- zinc-bearing metals or metals coated with zinc-bearing materials,
- lead base metals,
- cadmium-bearing filler metals, and
- chromium-bearing metals or metals coated with chromium-bearing materials.

29 CFR 1926.353(c)(1)(i-iv)

g. Local-exhaust ventilation systems or air-supplied respirators shall be provided for welding, cutting, or heating operations in enclosed spaces when the following metals are used:

- metals containing lead, other than as an impurity, or metals coated with lead-bearing materials;
- cadmium-bearing or cadmium-coated base metal; and
- metals coated with mercury-bearing metals.

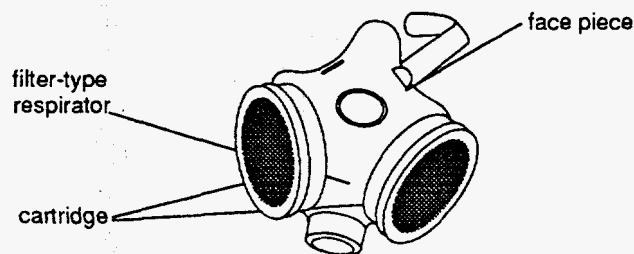
29 CFR 1926.353(c)(2)(i-iii)

h. Because of the high toxicity of beryllium, workers in welding, cutting, or heating operations that involve base or filler metals containing beryllium shall be provided with both a local-exhaust ventilation system and an air-line respirator.

29 CFR 1926.353(c)(2)(iv)

i. Workers performing operations in the open air that involve the metals specified in paragraphs f. and g. above shall be protected with a filter-type respirator, but persons working on base or filler metals containing beryllium shall be required to use an air-line respirator.

29 CFR 1926.353(c)(3)



j. When inert-gas metal arc-welding operations involve stainless steel, workers shall be provided with a general-mechanical or local-exhaust ventilation system or air-supplied respirators to protect personnel from dangerous levels of nitrogen dioxide.

29 CFR 1926.353(d)(1)(iv)





k. Workers exposed to the same atmospheres as hot workers (welders, cutters, and burners) shall be protected in the same manner.

29 CFR 1926.353(c)(4)

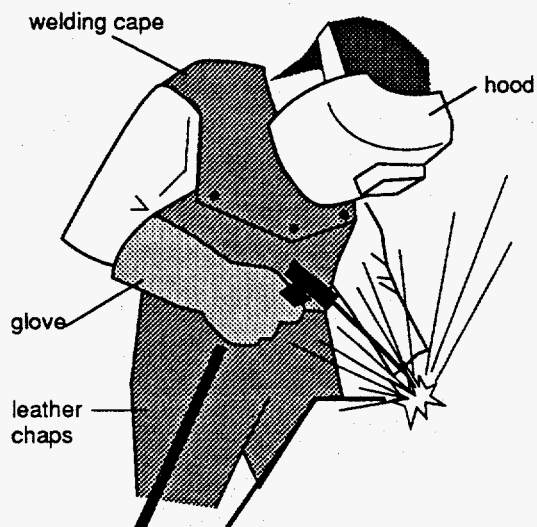
l. Because of the high level of ultraviolet radiation produced by inert gas and metal arc welding, chlorinated solvents (unless shielded) shall be kept at least 200 feet from the exposed arc. Surfaces cleaned or prepared with chlorinated solvents shall be dry before any welding is performed.

29 CFR 1926.353(d)(1)(i)



m. All workers exposed to radiation from arc or gas welding operations shall wear protective clothing, safety-approved hood, and other appropriate protective equipment, as may be necessary. (See appropriate parts of Section III.A.2. "Personal Protective Equipment")

29 CFR 1926.353(d)(1)(ii,iii),(e)(2)



## 5. Fire Protection and Fire Watch

a. A fire watch shall be assigned in areas where welding and cutting (flame or arc) are performed if there is the possibility of fire to combustible or flammable materials. The watch shall be maintained at least a one-half hour after completion of the welding or cutting operations.

29 CFR 1926.352(e)



b. An appropriate fire extinguisher shall be immediately available in the area of flame or arc welding and cutting operations.

29 CFR 1926.352(d)

c. Technical portions of ANSI Z49.1 "Safety in Welding and Cutting" shall apply for details not covered in this section.

29 CFR 1926.350(j)



## DEFINITIONS

**Arc Welding** — A welding operation for which the source of fuel is a large electric current.

**Cable** — Strands of insulated electrical conductors laid together, usually around a central core, and surrounded by heavy insulation.

**Confined Space** — An area having limited entry or exit points, poor ventilation, or other design features that prevent regular occupancy. Pits more than 4 feet deep, tanks, vessels, silos, utility vaults, pipelines, ducts, sewers, digesters, tunnels, process tanks, and vats are examples of confined spaces found on construction sites.

**Crack** — A method of opening a gas cylinder's valve that removes contaminants, such as dust or dirt, before the cylinder is connected to equipment.

**Cutting** — A process in which metal is severed by the controlled application of flame or an electric arc.

**Cylinder** — A bottle or metal container used to store compressed gas.

**Electrode** — An electrical conductor through which an electric current enters or leaves a medium.

**Exhaust** — A duct for the escape of gases, fumes, and odors from an enclosure, sometimes equipped with an arrangement of fans.

**Fuel Gas** — A flammable gas such as butane, propane, or acetylene that is burned with oxygen to provide heat energy.

**Gas Welding** — A welding operation for which flammable gas is the source of fuel.

**Preservative Coating** — A liquid that, when applied to metal, stops or slows down corrosion.

**Regulator** — A device that maintains a desired rate of gas flow or pressure.

**Shield** — Fire-retardant or noncombustible metal or plastic sheeting or cloth used to protect workers from direct rays of an arc.

**Ventilation** — The movement, circulation, and quality control of air in an enclosed space.

**KEY ITEMS CHECK LIST**  
**SECTION L. WELDING AND CUTTING**

Item	Paragraph	Notes
1. GAS WELDING AND CUTTING	L.1	
a. <i>Moving Compressed-Gas Cylinders</i>	L.1.a	
Are cylinders stored, handled, and moved properly?	L.1.a	
Are cylinders chained and capped as required?	L.1.a	
b. <i>Safety Procedures for Compressed-Gas Cylinders</i>	L.1.b	
Are employees who handle compressed gas instructed in the safe use of the cylinders?	L.1.b	
Are fuel gas and oxygen protected from electric current, heat, spark, arc contact, hazardous materials, and hazardous weather conditions?	L.1.b	
c. <i>Fuel-Gas and Oxygen Manifold Systems</i>	L.1.c	
Are manifolds appropriately identified and stored according to the type of gas?	L.1.c	
Are hoses and manifolds inspected for damage?	L.1.c	
d. <i>Torches and Regulators</i>	L.1.d	
Are torches inspected daily?	L.1.d	
Are back flow devices installed?	L.1.d	
e. <i>Oxygen Gas</i>	L.1.e	
Are oxygen cylinders, fittings connectors, manifolds, etc., free of oil and grease?	L.1.e	
Are oxygen or fuel-gas cylinders stored in nonrestrictive spaces when not in use?	L.1.e	
2. ARC WELDING AND CUTTING	L.2.a	
a. <i>Holders and Cables</i>	L.2.a	
Are damaged rod holders repaired?	L.2.a	
Are worn or damaged cables repaired or replaced?	L.2.a	
b. <i>Grounding</i>	L.2.b	
Are grounds adequate?	L.2.b	



## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
c. <i>Operating Instructions</i>	L.2.c	
Are welders adequately trained in welding procedures and precautions?	L.2.c	
d. <i>Electric Arc-Welder Disconnects</i>	L.2.d	
Are adequate disconnects provided?	L.2.d	
3. WELDING, CUTTING, AND HEATING ON PRESERVATIVE COATINGS	L.3	
Are flammable and toxic coatings removed before welding operations?	L.3.a	
4. VENTILATION FOR WELDING AND CUTTING	L.4	
Are ventilation systems adequate to reduce welding air contaminants to acceptable limits for the materials used?	L.4.a L.4.b L.4.f L.4.g L.4.h	
Is arc welding prohibited near chlorinated solvents?	L.4.i	
Are arc welding operations properly shielded?	L.4.m	
5. FIRE PROTECTION AND FIRE WATCH	L.5	
Is a fire watch maintained for at least half an hour after welding ends?	L.5.a	
Are fire extinguishers provided?	L.5.b	



## Section M. Motor Vehicles and Mechanized Equipment



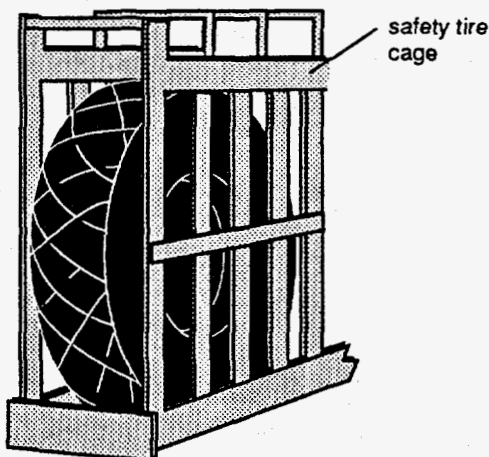
### 1. General Requirements

a. All equipment left near a highway or active construction site at night shall be set off with appropriate warning devices. See Section III.G of this guide, "Signs, Signals, and Barricades."

29 Code of Federal Regulations (CFR)  
1926.600(a)(1)

b. Tires mounted on split or locking-ring rims shall be installed, removed, or inflated in a safety tire rack, cage, or area that offers equivalent protection.

29 CFR 1926.600(a)(2)



safety tire cage

c. Workers may not work under or between heavy machinery, equipment, or parts of machinery or equipment suspended from slings, hoists, or jacks until the material is blocked or otherwise supported.

29 CFR 1926.600(a)(3)(i)

d. For battery service and charging see Section III.E.10.d. "Battery Servicing" in this guide and the appropriate CFR below.

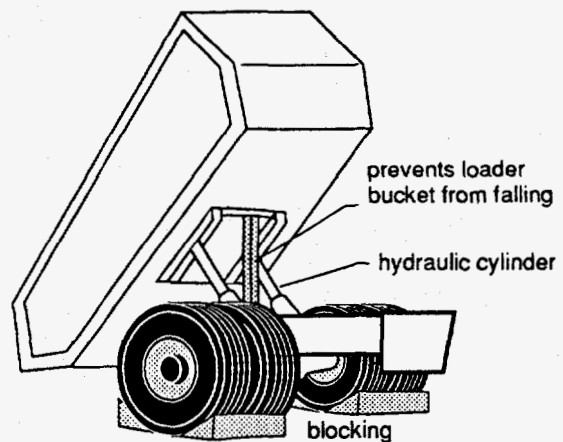
29 CFR 1926.441; .600(a)(4)

e. Equipment cabs shall have safety glass or equivalent glass that does not distort the driver's vision.

29 CFR 1926.600(a)(5)

f. Bulldozer and scraper blades, loader buckets, dump bodies, and similar equipment shall be fully lowered or blocked during repair or when not in use. Except when otherwise required, controls shall be in neutral; motors shall be turned off; and brakes shall be set on all machinery.

29 CFR 1926.600(a)(3)(i)



prevents loader bucket from falling

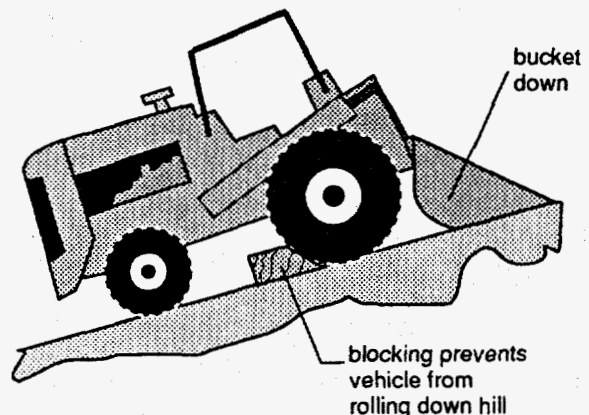
hydraulic cylinder

blocking

Dump Body

g. When equipment is parked, the parking brake shall be set. On an incline, the wheels also shall be blocked.

29 CFR 1926.600(a)(3)(ii)



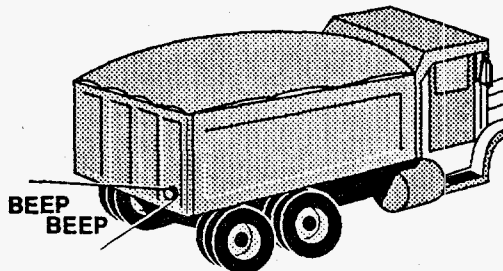
bucket down

blocking prevents vehicle from rolling down hill



h. Motor vehicles and bidirectional machines in which the rear view is obstructed shall have a reverse signal alarm audible above surrounding background noise or shall be backed up only when an observer signals backing is safe.

29 CFR 1926.601(b)(4)(i-ii); 602(a)(9)(ii)



Truck with Back-up Alarm

i. Only trained and authorized workers shall be allowed to operate powered industrial trucks.

29 CFR 1910.178(l)



j. Equipment used for lifting and handling (other than cranes, hoists, elevators, derricks, and conveyors) shall meet applicable requirements of design, construction, stability, testing, maintenance, inspection, and operation, as specified in American National Standard Institute (ANSI) B56.1, "Safety Standards for Powered Industrial Trucks."

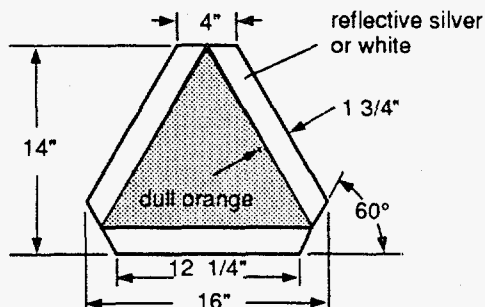
29 CFR 1926.602(c)(l)(vi)

k. For information on cranes, derricks, and hoists, see Section III.H of this guide.

l. Trucks hauling loads over public roads with material that can be freed by wind conditions shall be securely covered with a tarp or other means to prevent the load material from flying free and causing damage to other vehicles or a hazard to people. All hauled loads, regardless of load material, shall be appropriately secured. (See 49 CFR 393.100 for additional details.)

m. Vehicles and equipment designed to move slowly (25 mph or less) on public roads shall display a slow-moving traffic identification symbol.

29 CFR 1910.145(d)(10)



Slow-Moving Vehicle Emblem

## 2. Motor Vehicles

*The requirements below apply only to motor vehicles operating inside an off-highway construction site.*

a. All vehicles shall have a service, emergency, and parking brake system; these systems may use the same components. All braking systems shall be in good operating condition.

29 CFR 1926.601(b)(1)

b. When visibility conditions warrant additional light, vehicles shall be equipped with at least two headlights and two taillights. Vehicles shall have operable brake lights at all times.

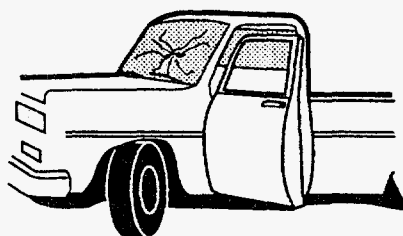
29 CFR 1926.601(b)(2)(i,ii)

c. Tools and materials that are carried in the same compartment with workers shall be secured.

29 CFR 1926.601(b)(7)

d. Vehicles with cabs shall have windshields and powered wipers. Cracked and broken windshield glass shall be replaced. Vehicles that operate in fog or frost shall have defogging and defrosting devices.

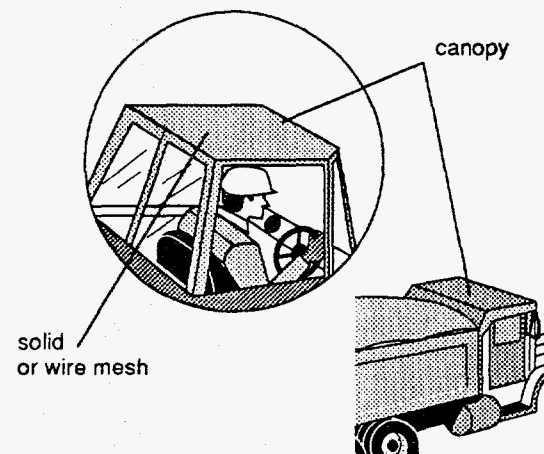
29 CFR 1926.601(b)(5)



Cracked windshields shall be replaced.

e. Vehicles whose payload is loaded by a crane, power shovel, loader, or similar equipment shall have a cab shield and/or canopy adequate to protect the operator.

29 CFR 1926.601(b)(6)



Examples of Canopies



f. Motor vehicles used to carry personnel shall be equipped with seat belts for all personnel being carried.

29 CFR 1926.601(b)(8)

g. Over-the-road vehicles shall have appropriate DOT approved flares, triangles, or other warning devices available in the vehicle for appropriate warning if vehicle is disabled.

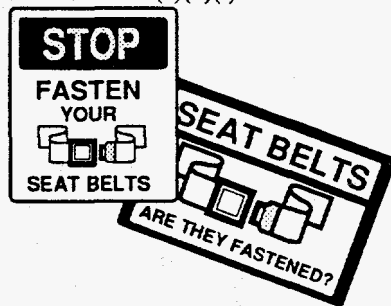
### 3. Earth-Moving Equipment

*Earth-moving equipment includes scrapers, loaders, crawlers or wheel tractors, bulldozers, off-highway trucks, graders, agricultural and industrial tractors, and similar equipment.*

29 CFR 1926.602(a)(1)

a. Seat belts shall be provided on all earth-moving equipment. These belts shall be used by all operators of such equipment.

29 CFR 1926.602(a)(2)(i)



b. Seat belts are not required in equipment that

- is designed for stand up operation only and/or
- lacks a rollover protection structure (ROPS) or adequate canopy protection.

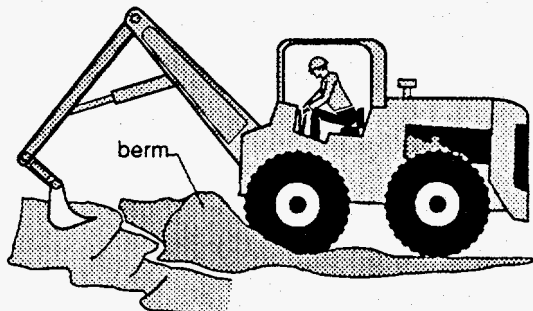
29 CFR 1926.602(a)(2)(ii,iii)

c. Construction equipment or vehicles shall not be moved on access roads or grades unless the road or grade has been constructed and maintained to safely accommodate such equipment.

29 CFR 1926.602(a)(3)(i)

d. When necessary, an emergency access ramp or berm shall be constructed to restrain runaway vehicles.

29 CFR 1926.602(a)(3)(ii)



e. Brakes on all earth-moving equipment detailed under 29 CFR 1926.602(a)(1) shall have service braking systems capable of stopping and holding the equipment while fully loaded as specified in the *Society of Automotive Engineers (SAE) Recommended Practices*.

29 CFR 1926.602(a)(4)

### 4. Pile-Driving Equipment

a. Overhead protection shall be provided when workers are exposed to falling objects. Protection shall be 2-inch planking or the equivalent and shall not block the view of the operator.

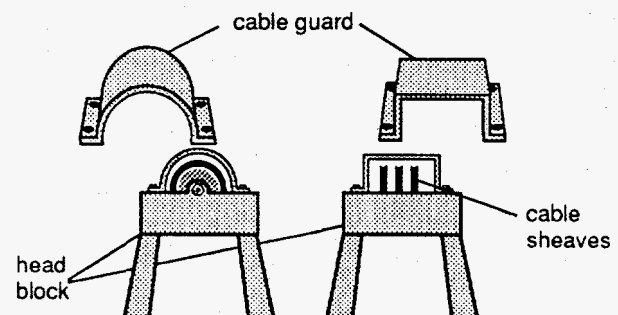
29 CFR 1926.603(a)(3)

b. A stop block shall be provided to prevent the hammer from being raised against the head block. A blocking device capable of supporting the hammer weight shall be placed in the leads under the hammer during the entire period that workers are under the hammer.

29 CFR 1926.603(a)(4,5)

c. Cable guards shall be provided across the top of the head block to prevent cables from jumping out of the sheaves.

29 CFR 1926.603(a)(6)



Head Block Cable Guards

d. When a batter pile is driven on an incline, the leads shall be stabilized.

29 CFR 1926.603(a)(7)

e. Ladders will have adequate rings or similar attachments through which fixed leads can pass to attach to the loft workers' safety belt harness.

29 CFR 1926.603(a)(8)

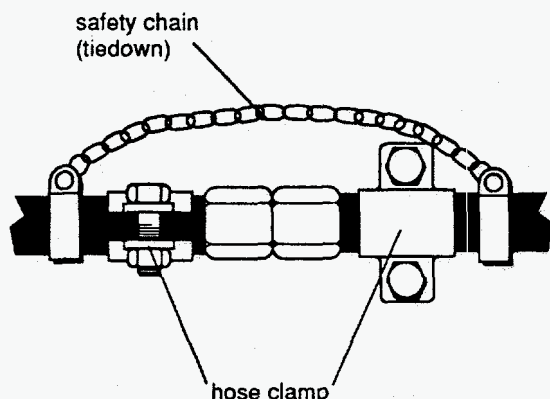
f. Pile-driver workers shall wear hearing protection when operations exceed the noise-time weighted-average exposure or for protection from high-impact noise. See Section III.B.3 of this guide for details on hearing protection.

29 CFR 1926.52



g. Steam hoses leading to a hammer or jet pipe shall be securely attached to the hammer with a tiedown that consists of at least a 1/4-inch chain or cable of adequate length. Safety chains or the equivalent shall be provided across each hose connection.

29 CFR 1926.603(a)(9,10)



High-Pressure Hose Connection

h. Steam-line controls shall be equipped with two shutoff valves, one of which shall be a quick-acting lever type, which is within easy reach of the hammer operator.

29 CFR 1026.603(a)(11)

i. Guys, outriggers, thrustouts, or counterbalances shall be provided as necessary to stabilize a pile-driver rig.

29 CFR 1926.603(a)(12)

j. Engineers and winchers shall accept signals from a designated signaler only.

29 CFR 1926.603(c)(1)

k. When piles are driven in an excavated pit, the pit walls shall be sloped to the angle of repose or sheet-piled and braced.

29 CFR 1926.603(c)(3)

l. When steel tube piles are being "blown out," workers shall be out of range of falling material.

29 CFR 1926.603(c)(4)

m. Pile-driving operations shall be suspended when driven piles are cut off except in a case where the cutting operations are located at least twice the length of the longest pile from the driver.

29 CFR 1926.603(c)(5)

n. While installing piles with jacking equipment under existing structures, all access pits shall be provided with ladders and bulkheaded curbs to prevent material from falling into the pit.

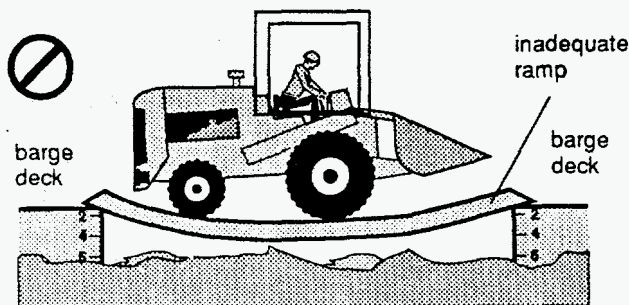
29 CFR 1926.603(c)(6)

## 5. Marine Operations and Equipment

### a. Access to Barges

(1) Vehicle ramps to or between barges shall be of adequate strength, have side boards, be well maintained, and be properly secured.

29 CFR 1926.605(b)(1)



Dock-to-Barge Ramp

(2) A safe means, walkway or ramp shall be provided for workers so they can safely step to or from a wharf, float, barge, or river towboat.

29 CFR 1926.605(b)(2)

(3) A Jacob's ladder shall be of the double rung or flat tread type, be well maintained and secured, and hang without slack from its lashings or be pulled up entirely.

29 CFR 1926.605(b)(3,4)

(4) When the upper end of the access to the barge rests on or is flush with the top of a bulwark, substantial steps equipped with a handrail at least 33 inches high shall be installed between the top of the bulwark and the deck.

29 CFR 1926.605(b)(5)

(5) Gangways shall be unobstructed and access shall be adequately lit.

29 CFR 1926.605(b)(6,7)

(6) Access to a barge shall be located so that loads do not pass over workers.

29 CFR 1926.605(b)(8)

**b. Work Surfaces on Barges**

(1) Workers shall not walk along the sides of covered lighters or barges with coamings more than 5 feet high unless a walkway 3 feet wide, a grab rail, or a taut handline is provided.

29 CFR 1926.605(c)(1)

(2) Decks and work surfaces shall be kept in safe condition.

29 CFR 1926.605(c)(2)

(3) Workers shall not pass fore and aft over or around deckloads unless there is a safe passageway.

29 CFR 1926.605(c)(3,4)

(4) If it is necessary to stand at the outboard or inboard edge of the deckload where there is less than 2 feet of bulwark, rail, or coamings, workers shall be protected from falling off the deckload.

29 CFR 1926.605(c)(4)

**c. Life Saving/Diving**

(1) Each barge shall have at least one life preserver (buoy or ring), approved by the US Coast Guard, with at least 90 feet of line attached. Each barge also shall have at least one portable ladder or permanent ladder that will reach from the top of the apron to the surface of the water. If this equipment is not available at the pier, the employer shall furnish it.

29 CFR 1926.605(d)(2)

(2) Workers walking or working on unguarded decks of barges shall wear life jackets approved by the US Coast Guard.

29 CFR 1926.605(d)(3)

(3) Commercial diving shall be done in accordance with subpart T of 29 CFR 1910.

29 CFR 1926.605(e)

**6. Roll-Over Protective Structures (ROPS)**

a. Roll-over protective structures (ROPS) apply to the following material handling equipment:

- rubber-tired, self-propelled scrapers,
- rubber-tired front-end loaders,
- rubber-tired dozers,
- wheeled-type agricultural and industrial tractors,
- crawler tractors,
- crawler-type loaders, and
- motor graders (with or without attachments).

29 CFR 1926.1000(a)(1)

b. Roll-over protective structures and supporting attachments shall meet the minimum performance of 29 CFR 1926.1001 and .1002 along with all applicable current standards.

29 CFR 1926.1000(c)(2)

c. Roll-over protection that has been removed shall be remounted with bolts or welding of equal or better quality than that required for the original mounting.

29 CFR 1926.1000(d)

d. Roll-over protection shall have a label permanently affixed showing the manufacturer or fabricator's name and address, ROPS model number, and the machine or equipment make, model, or service number that the structure is designed to fit.

29 CFR 1926.1000(e)(1-3)



## DEFINITIONS

**Bulwark** — The part of a ship's side that extends above the main deck.

**Cable Guard** — A device that crosses over a head block and prevents a cable from separating from its sheaves.

**Canopy** — A solid covering that extends over the cab of a motorized vehicle.

**Chock** — A device placed under a round object or a wheel that prevents it from rolling; or an open or closed metal fitting through which ropes, wires, or cables are passed.

**Coaming** — A rim placed on a roof or around a hatch, deck, or bulkhead opening to prevent water from entering.

**Guys (Outriggers, Thrustout)** — Ropes or wires that secure a pole, derrick, or similar temporary structure in a vertical position.

**Jacked Pile** — A pile that is installed with a hydraulic jack in a pit under an existing structure or building.

**Jacob's Ladder** — A rope, chain, or wire ladder with wooden or metal rungs that is slung over a ship's side for temporary use.

**Quick-Acting Lever Valve** — A valve that is operated by simply throwing the handle.

**Reverse Signal** — A warning beeper, located on specific motorized equipment, that is activated when the equipment moves in reverse; also known as a backing-up alarm.

**Ring Buoy** — A buoyant ring and line used for keeping a person afloat.

**Roll-over Protective Structure (ROPS)** — On a motorized vehicle or piece of equipment, a structure over the operator's position that keeps the cab from crushing during a roll-over.

**Safety Tire Rack (Cage)** — A protective structure into which tires mounted on split or locking rims are placed for installation, removal, or inflation.

**KEY ITEMS CHECK LIST**  
**SECTION M. MOTOR VEHICLE AND MECHANIZED EQUIPMENT**

Item	Paragraph	Notes
1. GENERAL REQUIREMENTS	M.1	
Are all operators trained?	M.1.i	
Are back-up alarms used on equipment as required?	M.1.h	
Are requirements met for design, construction, stability, testing, inspection, and maintenance?	M.1.j	
Is equipment that is parked near highways marked with signs, barricades, or other warning devices?	M.1.a	
Are safety tire cages used for split-rim tire work?	M.1.b	
Are workers protected from unblocked equipment that is on slings, hoists, or jacks?	M.1.c	
Are workers protected from unblocked blades, buckets, dump bodies, etc.?	M.1.f	
Do vehicle cabs have distortion-free safety glass?	M.1.e	
Is equipment parked with the brake set and the wheels blocked?	M.1.g	
Are tarps or covers provided and used over truck-bed loads as necessary?	M.1.l	
2. MOTOR VEHICLES	M.2	
Are required brakes, lights, wipers, defroster/defoggers, and windshields installed and used?	M.2.a M.2.b	
Are tools and other equipment that are carried in the cab secured?	M.2.c	
Do vehicles that are loaded by a crane or power shovel have a cab canopy?	M.2.e	
Are passenger vehicles equipped with seat belts?	M.2.f	



## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
3. EARTH-MOVING EQUIPMENT	M.3	
Are seat belts installed on vehicles that are equipped with rollover protection structures (ROPS)?	M.3.a M.3.b	
Are access roads and grades adequate?	M.3.c	
Are there emergency ramps to stop runaway vehicles?	M.3.d	
4. PILE-DRIVING EQUIPMENT	M.4	
Is overhead protection provided?	M.4.a	
Are leads secured?	M.4.b	
Are steam line couplers secured with chains and tied down at equipment junctions?	M.4.g	
Are head block guards in place and secure?	M.4.c	
5. MARINE OPERATIONS AND EQUIPMENT	M.5	
a. <i>Access to Barges</i>	M.5.a	
Are ramps and gangways adequate for the loads they bear; are they clear so that workers may pass?	M.5.a(1) M.5.a(2)	
c. <i>Life Saving/Diving</i>	M.5.c	
Are handrails and life jackets provided on barges?	M.5.b(1) M.5.c(2)	
Are rings, buoys, and lifelines available on barges?	M.5.c(1)	
6. ROLLOVER PROTECTIVE STRUCTURES (ROPS)	M.6	
Are all motorized graders, scrapers, bulldozers, crawlers, loaders, and tractors equipped with approved ROPS?	M.6.a	



## Section N. Demolition



### 1. General Requirements

a. Before workers start demolition operations, a competent person shall make an engineering survey of the structure to be demolished as well as adjacent structures in order to determine the condition of the frame, floors, and walls. The supervisor shall have available a written report of the survey.

29 Code of Federal Regulations (CFR) 1926.850(a)



b. All power sources (gas, water, electrical, sewer, and others) shall be shut off, capped, or controlled outside the building line before demolition begins. Utility companies involved shall be notified in advance.

29 CFR 1926.850(c)

c. When employees must work inside a structure that has been damaged by fire, flood, explosion, or other means, the walls and/or floors shall be shored or braced.

29 CFR 1926.850(b)

d. Worker entrances to multistory structures being demolished shall be protected by sidewalk sheds or canopies that extend out a minimum of 8 feet from the building. All such canopies shall be 2 feet wider than the building access (1 foot to each side) and capable of sustaining a load of 150 pounds per square foot.

29 CFR 1926.850(k)

e. Whenever the possibility exists that a worker might fall through a wall opening in a structure being demolished, the opening shall be protected to a height of 42 inches.

29 CFR 1926.850(g)

f. If power, water, or other utilities must be maintained during demolition operations, these lines shall be temporarily relocated and protected as necessary.

29 CFR 1926.850(d)

g. Floor openings not used as material drops shall be covered over with material substantial enough to support the weight of any load placed on them, and the coverings shall be secured with nails or bolts. Permanent flooring may also be used over floor openings.

29 CFR 1926.850(i)

h. If the presence of hazardous chemicals, gases, explosives, flammable materials, or other dangerous substances in pipes, tanks, or other equipment on the property is suspected or apparent, this equipment shall be tested and purged; the hazard shall be eliminated before demolition is started.

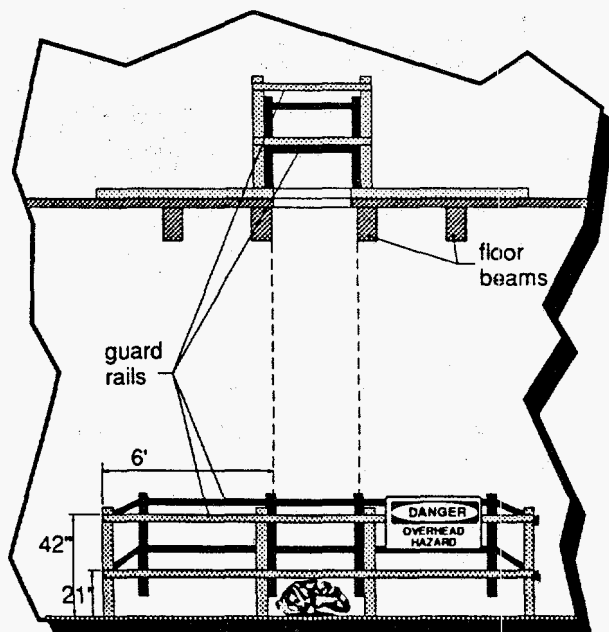
29 CFR 1926.850(e)

i. Glass that may potentially shatter shall be removed before work is done in the area.

29 CFR 1926.850(f)

j. When debris is dropped through holes in the floor (without the use of chutes), the area onto which it is dropped shall be enclosed with barricades at least 42 inches high and at least 6 feet from the projected edge of the opening above. Signs stating "DANGER—OVERHEAD HAZARD" shall be posted at each level. Debris shall not be removed in lower areas until persons dropping debris from above have ceased operations.

29 CFR 1926.850(h)



Open Flow Barricade

## 2. Chutes

a. All material chutes or sections of chutes at an angle of more than 45° from the horizontal shall be entirely enclosed except for openings used for insertion of material. These openings shall be no more than 4 feet high and shall be closed when not in use.

29 CFR 1926.852(b)

b. Chute openings into which workmen dump debris shall be protected by guardrails 42 inches above the floor. Any space between the chute and the edge of floor openings through which debris passes shall be covered securely.

29 CFR 1926.852(e)

c. No material shall be dropped to points lying outside the exterior walls of a structure unless the area is closed to workers and the public.

29 CFR 1926.852(a)

d. The area surrounding the discharge end of a chute shall be securely closed off when operations are not in progress.

29 CFR 1926.852(d)

e. Gates shall be installed at or near the discharge end of each chute. A competent person shall supervise operation of the gate and backing-up and loading of trucks.

29 CFR 1926.852(c)

f. Each chute opening into which material is dumped from mechanical equipment or wheelbarrows shall have a securely attached toeboard or bumper.

29 CFR 1926.852(f)

N-2

g. Chutes shall be strong enough to withstand expected loads.

29 CFR 1926.852(g)

## 3. Removal of Material Through Floor Openings

a. Openings cut in a floor for the disposal of material shall be no more than 25% of the total floor area. Openings may be larger if the lateral supports of the removed floor remain in place.

29 CFR 1926.853

b. Floors weakened or made otherwise unsafe by demolition operations shall be shored.

29 CFR 1926.853

## 4. Removal of Walls, Masonry Sections, and Chimneys

a. Masonry walls or sections of these walls shall be permitted to fall upon the floors of the building only in quantities within the safe carrying capacities of the floor.

29 CFR 1926.854(a)

b. Walls more than one-story high shall be laterally braced unless they were originally constructed to stand without lateral support and are in a condition to be self-supporting.

29 CFR 1926.854(b)

c. Workers shall not work on the top of walls when weather conditions are hazardous.

29 CFR 1926.854(c)

d. Structural or load-supporting members on any floor shall be cut or removed only after all stories above such a floor have been demolished and removed, unless otherwise discussed in paragraphs 3 and 5 of this section.

29 CFR 1926.854(d)

e. Walkways or ladders shall be provided for workers to safely reach or leave any scaffold or wall.

29 CFR 1926.854(g)

f. Retaining walls that support earth or adjoining structures shall not be demolished until such earth has been properly braced or the adjoining structures have been properly underpinned.

29 CFR 1926.854(h)

g. Debris shall be piled only against walls capable of supporting it.

29 CFR 1926.854(i)



- h. Floor openings within 10 feet of any wall being demolished shall be planked solidly when workers are required to work beneath such openings.

29 CFR 1926.854(e)

## 5. Manual Removal of Floors

- a. Openings cut in floors shall extend the full span of the arch between supports.

29 CFR 1926.855(a)

- b. Workers who break down floor arches shall stand on planks that are at least 2- by 10-inches in cross section. These planks shall be a maximum of 16 inches apart and positioned to provide a safe support for workers, should the arch between the beams collapse.

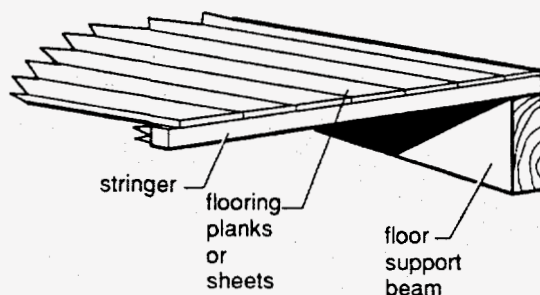
29 CFR 1926.855(b)

- c. Walkways not less than 18 inches wide and formed of planks not less than 2 inches thick or metal of equivalent strength shall be used by workers to walk between exposed beams.

29 CFR 1926.855(c)

- d. Stringers of sufficient strength to support floor planks shall be installed; the ends of such stringers shall be supported by floor beams or girders rather than by floor arches alone.

29 CFR 1926.855(d)



Floor Support Cross Section Members

- e. Planks shall be laid together over solid floor supports (bearings) with plank ends overlapping at least 1 foot.

29 CFR 1926.855(e)

- f. When floor arches are being removed, the area directly beneath shall be barricaded to prevent access to it.

29 CFR 1926.855(f)

- g. Demolition of floor arches shall begin only after debris and other unnecessary materials have been removed from the floor arch and within 20 feet of it.

29 CFR 1926.855(g)

## 6. Mechanical Removal of Walls, Floors, and Material

- a. Mechanical equipment shall be used only on floors or work surfaces that have sufficient strength to support the equipment.

29 CFR 1926.856(a)

- b. Floor openings shall have curbs (stoplogs) to prevent equipment from running over the edge.

29 CFR 1926.856(b)

## 7. Storage

- a. The storage of waste material and debris on any floor shall be within the allowable floor loads.

29 CFR 1926.857(a)

- b. Wooden floor boards may be removed from one floor above grade to provide storage space for debris only if falling material does not endanger the stability of the structure.

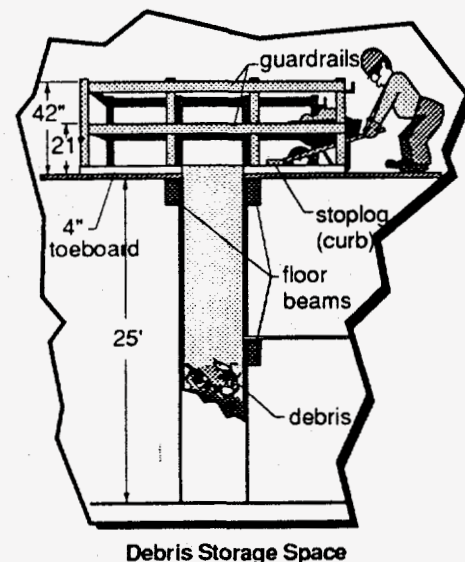
29 CFR 1926.857(b)

- c. When wooden floor beams serve to brace interior walls or free-standing exterior walls, the beams shall be left in place until other supports can be installed to replace them.

29 CFR 1926.857(c)

- d. Floor arches up to 25 feet above grade may be removed to provide a storage area for debris if such removal does not endanger the stability of the structure.

29 CFR 1926.857(d)



Debris Storage Space



- e. Storage space into which material is dumped shall be blocked off and closed except when removing materials.  
29 CFR 1926.857(e)

## 8. Removal of Steel Construction

- a. After floor arches have been removed, workers shall stand on at least 2- by 10-inch planks while razing the steel frame.  
29 CFR 1926.858(a)
- b. Steel construction shall be dismantled at first column length by column length and then tier by tier (columns may be in two-story lengths).  
29 CFR 1926.858(c)
- c. I-beams or columns being dismembered shall not be overstressed.  
29 CFR 1926.858(d)

## 9. Mechanical Demolition

- a. To prevent twisting of the load line, the ball shall be attached to it by a swivel-type connection and by a positive means, which prevents accidental disconnecting.  
29 CFR 1926.859(d)

- b. Workers shall not be allowed in areas where balling or clamming operations take place.  
29 CFR 1926.859(a)

- c. The weight of the demolition ball shall not exceed 50% of the crane's rated load or 25% of the nominal breaking strength of the wire rope or cable on which it is suspended, whichever results in the lesser value.  
29 CFR 1926.859(b)

- d. All affected steel members shall be cut free before pulling over walls or portions of walls.  
29 CFR 1926.859(e)

- e. All ornamental stonework, including cornices, shall be removed before the walls are pulled over.  
29 CFR 1926.859(f)

- f. Continuous inspections shall be made by a competent person to detect hazards resulting from weakened or deteriorated floors or walls or from loosened material. Where such hazards to employees exist, operations shall continue only after the hazards are corrected by shoring, bracing, or equivalent means.  
29 CFR 1926.859(g)





## DEFINITIONS

**Balling** — Swinging a round or egg-shaped steel ball suspended from a crane against the structural supports of a building or other enclosure to demolish it.

**Chute** — An inclined trough, passage, or channel through or down which free-flowing materials may pass.

**Clamming** — Using a clamshell bucket suspended from a crane to demolish the structural supports of a building or other enclosure.

**Clamshell Bucket** — A two-sided bucket used in a type of excavator to dig in a vertical direction. The bucket is dropped while its leaves are open; and as the leaves close, they dig into the ground.

**Floor Arch** — The primary support for a building or other enclosure (for example, the main bearing beam that supports a floor).

**Shore (Brace)** — A prop, such as a wooden beam, that is placed under or against walls or floors to support them.

**Sidewalk Shed (Canopy)** — A framed metal or wooden roof structure that shelters a walkway to the entrance or exit of a building that is being demolished.

**Stoplog (Curb)** — A raised stone, concrete, or wooden barrier installed around an opening in the floor to prevent equipment from falling through the opening.

**Stringer** — A secondary member that runs between two load-bearing points in the structural frame of a building or other enclosure.

**KEY ITEMS CHECK LIST  
SECTION N. DEMOLITION**

Item	Paragraph	Notes
1. GENERAL REQUIREMENTS	N.1	
Has a written engineering survey been done?	N.1.a	
Are utilities safe?	N.1.b	
Are buildings that have been damaged by fire, flood, etc., shored or braced?	N.1.c	
Are safe access canopies used for high-rise demolition?	N.1.d	
Are wall openings barricaded?	N.1.e	
Are floor openings covered?	N.1.g	
Are hazardous materials purged?	N.1.h	
Are workers protected from shattering glass?	N.1.i	
Are overhead-hazard signs posted where debris is dropped through floor holes?	N.1.j	
2. CHUTES	N.2	
Are high-angle chutes covered?	N.2.a	
Are chute openings guarded and a toe board or bumper attached?	N.2.f	
Are drop and chute areas outside the structure closed to workers and the public?	N.2.c N.2.d	
Are the chutes durable?	N.2.g	
3. REMOVAL OF MATERIAL THROUGH FLOOR OPENINGS	N.3	
Are floor openings no more than 25% of the total floor area?	N.3.a	
Are unsafe floors shored?	N.3.b	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
4. REMOVAL OF WALLS, MASONRY SECTIONS, AND CHIMNEYS	N.4	
Are masonry walls allowed to collapse only on floors strong enough to carry the load?	N.4.a	
Are weakened or unsafe walls and floors shored?	N.4.a N.4.b	
Does work on the top of walls stop when the weather is bad?	N.4.c	
Are structural members left in place until the work above them is completed?	N.4.d	
Is safe access provided to and from scaffolds and walls?	N.4.e	
Are retaining walls left in place until their load has been made safe?	N.4.f	
Is debris piled only against walls strong enough to support it?	N.4.g	
Is planking placed over floor openings that are within 10 feet of walls being removed and that are above the workers?	N.4.h	
5. MANUAL REMOVAL OF FLOORS	N.5	
Are floor openings cut to the full span between supports?	N.5.a	
Are workers who break down floor arches provided adequate support (planks to stand on)?	N.5.b N.5.c N.5.d N.5.e	
Are areas below floor-arch removal barricaded?	N.5.f	
Is debris removed from the floor arches before they are demolished?	N.5.g	
6. EQUIPMENT REMOVAL OF WALLS, FLOORS, AND MATERIAL	N.6	
Is equipment used only on surfaces that can support it?	N.6.a	
Are curbs or stoplogs used to contain equipment?	N.6.b	



## KEY ITEMS CHECK LIST (continued)

	Item	Paragraph	Notes
7.	STORAGE	N.7	
	Are floors adequate to support debris storage?	N.7.a	
		N.7.b	
	Is debris-storage space blocked off except for removal?	N.7.e	
8.	REMOVAL OF STEEL CONSTRUCTION	N.8	
	Are workers who take down steel frames provided adequate support (planks to stand on)?	N.8.a	
	Are steel construction frames dismantled in the safest order (columns before tiers)?	N.8.b	
	Is overstress of I-beams prevented?	N.8.c	
9.	MECHANICAL DEMOLITION	N.9	
	Is the wrecking ball attached by a positive means and provided a swivel?	N.9.a	
	Are workers kept away from balling or clamming operations?	N.9.b	
	Is the weight of the ball less than half the weight of the crane's rated load and a quarter of the wire rope's breaking strength?	N.9.c	
	Are affected steel members cut before walls are collapsed?	N.9.d	
	Are stone gargoyles, cornices, and other ornamentation removed before walls are collapsed?	N.9.e	
	Is inspection continuous to prevent operations from beginning where unsafe walls or floors could collapse on workers or the public?	N.9.f	



## Section O. Material Handling, Storage, Use, and Disposal



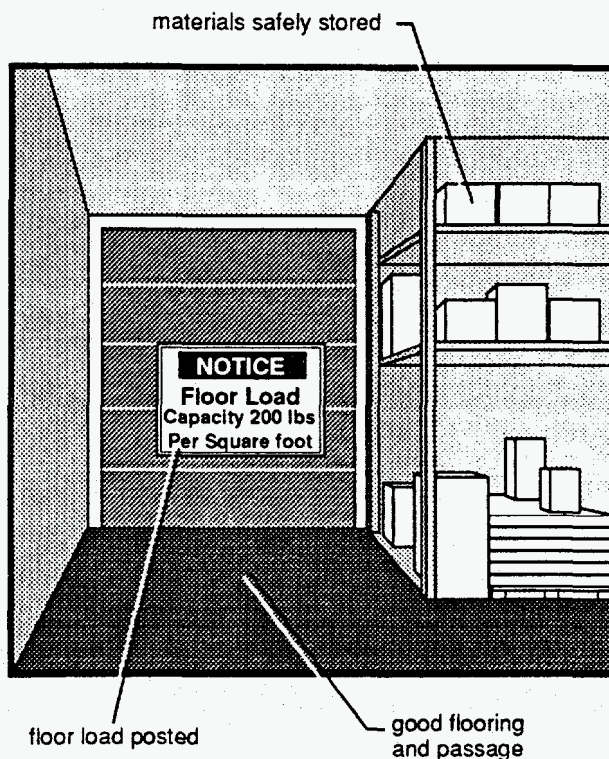
### 1. Storage

a. Tiered material shall be stored so it will not slide, fall, or collapse.

29 Code of Federal Regulations (CFR) 1926.250(a)(1)

b. Storage areas in buildings, except those located on the ground floor, shall be posted with maximum load limits in pounds per square foot (psf), and such limits shall not be exceeded.

29 CFR 1926.250(a)(2)



Storage Area

c. Passageways shall be unobstructed and in good repair so that material-handling equipment may be moved safely through them.

29 CFR 1926.250(a)(3)

d. When vehicles must be moved from one level to another, ramps, grading, or blocking shall be used so that they may be moved safely between levels.

29 CFR 1926.250(a)(4)

e. In buildings under construction, materials shall not be stored within 6 feet of a hoistway or inside floor opening or within 10 feet of a wall that does not extend above the stored material.

29 CFR 1926.250(b)(1)

f. Bagged material shall be stacked so that the layers are stepped back and crosskeyed at least every 10 bags.

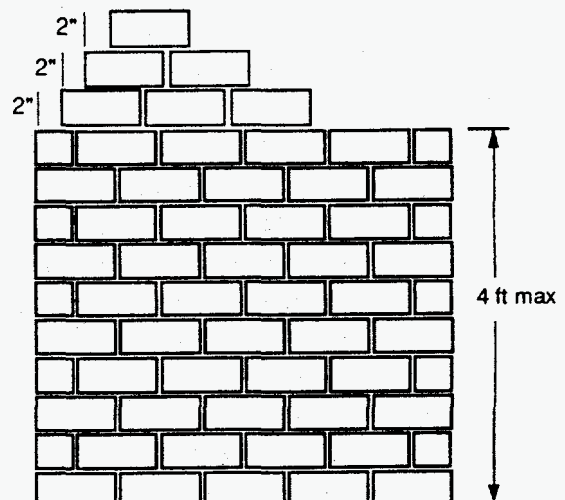
29 CFR 1926.250(b)(4)

g. Only material that is to be used immediately shall be stored on scaffolds or runways.

29 CFR 1926.250(b)(5)

h. Bricks shall be stacked no more than 7 feet high. When additional bricks are added to a 4-foot-high loose brick stack, the stack shall be tapered back 2 inches per layer.

29 CFR 1926.250 (b)(6)

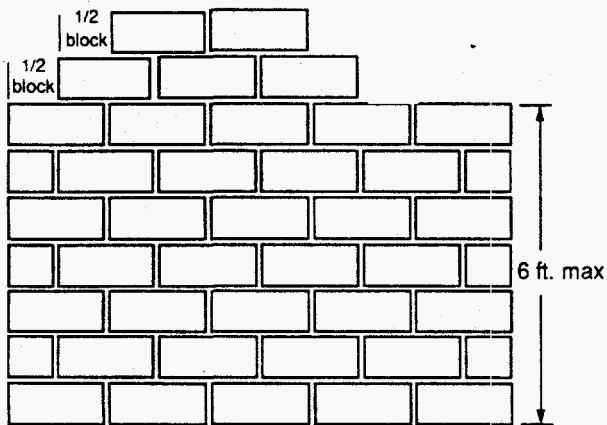


Loose Brick Pile



- i. When masonry blocks are stacked higher than 6 feet, the stack shall be tapered back 1/2 block per tier above the 6 foot level.

29 CFR 1926.250(b)(7)



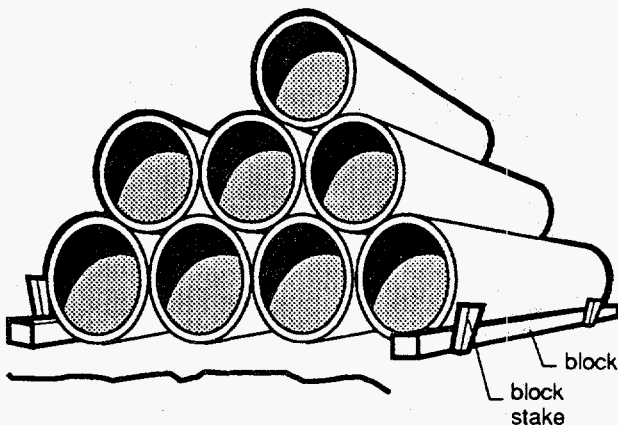
Masonry Blocks

- j. Used lumber shall be free of nails, and all lumber shall be stacked on level and solidly supported sills. Lumber shall be stacked so that it is stable and self-supporting. Used lumber shall be stored in piles no higher than 20 feet if stacked by machine or 16 feet if stacked by hand.

29 CFR 1926.250(b)(8)(i-iv)

- k. Cylindrically shaped material (not stored on a rack), such as structural steel, pipe, poles, and bar stock, shall be stacked or blocked to prevent it from tilting or spreading.

29 CFR 1926.250(b)(9)



Cylindrical Storage

## 2. Rigging Equipment for Material Handling

### a. General Requirements

- (1) All rigging equipment shall be inspected before it is used and, as necessary, while it is in use. Defective equipment shall not be used and shall be removed from service.

29 CFR 1926.251(a)(1)

- (2) Rigging equipment shall not be loaded over its recommended safe work load.

29 CFR 1926.251(a)(2)

- (3) Rigging equipment shall be removed from the immediate work area when it is not in use.

29 CFR 1926.251(a)(3)

- (4) Specially designed lifting equipment and accessories shall be marked to indicate the safe work load and shall be proof-tested to 125% of their rated work load before they are used.

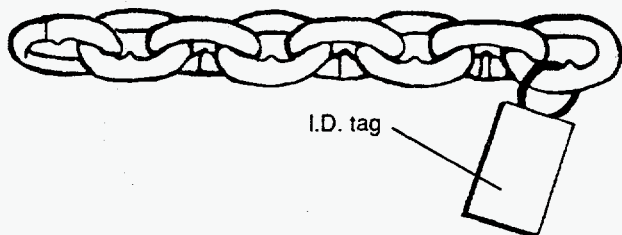
29 CFR 1926.251(a)(4)

**Note:** The guidance in this section also applies to cranes and derricks.

### b. Chains

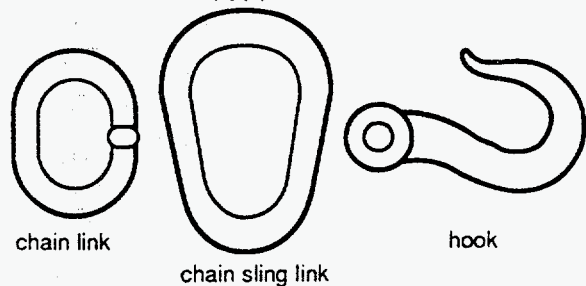
- (1) A welded alloy-steel chain sling shall have a permanently affixed, durable identification label stating size, grade, rated capacity, and manufacturer.

29 CFR 1926.251(b)(1)



- (2) A hook, link, or other accessory attached to an alloy-steel chain shall have a rated capacity at least equal to that of the chain.

29 CFR 1926.251(b)(2)



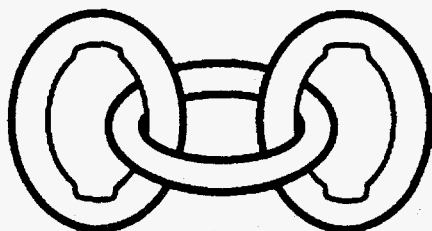


(3) A homemade job or shop hook, links or fasteners formed from a bolt or rod, and other similar makeshift attachments shall not be used.

29 CFR 1926.251(b)(3)

(4) When a link in a chain is worn beyond the allowable level, it shall be removed from service. (Refer to table H-2 in 29 CFR 1926.251.)

29 CFR 1926.251(b)(5)



Link Wear

#### c. Wire Rope

(1) Wire rope or wire-rope slings shall be used only within safe workload limits. For information about workload factors, refer to appropriate wire-rope tables in 29 CFR 1926.251 or to the manufacturer's recommendations.

29 CFR 1926.251(c)(1)

(2) Protruding ends of strands in splices on slings shall be covered or blunted.

29 CFR 1926.251(c)(2)

(3) Wire rope shall not be secured with knots. (An exception may be made for haul-back lines on scrapers.)

29 CFR 1926.251(c)(3)

(4) Eye splices shall have at least three tucks. Other types of eye splices may be used if they are not otherwise prohibited and if they have been shown to be effective (through a manufacturer's certificate of test available for examination, for example).

29 CFR 1926.251(c)(4)(i)

(5) Each wire rope used for lifting shall be one continuous piece, without a knot or splice. (Exception may be made for end eye splices and endless slings.)

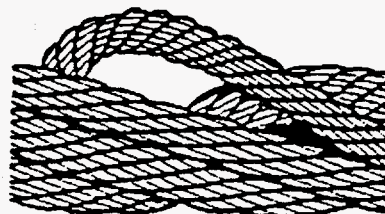
29 CFR 1926.251(c)(4)(ii)

(6) Eyes in bridles, slings, or bull wires shall not be formed by wire-rope clips or knots.

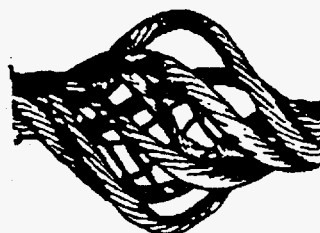
29 CFR 1926.251(c)(4)(iii)

(7) Wire rope shall not be used if either of the following conditions exist: (1) in any length of 8 diameters, the number of visible broken wires is more than 10% of the total; or (2) there are indications of defects, corrosion, or excessive wear, as shown in the following illustrations.

29 CFR 1926.251(c)(4)(iv)



high stranding



bird caging



broken strands



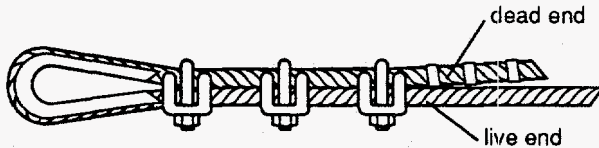
kinking

#### Wire-Rope Damage



(8) When U-bolt wire-rope clips are used to form eyes, the appropriate number of clips and the amount of space between the clips shall be determined according to Table O-1. The "u" section of a U-bolt shall always be in contact with the wire-rope dead end.

29 CFR 1926.251(c)(5), (c)(5)(i)



"U" Bolt Formed Eye

*"Never Saddle a Dead Horse" is a familiar expression which serves to remind riggers that the broad saddle-shaped portion of a wire-rope clip is less damaging than the U-bolt and therefore should be put over the live (load bearing) end.*

Table O-1. Number and Spacing of U-Bolt Wire-Rope Clips

Improved Plow Steel, Rope Diameter (Inches)	Number of Clips		Minimum Spacing (Inches)
	Drop Forged	Other Material	
1/2	3	4	3
5/8	3	4	3 3/4
3/4	4	5	4 1/2
7/8	4	5	5 1/4
1	5	6	6
1 1/8	6	6	6 3/4
1 1/4	6	7	7 1/2
1 3/8	7	7	8 1/4
1 1/2	7	8	9

#### d. Natural Rope and Synthetic-Fiber Rope

(1) Natural or synthetic-fiber rope shall be used only within its safe workload limits. Refer to tables in 29 CFR 1926.251.

29 CFR 1926.251(d)(1)

(2) Splices in rope slings shall be made according to the rope manufacturer's recommendations.

(a) Manila-rope eye splices shall have at least 3 full tucks; short splices shall have 6 full tucks (3 on each side of the center of splice).

29 CFR 1926.251(d)(2)(i)

(b) Synthetic-rope eye splices shall have at least 4 full tucks. Short splices shall have at least 8 full tucks (4 on each side of the center of splice).

29 CFR 1926.251(d)(2)(ii)

(3) Strand ends shall not be trimmed short (flush with the surface of the rope) if they are adjacent to the full tucks. For fiber rope less than 1 inch in diameter, the tails shall project at least 6 rope diameters beyond the last full tuck; for fiber rope 1 inch in diameter or larger, the tails shall project at least 6 inches beyond the last full tuck.

29 CFR 1926.251(d)(2)(iii)

(4) For all eye splices, the eye shall be large enough to form an included angle of no more than 60° at the splice when the eye is placed over the load or support.

29 CFR 1926.251(d)(2)(iv)

(5) Knots shall not be used instead of splices.

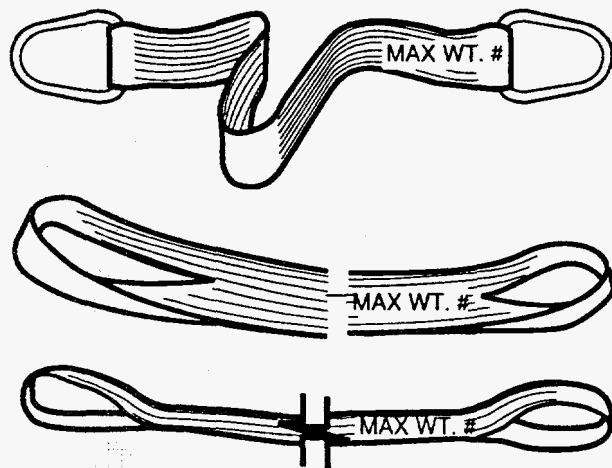
29 CFR 1926.251(d)(2)(v)

(6) Web or rope slings shall be protected (with a blunting material) to prevent cuts from the sharp edges of material being hoisted.

#### e. Synthetic Webbing

(1) Each synthetic web sling shall be marked or coded to show the manufacturer's name or trademark, rated capacity, and type of material.

29 CFR 1926.251(e)(1)(i-iii)



Synthetic Web Slings

(2) The rated capacity of synthetic webbing shall not be exceeded.

29 CFR 1926.251(e)(2)

(3) Synthetic web slings shall be protected (with a blunting material) to prevent cuts from the sharp edges of material being hoisted.





## f. Shackles and Hooks

(1) The safe workload of each shackle shall be calculated using Table O-2 or manufacturer's recommendations.

29 CFR 1926.251(f)(1)

**Table O-2. Safe Working Loads for Shackles**  
(In Tons of 2,000 Pounds)

Material Size (Inches)	Pin Diameter (Inches)	Safe Working Load
1/2	5/8	1.4
5/8	3/4	2.2
3/4	7/8	3.2
7/8	1	4.3
1	1 1/8	5.6
1 1/8	1 1/4	6.7
1 1/4	1 3/8	8.2
1 3/8	1 1/2	10.0
1 1/2	1 5/8	11.9
1 3/4	2	16.2
2	2 1/4	21.2

(2) To determine the safe workload for hooks, the manufacturer's recommendations shall be followed. All hooks for which the manufacturer's recommendations are not available shall be tested to twice the intended safe workload before they are used, and records of these tests shall be maintained.

29 CFR 1926.251(f)(2)

## 3. Waste Disposal

a. When debris must be dropped through holes in the floor without the use of a chute, refer to Sec. III.N.1.j for details.

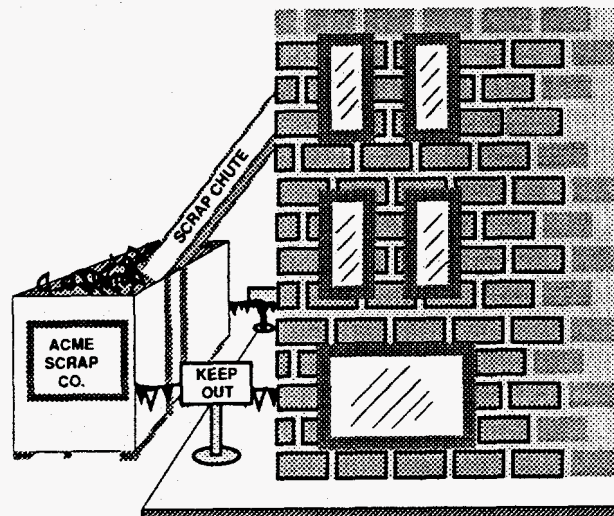
29 CFR 1926.252(b); 850(h)

b. All scrap material shall be removed as work progresses; waste shall be burned only in accordance with local fire and environmental regulations.

29 CFR 1926.252(c,d)

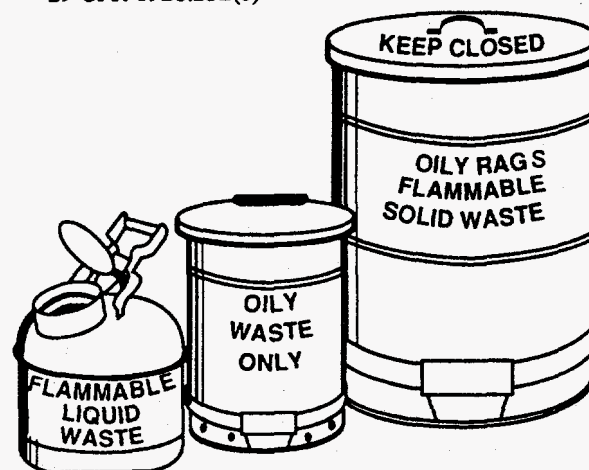
c. When material is dropped more than 20 feet to a point outside a building, an enclosed chute made of wood or other equivalent material shall be used.

29 CFR 1926.252(a)



d. Solvents, oily rags, and other flammable waste shall be kept in closed fire-resistant containers until they are removed from the worksite; they shall be disposed of in accordance with appropriate environmental regulations.

29 CFR 1926.252(e)



## 4. Safety Instruction

Workers shall be instructed in the basic safety of material storage and handling, and in the use of lifting equipment and devices necessary for their safety in their work assignment.

29 CFR 1926.21(b)(2)





## DEFINITIONS

**Hoistway** — The area in which materials are being hoisted.

**Load Limit** — The maximum amount of weight, in psf, allowable in a specific area, such as the floor of a building.

**Natural Rope** — Flexible, heavy cord made from twisted hemp or other natural fibers.

**Rigging** — Slings made of wire rope, chain, or synthetic or nylon web; spreader bars; and other special devices that are used to attach a load to a crane or to a hoist.

**Shackle** — U-shaped metal device and threaded pin to fit across the leg end closing the "U" opening that is used to fasten objects to rigging equipment for lifting.

**Sling** — A length of chain or natural, synthetic, or wire rope that supports a load and attaches to a crane hook.

**Splice** — To join two parts of natural or wire rope by interweaving the strands.

**Synthetic-Fiber Rope** — Flexible heavy cord of twisted nylon or other artificial fiber.

**Wire Rope (Cable, Steel Cable)** — Multiple twisted strands of wire.

**KEY ITEMS CHECK LIST**  
**SECTION O. MATERIAL HANDLING, STORAGE, USE, AND DISPOSAL**

Item	Paragraph	Notes
1. STORAGE	O.1	
Is material stored so that it will not collapse?	O.1.a	
Are load limits posted for floors?	O.1.b	
Are passageways unobstructed?	O.1.c	
Is material stored away from hoistways and floor openings?	O.1.e	
Is bagged material layered, stepped back, and crosskeyed?	O.1.f	
Is material storage on scaffolds and runways restricted?	O.1.g	
Are brick stacks limited to 7 feet in height, and are stacks tapered above the 4-foot level?	O.1.h	
Are block stacks either limited to 6 feet or tapered 1/2 block per tier above the 6-foot level?	O.1.i	
Are nails removed from used lumber?	O.1.j	
Is lumber stacked in stable piles?	O.1.j	
Are round materials, such as poles, pipes, and bar stock, blocked to prevent spreading or rolling?	O.1.k	
2. RIGGING EQUIPMENT FOR MATERIAL HANDLING	O.2	
a. <i>General Requirements</i>	O.2.a	
Is rigging equipment inspected, and are defective items excluded from use?	O.2.a (1)	
Are load limits observed?	O.2.a (2)	
Are unused items protected from damage?	O.2.a (3)	
Are specially designed lifting accessories proof-tested and marked to 125% of rating?	O.2.a (4)	
b. <i>Chains</i>	O.2.b	
Are chains tagged according to size, grade, and capacity?	O.2.b (1)	



## KEY ITEMS CHECK LIST (continued)

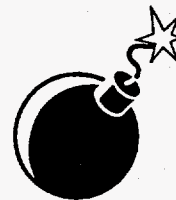
Item	Paragraph	Notes
Is the capacity of hooks, links, or other accessories equal to that of the alloy-steel chain to which these items are attached?	O.2.b (2)	
Are shop-made (makeshift) attachments prohibited?	O.2.b (3)	
Are worn chains removed from service?	O.2.b (4)	
c. <i>Wire Rope</i>	O.2.c	
Are the safe workload limits of wire rope known and observed?	O.2.c (1)	
Are defects such as bird caging, high stranding, broken strands, and kinking identified by inspection?	O.2.c (7)	
Are knots prohibited?	O.2.c (3)	
Are eye splices or wire-rope clips used correctly?	O.2.c (4) O.2.c (8)	
d. <i>Natural Rope and Synthetic-Fiber Rope</i>	O.2.d	
Are the safe workload limits of fiber rope known and observed?	O.2.d (1)	
Are the recommended splicing methods used? (3 tucks for Manila, 4 tucks for synthetic)	O.2.d (2)	
Are knots prohibited?	O.2.d (5)	
Are web or rope slings protected from sharp loads?	O.2.d (6)	
e. <i>Synthetic Webbing</i>	O.2.e	
Are maximum load, rated capacity, and type of material marked on each sling and observed?	O.2.e (1) O.2.e (2)	
Are synthetic slings protected from sharp loads?	O.2.e (3)	
f. <i>Shackles and Hooks</i>	O.2.f	
Are the workload limits of shackles and hooks known and observed?	O.2.f (1)	
Are unknown workloads for hooks determined by testing the hook at twice the intended safe workload and are records kept?	O.2.f (2)	
Are shackles and hooks used according to manufacturers' specifications?	O.2.f (2)	

# KEY ITEMS CHECK LIST (continued)

	Item	Paragraph	Notes
3.	WASTE DISPOSAL	O.3	
	Are waste and scrap drop-through chutes or openings clear, barricaded, or posted?	O.3.a	
	Is scrap removed?	O.3.b	
	Are fire-resistant containers provided and used for oily rags, flammable liquids, and other flammable waste?	O.3.d	
4.	SAFETY INSTRUCTION	O.4	
	Are workers instructed in safe material-handling techniques?	O.4	
	Are workers instructed in the safe use of material-handling devices?	O.4	



## Section P. Blasting and the Use of Explosives



### 1. General Requirements

a. Employers shall ensure that only authorized and qualified workers are allowed to use and handle explosives.

**Note:** *Authorized and qualified* should be represented as credible experience, training, or certification or licensing when applicable.

29 Code of Federal Regulations (CFR) 1926.900(a)



b. Cigarettes, firearms, matches, open flame lamps, fires and sparks, and flame- or heat-producing devices shall be prohibited in or near explosives magazines. They shall also be prohibited while explosives are being handled, transported, or used.

29 CFR 1926.900(b)



c. Workers and explosives handlers shall not handle or use explosives while under the influence of intoxicating liquor, narcotics, medication, or other dangerous drugs.

29 CFR 1926.900(c)

d. Explosives shall be accounted for at all times; explosives not being used shall be kept in a locked magazine accessible only to an authorized person. If there is any loss from, and/or unauthorized entry into, a storage magazine, the appropriate authorities shall be notified. Explosive and blasting agents shall not be abandoned.

29 CFR 1926.900(d,e)

e. Fires in immediate danger of contacting explosives shall not be fought. Workers shall move to a safe area and the fire area shall be guarded against intruders.

29 CFR 1926.900(f)

f. Detonators and other explosives taken from storage magazines to blasting areas shall be kept in their original containers or other containers designed for blasting material or explosives safety.

29 CFR 1926.900(g)

g. When blasting must take place in congested areas or near a structure, railway, highway, or any other installation that may be damaged, the blaster shall take special precautions in loading, delaying, or initiating blasting by confining each blast with mats or other methods to control the dispersal of fragments.

29 CFR 1926.900(h)

h. When preparing and conducting blast operations, authorized workers shall use every precaution to ensure personnel safety (for example, posting warning signs or sounding sirens) and to prevent access to the blasting area to all except essential personnel.

29 CFR 1926.900(i)





i. Above-ground blasting operations shall be conducted between sunup and sundown.

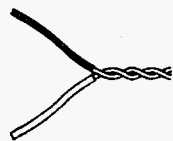
29 CFR 1926.900(j)

j. Precautions shall be taken to prevent extraneous currents induced by radar, radio transmitters, lightning, adjacent power lines, dust storms, or other sources of electricity from causing accidental discharge of electric blasting caps.

29 CFR 1926.900(k)

k. Until wired into the blasting circuit, detonators shall be short-circuited in holes that have been primed and shunted at the blasting machine.

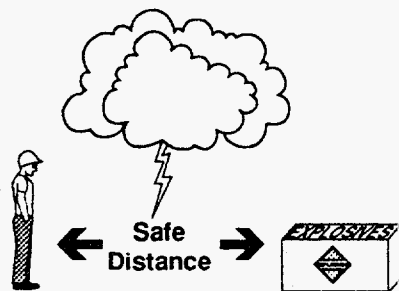
29 CFR 1926.900(k)(1)



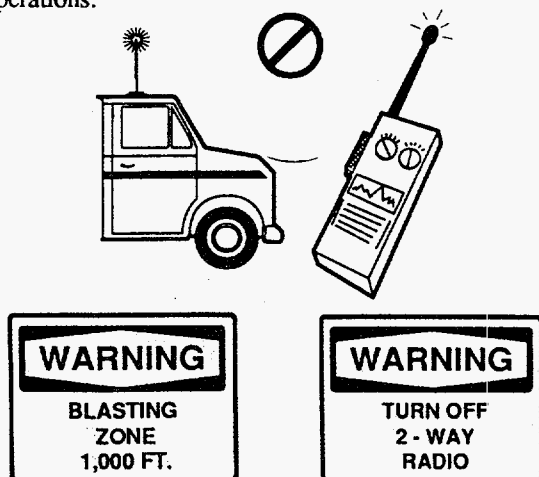
Short-Circuited Blasting Wire

l. Immediately before and during an electrical storm, workers shall move to a safe location and blasting operations shall be suspended.

29 CFR 1926.900(k)(2)



m. Precautions shall be taken to prevent extraneous currents induced by mobile radio transmitters from causing accidental discharge of electric blasting caps. Signs warning against the use of mobile radio transmitters shall be clearly posted on all roads within 1,000 feet of blasting operations.



n. If the 1,000-foot requirement for signs warning against using mobile radio transmitters in a blasting area creates operational problems, a competent person shall be consulted to evaluate the situation and make alternate provisions. A written record of the alternate provisions shall be kept at the construction site and be certified by the competent person as meeting the purpose of the requirement.

29 CFR 1926.900(k)(3)(i)



o. Mobile radio transmitters that are within 100 feet of electric blasting caps shall be de-energized and locked. All transmitter microphones on the blasting site shall be removed from the transmitter and locked under the control of the chief blaster.

29 CFR 1926.900(k)(4)

p. All boxes and fiber packing materials in which high explosives were packed shall not be reused for any purpose. Such boxes and packing materials, where allowed, shall be burned at an approved location in accordance with state and local regulations. Before any boxes are burned, they shall be inspected to ensure that they are empty.

29 CFR 1926.900(l)

q. Damaged or deteriorating explosives, blasting agents, and blasting supplies shall not be used.

29 CFR 1926.900(m)

r. Only authorized persons shall deliver and issue explosives. After the explosives have been delivered and issued, they shall be placed in authorized magazines or in approved temporary storage or handling areas.

29 CFR 1926.900(n)

s. Blasting operations shall not be carried out near overhead power lines, communication lines, utility services, or other services and structures until the operators and owners of these lines have been notified and safety control measures have been taken.

29 CFR 1926.900(o)



- t. Black powder shall not be used as a secondary or main charge explosive for blasting.

29 CFR 1926.900(p)



- u. All loading and firing shall be directed and supervised by competent persons thoroughly experienced in the use of explosives.

29 CFR 1926.900(q)



## 2. Blaster Qualifications

- a. Blasters shall be able to understand and give written and oral instructions and orders.

29 CFR 1926.901(a)

- b. Blasters shall be in good physical condition and shall not be addicted to narcotics, intoxicants, or similar drugs.

29 CFR 1926.901(b)

- c. Blasters shall be qualified through training, knowledge, or experience to transport, store, handle, and use explosives. Blasters shall also have a working knowledge of state and local laws and regulations governing explosives.

29 CFR 1926.901(c)



- d. Employers shall require and maintain satisfactory evidence of their blaster's competence in

- handling explosives and
- safely performing the type of blasting required.

29 CFR 1926.901(d)



- e. Blasters shall be knowledgeable and competent in the use of each type of blasting method.

29 CFR 1926.901(e)



## 3. Surface Transportation of Explosives

*Commercial vehicles and drivers must comply with applicable requirements of 49 CFR 390–397.*

- a. Only commercially licensed and physically fit drivers shall drive or be in charge of the motor vehicles or conveyances that transport explosives; drivers shall be familiar with the local, state, and federal regulations for transporting explosives.

29 CFR 1926.902(b)



- b. Workers shall not smoke or carry matches, firearms, loaded cartridges, or any other flame-producing devices while in or near a motor vehicle transporting explosives.



29 CFR 1926.902(c)

- c. Fuse caps, electric caps, monel caps, or any type of detonator (primary explosive) shall not be transported in the same vehicle with secondary or main charge explosives.

29 CFR 1926.902(d)

- d. Vehicles used for transporting explosives shall be capable of carrying the load without difficulty and shall be in good mechanical condition.

29 CFR 1926.902(e)

- e. When explosives are transported in an open-body vehicle, a securely mounted Class II magazine or original manufacturer's container shall be used to safely contain the cargo.

29 CFR 1926.902(f)

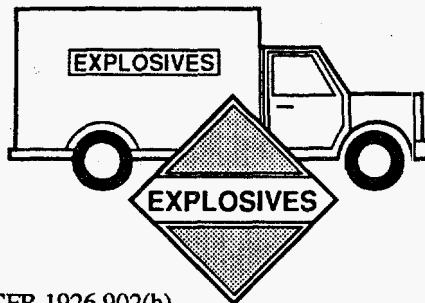
- f. All vehicles used to transport explosives shall have tight floors. Any exposed metal that might produce sparks inside the body of the vehicle shall be covered with wood or other nonsparking material.

**Note:** Privately owned vehicles shall not be used to transport explosives.



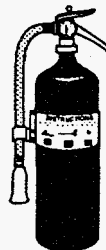
29 CFR 1926.902(g)

g. Every motor vehicle or conveyance used to transport explosives shall be marked to comply with Department of Transportation criteria.



29 CFR 1926.902(h)

h. Each vehicle used to transport explosives shall be equipped with a 10-A/B/C-rated, fully charged fire extinguisher. Drivers shall be taught how to use fire extinguishers supplied in the vehicles.



29 CFR 1926.902(i)

i. Motor vehicles or conveyances that are carrying explosives, blasting agents, or blasting supplies shall not be serviced or repaired indoors.

29 CFR 1926.902(j)

j. Motor vehicles that are transporting explosives shall never be left unattended.

29 CFR 1926.902(k)

#### 4. Storage of Explosives and Blasting Agents

*All explosives storage shall be in compliance with 29 CFR 1926.904 and the current DOE Explosives Safety Manual DOE/EV/06194. Strict detail shall be given to required distances to inhabited buildings, parking areas, public roads, and airfields.*

a. Blasting caps, detonating primers, and primed cartridges shall not be stored in the same magazine with other explosives or blasting agents.

29 CFR 1926.904(b)

b. Smoking and open flames shall not be permitted within 50 feet of explosives and detonator storage magazines.

29 CFR 1926.904(c)

c. The fire department and other emergency response agencies are to be notified of the location of explosives.

National Fire Protection Association (NFPA) 495 2-11

#### 5. Loading Explosives or Blasting Agents

a. A written conduct of operations should be established. A briefing for all workers on site shall be held before explosives are brought on site by the blaster.

b. Procedures for safe and efficient loading of explosives shall be established before loading or blasting begins. The number of workers present during operations shall be limited to only those needed for the operation.

29 CFR 1926.905(a)

c. All drill holes shall be large enough to allow explosive cartridges to be loaded freely.

29 CFR 1926.905(b)

d. Wooden rods or plastic tamping poles with no exposed metal parts shall be used to tamp explosives into drill holes. Violent tamping shall be avoided, and the primer shall never be tamped.

29 CFR 1926.905(c)

e. New holes shall not be drilled until all previously drilled holes have been examined for undetonated explosives. If misfires are discovered, the immediate supervisor shall be notified and provisions made to safely refire the hole. A worker shall stand guard at the misfire to ensure that unauthorized personnel do not enter the area where misfires have been found.

29 CFR 1926.905(e)

f. Workers shall not deepen drill holes which have previously contained explosives or blasting agents.

29 CFR 1926.905(f)

g. Explosives and blasting agents, including misfires, shall not be left unattended at the blasting site.

29 CFR 1926.905(g)

h. Only drill holes to be blasted shall be loaded. When loading is complete, all unused explosives shall be immediately returned to an authorized magazine.

29 CFR 1926.905(d)

i. Machines and tools not used for loading explosives shall be removed from the immediate area before explosives are delivered. Equipment shall not be operated within 50 feet of loaded holes.

29 CFR 1926.905(h)

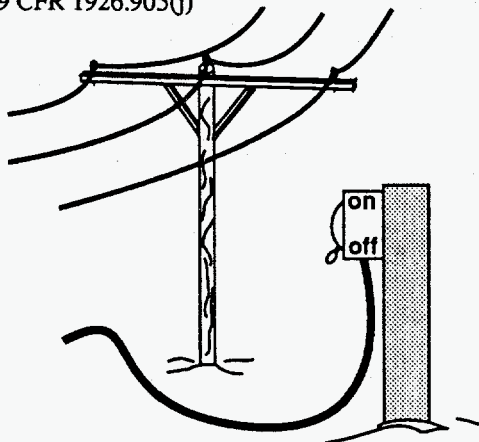


j. No activities other than those required to load holes with explosives shall be permitted in a blast area.

29 CFR 1926.905(i)

k. Power lines and portable electric cables for equipment shall be kept a safe distance from explosives or blasting agents being loaded into drill holes. Cables near the blast area shall be de-energized and locked out by the blaster.

29 CFR 1926.905(j)



l. Drill holes shall be checked before they are loaded to determine their depth and condition. Drilling shall not be performed within 50 feet of a misfire hole.

29 CFR 1926.905(k)

m. Warning signs shall be posted at all entries to the blast area.

29 CFR 1926.905(p)

n. Loaded holes shall not be left unattended or unprotected.

29 CFR 1926.905(s)

o. Blasters shall keep accurate, up-to-date records of explosives, blasting agents, and blasting supplies used in a blast. Blasters shall keep an accurate running inventory of all explosives and blasting agents stored on the construction site.

29 CFR 1926.905(t)



## 6. Initiation of Explosive Charges—Electric Blasting

a. Where extraneous sources of electricity make the use of electric blasting caps dangerous, electric blasting caps shall not be used. Blasting-cap leg wires shall be kept short-circuited (shunted) until they are connected into the circuit for firing.

29 CFR 1926.906(a)

b. During any individual blasting, all caps shall be of the same style, function, and manufacture.

29 CFR 1926.906(c)

c. Blasting circuits or power circuits used during electric blasting shall be set up following the recommendations of the electric blasting cap manufacturer, an approved contractor, or a designated representative.

29 CFR 1926.906(d)

d. Before adopting any system of electrical firing, blasters shall conduct a thorough survey for extraneous electrical currents; all such currents shall be eliminated before the holes are loaded.

29 CFR 1926.906(b)

e. When firing a circuit of electric blasting caps, care shall be taken to ensure that adequate current can be delivered according to the manufacturer's recommendation.

29 CFR 1926.906(e)

f. Connecting wires and lead wires shall be insulated, solid, single wires with sufficient current-carrying capacity.

29 CFR 1926.906(f)

g. Bus wires shall be solid, single wires with sufficient current-carrying capacity.

29 CFR 1926.906(g)



h. The insulation on all firing lines shall be adequate and in good condition.

29 CFR 1926.906(h)

i. The power circuit used to fire electric blasting caps shall not be grounded.

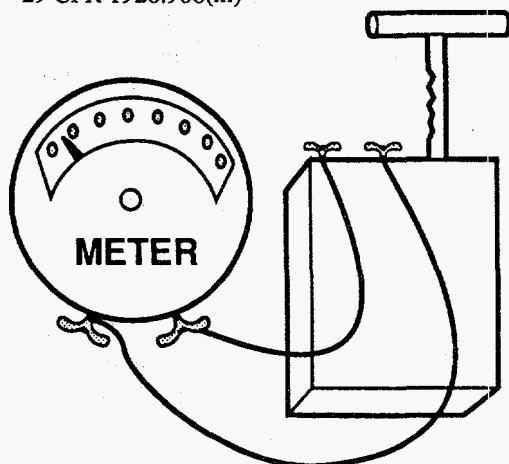
29 CFR 1926.906(i)





j. Blasting machines shall be in good condition and shall be tested periodically to make sure that they can deliver power at the rated capacity.

29 CFR 1926.906(m)



Blasting Machine and Meter

k. The connections made on firing machines shall be made according to the recommendations of the manufacturer of the blasting caps.

29 CFR 1926.906(n)

l. When a power circuit is used for firing, the firing switch shall be locked in the "Off" position before the round is fired. The switch shall be designed so that the firing lines to the cap circuit are automatically short-circuited when the switch is in the "Off" position. No one other than the blaster shall control the keys to the firing switch.

29 CFR 1926.906(l)

m. The number of electric blasting caps connected to a blasting machine shall not exceed the machine's rated capacity. In primary blasting, the number of blasting caps connected in series is limited by the cap manufacturer.

29 CFR 1926.906(o)

n. Blasters shall be in charge of the blasting machines. No one other than the blaster in charge shall connect the lead wires to the blasting machine.

29 CFR 1926.906(p)

o. When testing circuits leading to charged holes, blasters shall use blasting galvanometers that are equipped with a silver chloride cell or a blasting multimeter.

29 CFR 1926.906(q)

p. Whenever the possibility exists that a lead line or a blasting wire might be thrown over a live power line by the force of an explosion, care shall be taken to (1) make sure that the total length of wires is kept to a minimum so that the length is too short to contact the line or (2) make sure that the wires are securely anchored to the ground. If neither

precaution can be taken, a nonelectrical system shall be used.

29 CFR 1926.906(r)

q. The person connecting the lead wire shall fire the shot. All connections shall be made from the bore hole back to the source of firing current. Until the charge is to be fired, the lead wires shall remain shorted and shall not be connected to the blasting machine or other source of current.

29 CFR 1926.906(s)

## 7. Use of Safety Fuses

a. Safety fuses shall be used only when extraneous sources of electricity make the use of electric blasting caps dangerous. Hammered, crushed, or damaged fuses shall not be used.

29 CFR 1926.907(a)

b. Each blasting fuse shall have a fresh-cut end. To ensure a fresh cut, a short length of fuse shall be cut from the end of the supply reel before the safety fuse is capped. The cut piece should be taken to a safe location and burned.

29 CFR 1926.907(c)

c. Only a cap crimper of approved design shall be used to attach blasting caps to safety fuses. Crimpers shall be kept in good repair and accessible for use.

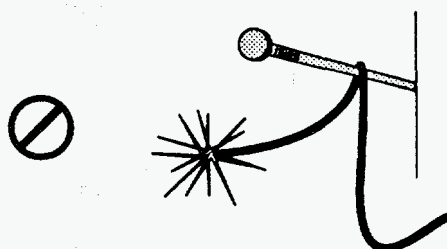
29 CFR 1926.907(d)

d. When blasting with safety fuses, consideration shall be given to the burning rate and length of the safety fuse to allow sufficient time for the blaster to reach a safe place before the blast goes off. It is advisable to cut a measured one foot of fuse and then test burn it at a remote safe location to confirm the burn and burn rate of the safety fuse.

29 CFR 1926.907(m)

e. Hanging fuses on nails or other projections that may form sharp bends in the fuses is prohibited.

29 CFR 1926.907(b)



f. No unused cap or short-capped fuse shall be placed in any hole to be blasted. Unused detonators shall be removed from the work area and destroyed.

29 CFR 1926.907(e)





g. Fuses shall not be capped and primers shall not be made up in any magazine or near any possible ignition source.

29 CFR 1926.907(f)

h. Workers shall not carry detonators or primers when they are in an unapproved area. Workers shall not carry detonators or primers in their pockets, around their necks, or on any part of their person.

29 CFR 1926.907(g)

i. Safety fuses used in blasting shall be at least 30 inches long.

29 CFR 1926.907(h)

j. Ignitor fuses are the recommended means of lighting fuse rounds. If ignitor fuses cannot be used and multiple cap and fuse blasting is done using hand-lighting methods, at least two people shall be present.

29 CFR 1926.907(i)

k. When the multiple cap and fuse blasting is done by hand-lighting methods, not more than 12 fuses shall be lit by each blaster.

29 CFR 1926.907(j)

## 8. Use of Detonating Cord

a. Care shall be taken to select detonating cord appropriate for the type and physical condition of the bore hole and the type of explosive used.

29 CFR 1926.908(a)

b. Before loading the remainder of a hole or placing additional charges, the line of detonating cord extending from a bore hole or from a charge shall be cut from the supply spool.

29 CFR 1926.908(c)

c. Detonating cord shall be handled and used with care to avoid damaging or cutting the cord during or after loading and hooking up.

29 CFR 1926.908(d)

d. Detonating cord connections shall be made following approved, recommended methods. Knot-type or other cord-to-cord connections shall be made only with detonating cord in which the explosive core is dry.

29 CFR 1926.908(e)

e. Before firing the blast, all detonating cord connections shall be inspected.

29 CFR 1926.908(g)

f. All detonating cord trunk lines and branch lines shall be free of loops, sharp kinks, or angles that direct the cord back toward the oncoming line of detonation.

29 CFR 1926.908(f)

g. When using detonating cord with millisecond-delay connectors or short-interval delay electric blasting caps, manufacturer's recommendations shall be strictly followed.

29 CFR 1926.908(h)

h. Detonators for firing the trunk-line shall not be brought to the loading area or attached to the detonating cord until the blast is about to be fired.

29 CFR 1926.908(j)

## 9. Firing the Blast

a. A code of blasting signs shall be posted in one or more prominent places at the operation. All workers shall be familiar with the code and shall conform to it. Danger signs shall be placed at appropriate locations. The following blasting signals shall be used:

29 CFR 1926.909(a)



- |                     |  |
|---------------------|--|
| 1. WARNING SIGNAL   | A 1-MINUTE SERIES OF LONG BLASTS 5 MINUTES BEFORE BLAST SIGNAL |
| 2. BLAST SIGNAL     | A SERIES OF SHORT BLASTS 1 MINUTE BEFORE THE SHOT              |
| 3. ALL-CLEAR SIGNAL | A PROLONGED BLAST FOLLOWING THE INSPECTION OF BLAST AREA       |

b. Before firing a blast, the blaster in charge shall give a loud warning signal. The blaster shall ensure that all surplus explosives are in a safe place and that all workers, vehicles, and equipment are at a safe distance or under sufficient cover.

Note: Be aware of probable close air traffic because it may become necessary to file firing schedules and traffic control plans with the Federal Aviation Administration (FAA).

29 CFR 1926.909(b)



c. Flaggers shall be safely stationed on highways that pass through the danger zone so that they can stop traffic during blasting operations.

29 CFR 1926.909(c)

d. Blasting times shall be arranged and coordinated by the blaster.

29 CFR 1926.909(d)

## 10. Inspection After Blasting

a. Immediately after the blast has been fired, the firing line shall be disconnected from the blasting machine. If power switches are used, they shall be locked in the "Off" position, and lead lines shall be short circuited.

29 CFR 1926.910(a)

b. If blasting is conducted in a tunnel, workers are not allowed to return to their work area for 15 minutes after blasting. Before workers are allowed to return to the operation, the blaster shall inspect the area and the surrounding rubble to ensure that all charges have exploded. The entire area shall be wet down to minimize dust exposure to workers.

29 CFR 1926.910(b)

## 11. Misfires

a. If a misfire is found, the blaster shall take proper precautions to ensure that all workers are kept from the danger zone.

29 CFR 1926.911(a)

b. No more work than what is necessary to remove the hazard of the misfire shall be done, and only those workers necessary to remove the hazard shall remain in the danger zone.

29 CFR 1926.911(b)

c. No attempt shall be made to remove explosives from any charged or misfire hole. If an explosive misfires, a new primer shall be put in the hole and the hole shall be reblasted. If refiring the misfire hole presents a hazard, the explosives shall be washed out of the hole with water or, if the misfire is underwater, it shall be blown out with air.

29 CFR 1926.911(c)

d. If there are any misfires while using a cap and fuse method, all workers shall stay away from the charge for at least 1 hour. Misfires shall be handled under the direction of the person in charge of the blasting. All wires and fuses shall be carefully traced, and a search shall be made for unexploded charges.

29 CFR 1926.911(d)

e. No drilling, digging, or picking shall be allowed until (1) all missed holes have been detonated or (2) the authorized representative gives approval.

29 CFR 1926.911(e)

## 12. Underwater Blasting

a. A blaster shall perform all blasting operations; no shot shall be fired without the blaster's approval.

29 CFR 1926.912(a)

b. Loading tubes and casings made of different metals shall not be used together because extraneous electrical currents may be generated from galvanic action of the metals and water.

29 CFR 1926.912(b)

c. Only water-resistant blasting caps and detonating cords shall be used for underwater blasting. If a loading tube is needed, a nonsparking metal tube shall be used.

29 CFR 1926.912(c)

d. Blasting flags shall be displayed in all areas around the blasting site.

29 CFR 1926.912(f)

e. When more than one charge is placed underwater, float devices shall be attached to an element of each charge so that, when a charge is fired, the float device is released.

29 CFR 1926.912(h)

f. No blasting shall be done when an underwater vessel is closer than 1,500 feet. Personnel on vessels that are moored or at anchor within 1,500 feet shall be notified before the blast is fired.

29 CFR 1926.912(d)

g. No blasting shall take place while swimming or diving operations are being conducted in the vicinity of the blasting area.

29 CFR 1926.912(e)



## DEFINITIONS

**Approved Storage Facility** — A facility for storing explosive materials. Approved storage facilities conform to 26 CFR Part 181 and to the manufacturer's recommended requirements for storing explosives.

**Blast Area** — The area in which explosives loading and blasting operations are conducted.

**Blaster** — A person authorized to use explosives for blasting purposes.

**Blasting Agent** — Any material or mixture consisting of a fuel and oxidizer used for blasting.

**Blasting Cap** — A metallic tube that is closed at one end and contains a charge of one or more detonating compounds. Blasting caps are designed for, and capable of, detonation from the sparks of a safety fuse that is inserted and crimped into the open end or from an electric charge to an electric blasting cap.

**Block holing** — Breaking of boulders by firing an explosive charge that has been loaded in a drill hole.

**Detonating Cord** — A flexible cord containing a center core of high explosives that, when detonated, has sufficient strength to detonate cap-sensitive explosives with which it is in contact.

**Detonator** — Any of the following devices: blasting cap, electric blasting cap, electric delay blasting cap, or nonelectric delay blasting cap.

**Drill Hole** — A hole drilled in a surface for the placement of explosives.

**Electric Blasting Circuitry** — Insulated wire used to carry a charge from an electrical power source to an electric blasting cap.

**Explosives** — A substance that is chemically stable but may be made to undergo rapid change that produces large quantities of energy and are defined into basic **classifications** as follows:

US Department of Transportation (DOT) classifications, ref. 29 CFR 1926.914(n)(3);

**Class A** — Explosives possessing a detonating hazard, such as dynamite, nitroglycerin, picric acid, lead azide, fulminate of mercury, black powder, blasting caps, and detonating primers.

**Class B** — Explosives possessing a flammable hazard, such as propellant explosives. Class B explosives include some smokeless propellants.

**Class C** — Explosives, including certain types of manufactured articles, which contain Class A and Class B explosives, or both, as components in restricted quantities.

United Nations Organization (UNO) classifications and divisions, ref. DOE Explosive Safety Manual IV-3,1;

**Class 1, Division 1** — Explosives that are mass detonating.

**Class 1, Division 2** — Explosives that are nonmass detonating, fragment producing.

**Class 1, Division 3** — Explosives that create a mass fire.

**Class 1, Division 4** — Explosives that create a moderate fire, no blast.

**Fuse Lighters** — Special devices used to ignite safety fuses.

**Leading Wire** — See Electric Blasting Circuitry.

**Magazine** — Any approved building or structure, other than an explosives manufacturing building, used to store explosives.



**Misfire** — An explosive charge that failed to detonate.

**Mud-Capping** — Blasting boulders by placing explosives against a rock, boulder, or other object without confining the explosives in a drill hole. This procedure is sometimes known as bulldozing, adobe blasting, or dobying.

**Nonelectric Delay Blasting Cap** — A blasting cap equipped with an integral delay element in conjunction with a detonation impulse or signal from miniaturized detonating cord. Nonelectric delay blasting caps can be detonated by detonation impulses or detonating cord signals.

**Primary Blast** — The blasting operation that dislodges original rock formations from their natural locations.

**Primer** — A cartridge or container of explosives into which fire is conveyed at a continuous and steady rate to fire blasting caps.

**Secondary Blast** — Using explosives to reduce materials to an appropriate size for handling or for mud-capping and blockholing operations.

**KEY ITEMS CHECK LIST**  
**SECTION P. BLASTING AND THE USE OF EXPLOSIVES**

Item	Paragraph	Notes
1. GENERAL REQUIREMENTS	P.1	
Are only authorized and qualified blasters allowed to handle explosives?	P.1.a	
Are ignition sources (cigarettes, firearms, or other flame-producing devices) kept away from explosives?	P.1.b	
Are explosives accounted for at all times?	P.1.d	
Are explosives stored in locked magazines?	P.1.d	
Are the authorities notified if magazine security is breached?	P.1.d	
Are detonators kept in the proper containers?	P.1.f	
Are special precautions taken in congested areas (for example, near highways)?	P.1.g	
Do the necessary signs and signals prevent access to the blast area?	P.1.h	
Are detonators short-circuited in holes that are primed and shunted until they are wired into the blasting circuit?	P.1.k	
Are precautions taken to prevent stray electricity from discharging electrical caps?	P.1.j	
Is above ground blasting forbidden in the dark?	P.1.i	
Is blasting suspended during electrical storms?	P.1.l	
Are two-way radios controlled within 1,000 feet of blasting operations?	P.1.m P.1.n P.1.o	
Is black powder forbidden?	P.1.t	
2. BLASTER QUALIFICATIONS	P.2	
Are blasters capable of giving written and oral instructions?	P.2.a	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
Are blasters adequately trained?	P.2.b P.2.c P.2.d P.2.e	
3. SURFACE TRANSPORTATION OF EXPLOSIVES	P.3	
Are the drivers commercially licensed and physically fit to drive?	P.3.a	
Is smoking forbidden near the vehicles carrying explosives?	P.3.b P.3.f	
Are the vehicles in good condition?	P.3.d	
Are primary and secondary explosives carried in separate vehicles?	P.3.c	
Are the vehicles marked according to Department of Transportation criteria?	P.3.g	
Is a fire extinguisher provided and drivers knowledgeable of its use?	P.3.h	
Are loaded vehicles kept outdoors during repairs?	P.3.i	
Are loaded vehicles always attended?	P.3.j	
4. STORAGE OF EXPLOSIVES AND BLASTING AGENTS	P.4	
Are primary and secondary explosives stored in separate magazines?	P.4.a	
Is smoking forbidden within 50 feet of the magazines?	P.4.b	
Do the local fire and emergency response teams know the location of the magazines?	P.4.c	
5. LOADING EXPLOSIVES OR BLASTING AGENTS	P.5	
Is a conduct of operations written?	P.5.a	
Are all workers briefed on operations?	P.5.a	
Are safe and efficient loading procedures established and followed?	P.5.b	

# KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
Are cables and power lines near the site de-energized and locked out?	P.5.i	
Are the number of personnel and their activities limited?	P.5.b P.5.j	
Are explosives always attended at the blasting site?	P.5.g	
Are the required warning signs posted?	P.5.m	
Are accurate records of explosives or other blasting supplies maintained?	P.5.o	
6. INITIATION OF EXPLOSIVE CHARGES— ELECTRIC BLASTING	P.6	
Has the blaster surveyed the site completely before selecting electric blasting?	P.6.d	
Are electric blasting caps allowed only when stray electricity is precluded?	P.6.a	
Are all the blasting caps for an individual blast made by the same manufacturer and used according to specifications?	P.6.b P.6.c	
Are the correct types of connecting, lead, and bus wires used?	P.6.f	
Is the blasting machine adequate?	P.6.j	
Is the firing switch locked "Off" and is the key controlled only by the blaster?	P.6.l	
Does only the blaster charge and connect the blasting machine and fire the blast?	P.6.n	
7. USE OF SAFETY FUSES	P.7	
Are safety fuses or nonelectric caps used only when stray electricity precludes the use of electric blasting caps?	P.7.a	
Are crushed or damaged fuses disallowed?	P.7.a	
Is the fuse burn rate tested in a safe place?	P.7.d	
Are approved crimpers used?	P.7.c	

## KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
Are fuses protected from sharp bends; is it prohibited to hang fuses on nails or other projections?	P.7.e	
Are unused detonators removed and destroyed?	P.7.f	
Are fuses and primers made up away from magazines?	P.7.g	
Are detonators carried only in approved containers (never in pockets or on the person)?	P.7.h	
Are safety fuses that are used in blasting at least 30 inches long?	P.7.i	
Are procedures for multiple cap and fuse lighting followed?	P.7.j P.7.k	
Is sufficient time allowed for the blaster to reach a safe place?	P.7.d	
8. USE OF DETONATING CORD	P.8.	
Is care taken in selecting, conditioning, and using cord?	P.8.a	
Is detonator cord cut to length from the spool as each hole is loaded?	P.8.b	
9. FIRING THE BLAST	P.9	
Is a code of authorized blasting signals posted and used?	P.9.a	
Are highway flaggers posted at a safe distance?	P.9.c	
Are blasting times coordinated by the blaster?	P.9.d	
10. INSPECTION AFTER BLASTING	P.10	
After the firing, is the blasting machine immediately disconnected, locked in the "Off" position, and short circuited?	P.10.a	
Is the area inspected by the blaster?	P.10.b	

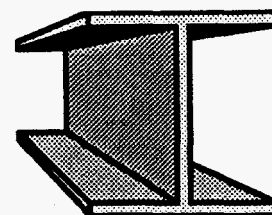


# KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
11. MISFIRES	P.11	
Are proper safety precautions taken in the event of a misfire?	P.11.a	
Are only those workers necessary for removal of a misfire in the danger zone of misfire?	P.11.b	
12. UNDERWATER BLASTING	P.12	
Are dissimilar metal blasting tubes prohibited?	P.12.b	
Are only water-resistant caps and detonating cords used?	P.12.c	
Are float devices used when more than one charge is fired?	P.12.e	
Are proper precautions taken with regard to swimmers, divers, and vessels in the area?	P.12.f P.12.g	



## Section Q. Steel Erection



### 1. Flooring Requirements

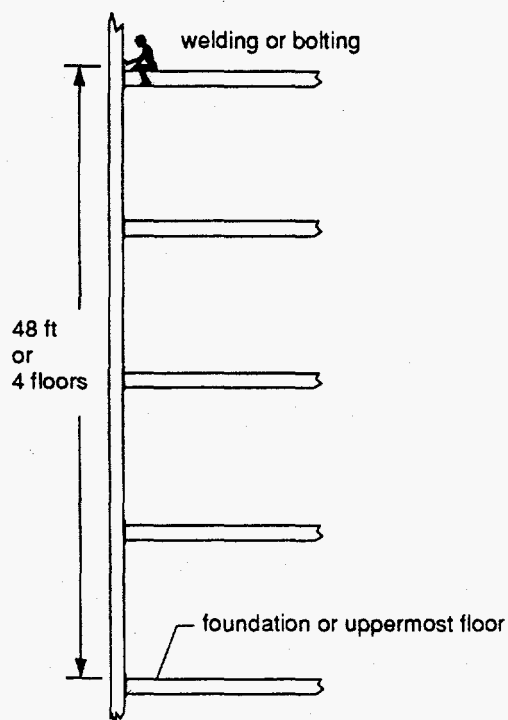
#### a. Permanent Floors—Skeleton Steel Construction in Tiered Buildings

(1) Permanent floors shall be installed as structural members are erected. There shall be no more than eight stories between the floor being erected and the uppermost permanent floor, except where structural integrity can be maintained because of design.

29 Code of Federal Regulations (CFR) 1926.750(a)(1)

(2) At no time shall there be more than 4 floors (or 48 feet) of unfinished welding or bolting above the foundation floor, or uppermost permanent floor.

29 CFR 1926.750(a)(2)



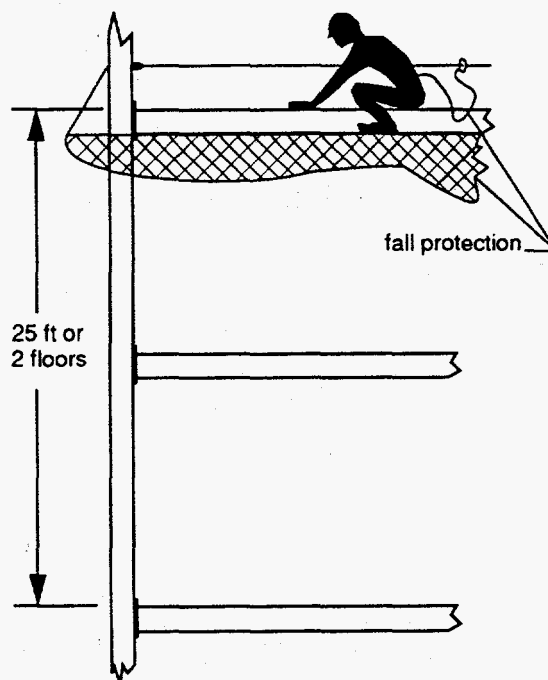
#### b. Temporary Floors—Skeleton Steel Construction in Tiered Buildings

(1) The derrick or erection floor shall be totally planked or decked except for access openings. Decking or planking shall be at least 2-inch-thick undressed solid wood and shall be laid tightly and secured to prevent it from moving. It shall be of sufficient strength to carry the working load.

29 CFR 1926.750(b)(1)(i)

(2) Safety nets or other fall protection systems shall be used and maintained if the fall distance is greater than 2 stories (or 25 feet) in buildings or structures in which scaffolds are not used and the structure is not adaptable to temporary flooring. See Sec. III.A.g for details on fall protection.

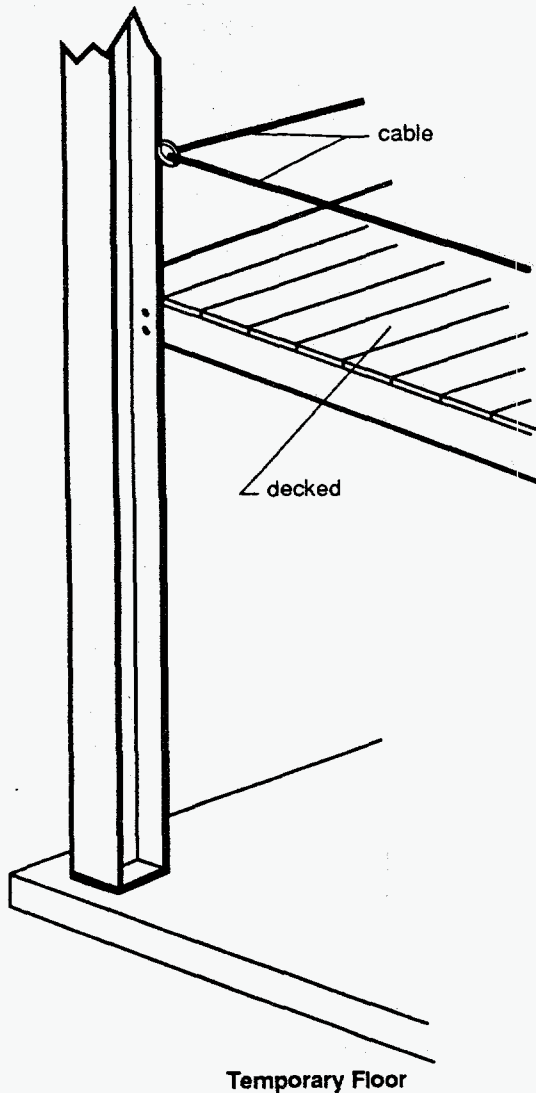
29 CFR 1926.750(b)(1)(ii)





(3) A 1/2-inch-thick wire rope or the equivalent shall be installed 42 inches high around the periphery of metal-decked or planked temporary floors.

29 CFR 1926.750(b)(1)(iii)



(4) A substantial, tightly planked floor shall be maintained (within 2 stories or 30 feet, whichever is less) directly below each tier of beams on which work is being performed. (This is not required when workers gather and stack temporary flooring to be transferred to a higher floor.)

Note: If installing this type of floor is not practical, safety nets shall be installed as described in Paragraph b. 2.

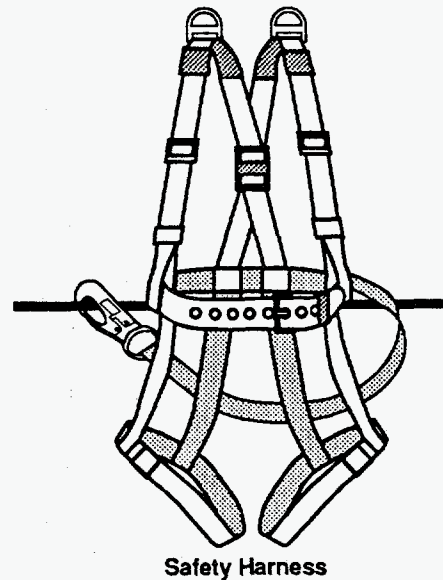
29 CFR 1926.750(b)(2)(i)

(5) Temporary floor planks shall be removed one by one, working toward the last panel, so that work is always done from the planked floor. Fall protection is recommended for this operation.

29 CFR 1926.750(b)(2)(ii)

(6) Workers who work from the last panel of a temporary floor shall wear a safety harness or belt with safety lines attached to a catenary line or other substantial anchorage.

29 CFR 1926.750(b)(2)(iii)



#### c. Flooring in Other Construction

(1) During erection of a building having a double wood flooring system, rough flooring shall be completed as the building progresses, including on the tier below the one on which floor joists are being installed.

29 CFR 1926.750(c)(1)

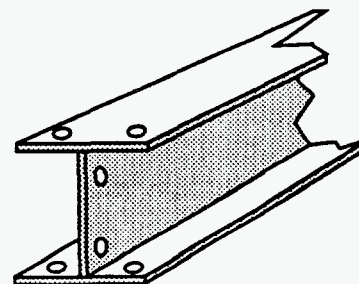
(2) For single wood or other flooring systems, the floor immediately below the level on which joists are being installed shall be kept planked or decked over.

29 CFR 1926.750(c)(2)

## 2. Structural Steel Assembly

a. When solid-web structural members are placed in their final positions, they shall not be released from the hoisting line until they are secured with at least two bolts drawn wrench-tight at each member connection.

29 CFR 1926.751(a)

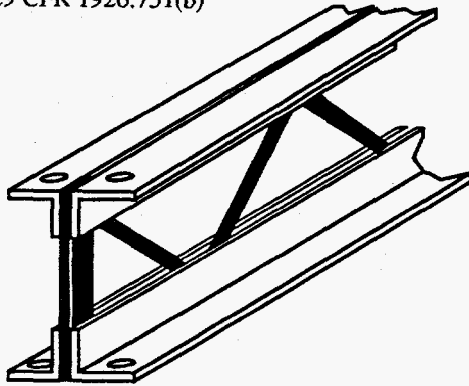


Solid-Web Structural Member



- b. Open-web steel joists shall not be placed on a framework unless the framework is securely bolted or welded together.

29 CFR 1926.751(b)



Open-Web Structural Member

- c. When bar joists are used in framing operations, and the columns are not framed in at least two directions with steel members, the bar joist shall be field-bolted at the columns to provide lateral stability.

29 CFR 1926.751(c)(1)

- d. When long-span joists or trusses (40 feet long or greater) are used, a center row of bolted bridging shall be installed to provide lateral stability before slacking the hoisting line.

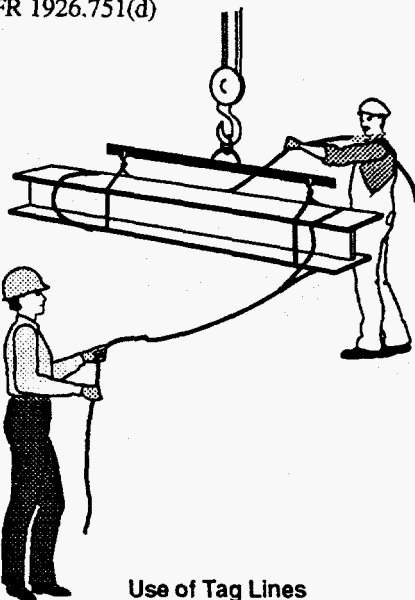
29 CFR 1926.751(c)(2)

- e. Loads shall not be placed on open-web joists until the joists are secured.

29 CFR 1926.751(c)(3)

- f. Tag lines shall be used to control loads.

29 CFR 1926.751(d)



Use of Tag Lines

### 3. Bolting, Riveting, Fitting-up, and Plumbing-up

#### a. General Requirements

- (1) Containers that are secured so they will not be accidentally displaced shall be provided for storing or carrying rivets, bolts, and drift pins.

29 CFR 1926.752(a)(1)

- (2) Pneumatic hand tools shall be disconnected from their power sources before they are repaired or adjusted, and the pressure on the hose line shall be released before repairs are made.

29 CFR 1926.752(a)(2)

- (3) Sections of air-line hoses shall be tied together except when quick-connect couplers are used to join them.

29 CFR 1926.752(a)(3)

#### b. Bolting

- (1) When bolts or drift pins are being knocked out, a means shall be provided to keep them from falling.

29 CFR 1926.752(b)(1)

- (2) Impact wrenches shall be equipped with a locking device for retaining the socket.

29 CFR 1926.752(b)(2)

#### c. Riveting

- (1) Riveting shall not be performed near combustible or flammable material unless precautions have been taken to prevent fires.

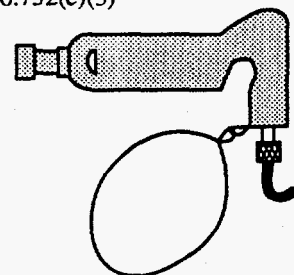
29 CFR 1926.752(c)(1)

- (2) A means shall be provided to keep knocked-off or backed-out rivet heads from falling.

29 CFR 1926.752(c)(2)

- (3) A safety wire shall be attached to the snap and handle of pneumatic riveting hammers at all times. The wire size leaving the handle shall not be less than No. 9 (B&S gauge) or the equivalent, and the wire on the snap shall be not less than annealed No. 14.

29 CFR 1926.752(c)(3)



Pneumatic Riveting Hammer



## d. Plumbing-up

- (1) Plumbing-up equipment connections shall be secured to prevent them from dropping.

29 CFR 1926.752(d)(1)

- (2) Plumbing-up guys shall be placed so workers can reach the connecting points; guys shall be removed only under the supervision of a competent person. Turnbuckles shall be secured to prevent unwinding while under stress.

29 CFR 1926.752(d)(2-4)

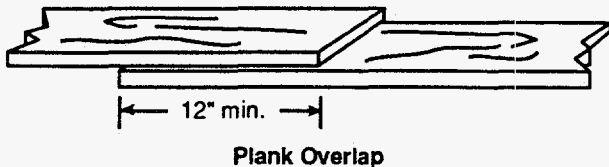


- (3) Wood planking shall be of a proper thickness to carry the working load. Planking must be at least 2-inch-thick undressed solid wood, 3/4-inch-thick exterior grade plywood, or equivalent material. Metal decking shall be of sufficient strength and laid tightly to prevent it from moving.

29 CFR 1926.752(e,f)

- (4) Planks shall overlap the bearing on each end by a minimum of 12 inches.

29 CFR 1926.752(g)



- (5) Wire mesh, exterior plywood, or equivalent materials shall be used around columns where planks do not fit tightly. All unused openings in floors shall be completely planked over or appropriately guarded. All floor coverings shall be secured.

29 CFR 1926.752(h-j)

- (6) Those working on float scaffolds shall be provided with and use fall protection, safety harnesses, or belts with the lanyard tied off.

29 CFR 1926.752(k)

**Special Notice**

*All iron connectors who are outside the specified working heights must have fall protection for all tasks. This should be emphasized on all DOE sites.*



## DEFINITIONS

**Catenary Line** — A substantial cable or chain that serves as a tie-off point for fall protection.

**Field-Bolted** — Assembled or fitted to the structure on-site.

**Float Scaffold** — A mobile, suspended scaffold.

**Plumbing-Up** — The final alignment process of a structural steel frame generally accomplished through the use of guys and turnbuckles.

**Pneumatic Hammer** — A hammer in which compressed air is used to produce the impacting blow.

**Tag Line** — A rope or line that is attached to a suspended load to guide the load and prevent its rotation.

**Temporary Floor** — A floor, composed of planking or decking, that is used during construction operations and then is removed, often to be replaced with a permanent floor.

**KEY ITEMS CHECK LIST  
SECTION Q. STEEL ERECTION**

Item	Paragraph	Notes
1. FLOORING REQUIREMENTS	Q.1	
Is structural integrity maintained by design, permanent flooring, and completed welding or bolting?	Q.1.a	
Is the derrick or erection floor totally planked?	Q.1.b (1)	
Are there safety nets to protect against falls of 25 feet or more?	Q.1.b (2)	
Is planking solid, 2-inch undressed lumber or 3/4-inch plywood?	Q.3.d (3) Q.3.d (5)	
Is fall protection provided during temporary floor installation or removal?	Q.1.b (5) Q.1.b (6)	
Is the floor below floor-joist installation work completed?	Q.1.c	
2. STRUCTURAL STEEL ASSEMBLY	Q.2	
Are solid-web members bolted before they are released from the hoisting line?	Q.2.a	
Is lateral stability maintained during installation of columns?	Q.2.c	
Are loads placed on open-web joists only when the joists are fully secured?	Q.2.e	
Are tag lines used?	Q.2.f	
3. BOLTING, RIVETING, FITTING-UP, AND PLUMBING-UP	Q.3	
a. <i>General Requirements</i>	Q.3.a	
Are bolts, rivets, and drift pins lifted in containers to prevent their falling on workers?	Q.3.a (1)	
Are pneumatic tools disconnected before service, repair, or setting?	Q.3.a (2)	
Are air-line hoses that don't use quick-disconnect couplers secured?	Q.3.a (3)	

# KEY ITEMS CHECK LIST (continued)

Item	Paragraph	Notes
<i>b. Bolting</i>	<i>Q.3.b</i>	
Are bolts, drift pins, and impact-wrench sockets prevented from falling on workers?	Q.3.b (1) Q.3.b (2)	
<i>c. Riveting</i>	<i>Q.3.c</i>	
Are hot rivets prevented from starting fires?	Q.3.c (1)	
Are snaps and handles of pneumatic riveting hammers safety wired?	Q.3.c (3)	
<i>d. Plumbing-Up</i>	<i>Q.3.d</i>	
Are equipment connections secure?	Q.3.d (1)	
Are guys removed only by a competent person?	Q.3.d (2)	
Are turnbuckles secured?	Q.3.d (2)	
Is decking adequate?	Q.3.d (3) Q.3.d (4)	
Are iron workers on float scaffolds provided with fall protection?	Q.3.d (6)	
<b>SPECIAL NOTICE</b>		
Is the required fall protection provided for iron connectors?	Q.3	



## **APPENDIX A**

### **Construction Project Safety and Health Management**

**(Reserved)**

## **APPENDIX B**

### **Eight-Block Safety Orientation Program**

**Purpose:** This appendix is a guideline to be used in presenting a safety orientation program to construction managers and workers. The program is generic and may be altered to fit specific needs or desires. It is a recommended safety orientation program provided for your desired use, application, and implementation. The program is composed of the following:

- a safety orientation program that can be photocopied and distributed as a handout to workers (cover page plus pp. ApB 4-22);
- a set of lesson plans used to present the orientation program to workers (pp. ApB 24-30);
- a set of lesson plans directed toward the supervisor's responsibilities (pp. ApB 31-35);
- a continued program effort entitled "Could This Happen to You" for workers or supervisors, which emphasizes eight severe accidents related directly to the orientation program text (pp. ApB 36-37); and
- a set of graphics to accompany the worker and supervisor lesson plans (pp. ApB 39-66) and the "Could This Happen to You" section (pp. ApB 67-75) that may be photocopied onto transparencies and used to enhance the program's presentation.

**Orientation Program:** A safety orientation program is an essential tool in the overall safety effort. This program provides managers with a way to express their interest in safety, to convey their expectations of the workers' safety performance, to promote an attitude of safety awareness among the workers, to increase the worker's awareness of potential hazards in the work place, and to inform the workers of the required safety procedures.

The orientation program is offered as a tool to promote and encourage safety in construction work and in other job-related activities. It includes an "Eight-Block Safety Orientation Program" composed of a management statement about safety awareness, a note about safety as part of the job, and the eight safety blocks structured to promote job safety awareness.

- **Management Statement:** "A Statement About Safety from Management" (see ApB-4) is a sample generic statement that emphasizes management's position on and commitment to worker safety. Either the heading or the statement may be used as is or changed to fit the needs of the user, organization, company, contractor, etc. The sample statement may be removed and replaced with the user organization's safety policy or other safety statement. It is also appropriate to follow the statement of policy with a written acknowledgment by a management official (i.e., CEO, president, manager). Additionally, this safety policy should be stated during the opening of the program's orientation.

To increase effectiveness, have a top-level manager present and discuss the safety statement.

- **Safety, It's Part of Your Job:** Moreover, this is an introduction to the eight safety blocks that makeup the foundation of the overall program (p. ApB-5).
- **The Eight Safety Blocks:** The eight safety blocks (pp. 6-21) offer general safety guidelines for avoiding accidents and injuries. The program discusses the fundamentals for on-the-job safety as well as home safety and is fully applicable to all work assignments and job situations. Each block item in the program addresses a different aspect of worker safety and approaches it from an individual and team perspective. Although developed to promote safety attitudes and awareness, the eight safety block items are not safety rules; however, they do represent knowledge and understanding of the overall safety effort.

The basic fundamentals in accident prevention are

1. Learn Job Safety
2. Avoid Unsafe Acts
3. Observe Safety Rules and Signs
4. Correct or Report Unsafe Conditions
5. Use Personal Protective Equipment
6. Respect Hazardous Chemicals and Materials
7. Report All Accidents and Injuries
8. Practice Home Safety

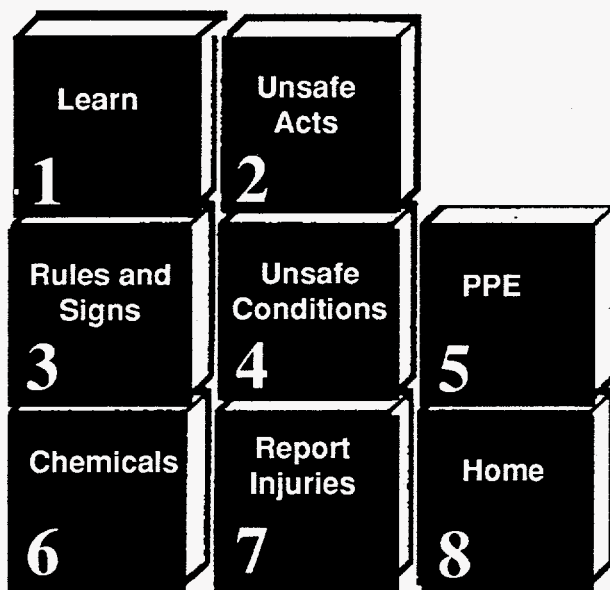
Additionally, the basic program can be extended beyond the basic employee safety orientation to train supervisors in safety responsibility, to outline safety meeting topics, and to facilitate safety tailgate sessions. The safety blocks are useful in performing any job.

**BUILD FOR SAFETY!!!**



# US Department of Energy Construction Safety Reference Guide

## Eight-Block Safety Orientation Program



### A Statement about Safety from Management

The management of this organization is concerned about your safety and health, and we are committed to an organization-wide safety effort. We want to have a safe, hazard free, healthful workplace, and we encourage a safety-oriented attitude at home and insist on it at work.

As employees of this organization, we are all members of a safety team and must support the safety effort. Regardless of who we are, what our job responsibilities are, or where we are assigned, we are dependent on one another to do our jobs with the utmost attention to safety. If we follow safe operating procedures and safe work practices, we can reduce the number of hazards and minimize accidents in the workplace.

If you don't follow safety rules, someone may be injured, property may be damaged, or a deadline may be missed. Regardless of the cause of an accident, the outcome will be lost time and lost resources. You must protect yourself, your fellow workers, your family, and the public by being as safe as you can in everything you do.

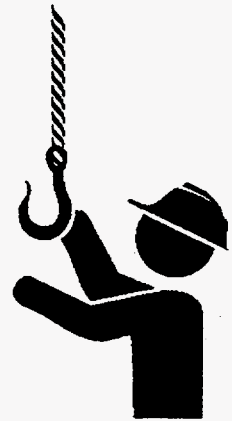
**Safety, it's part of your job.**

Whether we work on a construction site or in an office, laboratory, or other type of facility, there is one thing we should have in common: regard for our own safety and the safety of those around us.

This booklet introduces the EIGHT BLOCK program for worker safety. Its purpose is to help you perform your job safely and protect yourself and others from unsafe acts and unsafe conditions. If you follow the instructions in this booklet carefully, you will be well on your way to performing your job in the safest possible manner.

Remember, when we all take part in the safety effort and help stack the blocks of safety, accidents will decrease and we will enjoy a safe worksite.

The construction site is always changing, and new hazards are introduced each day. The hazards can be controlled or eliminated if you build safety into your job every day.



**1****Learn job safety.**

All jobs present some level of risk: the risk may be associated with tools or equipment, the type of job, or the workplace itself. However, if prescribed safety regulations are followed, any job can be performed without the worker or those around him taking unnecessary risks or being exposed unnecessarily to hazardous situations.

Your supervisors are responsible for your safety and the safety of the work areas and facilities under their control. They are here to help you, personally or by using other resources, to perform your job safely. You should know the accepted safety procedures for your skill or trade and always follow them. Your supervisor will inform you about any special safety procedures used on the construction site and will explain to you the general worksite rules. If you have a question about how to do your job safely—ASK! Don't take a chance if you are in doubt.

Your supervisor will give you information about job safety and explain other regulations related to your job or worksite; the information may be written operating procedures, individual directives, or it may be presented at individual or group training sessions. Make sure you read and understand this information—especially when any aspect of safety is involved.

Think about each task before you begin. Learn the safest way to do your job, and always do your job in the safest manner.

**Learn and do.**

**Review responsibilities**—As soon as you are assigned to a job, review your responsibilities with your supervisor, especially if this is a new or different type of assignment. Remember to ask questions if you do not understand your supervisor's explanations completely. Before you begin your job assignment, decide what tools or equipment you will need and review the safety rules. Be sure to talk to your coworkers to get ideas about how to do your job safely. Review and understand appropriate preliminary and activity hazard analyses and any written procedures associated with the job.

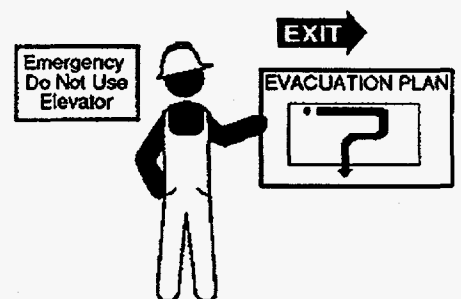
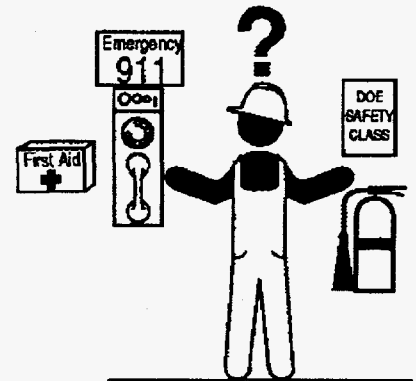
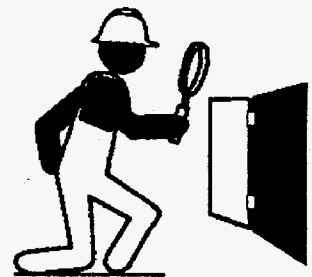
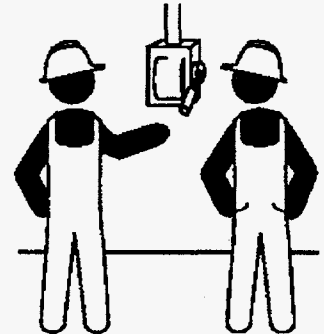
**Examine tasks**—Examine each task before you begin, and be sure to review all instructions. Be aware of all safety requirements, and if you have a question—ASK!

Do not undertake any activity

- for which you do not feel qualified, or
- for which you feel there is an undue exposure to a hazard.

**Know emergency procedures**—Know where all emergency equipment is located in your work area, and be sure you know how to use it. Know how to reach emergency assistance in the event of fire, sudden illness, or injury. Participate in any safety-related training offered on your site, and be familiar with safety information related to your job.

**Know emergency exits**—Know the paths to the emergency exits in your work area, and be aware of construction activities that may block them. If you must leave the area in an emergency, know where to assemble and how to be accounted for. Don't forget about coworkers or visitors who may need to be directed out of the area.

**1**



**2****Avoid unsafe acts.****Think, plan, and pay attention.**

More than 90% of all accidents (at work, at home, or on the highway) are the result of unsafe acts. Chances are that the last accident you saw on a TV news broadcast or read about in the newspaper was caused by someone who rushed through a task, took an unnecessary risk, violated a rule, or did not pay attention to what he or she was doing.

Most UNSAFE ACTS are caused by

- inattention,
- unnecessary rushing,
- assuming an unsafe position,
- lack of skill,
- failure to secure or warn,
- excessive emotion,
- use of an unsafe tool or using a tool unsafely,
- not following instructions, or
- violating a basic safety rule.

Always take sufficient time to do a job correctly because if you do it correctly, you are doing it safely. Pay attention to your work and your surroundings. Avoid having something happen by chance, and think before you act. No job is so important or so urgent that sufficient time cannot be taken to do it safely!

**Don't be part of the 90% factor.**

Here are some things you can do to avoid accidents and injuries.

**Lift carefully**—Back injuries are very common, but they can be avoided. First, size up the object and decide if you think you can handle it. Second, get a good grip on the object, lift with your legs, and keep your back straight. If necessary, ask for assistance, break down the load, or use lifting equipment. Remember, carefully evaluate the load before you act.

**Hands off**—Do not use power equipment or tools for which you are not trained, experienced, or authorized. Never tamper with a power source. Only trained personnel may handle power sources. Never remove or turn on a control, power source, or valve that is tagged out. Do not attempt to operate equipment that is locked or tagged out.

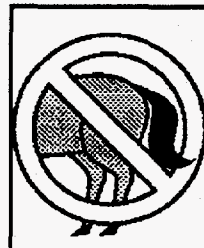
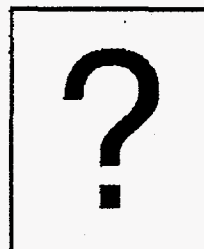
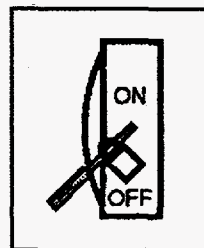
**Shut off power**—Shut off, tag, and lock power sources before repairing, adjusting, or servicing energized equipment. Be sure all guards or barriers are in place when you operate equipment, and replace guards on equipment after the equipment has been serviced or repaired.

**Falls**—Falls account for nearly one-third of all accidental injuries and can be avoided. Secure ladders, never stand on top rungs, use handrails on scaffolds, see that scaffold boards are safely placed, take caution on wet surfaces, and, as required, use fall-protection devices.

**Know the job**—Be sure you know the safety requirements for your job. If you work with others, keep the team concept in mind, and tell your coworkers about existing or potential hazards. If you don't know the answer or if you have any question—ASK!

**Horseplay**—Practical jokes, scuffling, and horseplay can lead to serious injury and will not be tolerated.

2



## 3

## Observe safety rules and signs.

BE CAREFUL is an expression that alerts us to upcoming danger, but wouldn't it be more effective to alert us to *WHAT* the upcoming danger will be? It is the *WHAT* that safety rules are all about. There are safety rules, which have evolved over time, for almost every activity we undertake; for construction work, for public sporting events, and even for relaxing at home. These safety rules, many of them informal, serve as guidelines for safe living. It is important that you understand and follow them.

If you have a safety manual that explains the rules for construction operations, great; if not, you may learn these rules from other guides, as a part of written work procedures or in training classes. Be sure you understand and follow the basic safety rules that are accepted in your trade. In addition to the rule, make sure you understand its *WHAT*.

Safety signs and posters explain important safety rules; always follow these instructions. Know the meaning of each color used on a safety sign.



## Danger Sign

Heading—red background, white letters

Message—black letters on white background

## Caution Sign

Heading—yellow background, white letters

Message—black letters on white background

## Safety Sign

Heading—green background, white letters

Message—black letters on white background

## Notice

Heading—blue background, white letters

Message—black letters on white background

## Radiation Area

Magenta (purple) on yellow background.

## Universal Prohibition

Red circle with a diagonal line through it

Black symbol usually located behind the diagonal



Signs and warning signals are for your benefit and protection. Always follow the instructions on safety signs.

*In today's environment, employers are legally required to ensure a safe and healthful worksite. Worksite requirements are established by the Department of Energy (DOE), which has adopted the Occupational Safety and Health Administration (OSHA) Standards for Construction Safety 29 CFR 1926. To ensure your own safety, you must follow DOE construction site requirements including 29 CFR 1926.*

**4****Correct or report unsafe conditions.**

An unsafe condition, such as a hazard that causes a person to trip and fall, a missing guard or barrier on equipment, an ungrounded electrical cord or plug, or a damaged piece of equipment may be found in any area of the construction site. Unsafe conditions usually don't just happen; they exist because someone wasn't careful and didn't follow the rules. Unsafe conditions can and do cause accidents, and they must be minimized.

Never create an unsafe condition; if you observe an unsafe condition, correct it if you can or report it immediately to your supervisor. Take an item out of service if it is a serious threat to the safety of workers or the public. Always tag a piece of unsafe equipment, and tell your coworkers that this equipment is out of service.

Because poor housekeeping is probably the most common reason for unsafe conditions, keep your work and storage areas clean and orderly. Poor housekeeping can result in falls, fire hazards, and a poor worker attitude. The expression "everything has a place and everything should be in its place" is most appropriate here. A worksite that is clean and orderly is usually safe and will help promote a positive attitude about safety on the job.

Be alert to possible fire hazards and correct or report them at once.

***A FIRE TODAY COULD MEAN NO JOB FOR YOU TOMORROW!***

Inspect your work area, tools, and materials; try to eliminate all unsafe conditions as soon as you observe them. Follow all rules and regulations that apply to your job.

**Do your part.****Site Keeping**

- Keep your work area clean and orderly.
- Keep boxes, material, and trash out of passageways and off stairways.
- Stack materials so they will not fall.
- Control the build-up of waste and scrap material; if it must be stored, store it neatly.
- Never leave a work location in an unsafe condition.
- Dispose of accumulated waste or scrap before it becomes a hazard.
- Clean your work area daily.
- Place trash and debris in proper containers.

**Prevent Fires**

- Obey NO SMOKING rules.
- Store flammable liquids in approved containers, and use them only in approved areas.
- Conduct hot-work operations away from combustible or flammable material.

**Tool Safety**

- Use only safe tools and equipment.
- Thoroughly inspect all tools and equipment before they are used.
- Use equipment and tools only for the purposes for which they were designed.
- Take extreme care with electric tools and cords; they should always be in good condition and grounded properly.
- Report or repair unsafe equipment, or remove it from service.

**Emergencies**

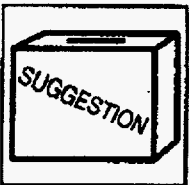
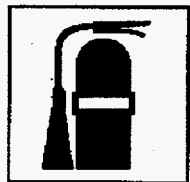
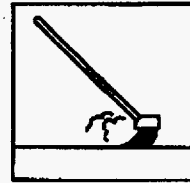
- Know emergency procedures, including how to report fires or other emergencies.
- Know where emergency equipment, such as fire extinguishers, first aid kits, and alarm signals, are located. Know how to use emergency equipment.

**Reporting Unsafe Conditions**

- Report continuing unsafe conditions as stated on the OSHA poster on the construction site bulletin board.
- If a reported unsafe condition is not remedied, report this to the Department of Energy (DOE) or the prime contractor's safety representative.

**Suggestions**

If you have a safety suggestion, be willing to share it. Your suggestion might prevent an accident and resulting injury or property damage.

**4**

*A clean site is a safe site.  
Do your part.*

**5****Use personal protective equipment.**

You must use and wear personal protective equipment (PPE) to protect your eyes, face, head, lungs, ears, and other body parts from hazards, when required. Equipment that you do not wear, such as machine guards and ventilation systems, also protect you from hazards. Always use any protective equipment or devices necessary for your job.

Your personal dress also affects your safety. Dress appropriately for the job and weather conditions.

Other equipment, such as a simple hand dolly to move heavy objects, an eye wash or safety shower, fire extinguisher, or other devices, are for your personal protection and are there to protect you from injury. Before starting a job, identify the PPE that is required and use it accordingly. Be sure the equipment is available, working properly, and that you know how to use it.

*Remember, you are expected to do your job safely.*

*Appropriate PPE will be provided to keep you safe.*

*Use all PPE as prescribed.*

**Use personal protective equipment.**

**Eyes and face**—Be sure to wear safety glasses on the construction site, especially in areas where flying particles may injure your eyes. The greater the chance for eye injury, the more complete the eye protection you require. Face shields or chemical goggles should always be used when you handle hazardous chemicals, and you must use a welding hood or eye protection with colored lenses to protect yourself from weld-flash.

**Gloves**—Use rubber or latex gloves for handling chemicals and corrosive material. Use cotton, cotton with plastic-coated palms, or leather gloves for handling general material and other worksite operations. Use special gloves during operations in which you handle very hot objects. Never wear gloves near moving or rotating machinery or equipment.

**Respirators**—Use a disposable face mask for nuisance dust and mist. To protect yourself from hazardous fumes, mist, dust, and gases, use an approved respirator with an appropriate filter and cartridge. Know how to use and care for the respirator, and be sure *you* are approved to use it. Use air-supplied or air-tank-supplied respirators (SCBA) for work in extremely hazardous atmospheres. (You must be specially trained to use SCBA equipment.)

**Noise**—Use ear plugs or ear muffs to protect yourself from high noise levels.

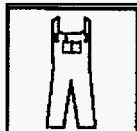
**Head**—Wear an approved hard hat on the construction site. Use only a nonconductive hard hat and never alter the hard hat.

**Feet**—Wear safety shoes or safety boots on the construction site.

**Emergency**—Be sure all appropriate emergency equipment is available on the site. You should know how and when to use this equipment.

**Dress**—Dress for the job and for the weather. Wear close-fitting clothing, and do not wear rings or other jewelry.

**Special**—Use items such as DOT orange traffic vests, safety harnesses, life jackets, and similar devices or equipment when appropriate.



*Personal protective equipment  
has a purpose—to protect you.*

*Use it when and as prescribed.*



## 6

**Respect hazardous chemicals and material.**

In the modern world, chemicals play an important role in our jobs and daily lives, and any chemical, regardless of its characteristics, can be dangerous if not handled properly. To ensure that hazardous chemicals or materials do not injure you, follow these basic rules.

**Know the chemical**—Know how to handle hazardous chemicals or materials. Know what the chemical or material is and how it should be used. Always read the container label, the manufacturer's instructions, and the Material Safety Data Sheet (MSDS).

**Use as prescribed**—Use the hazardous chemical or material as directed. Never mix hazardous chemicals unless you are told to do so by a supervisor or it is permitted on the manufacturer's instructions. If incompatible chemicals are mixed, a violent reaction could occur or harmful gases could be produced.

**Handle with care**—Handle hazardous chemicals and material with care; be sure the containers are not damaged and the original label remains on the container. If you transfer the chemical to a second container, relabel that container with the name of the chemical. Always transfer chemicals carefully. Dispose of chemical and hazardous waste according to regulations, and be extremely cautious if the hazardous chemical or material is flammable.

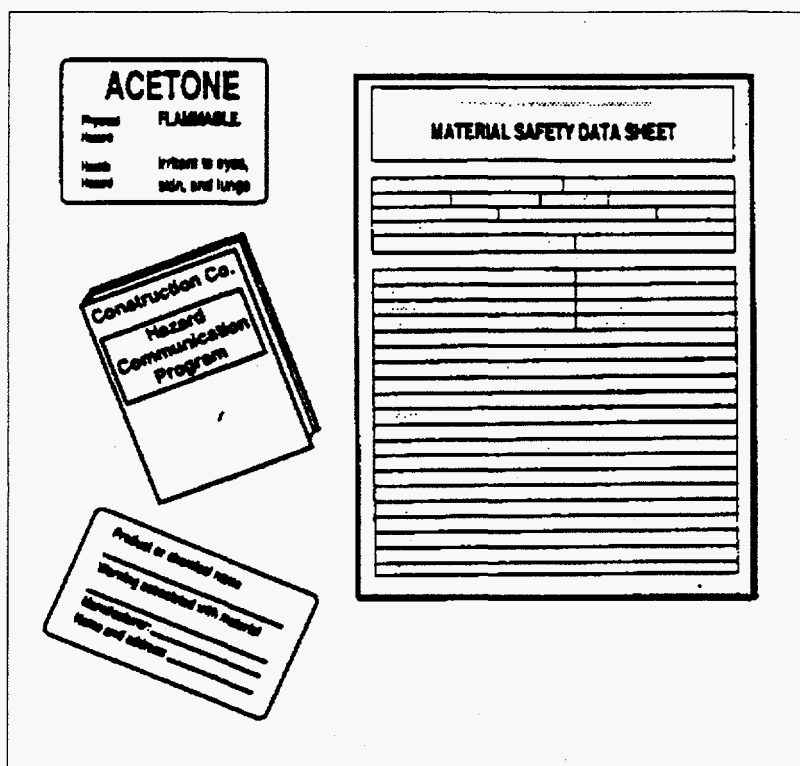
**Protect yourself**—Use personal protective equipment as prescribed by the manufacturer. Always avoid contact with harmful dust, fumes, or mist. Never drink, eat, or smoke when you are using chemicals or material. Practice good personal hygiene when you handle hazardous chemicals or materials.

**Instruction**—Be sure you are taught how to handle specific hazardous chemicals or materials, especially if you have a question about how to handle them safely. Know how to detect the presence or release of specific hazardous materials in the work area by either recognizing visual appearance, odors, physical effects of exposure, or through the use of a monitoring device. In addition, be familiar with emergency and first aid procedures for the chemicals you are working with. Warn those around you when you are using hazardous chemicals or materials.

**If in doubt**—If you are not sure how to use a hazardous chemical or hazardous material, DO NOT TAKE A CHANCE; ask your supervisor to review the MSDS with you.

*Be familiar with the hazardous materials you are using, and use them only for specified purposes.*

*Know how to protect yourself from the dangerous effects of any hazardous chemical or material.*



*Read each product label, and note any warnings stated on the label.*

*The chemical name on the product label must be the same as the chemical name on the MSDS.*

*Study the MSDS for each hazardous chemical or material you use.*

*Review your organization's hazard communication program.*

**7****Report all accidents and injuries.**

Reporting any accident or injury is not only an obligation to your employer, it is an obligation to yourself and to fellow employees. Even if you feel that an accident or incident is minor, report it to your supervisor to protect yourself. Be sure to get immediate first aid or medical treatment for any injury. Report any accident or incident where tools or equipment are involved so they can be examined for damage and safe-use condition.

Late reporting of an accident and probable injury could cause a delay in proper treatment and medical insurance benefits as well as allow additional accidents to occur. Don't take a chance, it's not worth it.

If you observe unsafe tools or equipment, repair them or remove them from service immediately and report it to your supervisor. Be sure to warn others of the condition.

**Follow these basic safety rules.**

If you are hurt, no matter how insignificant the injury, report it and go for treatment immediately.

Report all accidents, even if you are not injured.

Repair, report, or remove from service unsafe tools or equipment.

**Respond to sudden injury or illness.**

To treat a seriously injured accident victim or a person who has suddenly become seriously ill, do the following:

- Immediately call or send for emergency assistance. Give the exact location of the victim and the nature of the injury.
- Keep the person level and as comfortable as possible.
- Do not attempt to move the injured person. If you must move the victim out of a dangerous area, move the victim on a stretcher if possible.
- If the victim has stopped breathing and you are trained in mouth-to-mouth resuscitation and CPR, clear the airways and immediately apply the appropriate first aid procedures.
- In cases of severe bleeding, apply a tight compress directly to the wound.
- Remain at the location after the emergency personnel have arrived to offer assistance and information.

Every construction site should have first aid supplies, access to a medical treatment facility, and an emergency response plan to report fires or other catastrophes. Be sure you know how to handle emergencies.

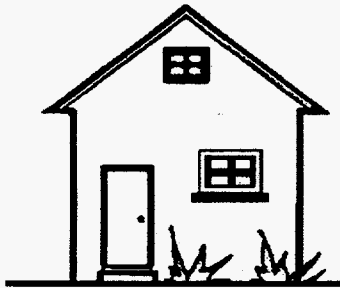
In the event that an emergency should occur, be sure you know

- how to reach emergency assistance and
- the exact location of the construction site.

*If you don't know what to do  
in an emergency, ask.*

*Don't wait for an emergency  
to occur.*

## 8

**Practice home safety.**

You are probably safer at work than away from work. Why? At work, you are in a controlled environment and must follow specific regulations; away from work, the environment is only controlled by you. If you don't observe the rules, no one will know—until you have an accident. You may travel or enjoy boating, hunting, or fishing; or you may have a hobby like fixing up your home, woodworking, gardening, or participating in team or individual sports. All of these recreational activities create some risk; to be safe, you must observe appropriate safety rules for the activity.

Your personal safety away from work is of interest to your employer because if you maintain a safety-oriented attitude away from work, it will carry over to the workplace. If you are injured at home and not able to work, it will be a loss to your family and your employer. Practice home safety and everyone will benefit.

Follow the safety rules that you learn on the job at home. Be sure that your home is a safe place for your family and friends.

**Home-safety check list.**

- Are all harmful chemicals and medicines in your home out of reach of children?
- Do you have a fire extinguisher and a smoke alarm in your home?
- Are paints and flammable materials stored in approved containers?
- Are all electrical outlets and appliances grounded? Are they in good condition?
- Are tools and sharp objects stored out of the reach of children? Are firearms and ammunition stored in separate locked areas?
- Do you have an emergency exit plan for your home, and does everyone in your family know how the plan works?
- If you have a fireplace, is the chimney clear of built-up material? Do you have a spark arrester and a substantial screen in front of your fireplace? Are combustibles kept away from the fireplace?
- Does your family "buckle up" when driving in an automobile? Do you use child-restraint seats?
- Are combustible materials and furniture kept away from floor furnaces, space heaters, and other hot surfaces? Are hot surfaces guarded so that children cannot reach them?
- Do you have emergency telephone numbers posted near the telephone? Do you know how to report an emergency? Fill out the following card and place it in a conspicuous location near each telephone in your home.

This check list cannot include every activity that could affect home safety, but it will give you a good start toward establishing a safe home for your family.

**HAVE A SAFE DAY—EVERY DAY.**

**Emergency Telephone Numbers**

Fire \_\_\_\_\_ or 911

Rescue \_\_\_\_\_ or 911

Police \_\_\_\_\_ or 911

Doctor \_\_\_\_\_ or 911

**Poison Control Center**

Local \_\_\_\_\_

Regional \_\_\_\_\_

HAVE

A

SAFE

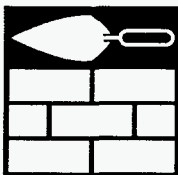
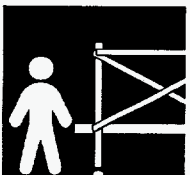
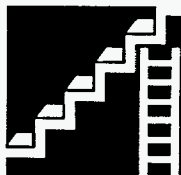
DAY



# US Department of Energy Construction Safety Reference Guide

## Lesson Plans

- Workers
  - Supervisors
    - Could This Happen To You





**Lesson Plans for Workers and Supervisors**

This section is composed of three sets of lesson plans and accompanying graphics: one for workers, for supervisors, and for all employees. The Worker Lesson Plans are a standard safety orientation program for all employees (pp. ApB 25-30). The Supervisor Lesson Plans follow the same format, but the content is directed toward supervisory information and instruction (pp. ApB 31-35). Twenty-eight graphics are included that may be photocopied onto transparencies and used as visual aids during program presentations (pp. ApB 39-66). The third set of lessons plans, "Could This Happen to You?" (pp. ApB 36-37), is an effort to promote continuous safety awareness and may be used after Block 8 of the worker or supervisor lesson plans. Nine graphics are included as potential visual aids (pp. ApB 67-75).

All the lesson plans are formatted into two columns: **Key** and **Promo**. In the **Key** column, the major subject matter topic or case item is summarized and when applicable, identified with a corresponding Block #; in the **Promo** column, the related promotional transparencies (T), the page number for the transparencies (T-1), and when applicable, the corresponding references are listed. A symbol (>) in the left margin of the Key column indicates that a specific job function may be applied and discussed; refer to the Construction Safety Guide for specific subjects.

The following example shows how specific information may be incorporated into the lesson plan and used for discussion in safety meetings and tailgate sessions.

"Excavations" (example of specific topic)

**Block #1: Learn Job Safely**

Use > symbol and add "Learn Excavation Safety"

- check condition of excavation prior to entry
- enter into and stay within the trench box
- ask about or know any special rules or operations (etc.)

**Block #1: Avoid Unsafe Acts**

Use > symbol and add "Avoid Unsafe Excavation Acts"

- never work under a suspended load
- never work below earth-moving equipment (etc.)

## WORKER LESSON PLANS

KEY	PROMO
Self-introduction	Who are you?—position and brief background
Explain purpose of meeting “Your personal safety” Note—No gain, only loss for failure: <ul style="list-style-type: none"> <li>• suffering,</li> <li>• lost time,</li> <li>• loss of wages,</li> <li>• personal and property damage, and</li> <li>• never a plus in accidents or injuries.</li> </ul>	T-1 “Safety”
Review management commitment: <ul style="list-style-type: none"> <li>• interest in you,</li> <li>• obligation to furnish a safe and healthful workplace, and</li> <li>• legal obligation; that is, adhere to DOE standards and requirements and the work contract.</li> </ul>	T-2 “Management” (policy or statement) (ref. p. ApB-4 of orientation program) T-3 (Copy DOE, OSHA, NEC #70)
Review worker obligation: <ul style="list-style-type: none"> <li>• to protect self,</li> <li>• coworkers,</li> <li>• family, and</li> <li>• “enjoy the safe side of life.”</li> </ul>	T-4 “Worker”
Discuss safety as <b>part of your job</b> : <ul style="list-style-type: none"> <li>• Emphasize that all jobs have an element of risk; in office, construction site, shop, lab, even going to and from work. Safety is not a separate part of the job—it is a <b>full part of every job!!</b> Regardless of where you work, what you do—safety is a vital part.</li> </ul>	T-5 “Safety is part of job” (ref. p. ApB-5 of orientation program)
Discuss the Eight Blocks of Safety: <ul style="list-style-type: none"> <li>• Explain that each block is there to help you work safely.</li> <li>• Not “Rules” but “Tools” to help you work safely.</li> <li>• Emphasize construction work is always changing. You can live with the changes through knowledge and control of hazards. <b>Use the Eight Blocks!!</b></li> </ul>	T-6 (8 Blocks)

KEYSafety Block One—**LEARN JOB SAFETY**

Discuss job knowledge:

- All jobs have risk.
- All risk can be controlled or removed.
- Supervisor's role is to teach, train, and inform.
- Your job—learn how to do your job—then

**Always Do It Safely!!**

## Learn and Do

Review the following:

- Understand the job before you do it.
- Know all safety aspects.
- Examine and analyze before you do it.
- **If you don't know—ASK.**
- Know and use emergency equipment.
- Maintain awareness of exits.
- Every job has special needs.

&gt; ..... (Specific subject)

Safety Block Two—**AVOID UNSAFE ACTS**

Discuss—Unsafe acts = 90% accident cause

Major items: (may ask class)

- inattention,
- rushing,
- failure to secure or warn,
- tools—unsafe or using unsafely,
- failure to follow instruction,
- rule violation,
- position/posture, and
- lack of skill.

**DON'T BECOME A 90% FACTOR**

Discuss following:

- Don't take chances—especially when you know it is wrong.
- Doing it safely is doing it right!

Review statement:

**"No job is so important or urgent that time cannot be taken to do it safely!"****Note—Falls are a major part of accidental injuries.**Discuss—Know that what may happen can happen!  
Carelessness"PROMO

## T-7 "Learn Job Safety"

(ref. p. ApB 6-7 of orientation program)

## T-8 "Learn and Do"

## T-9 "Avoid Unsafe Acts"

(ref. pp. ApB 8-9 of orientation program)

## T-10 "No Job Is So Important"

(Scaffolds, ladders, trips)

## T-11 "Accidents Are Premeditated"

<u>KEY</u>	<u>PROMO</u>
<p>Don't challenge "Murphy's Law"</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• pulling on bolt—tight location—bump elbow,</li> <li>• hammering with thumb next to nail,</li> <li>• gas burning or smoking next to flammables,</li> <li>• rushing the yellow light, and</li> <li>• taking chances.</li> </ul> <p>(Use any illustrations)</p> <p>Review acts common to accidents:</p> <ul style="list-style-type: none"> <li>• Lifting: use legs, break down load, use equipment, or get help.</li> <li>• Hands off: never use equipment or tools for which you are not trained or qualified. Do not violate a <b>Safety Tag</b>.</li> <li>• Shut off power: be sure there is no live energy when working on power sources.</li> <li>• Avoid falls, the number one cause of accidents.</li> </ul> <p>&gt;..... (Specific Subject)</p>	<p>T-12 (Symbols) (ref. p. ApB-9 of orientation program)</p>
<p>Safety Block Three—<b>OBSERVE SAFETY RULES AND SIGNS</b></p> <p>Discuss fact that we all live by rules, either:</p> <ul style="list-style-type: none"> <li>• traffic rules, drive right side, stop signs,</li> <li>• game rules, for fairness and play,</li> <li>• home rules, joking, take off dirty shoes, and</li> <li>• written rules or rules by functional necessity.</li> </ul> <p>Relate that you and your employer actually live by many safety rules and other rules generally known as codes, standards, regulations, and contract terms (OSHA, NEC, UBC, EPA).</p> <p><b>All have a purpose and need—each is there to help us.</b></p>	<p>T-13 "Rules and Signs" (ref. p. ApB 10-11 of orientation program)</p> <p>T-14 (Book of Rules)</p>
<p>Safety Signs</p> <p>Discuss general sign recognition:</p> <ul style="list-style-type: none"> <li>• caution = Yellow,</li> <li>• notice = Blue,</li> <li>• radiation = Purple with symbol, and</li> <li>• universal = Circle with slash or symbol.</li> </ul> <p>Learn to recognize and always follow!</p>	<p>T-15 "5 Safety Signs" (ref. p. ApB-11 of orientation program)</p>

**KEY**

A real sign with a real message without question.

Signs we all recognize.

Remember—Signs are also rules.

**Read and Obey! They can be SIGNS OF LIFE!**

Ask question—How many have children? How often have you ever warned “**Be careful**”? A concerning thought—but did you ever think of adding **Be careful of what?** Signs and safety tags and instruction labels often supply the answer to this **of what!** Signs and rules are the **what in be careful!**

**READ AND OBEY!!**

Safety Block Four—**CORRECT OR REPORT  
UNSAFE CONDITIONS**

Discuss what to do about unsafe conditions:

- correct only if within your skill and ability,
- report hazards beyond your ability to correct, and
- report to immediate supervisor and warn others as necessary.

**Do Your Part**

Discuss:

- Never create an unsafe condition.
- Maintain good housekeeping. Good housekeeping eliminates most of the slip/trip/fall hazards.
- Prevent fire hazards—A fire today could mean **no job tomorrow!**
- Use safe tools and use tools safely.
- Know what to do in case of an emergency.
- Analyze your job for hazards and warn others.
- Make suggestions.
- Communicate with coworkers and supervisors.

Concerning the reporting of hazards and unsafe conditions, the DOE has a system for reporting unsafe situations or conditions that lack action or correction. See the DOE Safety Poster at your worksite.  
>..... (Specific Subject)

**PROMO**

T-16 “Bull in Field”

T-17 (Signs)

Show of hands

T-18 “Unsafe Conditions”  
(ref. pp. ApB 12-13 of orientation program) Examples—Clear, simple hazard as opposed to working on electrical hazard for which not qualified or skilled

T-19 “Do Your Part”

KEY	PROMO
<p>Safety Block Five—<b>USE PERSONAL PROTECTIVE EQUIPMENT</b></p> <p>Statement—"Always use the personal protective equipment (PPE) necessary for your job and wear it as prescribed."</p> <p>Use Personal Protective Equipment</p> <p>Discuss PPE:</p> <ul style="list-style-type: none"> <li>• eye protection (and face),</li> <li>• hand (appropriate gloves),</li> <li>• respirator (gas, fumes, dust),</li> <li>• noise (protectors as required),</li> <li>• head (hard hats),</li> <li>• feet (safety shoes or boots), and</li> <li>• special.</li> </ul>	<p>T-20 "PPE" (ref. pp. ApB 14–15 of orientation program)</p> <p>T-21 "Personal protective equipment"</p> <p>Safety glasses a <b>MUST</b></p> <p>Rules and regs for use</p> <p>A <b>MUST</b> in construction</p> <p>A <b>MUST</b> in construction</p> <p>Per requirement (SCBA, clothing, etc.)</p>
<p>Safety Block Six—<b>RESPECT HAZARDOUS CHEMICALS AND MATERIALS</b></p> <p>Acknowledge that today we live in a chemical world. Able to use gasoline and home products safely. Many chemicals we use are hazardous—have knowledge of using them safely through basic knowledge.</p> <p>Basic instructions for use and handling:</p> <ul style="list-style-type: none"> <li>• Always read label.</li> <li>• Carefully read any warning.</li> <li>• Refer to Material Safety Data Sheet (<b>MSDS</b>).</li> <li>• Use only as prescribed.</li> <li>• Never mix unless directed.</li> <li>• Handle and use with care—only as directed.</li> <li>• Dispose of as directed.</li> <li>• Use PPE as prescribed.</li> <li>• Practice good hygiene.</li> <li>• Be sure to know how to use safely.</li> <li>• If you don't know—ASK!</li> </ul>	<p>T-22 "Hazardous Chemicals/Materials" (May ask for class to identify some home hazardous chemicals—use in discussion)</p> <p>T-23 (Illus. Label, MSDS) (ref. pp. ApB 16–17 of orientation program)</p>
<p>Review per illustration:</p> <ul style="list-style-type: none"> <li>• label name—warning—same as MSDS,</li> <li>• MSDS gives necessary information: <ul style="list-style-type: none"> <li>– chemical name,</li> <li>– company name, address, emergency phone number,</li> <li>– chemical formula, make-up,</li> <li>– protective measures to follow,</li> <li>– danger, warnings, and</li> <li>– <b>Everything you need to know.</b></li> </ul> </li> </ul>	<p>Use pointer to T-23</p>

**KEY**

Manufacturers have regulated obligation to provide safety information of material.

Employer has obligation to inform and train employees in safe use.

Worker has obligation to know and use safely.

>..... (Specific Subject)

**Safety Block Seven—REPORT ALL ACCIDENTS AND INJURIES**

Discuss importance of reporting:

- to supervisor or to medical personnel
- injuries (known or suspect), and
- unsafe equipment (remove from service).

Discuss protection, treatment, prevention, or correction.

Severe injury or illness

Discuss what to do:

- Get assistance, give exact location.
- Keep person down and comfortable.
- Don't move unless in danger.
- Control bleeding.
- Start CPR (if needed) and if trained.

Know how to get assistance.

The exact number to call; be careful about calling 911 from a cellular phone at a remote location. Use others to help direct.

>..... (Specific Subject)

**Safety Block Eight—PRACTICE HOME SAFETY**

Discuss:

- home safety importance to you and your employer,
- disabling home accidents are same as disabling work accidents—same loss (suffering, work, money), and
- may be safer at work than at home (work environment controlled – home risk)

Home Safety Check List:

- Review check list.
- Post emergency numbers.
- Teach children how to call.

**COMPLETION****OPEN FOR QUESTIONS**

**HAVE A SAFE DAY!!!!!!!**

**PROMO**

T-24 "Report Accidents and Injuries"  
(Ref. pp. ApB 18–19 of orientation program)

T-25 "Be Prepared"  
(ref. p. ApB-19 of orientation program)

T-26 "Home Safety"  
(ref. pp. ApB 20-21 of orientation program)

T-27 (Home Illus.)  
(ref. p. ApB-21 of orientation program)

T-28 "Safe Day"

## SUPERVISORY LESSON PLAN

<u>KEY</u>	<u>PROMO</u>
Explain purpose (supervisory responsibility to worker safety).	T-1 "Safety"
Explain management's responsibility: <ul style="list-style-type: none"> <li>• to furnish a safe and healthy workplace, and</li> <li>• to adhere to OSHA and DOE Codes and Regulations.</li> </ul>	T-2 "Management"
Discuss cost for failure: <ul style="list-style-type: none"> <li>• insurance cost,</li> <li>• accident cost (injury/property),</li> <li>• OSHA penalties (if applicable),</li> <li>• contractual loss for noncompletion, and</li> <li>• health and suffering.</li> </ul>	T-3 (Copy of DOE, OSHA, NFPA, etc.)
Review safety as part of every job: <ul style="list-style-type: none"> <li>• as supervisor—has responsibility to see that safety is part of every job and operation, and</li> <li>• use safety analysis for all jobs and convey information to workers.</li> </ul>	T-5 "Safety Part of Job"
Discuss daily change in construction sites: <ul style="list-style-type: none"> <li>• new hazards introduced everyday,</li> <li>• action plan to cover new hazards, and</li> <li>• control or eliminate hazards.</li> </ul>	
Review EIGHT BLOCKS OF SAFETY: <ul style="list-style-type: none"> <li>• explain Worker Orientation Program for all workers, and</li> <li>• discuss how supervisors fit into the program and their responsibility per block.</li> </ul>	T-6 (Copy of Eight-Block Cover)
Safety Block One— <b>LEARN JOB SAFETY</b> Discuss supervisor's role to teach, train, inform, and direct activity.	T-7 "Learn Job Safety"
Supervisors should always ensure that: <ul style="list-style-type: none"> <li>• worker has safety knowledge,</li> <li>• worker has skill or ability to perform job and certifications if applicable, and</li> <li>• worker performs job safely.</li> </ul>	
Safety Block Two— <b>AVOID UNSAFE ACTS</b> Discuss Unsafe Acts as being 90% of all	T-9 "Avoid Unsafe Acts"



<u>KEY</u>	<u>PROMO</u>
<p>accident causes.</p> <p>Cover major contributions:</p> <ul style="list-style-type: none"> <li>• inattention,</li> <li>• rushing or hurrying,</li> <li>• lack of skill,</li> <li>• failure to secure or warn,</li> <li>• tools that are either unsafe or used unsafely,</li> <li>• instructions not followed,</li> <li>• violation of safety rules, or</li> <li>• lack of knowledge (training).</li> </ul> <p><b>Don't Allow Anyone to Become a 90% Factor.</b></p> <p>Discuss taking chances. It only takes one miss. Encourage workers to avoid Unsafe Acts.</p> <p>Review - <b>"No job so important or urgent that time cannot be taken to do it safely."</b></p> <p>Review actions common to accidents:</p> <ul style="list-style-type: none"> <li>• lifting—use legs, get help, break down load, use equipment,</li> <li>• hands off—never allow use of unsafe equipment, or a worker to perform a job who is not trained or skilled. Never remove or alter "Safety Tag,"</li> <li>• shut off power—use lock-out program,</li> <li>• falls—scaffolds and ladders should be in safe condition and used properly. Falls are most common in construction operations, and</li> <li>• know the job—communicate job safety.</li> </ul> <p><b>Safety Block Three—OBSERVE SAFETY RULES AND SIGNS</b></p> <p>Post signs where required:</p> <ul style="list-style-type: none"> <li>• traffic,</li> <li>• safety,</li> <li>• posters DOE/OSHA,</li> <li>• fire, and</li> <li>• direction.</li> </ul> <p>Be sure they are meaningful and obeyed.</p> <p>Adhere to rules that are generally known as:</p> <ul style="list-style-type: none"> <li>• codes, such as building and electrical,</li> <li>• standards (ANSI, NEC),</li> <li>• contract (requirements),</li> <li>• DOE (orders), and</li> </ul>	<p>T-11 "Accidents are Premeditated Carelessness"</p> <p>T-12 (Symbols)</p> <p>T-13 "Rules and Signs"</p> <p>T-14 (Book of Rules)</p>

<u>KEY</u>	<u>PROMO</u>
<p>• OSHA (1910/1926).</p> <p>Obligation to follow rules:</p> <ul style="list-style-type: none"> <li>• cost in lost time,</li> <li>• cost in property/equipment damage, and</li> <li>• cost in penalty (contract, OSHA, or criminal actions).</li> </ul> <p>ALL RULES HAVE PURPOSE</p> <p>Safety Signs—One that is a good example Use signs—don't abuse signs.</p> <p>Safety Block Four—<b>CORRECT OR REPORT UNSAFE CONDITIONS</b></p> <p>Define "Unsafe Conditions"—Any condition that is not normal and can cause injury or accident; can cover several items:</p> <ul style="list-style-type: none"> <li>• Most unsafe conditions are caused by actions or lack of actions.</li> <li>• All unsafe conditions can be eliminated or controlled by good actions. Do your part. <ul style="list-style-type: none"> <li>– Encourage workers <b>not</b> to create unsafe conditions.</li> <li>– Do not allow workers to correct unsafe conditions for which they are not skilled.</li> <li>– Follow through in correcting reported unsafe conditions. Don't delay!</li> </ul> </li> </ul> <p>(Failure to correct could be a willful violation.)</p> <p>Discuss DOE safety reporting system. Worker has right to report without recourse. Reference DOE Safety Poster required to be posted.</p> <p>Discuss Practices:</p> <ul style="list-style-type: none"> <li>• housekeeping,</li> <li>• safe operations and procedures,</li> <li>• use of personal protective equipment (PPE),</li> <li>• safety by example, and</li> <li>• fire protection, extinguishers, and training.</li> </ul> <p><b>A Key Item—<u>Use technical assistance, such as industrial hygiene, fire protection, environmental, and radiation, in problem solving.</u></b></p>	<p>T-16 "Bull in Field"</p> <p>T-18 "Unsafe Conditions"</p>

<u>KEY</u>	<u>PROMO</u>
<p><b>ALWAYS TAKE ACTION TO CORRECT ANY UNSAFE CONDITION!!!!</b></p>	
<p><b>Safety Block Five—USE PERSONAL PROTECTIVE EQUIPMENT</b></p> <p>Supervisors must assure that all workers and visitors use appropriate PPE.</p> <p>Review PPE requirements:</p> <ul style="list-style-type: none"> <li>• eye protection (A MUST),</li> <li>• foot protection (A MUST),</li> <li>• head protection (A MUST), and</li> <li>• other protection:               <ul style="list-style-type: none"> <li>– noise—selected muffs or plugs,</li> <li>– respiratory—for specific hazard. Must meet appropriate medical and fit requirements,</li> <li>– safe personal dress—should comply with basic dress code, and</li> <li>– special—wet gear, gloves, contamination wear, welding, and so forth.</li> </ul> </li> </ul> <p>Don't forget training for all equipment use!!!!</p>	<p>T-20 "PPE"</p>
<p><b>Safety Block Six—RESPECT HAZARDOUS CHEMICALS AND MATERIALS</b></p> <p>Discuss responsibility of supervisors to see that workers are knowledgeable and trained in the care and use of hazardous chemicals or materials.</p>	<p>T-22 "Hazardous Chemical"</p>
<p><b>OSHA Hazardous Communications Standard requirements:</b></p> <ul style="list-style-type: none"> <li>• written program available for review,</li> <li>• inventory and control of all hazardous chemicals on the worksite,</li> <li>• MSDS available for each hazardous chemical and MSDS location,</li> <li>• containers labeled,</li> <li>• workers knowledgeable of program,</li> <li>• workers informed of any exposure and introduction of new materials,</li> <li>• workers trained in safe use, and</li> <li>• PPE provided and used.</li> </ul> <p>Discuss exceptions, such as drugs, food products, over-the-counter products, and handling as opposed to use.</p>	<p>T-23 "Labels and MSDS"</p>

<u>KEY</u>	<u>PROMO</u>
<p><b>Safety Block Seven—REPORT ALL ACCIDENTS AND INJURIES</b></p> <p>Discuss:</p> <ul style="list-style-type: none"> <li>• having a known system for reporting,</li> <li>• injuries—first aid and medical attention that is available,</li> <li>• unsafe conditions—review and correct,</li> <li>• emergency response—how and where,</li> <li>• caution #911 from mobile phone, and</li> <li>• instruct workers.</li> </ul> <p>Be prepared in the event of emergency. All workers should know how to report, respond, and get help.</p> <p><b>Safety Block Eight—PRACTICE HOME SAFETY</b></p> <p>Discuss and encourage the need for workers to practice home safety:</p> <ul style="list-style-type: none"> <li>• lost wages,</li> <li>• suffering, and</li> <li>• family needs.</li> </ul> <p><b>Take Safety Home—It's Free.</b></p> <p>Note and discuss: Supervisors have a wide range of responsibilities. It is important to the worker, the job, and to the supervisor that all necessary safety items (conditions and practices) at a worksite have the full and complete attention of the supervisors. <b>If you allow accidents to happen, they will happen!</b></p> <p>It is recommended that the Eight Blocks be used as an outline for tailgate or lunch-box safety meetings, along with technical safety items or subjects.</p> <p>Recommended topics:</p> <ul style="list-style-type: none"> <li>• ladder safety,</li> <li>• hazardous chemicals,</li> <li>• emergency calls,</li> <li>• excavations,</li> <li>• confined space,</li> <li>• personal protective equipment,</li> <li>• lockout/tagout program,</li> <li>• fire protection, and</li> <li>• personal dress.</li> </ul> <p><b>Completion - Have a Safe Day!!!!</b></p>	<p>T-24 "Report Accidents and Injuries"</p> <p>T-25 "Be Prepared"</p> <p>T-26 "Home Safety"</p> <p>T-28 "Have a Safe Day"</p>

**COULD THIS HAPPEN TO YOU?***(Continuance Program)***KEY****PROMO**

Explain eight situations where someone thought,  
**"This couldn't happen to me."**

For each accident scenario, ask class to note if:

- unsafe Act,
- unsafe Condition, or
- both.

Training note - This can also be used for  
 Supervisory Training.

**COULD THIS HAPPEN TO YOU?**

**Case #1** Three men lowered a gasoline pump into a 40-ft deep well to pump out water. The pump was not running properly. One man went in to check pump. Man was noticed to be in trouble; two others went in to help. All three died of CO inhalation.

**Case #2** Worker was told to cut some metal but **not** to operate crane to handle metal. Worker ran crane into high-energy electrical lines. Electrocuted.

**Case #3** Maintenance worker on a safety platform attached to a lift truck. Lift-truck operator left to get some supplies. Truck rolled, knocking maintenance worker from platform. Died from fall.

**Case #4** Electrician looking for a bad smell in an electrical supply cabinet stood on a metal bucket to be able to see and reach. Bucket slipped, causing contact with high voltage in cabinet. Electrocuted.

**Case #5** Worker entered an 8 1/2-foot-deep trench to tighten a coupling. Trench caved in. Fast work of others with ready equipment saved buried worker 1 1/2 hours later with use of shoring.

**Case #6** Electrical switchman attempted to activate a 115 kV switch in moist weather, using a wood switchstick and rubber gloves. Near-miss shock in process. It was found that the switch pole was wet and gloves had a pinhole.

T-29 "Couldn't Happen"

T-30 "3 Men Die in Well"  
 (Unsafe Condition and  
 Unsafe Acts—Mostly Acts)

T-31 "Crane Electrocution"  
 (Unsafe Act)

T-32 "Fall Kills"  
 (Unsafe Act with ? of Unsafe  
 Condition—Brakes)

T-33 "Electrician Killed"  
 (Unsafe Act)  
 Note—Smell was a dead snake  
 in bottom of cabinet.

T-34 "Cave-In Traps"  
 (Unsafe Act)

T-35 "PPE Can Be Shocking"  
 (Unsafe Acts using wet stick and  
 wet gloves)

<u>KEY</u>	<u>PROMO</u>
<p><b>Case #7</b> Laborer was electrocuted while chucking a drill bit in a 110 V drill motor. The supply was a 150-ft extension cord made at the worksite. The ground circuit was disconnected in three places. The damaged area allowed phase-to-ground from the fault to the drillcase. Victim was sitting on metal steps.</p> <p><b>Case #8</b> An equipment operator (not electrician) attempted to troubleshoot an electrical starter switch that had been dropping out (tripping) and was being mechanically held in place. With power on, the equipment operator made contact with 480-V connection. Electrocuted.</p> <p><b>COULD THIS HAPPEN TO YOU?</b></p>	<p>T-36 "Laborer Electrocuted" (Unsafe Condition)</p> <p>T-37 "Switch Repair Electrocution" (Unsafe Act)</p>



# SAFETY

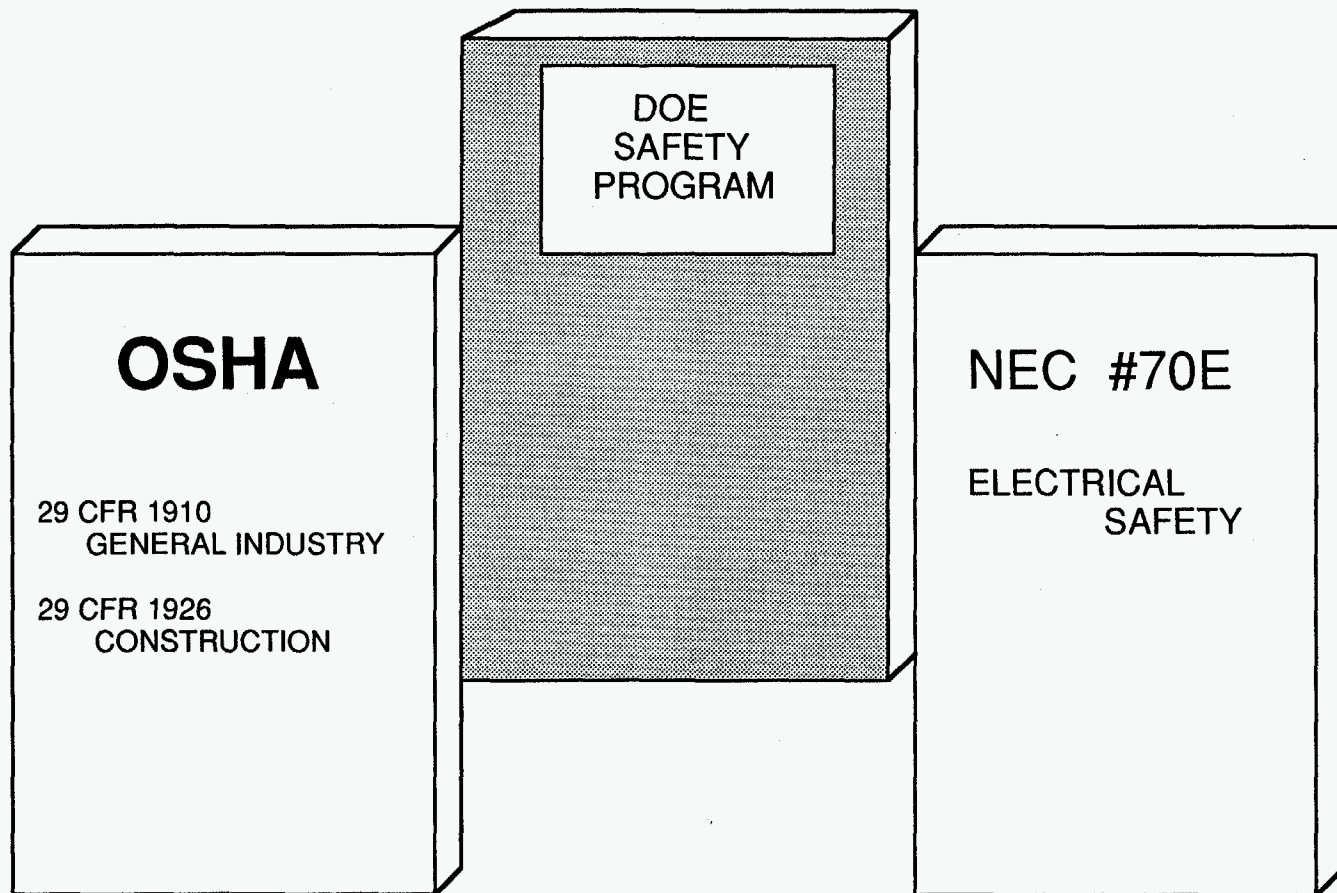
T-1

ApB-39



# **MANAGEMENT**

- **Direct obligation to workers**
- **Responsible for regulations**



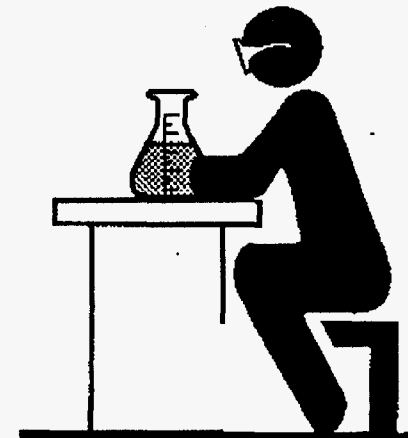
T-3

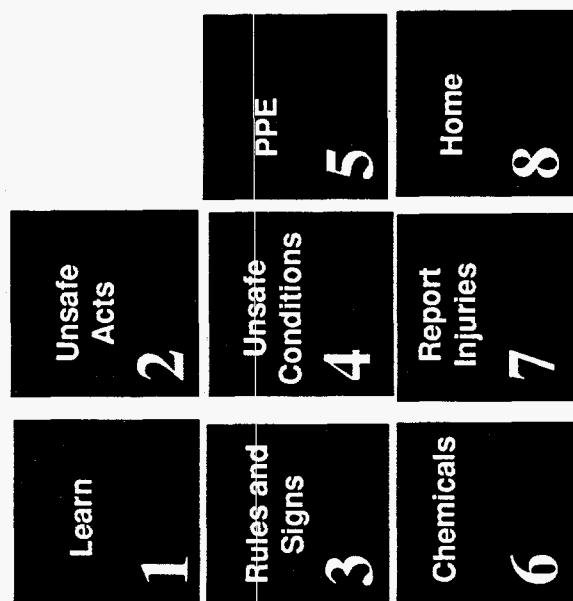
# **WORKERS TO PROTECT**

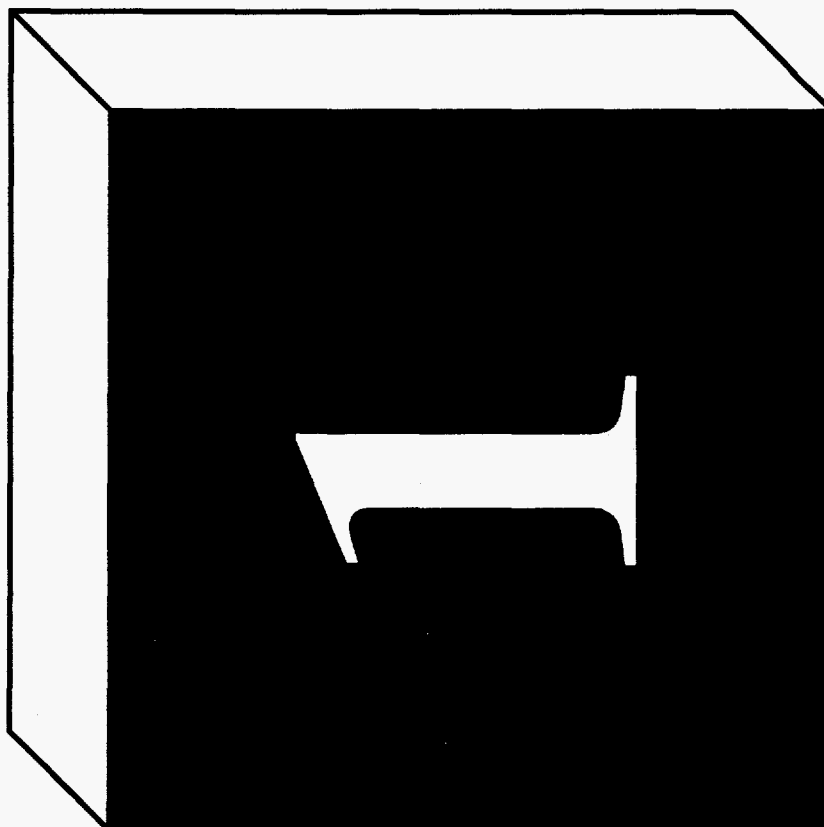
- Self**
- Co-workers**
- Family**



# Safety is Part of Your Job



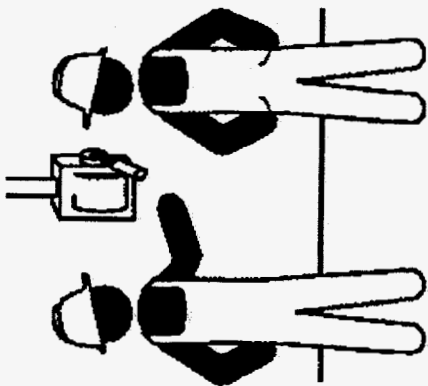




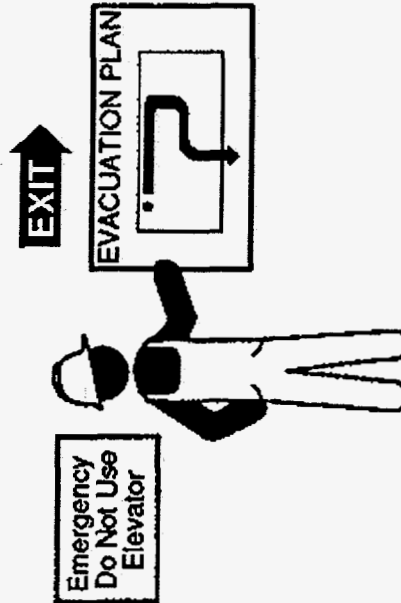
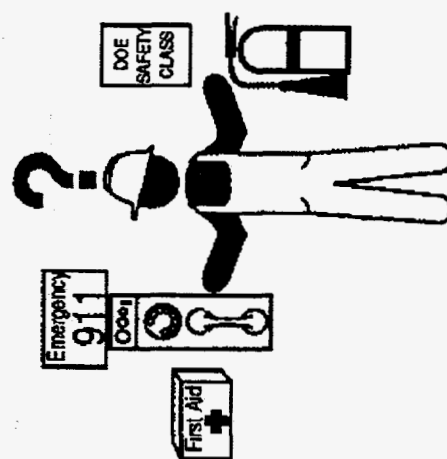
# Learn Job Safety

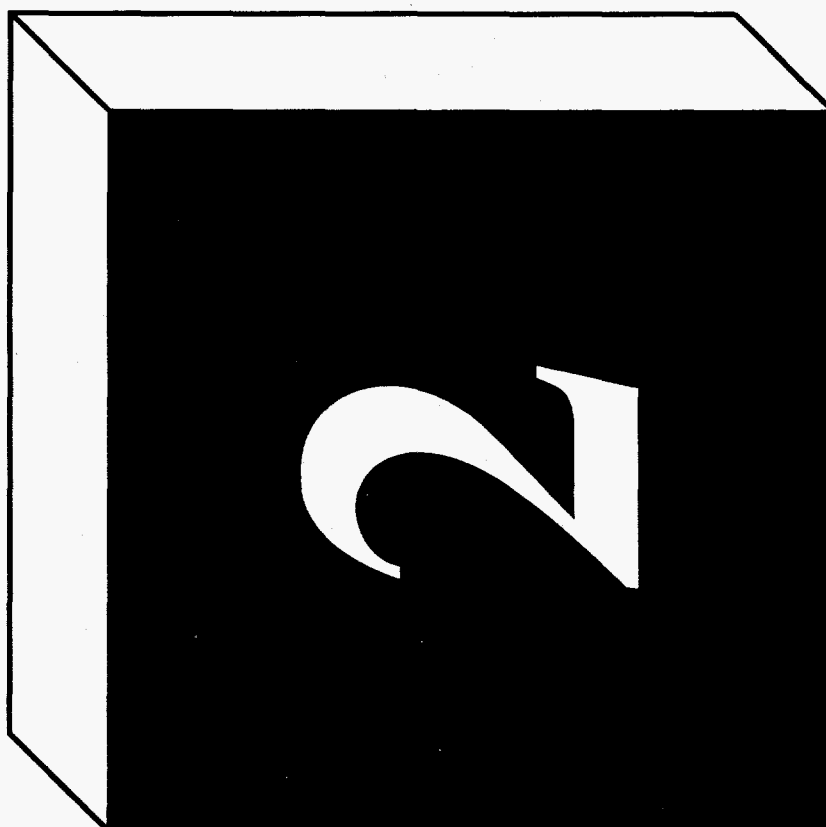
T-7

ApB-45



## Learn and Do





**Avoid Unsafe Acts**

T-9

ApB-47

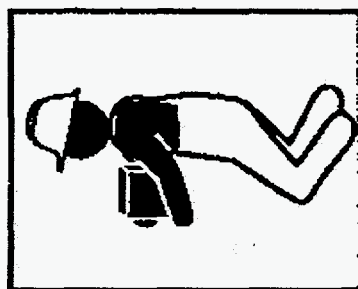
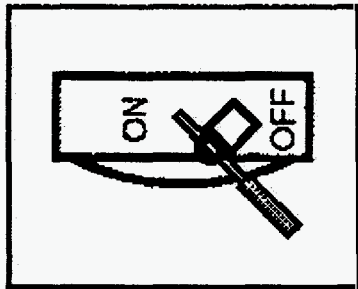


**No job is so important  
or urgent that time  
cannot be taken  
to do it safely!**

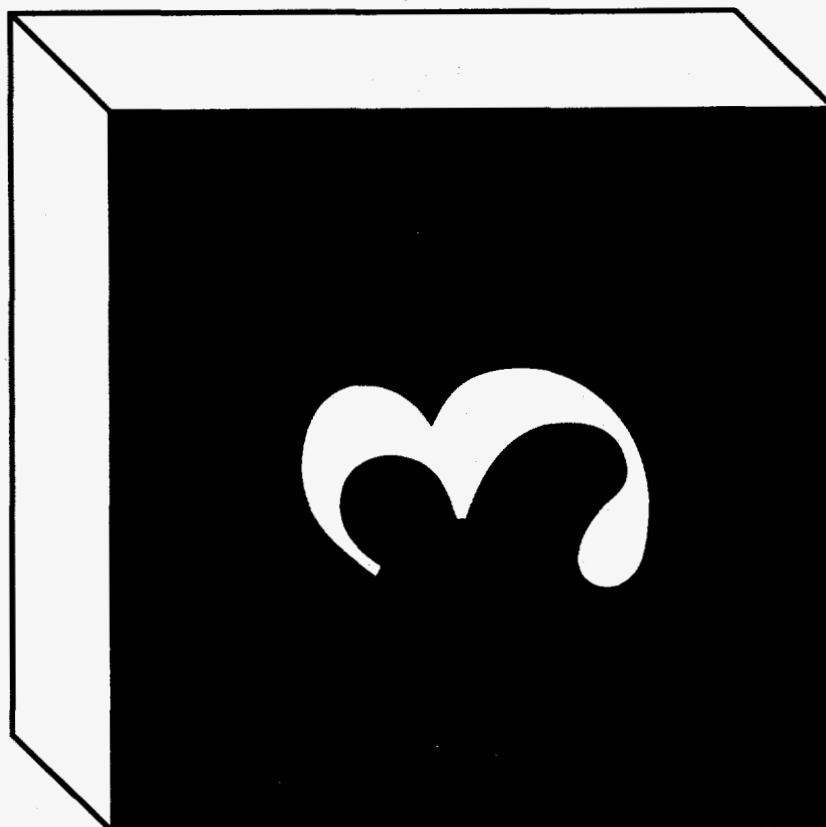
**Accidents  
are  
Premeditated  
Carelessness**

T-11

ApB-49



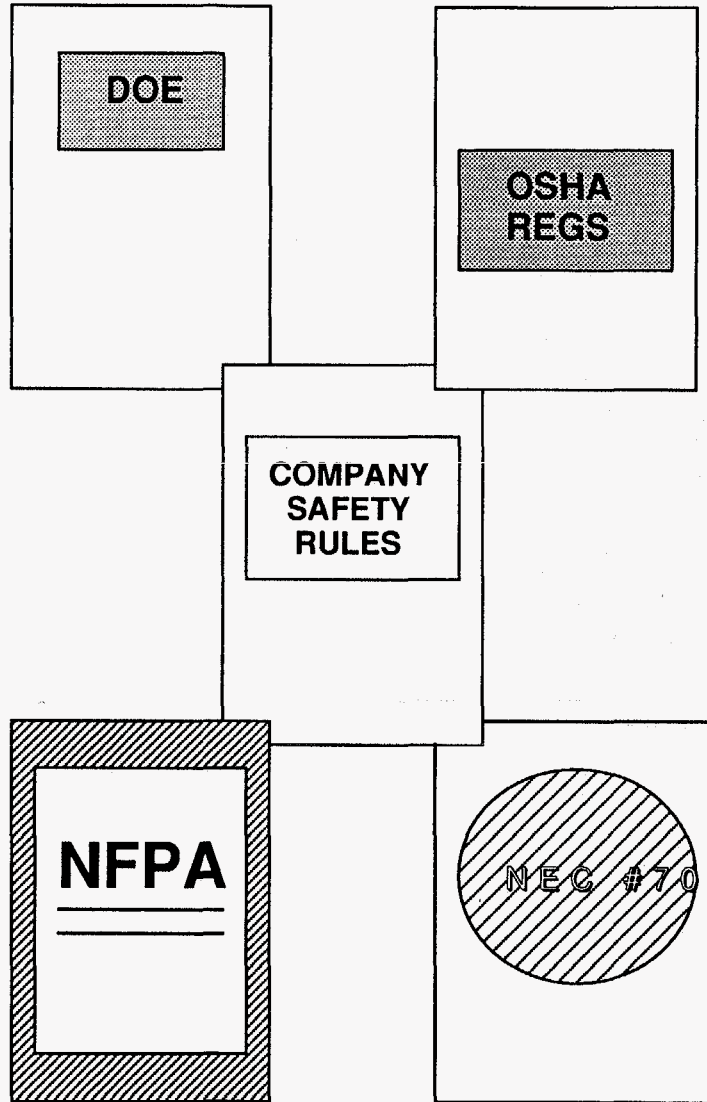
T-12

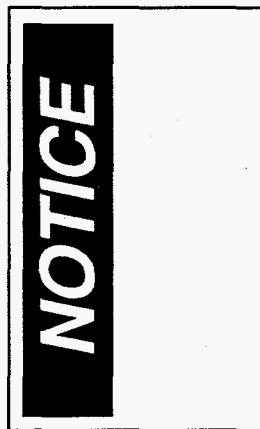
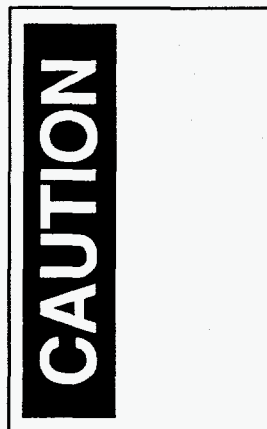
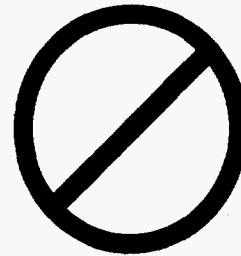
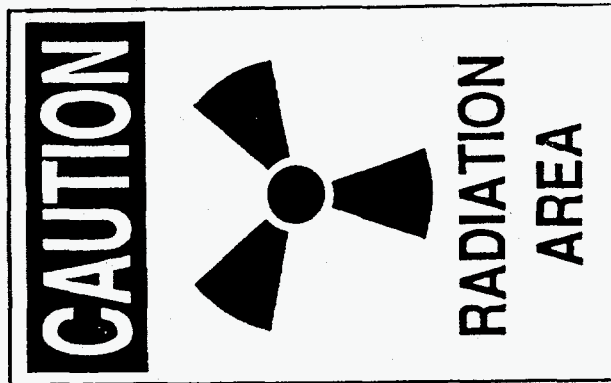


## Rules and Signs

T-13

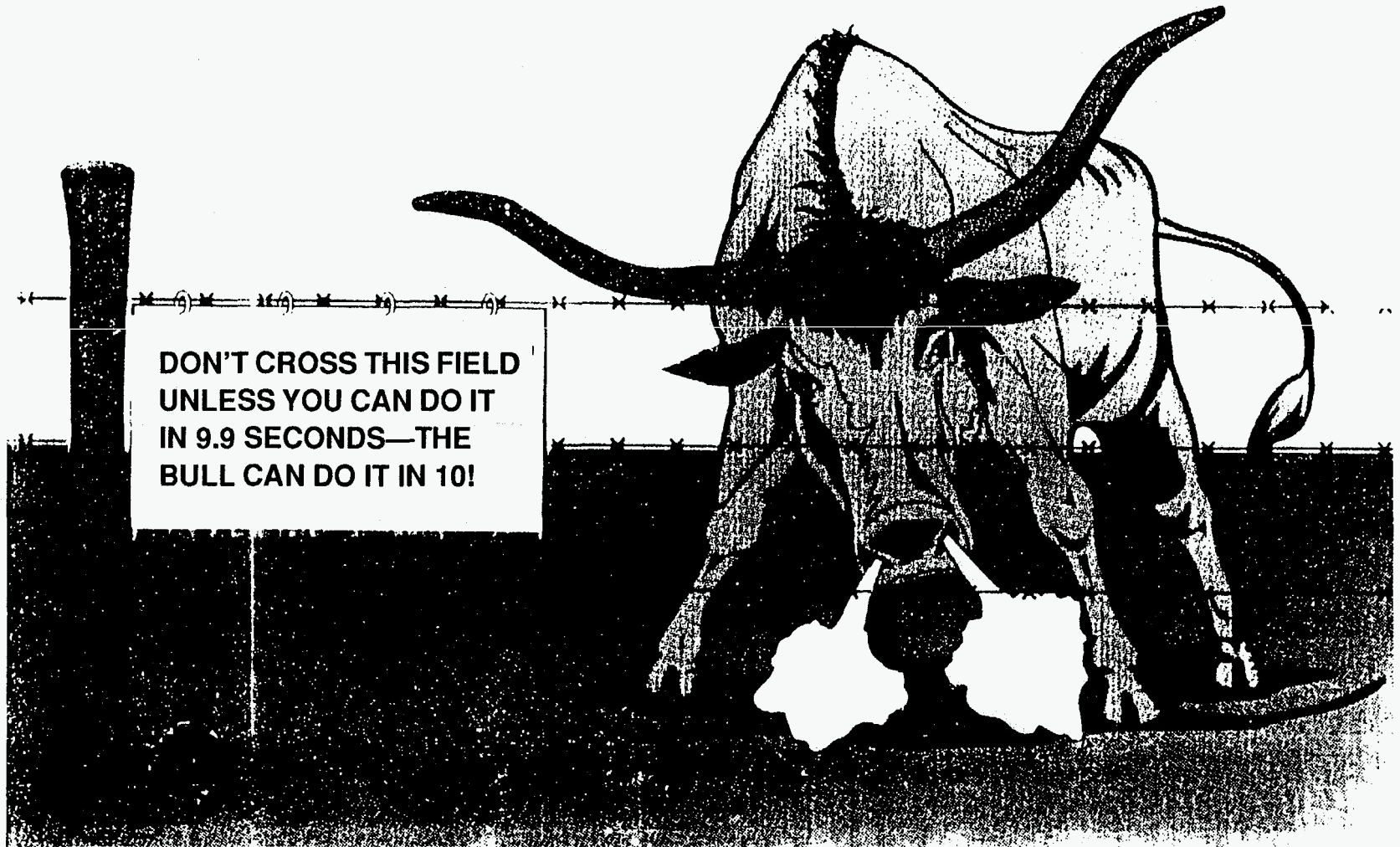
ApB-51

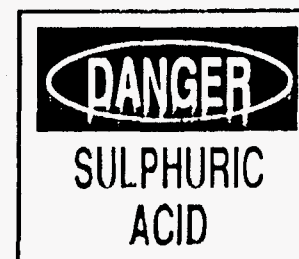
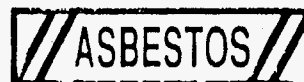
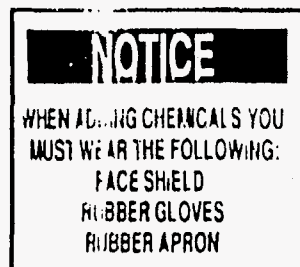
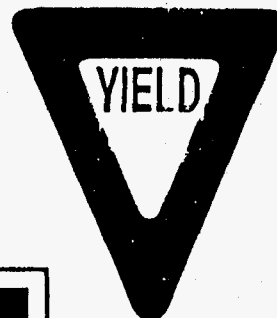




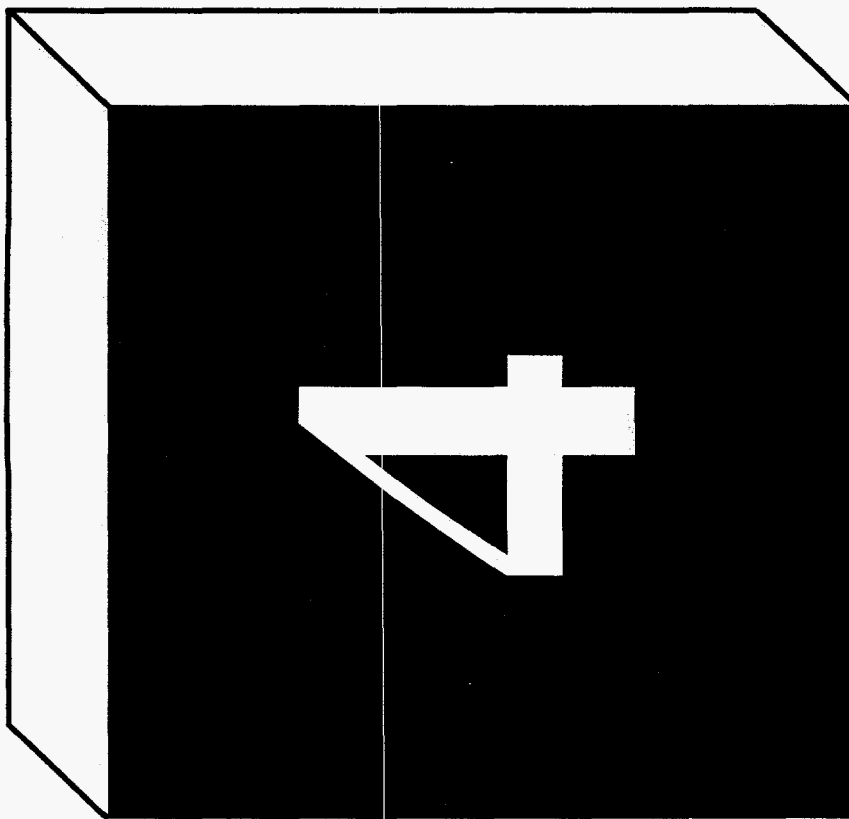
T-15

ApB-53



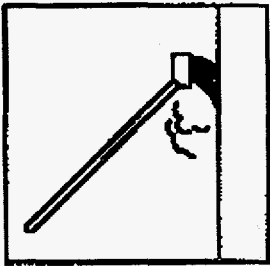
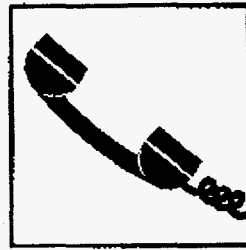




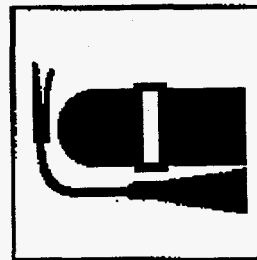
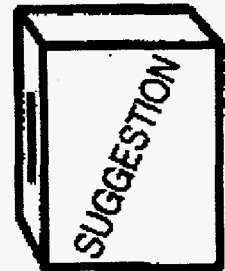


**Unsafe Conditions**

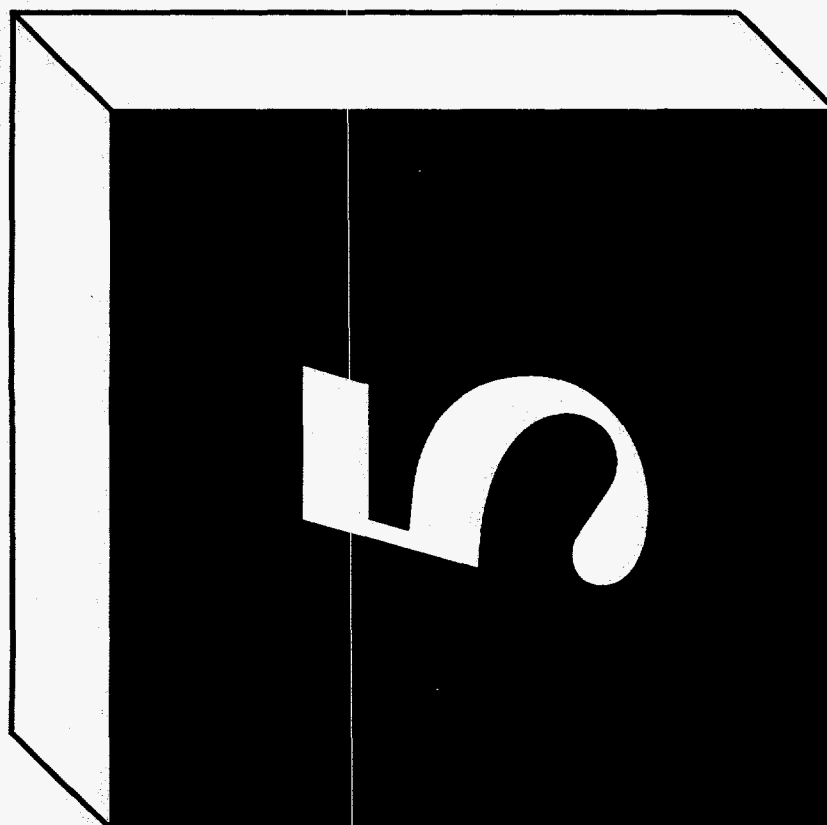
**T-18**



## Do Your Part



T-19



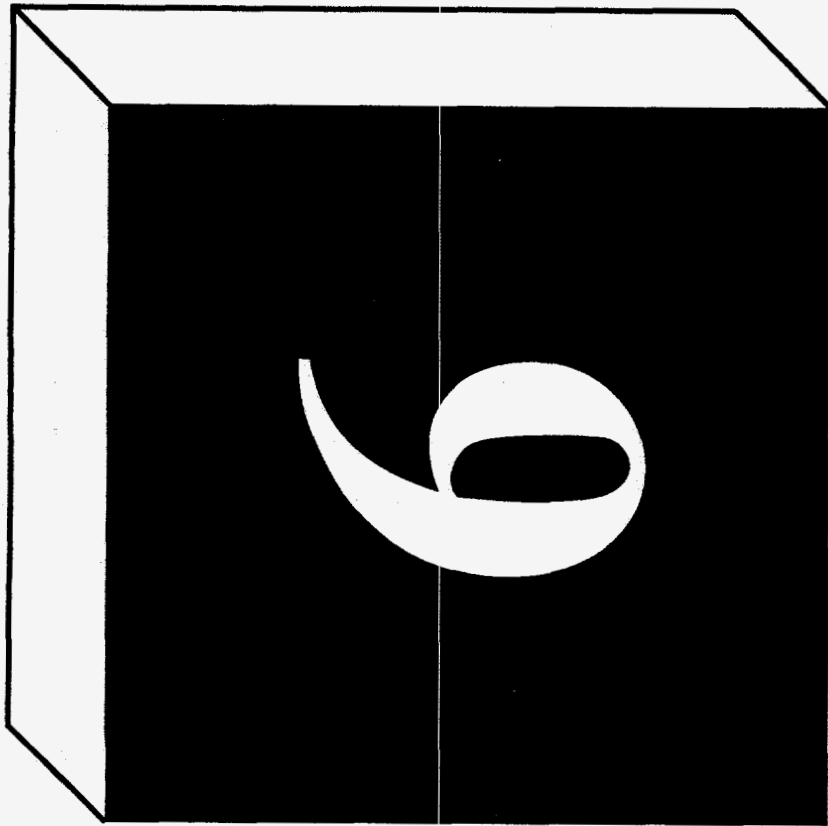
P. P. E.

T-20

# **Use personal protective equipment**

- **Eye protection**
- **Hand**
- **Respirator**
- **Noise Protection**
- **Head**
- **Feet**
- **Special**

ApB-60



# **Hazardous Chemicals and Materials**

T-22

**ACETONE**

**FLAMMABLE**

**IRRITANT TO EYES,  
SKIN, AND LUNGS**

**COMPANY  
HAZARD  
COMMUNICATION  
PROGRAM**

(Written program)

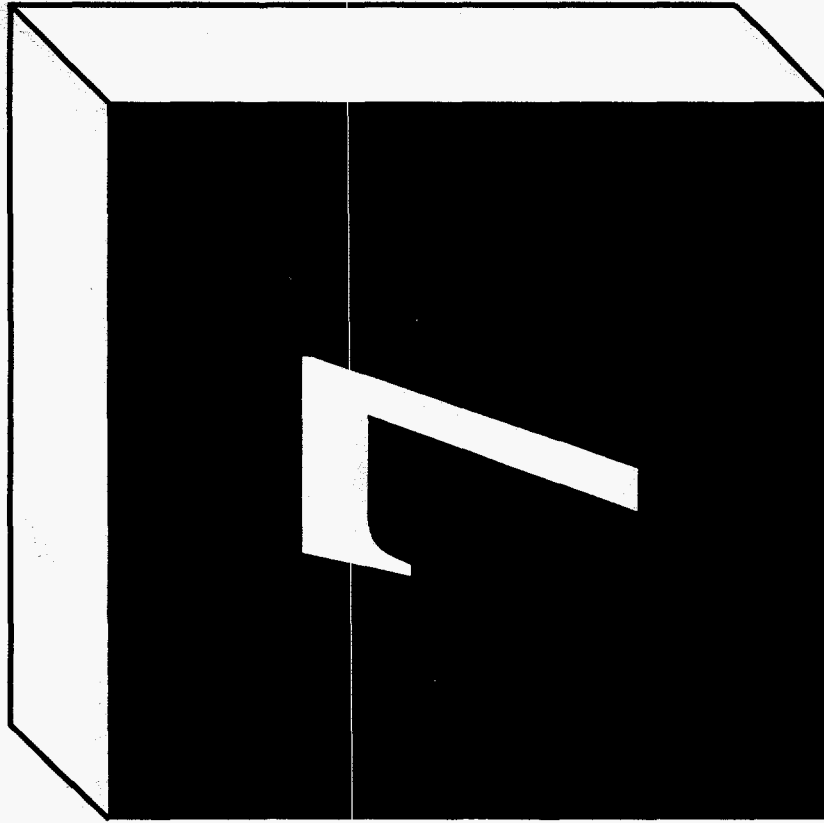
**MATERIAL SAFETY DATA SHEET**




Product Name

Warning

Manufacturere's Name and Address



# Accident & Injury Reporting

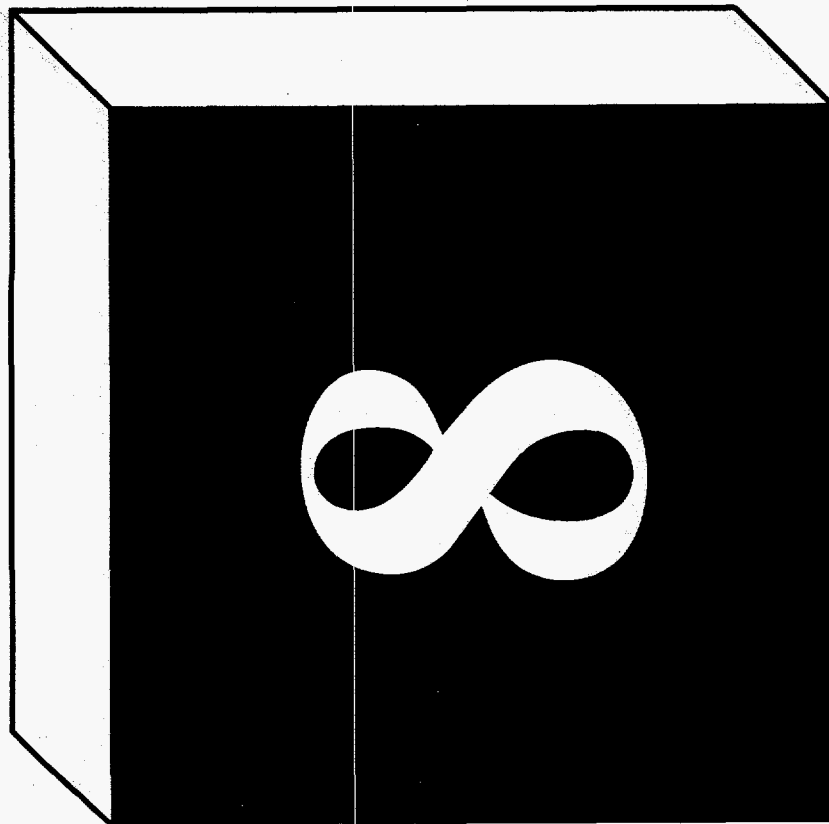
T-24

**Be prepared in event  
of an emergency**

**T-25**

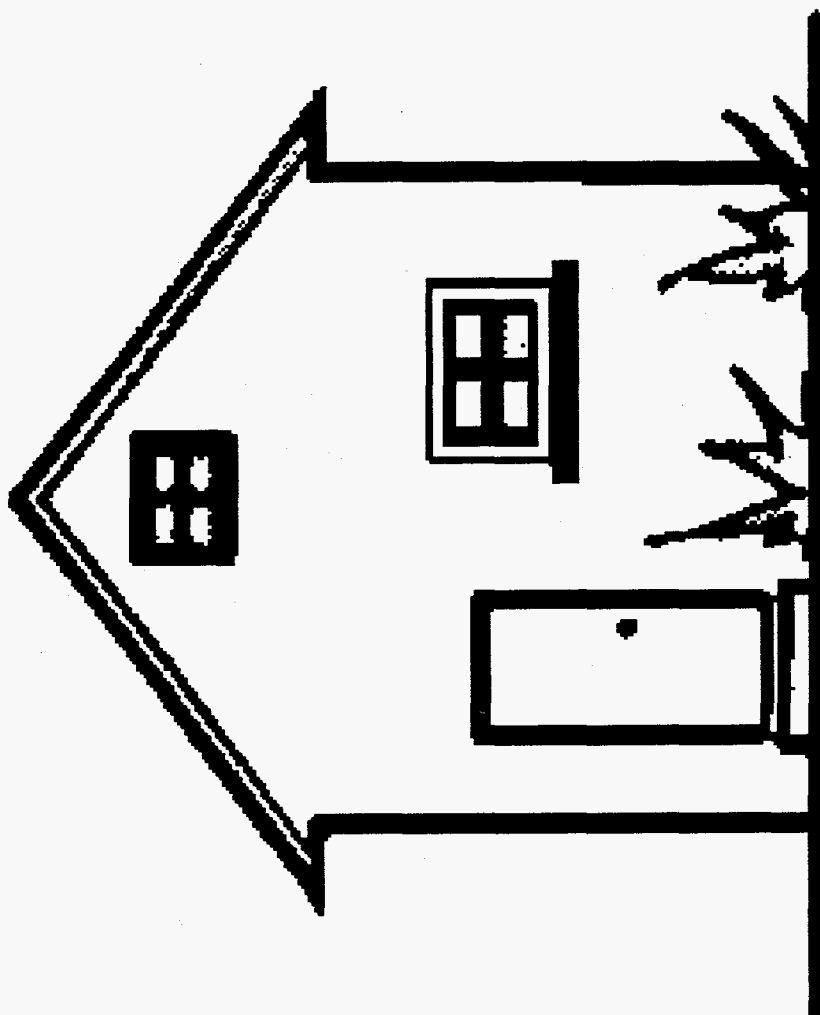
**ApB-63**





# Home Safety

T-26



T-27

ApB-65

**Have  
A  
Safe  
Day**

**T-28**

**Could this happen  
to you?**

**T-29**

**ApB-67**

# Three men die in well shaft

By JIM KERRIGAN  
of the Journal Star

**BROWNING** — It was a tragic case of follow-the-leader in which a man descended a well shaft to check a water pump and did not return.

He was followed into the 40-foot-deep pit by a would-be rescuer who, himself, quickly disappeared. A third man then went to the aid of the others and likewise did not return.

Firefighters were summoned and they, too, plunged into the dark hole in the ground where they met the unseen foe: carbon monoxide.

When the events of Monday evening were concluded here, five victims were hauled from the well. Three of them — Ronald E. Meyer, 41, his son, Shawn M. Meyer, 21, both of rural Browning, and Larry W. Briggs, 42, of Astoria — were dead.

It began at the rural residence of Ronald Meyer, where a residential well had for some time refused to supply water. "It wasn't functioning and he was pumping it out trying to fix it," said Donna Baum, the Browning Fire Department dispatcher.

Although the water supply to the residence had been cut off, the well still contained about 4 feet of water, explained Baum.

According to reports, the three men had lowered a gasoline-powered water pump into the well via a rope. Apparently "the pump had started to malfunction and slow down, and so Larry Briggs went down in the well to see what was wrong," Baum said.

"They had a ladder down the well ... and he was pretty bruised up to where it looked like he had just got so much carbon monoxide that he passed out" and fell off the ladder.

"There was so much carbon monoxide down there, it got them all instantly," she said. "Ronnie Meyer, the owner of the property, went down when he saw him (Briggs) fall. He went down to help him, and he didn't get but half-way down the ladder. I guess, when he (also) fell in.

"Anyway, then the son, Shawn Meyer, when his dad fell, they said he just roared or less dove in trying to get them out."

A call then went out to fire and rescue units. Volunteers from the Browning Fire Department were the first emergency personnel to reach the scene. Browning is approximately 10 miles east of Rushville.

"At that time, I don't really think they realized it was

carbon monoxide that was doing it," Baum said, explaining that firefighters knew only that people had fallen into the well.

Two Browning volunteers, Burl Boyd and Elmer Berry, were to learn almost too late what the real danger was.

Both men had air masks when they descended the well, but "Boyd's mask, he was having trouble getting it regulated, so he went halfway down the ladder to help get one guy out, and he didn't have his mask on and he was overcome," the dispatcher continued.

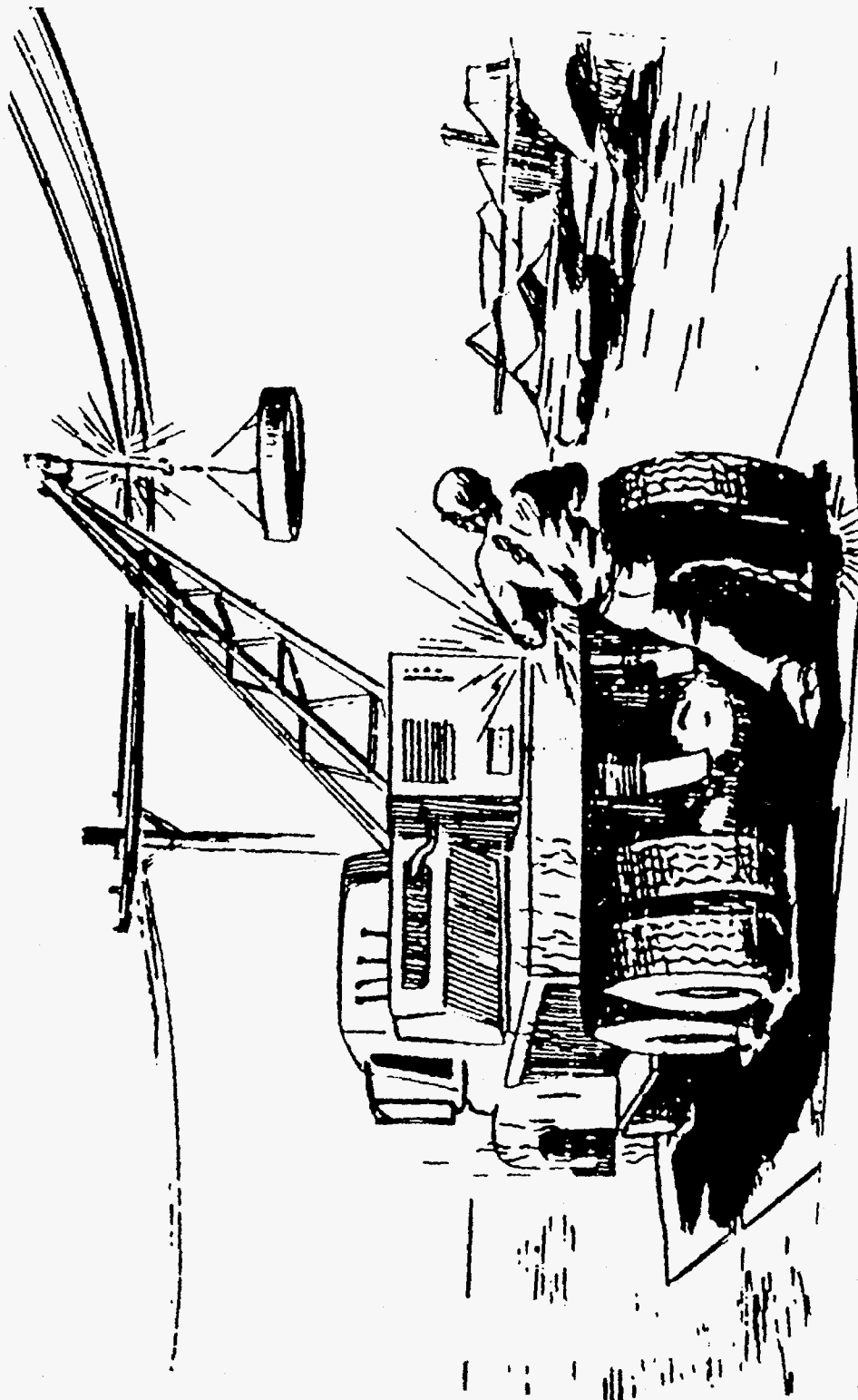
Berry, whose mask either leaked or wasn't worn, also suffered from the fumes as he tried to rescue the others.

Baum said it wasn't until the firefighters were overcome that emergency personnel began to realize that exhaust gas from the pump was the likely culprit.

All five victims were rushed to area hospitals. Larry Briggs and Shawn Meyer were pronounced dead shortly before 9 p.m. at Culbertson Memorial Hospital in Rushville, and Ronald Meyer was pronounced dead a short time later at Passavant Hospital in Jacksonville.

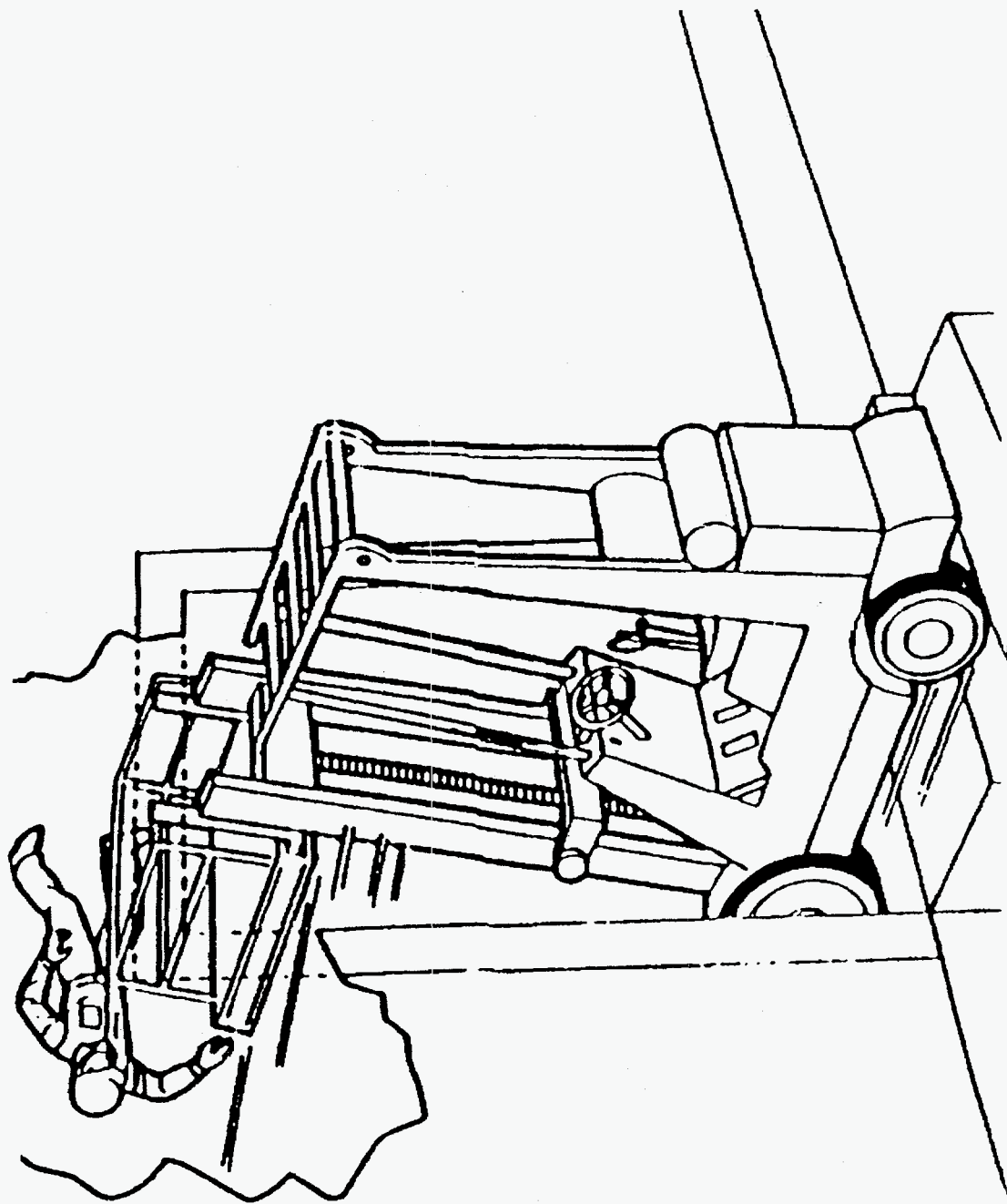
Boyd was reported in stable condition Tuesday at Culbertson Memorial, and Berry was released after emergency room treatment at the same hospital.

Baum said autopsy results have not been completed, so the cause of the deaths remains officially undetermined. She said, however, that officials theorized the gasoline engine used to power the water pump had filled the well with toxic carbon monoxide fumes which knocked out the men almost as soon as they entered the hole.



T-31

ApB-69



T-32

ApB-70

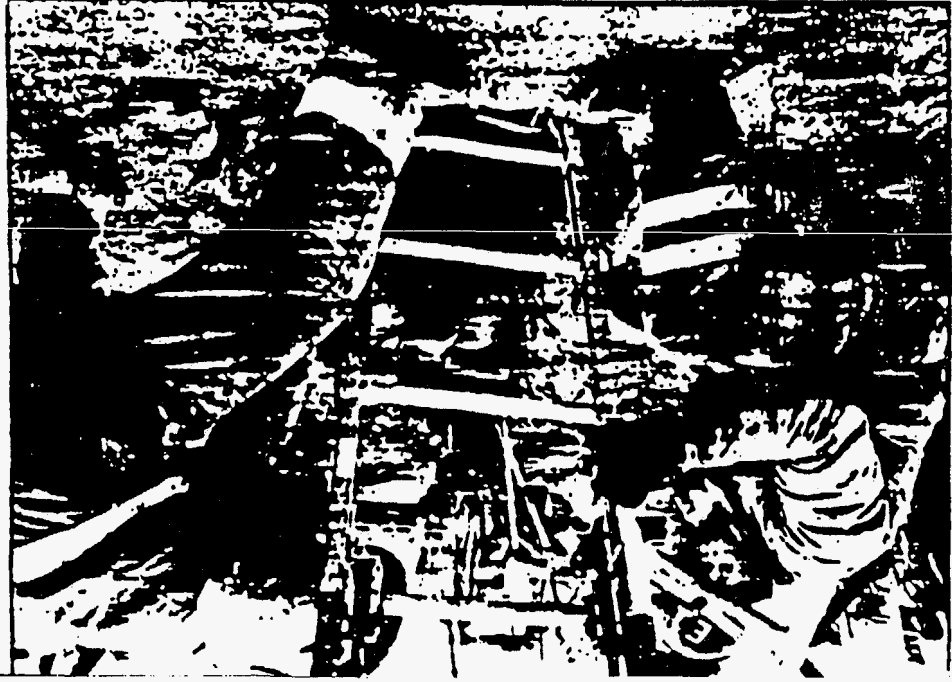


T-33

ApB-71



# Cave-in traps construction worker



Construction worker trapped under debris after cave-in. The 114-hour project was scheduled to begin Monday. Workers are now working to clear the debris and rescue the trapped worker.

5:30 p.m. and trapped him for nearly 14 hours.

After finding his own leg, Jackson said he was "worried about the way the earth was settling." A steel worker nearby said he saw the earth "settling" and "saw the earth was settling."

Kelly's (phonetic) a neighbor, was not present the night the earth was settling. Jackson said he was "worried about the way the earth was settling."

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With Doug Westbrook, who had just returned from a two-day assignment in South Africa, and Paul Brown, spokesman for the Bureau of Reclamation, Jackson said he was "worried about the way the earth was settling."

After Westbrook's return to the Bureau, Jackson said he was "worried about the way the earth was settling."

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## Personal Protection Can Be Shocking

Earlier this year, a "near miss" was experienced by an electrical switchman in a system substation. While switching 115kv with a wooden switchstick, in a wet atmosphere, the switchman experienced an electrical shock. The cause of the shock was determined to be a poorly maintained switchstick and a faulty, protective rubber glove.

The rubber glove had a small hole in it between the thumb and forefinger. Fortunately, the employee was not injured. Under other conditions, this accident possibly could have been fatal.

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### Condition of Equipment

The varnish sealer on the wooden switchstick was worn off, which

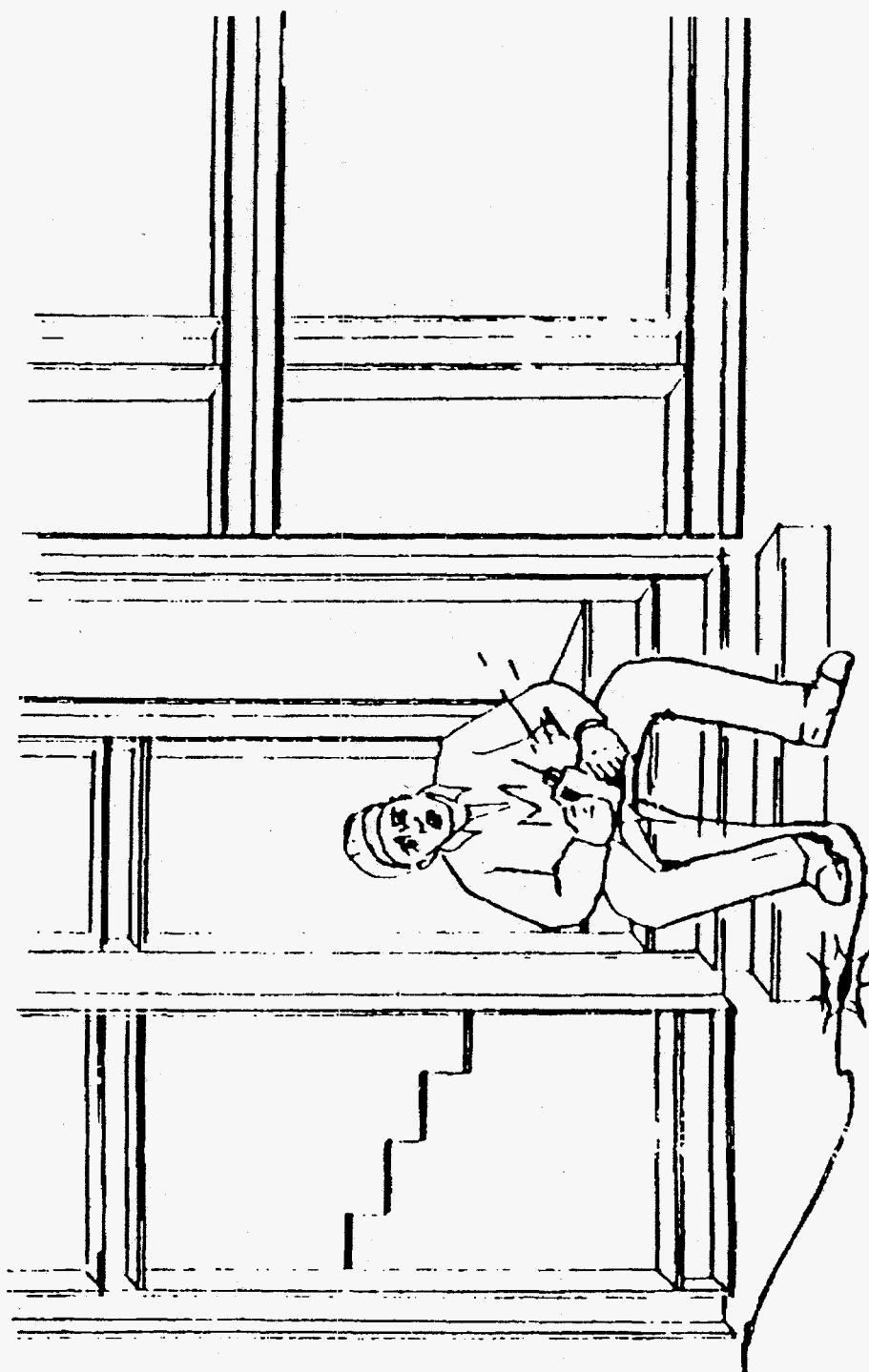
made it more susceptible to moisture absorption and "tracking."

The rubber gloves had recently been electrically tested and passed. However, they were not "air tested" prior to the incident.

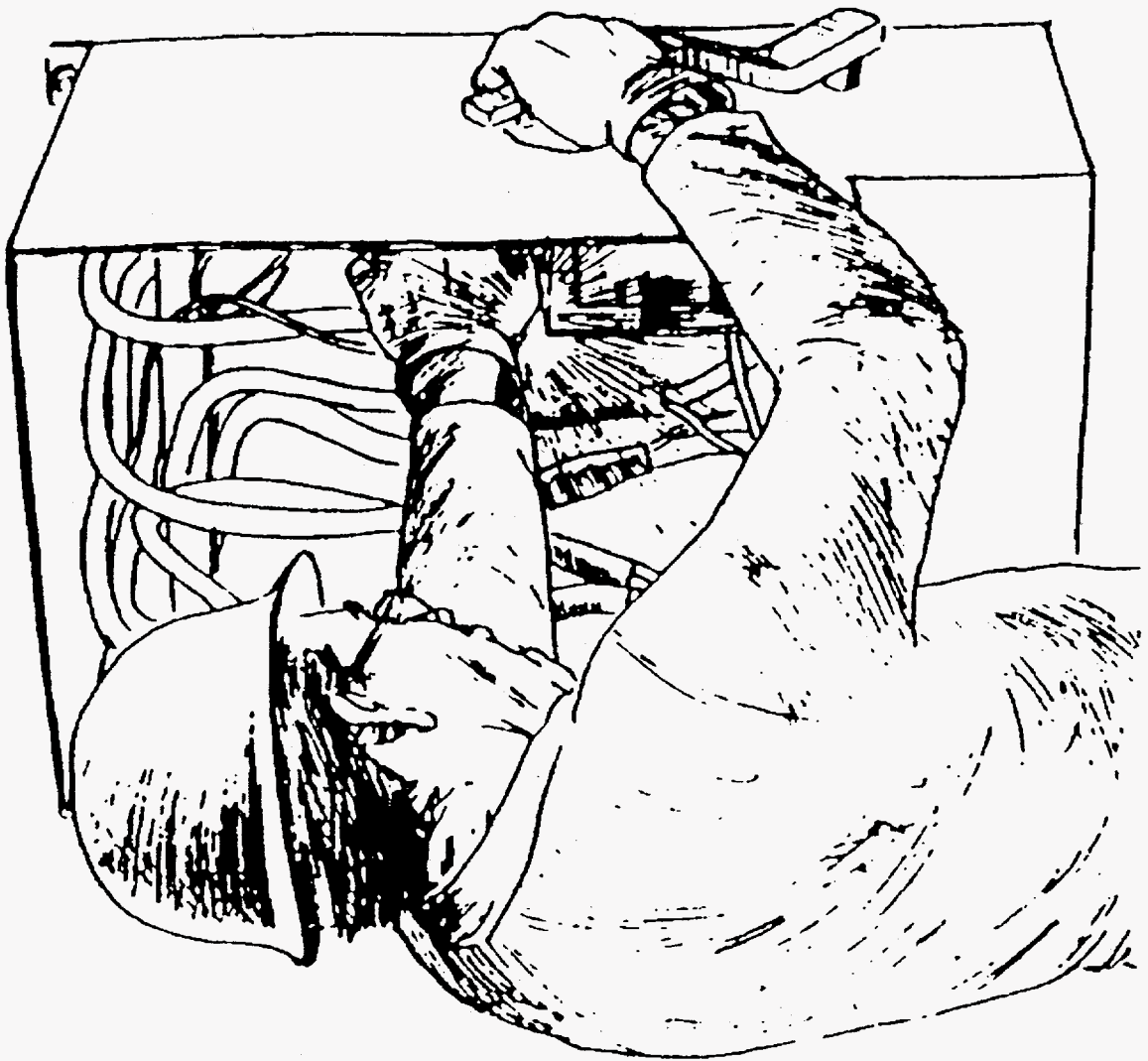
Always inspect equipment before use. Employees should get into the practice of always "air testing" protective gloves before each use.

Usually, there are many things that contribute to an accident. Never take anything for granted. Even if your equipment is new, or has recently been tested, take the time to check it out. The time spent may very well save your life.

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## **APPENDIX C**

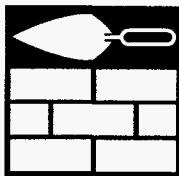
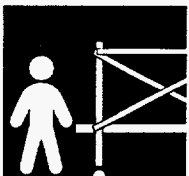
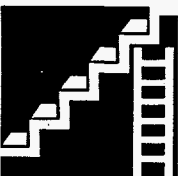
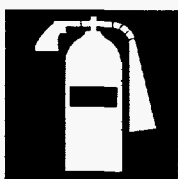
### **Training Requirements**



# US Department of Energy Construction Safety Reference Guide

## Appendix C

### Training Requirements of Construction Safety



## Introduction

Training and instruction are key elements of the knowledge and quality performance of any job. In the area of safety and health, knowledge and understanding are essential tools in the avoidance of accidents and injuries and in overall accident prevention. The majority of accidents are classified as unsafe acts, which directly points to a cause rooted in lack of understanding, training, or skill as the prime mover in the accident sequence. To perform safely is as important, if not more so, as the job or task at hand. Safety is a quality part of any job.

## Scope

There are many tasks in every job that require some special or standard knowledge of the job and associated operations. Within the reference guide and appendixes, items have been identified by OSHA, ANSI, NFPA, and other standards, codes, and regulations in which special or specific training or knowledge in related safety and health is or may be required.

Often the term training or instruction is thought to represent an organized or formal process. In many cases a structured training or education process is realized; however, there are other processes to be realized, such as job awareness, basic instruction in operations, and technical-application information. In the text of this guide, training direction has been mostly identified through recognized OSHA training requirement guidelines, plus some additions to recommendations made in related codes and standards and practical application.

Terms such as *competent*, *qualified*, *proficient*, and *designated*, as used in this text, all directly or indirectly relate to knowledge or training. Additionally, training or instruction is implied in such terms as *registered professional engineer*, *qualified engineer*, *qualified person*, *competent person*, and *certified*. In such cases it must be realized that an added discipline must be involved to mean *in the field of the subject matter or knowledgeable of the source, equipment, material, or operation*. Such recognition may also be expressed by one who is an *industrial hygienist*, *health physicist*, *safety engineer*, *fire protection engineer*, *designated specialist*, or specialist in other, related disciplines.

Standards and regulations make it the employer's responsibility to limit certain job assignments to employees who are "qualified," "certified," or "competent," meaning that they have had special previous training, in or out of the workplace. *Qualified*, by definition, may be expressed as describing one who by possession of a degree, license, certificate, or professional standing or who by extensive knowledge, training, and experience has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project. *Competent* may be defined

as describing a person capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees and authorized to take prompt corrective measures to eliminate them. *Designated* normally describes a person selected or assigned as being qualified to perform specific duties.

*Workers who have limited proficiency in English must nevertheless fully understand all safety and health procedures. Special training and instruction are appropriate for these workers, and employers must provide for such.*

## Training and Instruction References Listing

The following list of Training and Instruction References is provided to summarize training requirements. The specific training requirement is underlined, the corresponding section and paragraph in this guide is indicated in boldface, and the federal regulations pertaining thereto are cited.

Within the text of the Construction Safety Reference Guide, each paragraph that reflects a training requirement is indicated with a bold Circle T.



This indicator is a mark of training direction applied in each section paragraph or requirement specified as a ready reminder of a training requirement.

## Record Keeping

In most cases a record of training should be maintained, whether conducted in a formal status or casual instruction. A matter of record in many cases of training or authority (for example, licenses, certification, qualification) is a requirement and must be maintained.

## Summary

Training, instruction, design requirements, and inspection competency, as specified herein should be carefully and adequately applied. This listing may or may not cover all the training and instruction needs for any job or jobsite. It is the employer's responsibility to be aware of the needs for the jobsite or of the individual worker for training and associated instruction. The employer shall implement any training programs necessary to the health and safety of the employees. The key is that the employer shall instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to the work environment to control or eliminate any hazards or other exposure to illness or injury.

## TRAINING AND INSTRUCTION REFERENCES

<u>Section, Subject Paragraph</u>	<u>Training Requirement</u>
<b>Section II. B Site Preparation</b>	
B.10	<u>Safety Program</u> —Established and written safety and health program. 29 CFR 1926.20(b)(1) (See Appendix A for sample program)
B.10	<u>Competent Person</u> —Frequent and regular site safety inspections by a competent person. 29 CFR 1926.20(b)(2)
(Last Item)	<u>Site Clearing</u> —Knowledge of hazards and first aid procedures among site-clearing workers. 29 CFR 1926.604(a)(1)
<b>Section III. A Site and Worker Safety</b>	
A.2.g(1)(c)	<u>Fall Protection</u> —Use and inspection training.
A.2.g(2)(a)	<u>Rope and Lanyard Inspection</u> —Inspection by a competent person. 29 CFR 1926.20(b)(2)
<b>Section III. B Protecting Worker Health and the Environment</b>	
B.1.c	<u>First Aid</u> —Training in absence of health-care provider or facility. 29 CFR 1926.50(c)
B.3.d	<u>Noise</u> —Worker training program. 29 CFR 1910.95(c)(2) and (d-o)
B.4.c	<u>Hazard Communications</u> —General and specific training. 29 CFR 1926.59(e)
B.4.d	<u>Hazardous Materials</u> —Worker knowledge of program and MSDS. 29 CFR 1926.59(h)
B.4.g(1)	<u>Electronic Retrieval (MSDS)</u> —Instruction for workers in method of MSDS access by electronic method at site. 29 CFR 1926.59(g)
B.4.g(2)	<u>Hazardous Materials</u> —Complete training program for those using hazardous materials. 29 CFR 1926.59(h)(2)
B.5.e	<u>Confined-Space Monitoring</u> —Monitoring by a qualified person with appropriate measuring equipment. 29 CFR 1910.146
B.5.h.(1),(a)	<u>Confined-Space Training</u> —Training for confined-space workers and supervisors. 29 CFR 1910.146
B.5.h.(1)(b)	<u>Confined-Space Watch</u> —Training for watchmen or standby personnel. 29 CFR 1910.146
B.5.h(2)	<u>Confined-Space Worker</u> —Prephase training for all confined-space workers. 29 CFR 1910.146
B.7.e	<u>Asbestos</u> —Supervision control and removal by a competent person. 29 CFR 1926.58
B.8.a(3)	<u>Lockout Information</u> —Knowledge of lockout/tagout program among all workers. 29 CFR 1926.147
B.9.b	<u>Respirator Program</u> —Written program and training. 29 CFR 1910.134(b)(1)
B.9.f,g	<u>Respiratory Equipment</u> —Training in selection, use, and limitations. 29 CFR 1910.134(e)(2); 1926.103(c)(1)
B.10.a(2)	<u>Rad Use</u> —Use of radioactive materials or x-ray equipment by a competent person. 29 CFR 1926.53(b)
B.10.b(1)	<u>Laser Use</u> —Use of lasers by qualified, trained workers. 29 CFR 1926.54(a, b)
<b>Section III. C Excavations</b>	
C.1.e	<u>Ramp Design</u> —Requirements for design by a competent person. 29 CFR 1926.651(c)(1)(i-v)
C.1.k	<u>Daily Inspections</u> —Inspection of excavation and adjacent area by a competent person. 29 CFR 1926.651(k)(1, 2)
C.2.c	<u>Over 5-ft Deep</u> —Vertical cut wall protection, specified in Option 3, as approved by a professional engineer. 29 CFR 1926.652(b)(4)
C.3	<u>Over 20-ft Deep</u> —Protection as designed by a registered professional engineer. 29 CFR 1926.652
C.6.a	<u>Shoring System Design</u> —Requirements for systems design by a registered professional engineer. 29 CFR 1926.652(b)(4)



## Section III. D Scaffolding

- D.1.a Erected, Moved, Dismantled, Altered—Supervision by a competent person.  
29 CFR 1926.451(a)(3)
- D.1.p Special Design—Design by a qualified or registered engineer for
- wood pole over 60 ft;
  - certain types of tube and coupler;
  - frame over 125 ft;
  - outrigger.
- 29 CFR 1926.451(b)(16), (c)(4), (d)(9), and (g)(3)
- D.5.g Outrigger—Design by a professional engineer. 29 CFR 1926.451(g)(3)

## Section III. E Electrical Safety

- E.2.a Safety Related Work—Workers trained in safe-work practices, recognition of job-related electrical hazards. NFPA 70E, II, 1, A
- E.2.c Use of Test Instruments—Use by trained, qualified workers. 29 CFR 1910.334(c)(1)
- E.12.a.6(a-g) Power Transmission/Distribution Lines—General requirements for lines over 600 volts, *means of disconnect not visually open*
- designated worker (qualified person delegated to perform specific work);
  - line identification and isolation, method of performance;
  - visual inspection to ensure de-energized state;
  - method of protecting grounds;
  - tag (or lock) placement;
  - work completion safety process, tag removal, and notification.
- 29 CFR 1926.950(d)(1)(i-vii)
- E.12.a(7) Power Transmission and Distribution—General requirements for lines over 600 volts, *means of disconnect visually open*
- line identification and isolation, method of performance;
  - designated worker (qualified person delegated to perform specific work).
- 29 CFR 1926.950(d)(2)
- E.12.a(8) First Aid/Emergency—Worker proficiency in first aid and emergency procedures.  
29 CFR 1926.950(e)(1, 2)
- E.12.b(1)(b) Rubber Protective Equipment—Visual inspection before use. 29 CFR 1926.951(a)(1)(ii,iii)
- E.12.g(1) Stringing Line Operations—Briefing of workers in assignment, equipment, and precautions.  
29 CFR 1926.955(c)(2)
- E.12.h(1) Stringing Next to Energized Lines—Procedures covering
- assessment of danger from buildup of induced voltages;
  - isolation, insulation, and grounding of pulling and tension equipment;
  - grounding demands;
  - location of grounds;
  - tower bonding grounds.
- 29 CFR 1926.955(d)(1-9)
- E.12.i(1) Live-Line Bare-Hand Work—Worker training in process prior to such work.  
29 CFR 1926.955(e)(1)
- E.12.i(4) Live-Line Bare-Hand Equipment—Equipment and work supervision by a trained and qualified worker. 29 CFR 1926.955(e)(3,4,8)
- E.12.j(2)(a) Working in Holes—Safety watch or allowable work by a qualified worker.  
29 CFR 1926.956(b)(1)
- E.12.j(3)(a) Trenching/Excavations—Compliance with Section C and direction of mobile equipment by observer. 29 CFR 1926.956(c)(2)
- E.12.k(1)(a) Energized Substations—Approve start of construction by an authorized person. 29 CFR 1926.957(a)(1)
- E.12.k(1)(f) Energized Control Panel—Performance by a designated worker. 29 CFR 1926.957(d)(1)
- E.12.k(2)(a) Mechanical Equipment—Control by a designated worker when in restricted or hazardous location.  
29 CFR 1926.957(e)(1)
- E.12.l(3) Lineman's Belt—Inspection before each use. 29 CFR 1926.951(b)(3); .959(a)(2-4) and (b)(1)(ii)

## Section III. F Fire Protection

- F.1.c Fire Equipment—Maintenance and inspection. 29 CFR 1926.150(a)(2-4)  
 F.1.d Fire Fighting—Training for workers in basic use of fire-fighting equipment. 29 CFR 1926.21(b)(5)  
 F.1.k Fire Alarm—Instruction for workers on procedure of reporting a fire. 29 CFR 1926.150(e)(1,2)  
 F.3.e Fire Extinguishers—Monthly visual inspection, annual maintenance, and required testing. 29 CFR 1926.150(c)(1)(viii)  
 F.15.a(3) Firewatch—Instruction for hot-work fire watch in probable hazards and use of fire equipment.  
 F.15.a(4); F.18.f 29 CFR 1926.352(e-f) and NFPA 241 6-4.3.11

## Section III. G Signs, Signals, and Barricades

- G.2.e Flaggers—Instruction in traffic safety and flagging. 29 CFR 1926.201(a)(2,3)  
 G.3.a; G.3.b Signals and Barricades—Training in traffic posting and decisions for traffic marking.

## Section III. H Cranes and Derricks

- H.1.a(1) Crane Operation—Compliance with manufacturer's operating instruction. 29 CFR 1926.550(a)(1)  
 H.1.a(2)(a) Inspection—Initial inspection by a qualified person of a new or altered crane before use. ANSI B30\*  
 H.1.a(2)(b) Frequent Inspection—Daily to monthly general inspection by a designated person. 29 CFR 1926.550(a)(5)  
 H.1.a(2)(c) Periodic Inspection—Inspection at intervals related to crane or hoist use; in-depth inspection by a qualified person. 29 CFR 1926.550(a)(6)  
 H.1.a(5) Rate Load Test and Inspection—Inspection by or under the direction of a designated or authorized person. 29 CFR 1926.550(a)(5,6)  
 H.1.a(6) Assigned Limitations—Assignment by a qualified engineer when manufacturer's specifications are not available. 29 CFR 1926.550(a)(1)  
 H.1.b(5) Inspection Defect Exception—Completion of repairs before use unless certified safe by a qualified person. ANSI B30  
 H.1.c(2) Periodic Wire-Rope Inspection—Inspection by a qualified person. ANSI B30  
 H.1.d(1) Crane and Hoist Operations—Operation by only a designated person, trainee, or other noted in CFR. ANSI B30  
 H.1.d(2) Operator Exam—Written, oral, and practical operating examination for operators or evidence of experience. ANSI B30  
 H.1.d(9) Overload—Determination of load weight by person responsible for lift. ANSI B30  
 H.1.e(1) Floor Control Operations—Practical examination for operators. ANSI B30  
 H.1.f(1) Alarms and Warning Signals—Familiarity with alarms and signals. ANSI B30  
 H.1.j(2) Electric Line Clearance—Observation and timely warning by designated person. ANSI B30  
 H.3.a Hammerhead Crane Erection—Supervision by a competent person. ANSI B30.3-1.1.2(b)  
 H.5.a Portal, Tower, or Pillar Crane Erection—Supervision by a qualified person. ANSI B30.4-1.1.2(b)  
 H.9.b(2) Personnel Platform Design—Design by a qualified engineer or qualified person. 29 CFR 1926.550(g)(4)(i)(A)  
 H.9.b(9) Platform Welding—Performance by a qualified welder. 29 CFR 1926.550(g)(4)(ii)(H)  
 H.9.c(7) Personnel Platform Inspection—Inspection by a competent person of all equipment following trial lift. 29 CFR 1916.550(g)(5)(iv)  
 H.10.a(1) Material Hoist Limitation—Assignment by a professional engineer when manufacturer's specifications are not available. 29 CFR 1926.552(a)(1)  
 H.10.b(8) Material Hoist Design—Design by a licensed professional engineer. 29 CFR 1926.552(b)(7)  
 H.10.c(11) Personnel Hoist Inspection and Test—Inspection and testing by a competent person of safety devices and functions. 29 CFR 1926.552(c)(15)  
 H.11.j Conveyor Maintenance—Maintenance by trained, qualified personnel. ANSI/ASME B20.1b 5.2a  
 H.11.k Worker Hazard Training—Training dealing with moving conveyor for maintenance personnel. ANSI/ASME B20.1b 5.2c  
 H.11.p Conveyor Operation—Training under normal and emergency operation for all workers working on conveyors. ANSI/ASME B20.1b 5.12

- H.12.u Aerial Lift Use—Use only by persons qualified by training. ANSI/ASME A92.2 7.1  
H.12.v Aerial Lift Operator Instructed—Instruction for operators in safe and proper use. ANSI/ASME A92.2 7.2

**Section III. I Hand and Power Tools**

- I.4.b Powder-Actuated Tool Operation—Training in safe use before operation of power-actuated tool. 29 CFR 1926.302(e)(1)  
I.6.a(2) Woodworking Machines—Instruction for authorized operators in hazards and safe use. 29 CFR 1926.304(f)

**Section III. J Concrete and Masonry**

- J.1.a Concrete Structure—Determination of adequate support before load is placed. 29 CFR 1926.701(a)  
J.3.i Single-Post Shores—When tiered, preparation by a qualified designer and inspection by a structural design engineer. 29 CFR 1926.703(b)(8)(iii,iv)  
J.5.a Lift-Slab Design—Design and planning by a registered professional engineer. 29 CFR 1926.705(a)

**Section III. K Stairways and Ladders**

- K.3.d Ladder Inspection—Periodic inspection by a competent person. 29 CFR 1926.1053(b)(15,16)  
K.4.a General Ladder Training—Training for workers. 29 CFR 1926.1060(a)  
K.4.b Fall-Protection Safety—General fall-protection training for workers, including fall-hazards recognition, correct procedures for fall-protection equipment, ladder use, and ladder-load limits. 29 CFR 1926.1060(a)(1)(i-v)  
K.4.c

**Section III. L Welding and Cutting**

- L.1.b(4) Cracking—Training in cracking cylinder valves. 29 CFR 1926.350(d)(1,2,4,5)  
L.1.b(6) Leaking Cylinder—Action to take in event of a gas cylinder leak. 29 CFR 1926.350(d)(6)  
L.1.b(7) Special Wrench Emergency—Requirement for leaving shutoff wrench in place and accessible in an emergency. 29 CFR 1926.350(d)(2)  
L.2.c(1) Equipment Safety Inspection—Instruction in safety equipment for welders. 29 CFR 1926.351(d)(1-4)  
L.3.a Preservative Coatings—Determination by a competent person of fire hazard connected with coatings. 29 CFR 1926.354(a)  
L.5.a Fire Watch—Posting of fire watch for at least one-half hour after close of work. 29 CFR 1926.352(e)

**Section III. M Motor Vehicles and Mechanized Equipment**

- M.1.i Operation of Equipment—Operation of powered industrial trucks by authorized workers. 29 CFR 1910.178(1)

**Section III. N Demolition**

- N.1.a Structure Survey—Written report on conditions before work by a competent person. 29 CFR 1926.850(a)  
N.2.e Chute Operation—Supervision of gate and loading operation by a competent person. 29 CFR 1926.852(c)  
N.9.f Continuous Inspection—Inspection during mechanical demolition by a competent person. 29 CFR 1926.859(g)

**Section III. O Material Handling, Storage, Use, and Disposal**

- O.4                    General Safety Instruction—Instruction for workers in safe material handling and storage and the safe use of lifting equipment. 29 CFR 1926.21(b)(2)

**Section III. P Blasting and the Use of Explosives**

- P.1.a                Use and Handling—Use and handling only by *qualified* workers. 29 CFR 1926.900(a)  
P.1.n                Radio Transmission Range—Assessment and written report by a competent person in cases where operational problems result from observance of radio silence within 1000 ft of a blasting zone. 29 CFR 1926.900(k)(3)(i)  
P.1.u                Loading and Firing—Direction and supervision by a competent person. 29 CFR 1926.900(q)  
P.2.c-e              Blaster Qualification—Qualification through training, knowledge, and experience; satisfactory evidence of competence in each type of blasting method. 29 CFR 1926.901(c-e)  
P.3.a                Driver Certification—Physical fitness, *licensing*, and familiarity with transportation regulations. 29 CFR 1926.902(b)  
P.3.h                Driver Fire Protection—Availability of fire extinguisher; instruction in use for driver. 29 CFR 1926.902(i)  
P.9.a                Blast Signals—Familiarity with blast signals among workers. 29 CFR 1926.909(a)

**Section III. Q Steel Erection**

- Q.3.d(2)            Guy Removal—Removal of plumbing-up guys under the supervision of a competent person. 29 CFR 1926.752(d)(2-4)

## ISSUE RECORD

The manual contents will be controlled by the use of "Issue Numbers." Each transmittal for inclusion in the manual will bear an "Issue Number" assigned in sequential order. As each transmittal is received, cross off the "Issue Number" below, corresponding to the "Issue Number" on the Publications Transmittal. Numbers not crossed off will identify changes not entered in the manual.

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