NIOSH

Health and Safety Guide for Masonry, Stonework, Tilesetting, Insulation, and Plastering Contractors

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health

HEALTH AND SAFETY GUIDE FOR MASONRY, STONEWORK, TILESETTING, INSULATION, AND PLASTERING CONTRACTORS

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Public Health Service
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CONTENTS

INTRODUCTION

The Williams-Steiger "Occupational Safety and Health Act of 1970" was passed into law "to assure safe and healthful working conditions for working men and women . . ." This Act established the National Institute for Occupational Safety and Health (NIOSH) in the Department of Health, Education, and Welfare (DHEW) and the Occupational Safety and Health Administration (OSHA) in the Department of Labor (DOL). The Act provides for research, informational programs, education, and training in the field of occupational safety and health and authorized the promulgation and enforcement of standards. As part of these activities, surveys have been made by NIOSH to determine the most common health and safety problems in small businesses. This booklet was written primarily for those special trade contractors engaged in masonry, stonework, tile setting, insulation, and plastering.

The aim of this Guide is to assist in providing a safe and healthful workplace by describing safe practices and methods of correcting some of the frequently violated safety and health standards. It is not intended to provide total information in all areas of compliance. Additional information can be found in the General Industry Standards (Code of Federal Regulations, Title 29, Part 1910 - Occupational Safety and Health Standards) and in the Construction Safety and Health Regulations (Code of Federal Regulations, Title 29, Part 1926 - Occupational Safety and Health Regulations for Construction).

Words such as "must," "shall," "required," and "necessary," appearing indicate requirements under the Federal Regulations. Procedures indicated by "should" or "suggested" constitute generally accepted good practices.

In some states, the Federal government has delegated enforcement authority for occupational safety and health to the state government. Although state programs sometimes differ from Federal programs, they must be at least as effective as the Federal programs.

On the last few pages of the Guide are listed addresses of NIOSH and OSHA regional offices where additional information and materials can be obtained.

HEALTH AND SAFETY HAZARDS IN THE SPECIAL CONSTRUCTION TRADES

General

The special trade contractors engaged in masonry, stonework, tile setting, insulation, and plastering employ approximately 6 percent of all contract construction workers. U.S. Department of Commerce statistics show that over 90 percent of the special trade (masonry, stonework, insulation, and plastering) contractors employ fewer than 20 workers each. These employees are often present at the same job site with other construction trades and general building contractors. They are not only exposed to hazards associated with their own trades, but also to potential safety and health hazards which are present at the construction site. The purpose of this Guide is to aid contractors engaged in masonry, stonework, tilesetting, insulation, and plastering in the identification of health and safety hazards associated with their construction trades, and to recommend methods of controlling these hazards.

Injury and Illness Rates

In the evaluation of the health and safety records of masonry, stonework, tile setting, insulation, and plastering contractors, occupational illness and injury statistics compiled by the Bureau of Labor Statistics were reviewed. The incidence rate (IR) for injuries and illnesses is regarded as a significant index in this assessment.

$$IR = \frac{\text{No. of injuries and illnesses} \times 200{,}000}{\text{Hours worked (all employees)}}$$

Type	Standard Industrial Classification Code (SIC)	Incidence Rates: Total Cases (cases/100 full-time employees)		Incidence Rates: Lost Workdays (days/100 full-time employees)	
		1975	(1974)	1975	(1974)
All construction contractors	152-179	16.0	(18.3)	100.8	(99.8)
Masonry, stonework, etc., special construction contractors	174	14.4	(16.7)	99.4	(93.3)
All manufacturing	201-399	13.0	(14.6)	75.4	(72.7)

A review of the Table indicates that special trades and other construction contractors have approximately the same incidence rate for injuries and illnesses, but this exceeds the incidence rates which occur in manufacturing firms. Masonry, stonework, tile setting, insulation, and plastering contractors were sixth in the list of the high-rate industries compiled by the State of California in 1975. The same study showed that 82 percent of the total cases (for masonry, stonework, tile setting, insulation, and plastering contractors) involved injuries which resulted from:

1. strain and overexertion,

2. falls (particularly from elevated places such as ladders and platforms), slips and trips, or

3. being struck by and/or striking against objects, including falling or flying objects which may be due to improper use of hand tools, etc.

A NIOSH Safety Task Force Report (1976) includes a list of industries ranked by number of fatalities for 1973 and 1974. The SIC category 174 (including masonry, stonework, tile setting, insulation, and plastering contractors) is unranked in 1973, but is ranked 23rd in 1974 with 64 fatalities. The rankings only include the top 30 industries. In the same reference, NIOSH lists the top 100 industries in terms of needed research and emphasis in health and safety; SIC 174 is ranked 38th. It is apparent that occupational injuries still pose a major and continuing threat to the health and well-being of special trades construction workers.

Hazards Common to the Special Trades

In most special trades covered by this Guide, there is no permanent workplace. With each new project the workplace changes and sometimes the equipment and the type of work also changes. As work proceeds, these conditions may change again and again. Workplaces and workers are exposed to all the vagaries of the weather. Organization and safety are hampered by short-term use of equipment with occasional improvisation often taking the place of good planning. Responsibility may be diffused as several different contractors may be at work at the same time. Some of the work force may be casually recruited and unskilled or untrained for construction work. Therefore, cooperation by all of the trades and contractors at construction sites is needed to provide a safe and healthful work environment for all employees.

Each of the special trades included in SIC 174 has dangers and hazardous conditions which are characteristic of the trade. The trades are discussed individually later in this section (pages 9 to 22), with emphasis on specific occupational hazards.

Hazards which were noted to be common to all the special trades are listed below:

.Falls, including those caused by:

-improperly constructed scaffolding, failure to secure or anchor scaffolds, lack of proper guardrails and toe boards on scaffolds, illegal spacing or lapping of planking on scaffolds, and failure to adhere to safe load limit requirements for specific types of scaffolding;

-collapsing or falling structures, walls, stairways; falls from roofs, walls, or through openings in floors and fragile roofs, or unprotected pits or shafts;

-the use of unsafe portable ladders or the use of portable ladders unsafely;

-uneven walking surfaces and littered workplaces.

.Overexertion and strains occurring from the improper handling of heavy loads. Manual handling of loads may cause injuries from sharp or pointed objects, tools, splinters, shavings, and dust. Littered and uneven ground may cause foot injuries.

.Improper use of or inadequate hand tools, power tools, and site machinery. Some of these aspects are dealt with in separate sections (e.g., abrasive wheel tools, power tools, etc.). However, the special conditions at the construction site may require additional precautions. Special precautions against electrical risks are usually necessary because of rough usage and the hazards of damp and stormy weather. Extra-strong conductors, plug and socket connectors, lamps, etc., are necessary in these rough conditions. The use of a low-voltage supply is desirable. Other common hazards include failure to ground powered hand tools, temporary lights without bulb guards, frayed cords, and unsafe plugs and splicing.

.Accidents during the horizontal or vertical transport of materials and structures. Mechanical transport equipment, including dumping machinery, lifting machinery, cranes, hoists, and other lifting appliances, presents hazards. The increasing weight of loads due to the introduction of prefabricated structures (e.g., brick walls, floors, etc.) is of particular significance in this respect.

.Diseases caused by exposure to dust, fumes, liquids, and vapors. Exposures to cement and silica are especially common in the special trades.

.Hearing loss caused by overexposure to noise. Many types of power equipment used by special trades contractors generate potentially hazardous noise levels. Some examples of equipment which can be excessively noisy are cement mixers; gasoline powered pumps, blowers, and compressors; power saws, grinders, powder actuated tools, industrial trucks, and material handling equipment. Occupational noise exposure

is discussed in the "Frequently Violated Regulations" section, pages 39-41.

- Improper use of personal protective equipment or unavailability of protective equipment. This is particularly important on construction sites. Head protection should be used against falling objects and impact injuries. Foot and leg protection such as safety boots help prevent punctures from nails and toe injuries from falling objects. Many jobs require the use of eye and face protection which must be suited both to the risk and to the wearer. In all work in which dangerous vapors, fumes, and dusts occur, efforts must be made to minimize worker exposures by substituting less hazardous materials, modifying or isolating the process, providing ventilation to remove contaminants, or, as a last resort, providing approved respirators, gloves, clothing, and other equipment to protect workers. (These control methods are discussed under "Occupational Health and Environmental Controls," pages 36-41.)

- Poor housekeeping, including refuse and non-salvageable materials not being removed at regular intervals; cords and hoses (electrical, compressed gas, rigging, etc.) scattered on floors; oily, greasy spots or water pools, and materials such as sheet metal, cardboard, and turnings on floors.

- Failure to use appropriate safety nets, belts, lifelines, or lanyards where required.

- Pulleys, gears, and the "point of operation" of equipment, particularly small and intermediate saws, shears, and grinders not provided with barrier guards or other effective guarding devices or methods.

- Unsecured and improper storage of compressed gas cylinders and improper use of heating devices such as salamanders.

- Fire hazards due to improper storage and use of flammable and combustible materials (e.g., solvents, organic cement, adhesives, gasoline, acetylene, wood) and the presence of various ignition sources (welding, burning, soldering, etc.).

- Injuries and illnesses related to exposure to extreme heat and cold. Workers in the special trades may be subject to cold-related injuries, primarily frostbite. Heat stress can be a major health hazard to special trades workers. When doing heavy labor during hot weather, workers are subject to heat rash, heat cramps, and heat stroke. Early symptoms of heat stress are weakness, extreme fatigue, dizziness, nausea, headache, and thirst. More advanced symptoms are arm, leg, and stomach muscle spasms; irregular or increased heart beat; extreme thirst and fainting. Further exposure to heat can result in unconsciousness.

One of the best ways to avoid heat stress is acclimatization. Workers should be allowed to accustom themselves to high temperatures gradually--that is, a short period the first day, a longer period the second, and so on. Within a week, a full shift of hard work should produce few ill effects. Workers should be encouraged to drink plenty of water and replace salt, by salting food, by drinking lightly salted water or one of the commercial products made to replace fluids and salts lost during exercise. Persons with high blood pressure or circulatory system disease should consult their physician for guidance on replacing salt lost through exercise.

The above list summarizes health and safety hazards commonly found in special construction trades. Each of the trades is discussed individually in the following sections, with emphasis on the most significant health hazards found in the trade.

Characteristic Hazards of Each Special Trade

The following sections are designed to assist in the identification and control of health hazards associated with each of the trades included in the SIC 174 group.

Stonesetting, Masonry Block, and Bricklaying

Many types of cement (asphalt tar, natural, artificial, clay, etc.) as well as many different types of brick (fire, acid resistant, red brick, etc.) are widely used. The additives (such as coal tar and asbestos) to a particular cement or brick may present significant health problems (such as asbestosis and other lung and skin diseases). In addition, some types of cement and brick may present a hazard from the finely ground silica (quartz) content.

DUSTS can be a major health hazard in cement block, stone setting, and bricklaying. Dusts which are generated when mixing concrete and mortar contain silica (including varying amounts of quartz and other forms of free silica), chromium, calcium oxide, and aluminum oxide. Dusts generated by brick and masonry saws and tuckpointer's grinders may contain potentially hazardous levels of free silica. Inhalation of free silica can lead to a respiratory disease called silicosis, a progressive disease which diminishes lung capacity and can cause increased

susceptibility to tuberculosis. Cement dusts can cause skin irritation (cement dermatitis), and eye and nose irritation. Some workers may develop allergic sensititivity to certain constituents of cement dust, especially hexavalent chromium.

Ventilation and good work practices are the most effective methods of controlling worker exposures to dusts. Whenever possible, concrete and mortar should be mixed outdoors. When mixing, workers should stand upwind so dusts are blown away from them. When mixing must be done indoors, portable fans or blowers should be used to remove dust. If ventilation cannot be provided, mixing should be done in drafts from stairwells or open windows to minimize dust exposures. If mixing must be performed indoors or in spaces which cannot be ventilated, a NIOSH-approved dust respirator should be used.

Wet sawing does not usually generate significant amounts of dust; however, dry sawing and grinding can create hazardous dust levels. Operators of dry masonry table saws, hand held saws, and grinders should wear NIOSH-approved dust respirators, especially when working indoors. Safety glasses or goggles should be used when sawing or grinding to protect the eyes from dusts, chips, and flying particles.

NOTE: Many particles which can cause respiratory disease (such as silicosis and asbestosis) are too small to be seen with the naked eye. The amount of dust which can be seen in air may not be a good indication of health hazards which may be present.

MORTAR AND CONCRETE can cause skin irritation. The cement used in mortar and concrete can produce cement dermatitis from skin contact with mortar or concrete in its plastic (wet) or dry forms. Dry, cracked, scaly skin on the backs of the hands, between the

fingers, and on the wrists and arms are common symptoms of cement dermatitis.

Skin protection is the best way to prevent skin irritations. For some jobs, gloves may work. In other cases where gloves cannot be used, barrier creams will help protect the skin. Long sleeved shirts will protect the arms. Some workers are more susceptible to skin irritation than others; however, all workers should be encouraged to practice good personal hygiene, including washing frequently and showering after work. Workers can develop an allergic sensitivity to cement over a period of time, even though no immediate symptoms are noticed.

CLEANING solutions used to remove mortar stains from finished wall sections can present hazards. Hydrochloric (muriatic) acid and other acid cleaners are often used. These liquids can be dangerous during the mixing and brushing operations, mainly by causing chemical burns of the skin and eyes.

The best ways to prevent skin and eye injury when using cleaning solutions are to use protective equipment and follow safe work practices. Acid cleaning solution should always be prepared by adding acid to water in a non-metallic (plastic or rubber) container. Goggles or face shields and gloves should always be used when handling and mixing concentrated acids. Aprons will protect clothing from chemical splashes. When applying acids, gloves and long handled brushes should be used to prevent skin contact. Safety glasses or goggles are necessary to protect the eyes from chemical splashes and spattering. A 15 minute supply of running water should be provided at the worksite for flushing the skin and eyes in the event of an acid splash or spill. Workers should be trained to respond to an acid-splash emergency, including methods of flushing the eyes with water and otherwise assisting themselves or other workers who have come in contact

with dangerous chemicals.

WATERPROOFING compounds, such as silicone and asphalt-based liquids, can present hazards during handling and application processes. Silicone-based waterproofing compounds can cause skin and eye irritation. Workers brushing or spraying these materials onto walls should always wear aprons, protective gloves, safety glasses with side shields, or chemical goggles. Some silicone waterproofing compounds may evolve hazardous vapors during handling and application. Mechanical ventilation, such as fans or blowers, may be necessary when these materials are used on interior walls and floors, or in areas where natural ventilation is poor, such as in deep trenches around building foundations. Manufacturer's product safety information (material safety data sheets are available from many manufacturers) and warning labels on product containers should always be consulted to determine safe storage and handling practices.

Asphalt-based liquids are applied as both hot and cold waterproofing coatings. These materials should be used only in well-ventilated areas, and mechanical ventilation may be necessary to remove hazardous vapors when waterproofing indoors or in poorly ventilated areas around foundations. Skin and eye protection must be used when applying these materials--gloves, long sleeved shirts or coveralls, aprons, and safety glasses or goggles will protect the worker and make cleanup easier.

Solvents used to clean tools should be chosen with regard to their fire hazard--flammable liquids such as gasoline, naphtha, and lacquer thinner should not be used. Mineral oil or any of the common safety solvents should be used for cleanup. Employees should never clean asphalts from their skin with solvents--skin dryness and irritation can result. Workers should be encouraged to shower after work.

Terrazzo, Tile, Marble, and Mosaic Work

Surface Preparation

Dusts generated during the preparation of surfaces to receive terrazzo, tile, marble, and mosaic can present significant health hazards. When concrete floors and walls are ground, hazardous amounts of dust containing free silica may be created, especially indoors. Grinding and sanding wood or metal surfaces can also generate hazardous dusts. Dusts may be controlled by wetting the work surfaces (if possible), ventilating by opening windows or providing portable fans or blowers, or utilizing grinding and sanding equipment equipped with dust collectors. If dust control is not possible, approved dust respirators and protective clothing must be worn to reduce workers' exposures.

Cleaning and etching concrete surfaces with muriatic (hydrochloric) acid requires that safe handling procedures be followed:

- Concentrated acid must always be added to water with stirring (never add water to acid) and mixing must be done in a non-metallic (plastic or rubber) container.

- Skin and face protection must be used when mixing and applying acids. Gloves, aprons, boots, and face shields will prevent accidental contact with acids.

- Running water to flush acid from the skin and eyes must be available when acids are in use.

Installation

Tile, marble, and mosaics are installed with mortar or organic adhesives. The cement in mortar and grout can cause skin irritation and respiratory disease (see pages 10-11 for a discussion of the hazards associated with cement use).

Organic adhesives, including a wide variety of epoxy systems, are used for mounting and grouting. These systems frequently use amine curing agents. Amine vapors are given off during the mixing and curing (hardening) steps. Some amines are severe eye, skin, and lung irritants. Although some workers may exhibit greater sensitivity to amines than other workers, repeated contact can cause SENSITIZATION. Sensitization to amines can develop in a manner similar to that of poison ivy--no symptoms may appear the first few times a worker handles epoxies, but as he becomes sensitized through repeated contact, he may suddenly develop an allergic-type reaction.

Workers using epoxies should protect their skin and eyes by using gloves, long sleeved shirts (when possible), and safety glasses or goggles. Washing facilities must be provided. When epoxies are applied indoors, ventilation must be provided while the epoxy is applied and cures. If good natural ventilation cannot be acheived by opening doors and windows, portable fans or blowers should be used to remove vapors from the area to prevent unnecessary exposures. Whenever possible, vapors should be vented outdoors, not blown into another work area. Workers should not remain in the area while epoxies are curing. Workers should be instructed to use extreme care in the use of all epoxies, and to be alert to eye, skin, or respiratory irritations which may be symptoms of sensitivity to amines.

Grinding terrazzo surfaces can generate dusts containing cement and silica, or hardened epoxy, depending on the type of terrazzo, chip, or aggregate system used. Systems using a grout or mortar matrix

will generate cement and silica-containing dusts--precautions for cement dust as described on page 10 should be followed. Grinding surfaces of epoxy matrix systems may generate hazardous dust levels--adequate ventilation to remove dust, or personal protective equipment, including approved dust respirators, should be used.

Cleanup

Tools used in the mixing and application of mortar, grout, and epoxy must be cleaned as soon as possible after use. When using solvents to remove epoxies, consideration should be given to the fire hazard which solvents present, and flammable liquids such as toluene and acetone should be avoided. Epoxy thinners and cleaners should never be used for skin and hand cleaners.

Drywall, Plastering, and Lathing

Drywall, Sheetrock, and Lathing Installers

Installation of drywall, sheetrock, and lathing is done primarily using hand tools and small power tools such as sheetrock screwdrivers. Workers using powder actuated tools to install framing must be trained in their use (see page 73). When pneumatic fastening tools are used to drive fasteners, air compressors should be located so noise and combustion products do not create hazardous conditions for the workers.

The most common hazard to drywall, sheetrock, and lathing installers is cuts from the sharp tools used to cut the wall boards and from the sharp edges and corners of the framing materials. Although it may

not be possible to wear protective gloves during installation, gloves can reduce the number of injuries substained during the handling and cutting of boards and framing materials. To prevent infections and further complications from minor cuts and injuries, workers must be required to obtain first aid whenever injuries occur.

Some joint cements contain asbestos, which can become airborne when joints are sanded. This potential hazard can be eliminated by using asbestos-free jointing compounds.

Electric shocks are a constant hazard when using sheetrock screwdrivers and power saws. The power cords of these tools are easily caught on the sharp edges of framing material and the insulation can be cut or abraded, creating an electrical shock hazard. Power cords should be inspected frequently and replaced immediately if signs of wear appear. Ground-fault circuit interrupters or an assured grounding program must be used in conjunction with these power tools.

Plasterers

Manual application of gypsum plaster presents the hazard of skin irritation from the drying effects of plaster. Skin contact should be minimized by using gloves, barrier creams, or lotions. Washing facilities should be provided and workers should be encouraged to wash frequently. Mixing should be done outdoors or in a well-ventilated area to prevent unnecessary exposure to gypsum and silica dust. Approved dust respirators may be necessary when mixing is done indoors.

Pneumatic plaster application generates hazardous levels of airborne silica and plaster-containing

droplets. Silica is a respiratory hazard (see page 9 for a discussion of silicosis), while the wet plaster spray can be a skin and eye irritant. Members of plastering crews require varying degrees of protection, depending on their distance from the point of application. The spray gun operator should wear an air-supplied, full face respirator and skin protection, including gloves and a long sleeved shirt. Each member of the spraying crew should wear an approved dust respirator and gloves. When gasoline powered plaster pumps are used, they should be located in well-ventilated areas, outside if possible.

Insulation and Acoustical Work

The wide variety of materials used in insulation and acoustical work present installers with a large number of potential occupational hazards. This section is intended to aid in the identification of these hazards and to suggest methods of controlling worker exposures.

Many of the materials used for thermal and acoustical insulation present respiratory hazards to the installers. Dusts are released from cement, sand, and vermiculite; fibers are generated by asbestos, mineral wool, and fiberglass; gases and vapors evolve from foamed-in-place insulation compounds. Some insulation and acoustical materials can cause skin irritation and eye damage. The most common hazards of insulation and acoustical work are discussed below.

Heat stress can be a severe problem for insulation installers. Workers can be protected from heat stress by limiting the amount of time each worker spends in hot spaces (such as attics); by rotating workers between jobs on the installing crew; by

providing adequate rest periods in cooler places; and by encouraging workers to replace lost water and salt by drinking lightly salted water and eating extra salt with meals.

Asbestos has been a very widely used insulation material; however, it presents serious health hazards and many contractors are using substitute materials. Asbestos fibers can become airborne during many insulation jobs such as handling and mixing of asbestos cements, cutting asbestos-containing boards and sleeves (for insulating ducts and pipes), spraying asbestos-containing insulation, and cleaning up waste and debris. Repair jobs involving the removal of asbestos insulation can be a significant source of asbestos exposure.

The health effects of asbestos fibers include asbestosis, a lung disease characterized by scarring and thickening of the lung wall; cancer of the chest or abdominal lining; cancer of the trachea; cancer of the colon and stomach; and cancer of the lung. These diseases are much more common among asbestos workers who smoke than those who are non-smokers.

There are specific OSHA standards which apply to the use of asbestos-containing materials. Any employees engaged in spraying, removal, or demolition of asbestos-containing materials must be provided with supplied-air respirators, coveralls, head coverings, gloves, and foot coverings. Workplaces where asbestos fibers are released must be monitored to determine the worker's exposure--if this is impractical, workers must be provided with respirators approved for asbestos. Engineering controls such as exhaust ventilation on saws and drills must be used to prevent the release of asbestos fibers into the air. Work practices to reduce asbestos exposures must be followed-- these include keeping asbestos wet whenever it is handled, removed, or worked in any way. Cleanup should always

be done by vacuuming; sweeping re-suspends asbestos in the air where fibers can remain suspended for hours. Employees must be advised of the hazards associated with asbestos exposure, and provided with regular physical examinations which include chest X-rays and tests of lung function. Protective clothing (coveralls, head coverings, gloves, and foot coverings) must be provided for any worker exposed to hazardous levels of asbestos, and laundering of this clothing must be done in a manner to prevent exposure of others. The employees must not wear their work clothing home.

Fiberglass, mineral wool, and cellulose fiber insulation materials can be very irritating to the skin, eyes, nose, and throat. When these materials are handled, they drop tiny fibers which cling to the skin and penetrate, causing itching. This irritation can leave the skin vulnerable to infection. These fibers are also respiratory tract irritants. Fiberglass can cut and scar the eyeball, causing possible vision impairment.

The best way to protect employees from skin irritation is to prevent skin contact with materials which give off fibers. This is done by wearing proper clothing: gloves, eye protection, and long sleeved shirts which button at the cuffs and collar.

Personal hygiene such as frequent washing to remove particles from the skin and regular changing of work clothes will reduce the chance of irritation developing. Workers should be advised to report even minor skin irritations so they can be treated before complications (such as infections) develop.

When handling and installing any of these insulation materials, workers should be protected from respiratory hazards by ventilating the work area. If ventilation is not possible, approved respirators must be used.

Foamed-in-place materials have found many applications as thermal and acoustical insulation. The most commonly used materials are urethane foam and urea-formaldehyde foam systems.

Urethane foams are produced by a chemical reaction of a two or three component system. These systems include chemicals known as isocyanates, typically abbreviated as TDI, MDI , and PAPI. Isocyanates are severe irritants of the nose, throat, and lungs, causing asthma-like spasms and coughing attacks. They are also irritating to the skin and eyes. Isocyanates are sensitizers, which means that some individuals who may not exhibit any symptoms at first may suddenly develop a severe reaction after a later exposure.

All isocyanates are chemically similar; however, the health effects of TDI are much more severe than those of MDI or PAPI. TDI vaporizes more readily than the other isocyanates, posing a greater health hazard.

Amines are used as catalysts in the B component of two component systems and in the C component of three component systems. These amines are strong irritants to the eyes and the respiratory tract, and they can also cause dermatitis and skin sensitization.

A variety of freon-type compounds and carbon dioxide are commonly used as blowing agents. The freon-type compounds can break down into hazardous gases when they contact open flames or welding arcs. Smoking and open flames must be prohibited around foaming operations. Spraying foams in confined spaces can create an oxygen-deficient atmosphere by displacing air.

Personal protection is essential to safe use of urethane foams. When urethane foams are sprayed, workers must wear hooded, air-supplied masks, gloves which are impervious to isocyanates and amines, long sleeved protective clothing, and footwear. Workers should be thoroughly instructed to avoid contact with urethane foam components in the forms of liquids, vapors, or mists.

Cleanup activities are a potential source of exposure to the components of urethane foams and to organic solvents. Methylene chloride is frequently used to clean foam guns and nozzles. Methylene chloride does not present a fire hazard, but it can be a skin irritant, causing burns and dermatitis. It is also a mild narcotic, causing headache, numbness, tingling in the arms and legs, and giddiness. Any equipment cleaning with methylene chloride should be done in well-ventilated areas, using protective gloves.

Urea-formaldehyde foams are produced from two component systems. One component contains a urea-formaldehyde resin, the other contains a catalyst foaming agent, usually an acid. These foamed systems are primarily used as cavity-filling materials, designed for insulation between the studs of walls or in the cores of exterior masonry block walls.

The hazards associated with urea-formaldehyde foams are less severe than with the polyurethanes.

Vapors generated during foaming contain unreacted formaldehyde and acid catalyst (typically phosphoric acid). These chemicals are eye and respiratory tract irritants. When workers are foaming outside walls, natural ventilation should be adequate to remove vapors. If foaming is done indoors, or in confined spaces, mechanical ventilation (fans or blowers) may be necessary to prevent worker exposures. Workers should wear protective gloves and goggles while foaming, and especially when testing and calibrating foam guns. If methylene chloride is used for equipment cleanup, the precautions described on page 21 should be followed.

HEALTH AND SAFETY GUIDELINES

General Philosophy for Health and Safety Compliance

By doing a thorough analysis of the workplace for health and safety hazards, existing unsafe acts or conditions should become apparent. Many conditions are covered by specific standards. For those hazardous conditions or practices which are encountered by special trade contractors and are not covered by specific OSHA standards, the general duty clause of the Act applies. This clause states that "Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees." Therefore, it is important to find controls for all "recognized" hazards.

During the analysis for standards compliance, it may become apparent that "the letter of the law" is not being met. This may be particularly noticeable where dimensions are given for ladders, stairs, railings, etc. If it is apparent to all concerned that the "intent" of the law is being met, a variance from the applicable standard may be requested from OSHA. If

an employer receives a visit from OSHA, it is important that the employer have demonstrated his willingness to comply with the intent of the law by the operation of an effective, on-going safety and health program, correction of existing hazards in the workplace, and maintenance of records of purchases, installations, and other compliance-promoting activities.

Health and Safety Program

A health and safety program is an effective method to assist in providing a safe working environment. The purpose of such a program is to recognize, evaluate, and control hazards and potential hazards in the workplace.

Hazards may be identified by performing self-inspections, soliciting employee input (interviews, suggestions, and complaints), promptly investigating accidents, reviewing injury and illness records, providing employee medical examinations, and using material in this Guide and other information sources. Typical examples of hazards are unsafe walking surfaces, unguarded machinery, electrical hazards, improper lifting, noisy equipment, and air contaminants. The "Checklist" in the back of this book is of particular importance in identifying hazards. It should be customized to fit the needs of your program.

Situations that occur more frequently or cause the most severe problems should be given priority for corrective action. This Guide contains many of the requirements and good practices needed to correct hazards. For more complex problems, such as those requiring engineering controls to reduce noise or airborne contamination, outside consultants may be needed. Such consultations are available from OSHA,

NIOSH, and some state agencies (refer to pages 148 and 149 for lists of OSHA and NIOSH regional offices).

Management may want to assign safety and health responsibilities to employer or employee groups in the areas of both program development and implementation. Regular meetings or informal discussions can be held to discuss safety promotions, hazards, and injury and work-related illness records. To ensure program success, management leadership is necessary. The person assigned responsibility for carrying out the program must be delegated the authority and have management support. Likewise, everyone in the establishment should be aware of the program activities through a systematic interchange of information. Employees cannot take an interest in the program if they are unaware of what is occurring. Conversely, well-informed employees are more apt to show interest and a desire to participate.

Employee Training

An important part of a health and safety program is employee training. Records which show evidence of employee training should be carefully maintained. Although training needs may differ with the type of equipment used, the following suggestions for training generally apply:

- Impress on the worker the need for constant awareness of all aspects of safety, particularly good housekeeping and the elimination of slipping, tripping, and other hazards.

- Instruct employees in the proper handling, storing, mixing, use, and disposal of hazardous substances. Many of these substances are identified in the "Health and Safety Hazards in the Special Construction Trades" section, page .

- Train employees in the proper use of protective safety equipment such as respirators, hearing protection, and safety belts, and be sure that this equipment is used.

- Train employees in good personal hygiene practices. Admonish employees to thoroughly wash their faces, hands, and arms prior to eating or smoking to prevent inadvertent ingestion of toxic substances, and to minimize the risk of skin irritations.

- Promote good housekeeping. It can reduce accidents and fire hazards, and develop in employees a sense of pride in their surroundings. All employees should take part in the clean up. They should know the hazards involved and proper clean up procedures.

.Train employees in the erection, maintenance, and use of scaffolds. Employee awareness of the special precautions required in the use of scaffolding is essential to an effective health and safety program. (See "Ladders and Scaffolding," page 84).

.Train employees in the use of hand and power tools including masonry saws, drills, power hammers, and powder actuated tools. Employees should be made aware of the hazards associated with this equipment and the precautions necessary for safe operation. (See "Hand and Power Tools," page 63).

.Instruct employees in the use of portable fire extinguishers. (Refer to the fold-out chart in this booklet.) Post the telephone numbers of the local fire department. Develop emergency procedures in case of fire.

.Provide first aid training for at least one worker on each job site. Approved courses are offered by the American Red Cross.

.Instruct employees in safe lifting. An easily understood chart, "How to Lift Safely," is included in the back of this book.

Occupational Health and Environmental Control

Any health and safety program must begin with the identification of hazards in the workplace. The information presented in this booklet is designed to help the special trades contractor evaluate his own operations, to identify the occupational health and safety hazards his employees may encounter, and to take appropriate action to control those hazards. One possible method of identifying hazards is by performing a job hazard analysis. This can be done by breaking a job down into the individual steps which make up an entire job, as shown below.

JOB HAZARD ANALYSIS

Job Description: Construction of an exterior brick wall

Operation	Exposures	Recommended Controls
Mixing mortar	Silica(sand), lime, aluminum oxide	Natural ventilation (perform mixing outdoors), gloves, goggles, dust respirators
	Noise (from mixer) 90-100 dBA	Earmuffs or earplugs
Use of scaffolding	Potential falls, dropping objects from scaffolding	Safe scaffold construction, including toeboards and guardrails; safety lines
Bricklaying	Mortar, dust	Skin protection (gloves, barrier creams), washing facilities

Cutting brick with saws	Dust, high speed particles	Gloves, goggles or faceshields, natural ventilation (perform sawing outdoors, dust respirator may be necessary for dry sawing)
	Noise (90-95 dBA)	Earmuffs or ear plugs
Tuckpointing	Dusts, mortar	Gloves, dust respirator, washing facilities
Cleaning stains from masonry	Acid cleaning solutions	Gloves, aprons, faceshields, running water for flushing skin and eyes, washing facilities

In some cases, information on hazardous properties of materials used in construction may not be known. In many instances, the manufacturer or supplier can supply material safety data sheets for their products. These sheets will provide information on the hazardous properties of the material, and recommended controls to protect the employees using it. This product safety information can be used in conjunction with this booklet to determine the control measures (gloves, respirators, ventilation, etc.) which should be recommended to minimize employee exposures to hazardous materials and conditions.

General Methods of Environmental Control

Various techniques can be used to prevent or reduce employee exposures to hazardous conditions and substances. Some of these methods, which can be used singly or in combination, are:

- Substitution of less hazardous materials--for example, using a safety solvent instead of lacquer thinner to clean tools.

- Change in a process--for example, using wet masonry saws instead of dry saws to minimize dust production.

- Isolation--Enclosing or placing a hazardous process or piece of equipment in a separate room or area of a building to reduce the number of persons exposed. Locating portable gasoline powered compressors in areas separated from the actual worksite to minimize the workers' exposure to noise and exhaust gases (including carbon monoxide) is an example of equipment isolation.

- Ventilation--Local exhaust ventilation will remove contaminants at their point of generation--for example, providing a fan or a blower to ventilate the mixing of epoxy resins and hardeners. General dilution ventilation may be necessary to remove contaminants from large areas--for example, providing fans to remove solvent vapors when waterproofing interior walls and floors.

- Administrative controls--Limiting the total amount of time a worker is exposed to a health hazard, and rotating workers through various jobs each day. For example, rotating jobs between members of an insulating crew so that no person spends all his time in a hot attic.

- Training and education of employees--Employees should be told what hazards they are exposed to, and how to limit or reduce the exposures. They should also know the meaning of certain physical signs and conditions--for example, the development of cement dermatitis from prolonged exposure to plaster or concrete (See "Employee Training," page 24).

- Personal hygiene--Cannot be overemphasized. Persons should wash their hands before eating or smoking. If chemicals such as acids, cement, epoxy resins, sealants, and waterproofing compounds get on the skin, they should be washed off immediately. Since skin irritation is a major health problem for workers who handle cement, mortar, and grout, frequent washing and showering is an extremely important preventive measure. Clothing should be changed and washed daily; more often, if it becomes contaminated with chemicals, dusts, or liquids.

- Personal protective equipment--Use of items such as respirators, hearing protective devices, protective clothing, and protective equipment is essential to reduce exposures to hazardous conditions and substances (See "Personal Protective Equipment," page 44.)

General Safety Guidelines

Workers employed in the special trades included in this Guide are engaged in a wide variety of activities, each of which has special safety requirements necessary to protect the workers. Many of these special requirements are discussed in the "Frequently Violated Regulations" section of this Guide. Some general safety guidelines apply to all work done in the special construction trades, and these guidelines are listed below.

Personal Safety Rules

- Wear hard hat and safety shoes whenever you are on the job.
- Wear clothing appropriate to the type of work you are doing.
- Wear goggles or safety glasses with side shields when cutting, chipping, or grinding.
- Wear goggles when using hazardous chemicals.
- Confine hair and loose clothing when using rotating equipment.
- Remove rings and other jewelry when working.
- Wash frequently with mild soap and water to prevent skin disease. Do not use harsh, abrasive soaps or solvents to clean your skin.
- Never use compressed air to clean your clothing. Vacuuming is recommended to remove dust and debris from clothing.

Safe Use of Tools

Employees should be instructed in the following safe work practices:

- Do not remove guards, barriers, safety devices, or grounding prongs from tools. Do not operate tools which have had safety equipment removed.

- Perform a visual inspection of every tool before using it--do not use tools which are in poor operating condition. Keep tools clean, sharp, and in good working order.

- Report defective tools to the supervisor.

- Never leave a tool without turning off the power and making sure the tool has stopped running.

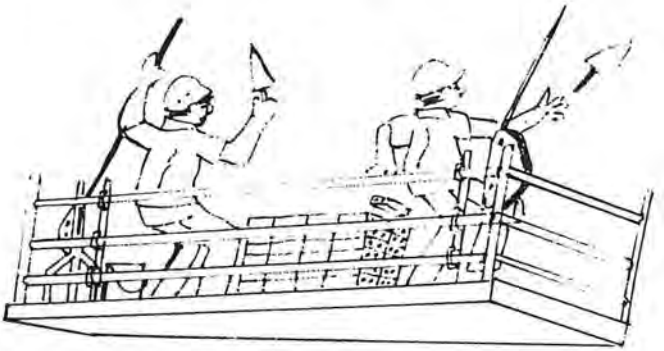
- Always make sure tools are disconnected or locked out from their power source before performing maintenance or cleaning tasks.

- Clean dust or chips from machines using a brush--never use compressed air, rags, or bare hands.

Good Housekeeping

Employees should be required to observe the following good housekeeping rules:

- Keep walking surfaces free of wood scraps, bricks, blocks, cement bags, tools, and debris to prevent tripping and slipping.
- Clean up spilled liquids immediately to eliminate slipping hazards.
- Stack work materials (bricks, cement bags, etc.) in a safe, secure location.
- Keep exits and stairwells free from trash and debris.
- Keep housekeeping equipment (brooms, brushes, mops, etc.) readily available.



Safe Scaffolding Practices

Employees should follow these guidelines for the safe use of scaffolding:

.Do not load scaffolds in excess of the working load for which they were designed.

.Maintain scaffolds in good working condition--do not use scaffolds which are weakened or in need of repair.

.Do not move form scaffolds while they are in use or occupied.

.Remove ice and snow from scaffolds, and sand the planking before use.

.Do not permit workers to use scaffolds in high winds.

.Tools, work materials, and debris should not be allowed to accumulate in quantities sufficient to create a hazard.

.Use swing scaffolds only after proper instruction.

Proper Lifting Procedures
(see foldout)

Employees must be trained to: Use safe lifting procedures. The foldout in the back of this book describes safe practices which should be observed in order to avoid injury.

FREQUENTLY VIOLATED REGULATIONS

This section outlines the OSHA regulations which are most applicable to the operations of special trade contractors at construction sites. The standards are listed in the same order as the OSHA Construction Safety and Health Regulations (29 CFR 1926) and the important points of the applicable standards are summarized. General conditions and controls are discussed. Your particular operations will vary, so some of these standards may not apply, or some additional standards may be applicable. The control methods presented are only brief, general suggestions as to how hazardous conditions may be corrected. For detailed information on control problems such as noise, air contaminants, or machine guarding where specific designs must be implemented, you may need the services of a professional consultant.

General Safety and Health Provisions

Safety Training and Education

The employer must instruct each employee in methods of recognizing and avoiding hazards in his work environment. In addition, workers who are required to use or handle acids, caustics, flammable liquids and gases, and other hazardous materials must be instructed in safe handling methods, the hazards associated with these materials, and the personal protective measures required. Employees who wear respirators must be trained in their use, maintenance, and limitations (see "Respiratory Protection", pages 48-49). Safety training and education are important parts of any health and safety program. Records of safety training should be

kept. The basic elements of employee training are discussed in the section "Health and Safety Program," page 23.

Housekeeping

Special construction trades create large amounts of scrap, waste material, and other debris. Lumber and drywall scraps, wrapping bands, bricks, cement blocks, tile, cement bags, buckets, insulation scraps, and bags can accumulate at the worksite and create fire and tripping hazards. Work areas, passageways, and stairs must be kept clear of all work materials, tools, and construction debris.

Occupational Health and Environmental Controls

Medical Services and First Aid

The employer interested in maintaining production, preventing loss of work time, receiving efficient employee performance, and achieving good morale should adopt ways of preserving employees' health. A good practice is to require preplacement medical

examinations to insure that prospective employees are physically able to do the specific work. Periodic health evaluations for hazardous jobs and early treatment of any illness or injury should also be encouraged.

Before a construction project begins, provisions must be made for prompt medical attention in case of a serious injury. Equipment must be available to transport an injured person to a physician or hospital, or a communications system must be provided to contact an ambulance service. Emergency phone numbers must be conspicuously posted (See "Emergency Information Chart" on the back cover).

In the absence of an infirmary, clinic, or hospital in close proximity to the workplace which is used for treatment of injured or ill employees, the following are required:

- At least one and preferably two employees on each shift must be adequately trained to render first aid. The American Red Cross, some insurance carriers, local safety councils, and others provide acceptable training.

- First aid supplies must be readily available and approved by a consulting physician. A list of suggested first aid supplies is included on page 145. These supplies must be in weatherproof, sanitary containers with individually sealed packages for material such as gauze, bandages, and dressings that must be sterile. Other items often needed are adhesive tape, triangular bandages (to be used as slings), inflatable plastic splints, scissors, and mild soap for cleansing of wounds or cuts.

Suitable facilities for quick drenching or flushing of the eyes and body must be provided within the work area when a person may be exposed to injurious corrosive materials.

Some states have laws concerning medical practice which establish limits on first aid given by the lay person. Trained employees should understand where first aid ends and treatment by a physician begins.

NOTE: First aid is immediate, temporary treatment given in the event of accident or illness--before the doctor arrives. Immediate first aid (within 4 minutes) may be the difference between complete recovery, permanent impairment, or death.

Sanitation at Construction Sites

Potable Water

Portable containers used to dispense drinking water must be capable of being tightly closed, equipped with a tap, and water must not be obtained by dipping into the container. Each container must be clearly marked as to contents and not used for any other purpose.

The community drinking cup is prohibited and single service cups (to be used only once) must be supplied. Containers shall be provided for unused cups and also for used cups.

Outlets for non-potable water must be appropriately identified to indicate clearly that the water is unsafe for drinking, washing, or cooking purposes.

Toilets

At least one toilet must be provided for 20 employees or less; one toilet seat and one urinal per 40 employees; and one toilet seat and one urinal per 50 employees if there are more than 200 employees. This requirement is not applicable to mobile crews having readily available transportation nor to personnel at the place of business. Job sites not provided with a sanitary sewer may be provided (unless prohibited by local codes) with chemical recirculating and/or combustion toilets or privies if the use of the latter will not contaminate ground or surface water. Toilet rooms shall have a latch on the door and the door shall be self-closing. Adequate supplies (toilet paper, holder, etc.) must be available.

Washing Facilities

Adequate washing facilities must be provided for employees engaged in operations involving harmful contaminants; washing facilities must be equipped to remove harmful substances. Such facilities must be in close proximity to the work site.

Occupational Noise Exposure

Excessive noise can cause permanent hearing damage; yet the noise standard is one of the most commonly violated standards. It is management's responsibility to make sure employees are not exposed to noise levels in excess of the standard.

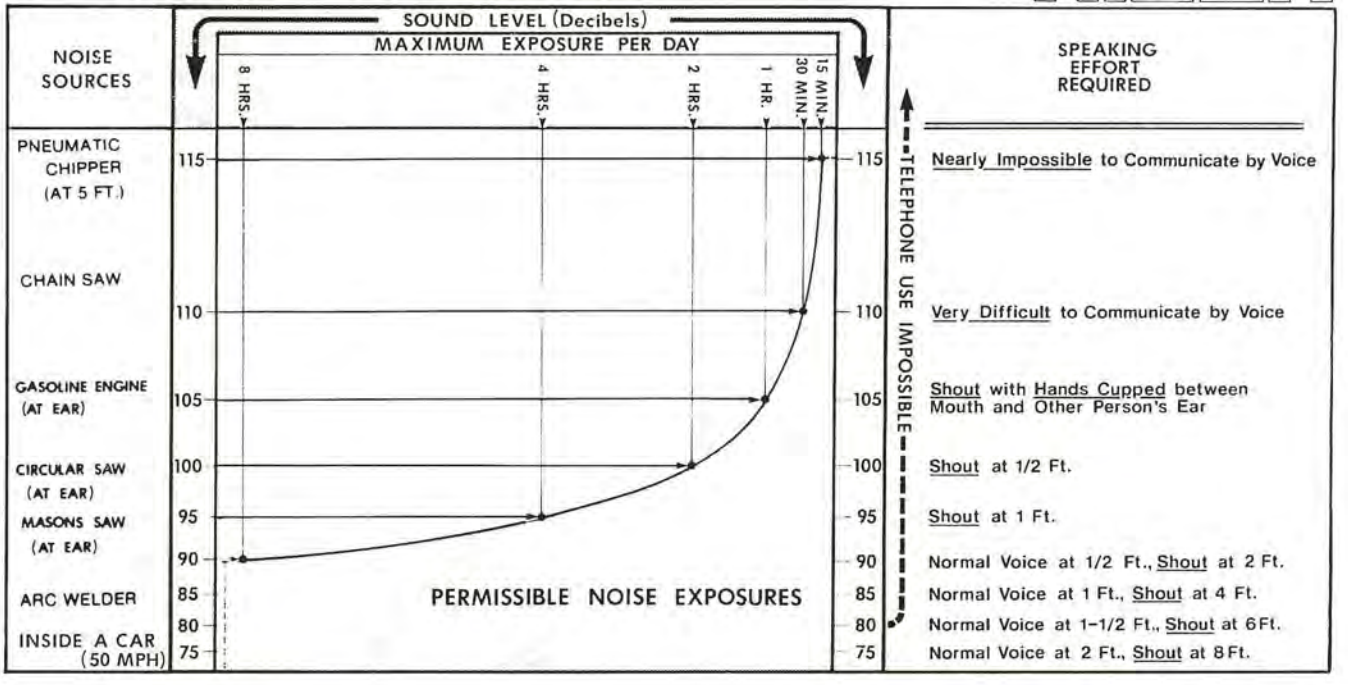
The current standard is 90 decibels, A-weighted (dBA), for an 8-hour exposure. Even at this noise level, hearing damage can be expected in some individuals. As noise level increases, the maximum permissible exposure time decreases (e.g., if the noise level is 95 dBA, the permissible exposure time is 4 hours). It may soon be a requirement, and it is considered good practice, to have hearing checked (audiometric testing) on an annual basis for all employees exposed to 85-90 dBA noise levels for 8 hours daily.

At greater than 90 dBA exposure (8 hours per day) or for higher noise levels in excess of the allowable time (e.g., 100 dBA for more than 2 hours), a continuing, effective hearing conservation program must be administered. Reference to the following table gives estimates of noise levels and the maximum allowable exposure times. It is required that either engineering controls such as enclosing noisy equipment, or administrative controls such as limiting time of the exposure, be utilized to reduce noise levels or the exposure times to comply with the standard. If these control measures are not feasible, then effective personal protective equipment is required. There are many forms and types of ear protection that can be used such as ear muffs or ear plugs. Some are more useful than others, depending on the noise level, the frequency of the noise, and how well they fit the individual. It is necessary to provide protection that is effective and yet reasonably comfortable to the wearer.

The following table is provided to assist in the evaluation of the noise levels in the workplace. If referral to the table indicates that levels and time of exposure are such that corrective action is needed, it is recommended that professional help be sought to correct the problem. A noise survey by adequately equipped and trained personnel should be made to identify noise hazardous operations, and to recommend methods of noise control.

PERMISSIBLE NOISE EXPOSURES

NIOSH



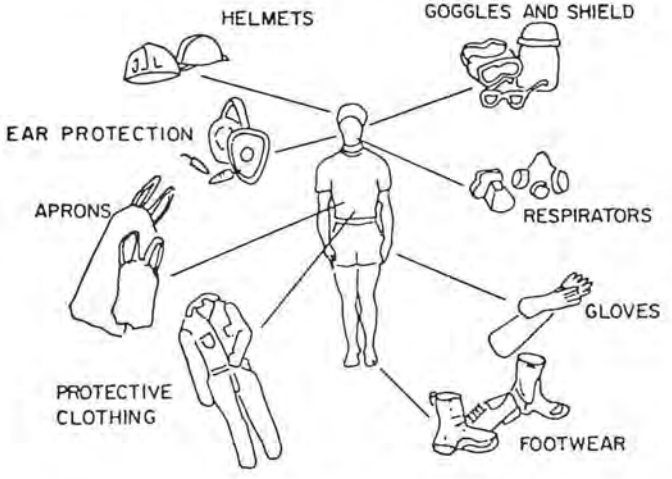
Gases, Vapors, Fumes, Dusts, and Mists

In the special construction trades, employees may be exposed to hazardous materials in a variety of forms, including gases, vapors, fumes, dusts, and mists. Many of these materials are identified in the "Health and Safety Hazards in the Special Construction Trades" section (pages 1 to 22), and recommended methods for controlling exposures to these materials are described. As a general rule, engineering controls such as installing ventilation systems to prevent overexposures to hazardous material, or administrative controls such as limiting the amount of time employees spend on hazardous jobs must be implemented whenever they are feasible. If employee exposures cannot be controlled by these methods, then protective equipment such as respirators must be used to keep these exposures within allowable limits.

Ventilation

Ventilation is frequently the method of choice for reducing employee exposures to airborne contaminants. Much of the work done in the special construction trades is performed outdoors where natural ventilation may prevent hazardous air contaminants from accumulating. Any activity which could release dusts, mists, or vapors (including grinding, dry sawing, cleaning with solvents, mixing mortar or epoxies) should be performed outdoors whenever possible. Jobs which must be done indoors or in confined spaces (including tile setting with epoxies, insulation installing, and spraying waterproofing silicones around foundations) should be ventilated to remove dusts, mists, and vapors from the worker's breathing zone. Portable blowers and fans can be used to maintain contaminant levels below hazardous concentrations. Power saws used to cut asbestos-

containing insulation materials should be ventilated to collect asbestos fibers before they become airborne. Whenever ventilation systems are used, however, care must be taken that the contaminant is not just blown around the room, or into another work area. To be effective, a ventilation system should dilute contaminants below hazardous levels, or exhaust the contaminated air to the outdoors. Specific operations which may require ventilation are discussed in the "Health and Safety Hazards in the Special Construction Trades" section, pages 1 to 22.



Personal Protective and Life Saving Equipment

General

Personal protective equipment is not to be used as a substitute for feasible administrative or engineering controls. If these control methods are not feasible, personal protective equipment is required whenever there are hazards that can do bodily harm through absorption, inhalation, or physical contact. This equipment includes respiratory and hearing protective

devices, clothing, and protective devices for the eyes, face, head, and extremities. All personal protective equipment must be of safe design and construction for the work to be performed, and maintained in a sanitary and reliable condition.

Eye and Face Protection

Eye protection is required where there is a possibility of any eye injury from flying particles, chips, and splashes from liquids such as caustics, solvents, or hot or molten metals. Employees must wear this equipment when using grinders, power drills, pneumatic chisels, etc.

Eye and face guards must be designed to provide adequate protection against the particular hazards to which the employee is exposed. The equipment must be easy to clean and capable of being disinfected. If it is worn by persons whose vision requires corrective lenses, goggles must be capable of being worn over glasses, or constructed so that the corrective lenses can be mounted behind the protective lenses.

Head Protection

Helmets are required in a situation where workers may be subjected to impact from falling or flying objects. Helmets are normally mandatory for construction operations.

Foot Protection

Safety shoes are required to prevent injury to the feet from falling objects and other hazards. Appropriate footwear (rubber boots, etc.) which provides good traction should be used on slippery walking surfaces.

Clothing

Ear Protection

Noise levels above 90 dBA are frequent at many construction operations and areas. If noise levels have not been reduced to a safe level of exposure, hearing protection must be worn. (See "Occupational Noise Exposure," pages 39 to 41).

It is important to note that there may be an overexposure if a combination of noise levels and time exceeds the daily allowable exposure time (e.g., if an employee is exposed to 105 dBA for 1 hour, he may not be exposed to 90 dBA or higher any more that day).

Gloves

When handling hazardous liquids, resins, acids, or other hazardous materials, employees must wear gloves which are impervious to such materials. The gloves must be long enough to protect the forearms. Gloves should be inspected periodically for pinholes and material integrity. The following table suggests glove types for exposure to the listed substances (a decision regarding the use of a specific glove type should be made in consultation with the supplier):

Chemical	Neo-prene	Natural rubber or latex	Poly-vinyl alcohol	Buna-N	Poly-D (poly-ethylene)	Vinyl Tru-Touch
Animal Oils	E	F	E	E	E	G
Degreasing Fluids	F	P	E	G	E	P
Epoxy Resins, Dry	E	E	E	E	E	E
Chromic Acid	F	P	P	F	G	G
Hydraulic Oil:						
Petroleum Base	G	P	E	E	E	F
Ester Base	E	P	G	G	G	P
Inorganic Salts	E	E	F	E	E	G
Isopropyl Alcohol	E	E	F	E	E	G
Lacquer Thinners	G	F	E	G	F	F
Mercury	G	G	P	P	E	F
Nitric Acid	G	F	NR	F	F	F
Paint Thinners	G	F	E	G	G	F
Petroleum Spirits	E	F	E	E	G	P
Phosphoric Acid	E	G	P	E	E	G
Potassium Hydroxide	E	E	P	E	E	G
Sodium Hydroxide	E	E	P	E	E	G
Stoddard Solvent	E	F	E	E	G	F
Sulphuric Acid	G	G	P	G	F	F
Toluol	F	P	E	E	G	P
Trichlorethylene	F	P	E	E	G	P
Xylol	P	P	E	E	G	P

KEY: E-Excellent; G-Good; F-Fair; P-Poor; NR-Not Recommended.

Under certain conditions (e.g., dusty operations, etc.), coveralls, caps, aprons, and other types of clothing (e.g., rubber suits, etc.) may be necessary for a complete change of outer work clothes. This type of clothing should be discarded in appropriate hampers and the employee should change to street clothes after a shower, if necessary. It may also be necessary for the company to have a separate laundry facility or have the clothing sent to a commercial laundry.

Respiratory Protection

NIOSH-approved respirators must be provided by the employer when the workplace air is contaminated with excessive concentrations of harmful dusts, fumes, mists, gases, or vapors. Respirators may be used as a control only when engineering or administrative controls are not feasible, or while they are being implemented.

If respirators are used, a written respirator program must be established and must include the following requirements:

- The respirators selected for use must be designed to protect against the specific hazards to which the employees are exposed.
- Written instructions on the selection and use of respirators must be available. A record of persons issued respirators should be maintained.
- Employees must be trained in the use and limitations of respirators and in their proper fitting and maintenance.
- Respirators should be cleaned at the end of each use. They should be taken apart, washed, dried, and defective parts replaced.
- If a respirator is used by two people, it must be cleaned and disinfected after each person's use.
- When the respirator is worn, all straps must be adjusted and fastened.

To ensure proper function of the respirator, a good face seal is necessary. Beards, long sideburns, and glasses may interfere with the fit.

Filters used in dust respirators should be replaced when breathing becomes difficult. Cartridges used in chemical cartridge respirators should be replaced at the expiration of the lifetime of the cartridge, or when breathing becomes difficult, or when the employee can smell vapors in the mask, whichever comes first.

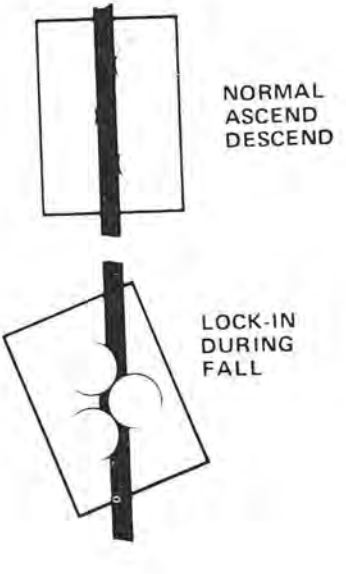
Respirator requirements vary, depending on the chemical composition of the air contaminants and the concentration of the contaminants. The NIOSH Standards Completion Program "Guidelines" suggest the proper respirators to use for exposure to particular chemicals. Contact the NIOSH or OSHA Regional Office nearest you for information on respirator selection guidelines and use requirements.

Safety Belts, Lifelines, Lanyards, and Nets

All safety belts, lifelines, and lanyards must have a minimum breaking strength of 5,400 pounds and the associated hardware must be capable of withstanding a minimum tensile loading of 4,000 pounds without breaking, ripping, or any permanent deformation. Any such equipment must be anchored to a structural member capable of supporting 5,400 pounds of dead weight.

Where the use of scaffolds, ladders, safety lines, or belts is impractical, safety nets must be provided when workers are exposed to heights greater than 25 feet.

Operations where nets are required must not be undertaken until the net is in place and tested.



Fire Protection and Prevention

Portable Fire Extinguishers must:

- Be kept fully charged and in their designated places
- Be easily accessible.
- Be located along normal paths of travel.
- Not be obstructed or obscured from view.
- Not be mounted higher than 5 feet (to the top of the extinguisher) if 40 pounds or less, or 3 feet if heavier. (OSHA may eliminate this requirement. Check with your OSHA area or regional office for more information.)
- Be inspected by management or a designated employee at least monthly to insure that they:
  - -are in their designated places,
  - -have not been tampered with or actuated, and
  - -do not have corrosion or other impairments.
- Be thoroughly examined at least yearly and recharged or repaired as necessary to insure operability and safety. A tag must be attached to show the maintenance or recharge date and signature or initials of the person performing the service.
- Be hydrostatically tested. The extinguisher sales representative usually will perform this service at appropriate intervals.

- Be selected on the basis of type of hazard, degree of hazard, and area to be protected.

- Be placed so that the maximum travel distances, unless there are extremely hazardous conditions, do not exceed 75 feet for Class A or 50 feet for Class B extinguishers.

A chart showing fire extinguishers by class and how to use them is located in the back of this booklet.

Fire Protection at Construction Sites

- The employer is responsible for establishing an adequate fire protection program covering all phases of construction and/or demolition work. Effective fire fighting equipment must be promptly available to meet all fire hazards.

- Fire fighting equipment must be conspicuously located, inspected monthly, appropriately maintained, and readily accessible; it must be promptly replaced if found defective. Carbon tetrachloride and other toxic vaporizing liquid fire extinguishers are prohibited. Appropriate fire extinguishers must be readily available for hot work operations such as welding. A fire extinguisher must be readily accessible for each stairway in multi-story buildings, and a fire extinguisher rated 2A or equivalent must be provided within 100 feet of any point in the protected area for each 3,000 square feet of protected building. The employer is responsible for having a fire alarm or other system to warn employees of a fire and for having means available (phone number posted) to promptly obtain the services of the local fire department. Smoking is prohibited in areas of potential fire hazards and "NO SMOKING" signs must be conspicuously posted.

- If the building being constructed includes automatic sprinkler protection and/or fire alarm devices, or standpipes, they are to be placed in service as soon as applicable laws permit, following completion of each story, and shall be maintained as construction progresses. Likewise, fire walls and exit stairways are required to be installed on a priority basis.

- Only approved containers and portable tanks shall be used to store flammable and combustible liquid; and such liquids must not be stored in or around exit routes such as stairways and exits. At least one approved fire extinguisher must be located within 10 feet of any room or inside storage area used to store such liquids and must not be more than 75 feet from any outside storage area.

Temporary Heating Devices

When salamanders or similar heating units are used to protect concrete or for the comfort of employees, the following precautions shall be taken:

- All salamanders must be covered and equipped with exhaust stacks.

- Heating units must not be set on or placed near wood or combustible materials.

- Salamanders, as well as other oil- or gas-fired temporarily installed heating equipments, should be attended at all times, and suitable fire extinguishers maintained readily available in the area.

- Fuel oil must be stored and handled in covered, approved-type flammable liquid containers.

Salamanders shall not be refueled until extinguished and permitted to cool.

- The presence of carbon monoxide is an inherent danger and prolonged exposure can result in death. Adequate general ventilation is essential to eliminate this exposure and salamanders should never be used in confined areas without adequate local ventilation to the outside air.

- Periodic checks by one or more attendants should be made of such temporary heating units to assure proper operation at all hours while they are in use.

- Units must be shut down during removal or any movement of the heating device.

- Adequate fire extinguishers shall be available and units must be well secured to prevent "knocking over."

- Improvised drums or solvent containers must not be used as heating devices.

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

Liquified Petroleum Gas (LP-Gas)

"NO SMOKING" signs must be present on the storage tank. Units to be fueled must be turned off while they are being filled.

The LP tank must be guarded to protect it from vehicular damage. Electrical connections, pumps, switches, etc. must be vapor- and explosion-proof.

Accident Prevention Signs and Tags

The construction safety and health regulations require the use of signs and tags as described below:

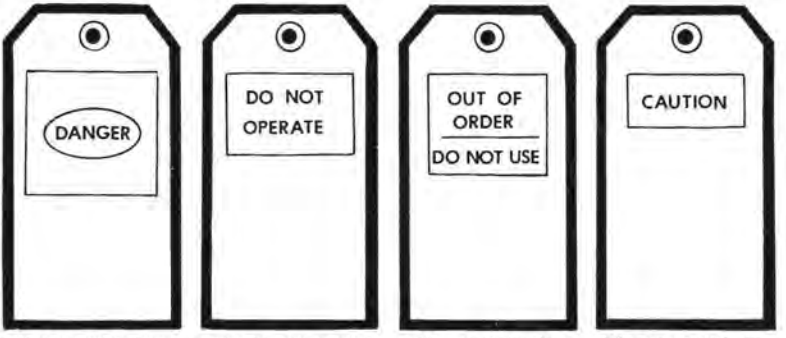
Signs

- Signs that warn of real or potential hazards must be visible to employees and promptly removed or covered when the hazard no longer exists.

- Danger signs must be used where an immediate hazard exists.

.Caution signs are to be used to warn against potential hazards or unsafe practices.

.Construction areas must have legible traffic signs at hazardous points. Safety instruction signs and directional signs are other types of signs used.



White tag-White letters on red square

White tag-White letters on red oval with a black square

Yellow tag-Yellow letters on a black background

White tag- White letters on black background

Tags

Accident prevention tags differ from signs in that they are used as a temporary means of warning employees of existing hazards such as defective tools or equipment. They may not be used in place of accident prevention signs. The above illustrations are examples of preferred accident prevention tags, although similar tags are acceptable.

It is recommended that locks be used in combination with tags to lock out controls, switches, etc. A written lockout procedure should be developed for repairs and maintenance on any equipment which could accidentally be activated.

The Safety Color Code

Federal safety red--basic color for the identification of:

- Fire protection equipment and apparatus
- Portable containers of flammable liquids
- Emergency stop bars, stop buttons, and emergency electrical stop switches on machinery

Federal safety yellow--basic color for designating:

- Caution and for marking physical hazards
- Waste containers for explosive or combustible materials
- Caution against starting, using, or moving equipment under repair
- Identification of the starting point or power source of machinery

Federal safety orange--basic color for designating:

- Dangerous parts of machines
- Safety starter buttons
- Exposed parts (edges only) of pulleys, gears, rollers, cutting devices, and power saws

Federal safety purple--basic color for designating radiation hazards.

Federal safety green--basic color of designating:

- Safety
- Location of first aid equipment (NOTE: This applied to equipment other than fire-fighting equipment)

Federal safety black and white (used individually or in combination)--basic colors for designating:

- Traffic flow
- Housekeeping

NOTE: THE SAFETY AND HEALTH REGULATIONS REQUIRE THE USE OF SIGNS AND TAGS AS DESCRIBED ABOVE.

Materials Handling, Storage, Use, and Disposal

General Requirements for Storage

Construction materials must be stored in a secure fashion to prevent hazards caused by sliding, falling, and collapse. Materials must not be stored in aisles and passageways, and storage must not obstruct exits. Materials shall not be stored on scaffolds or runways in excess of the amounts needed for immediate operations. Materials must be stored with due regard for their fire characteristics.

Storage of Bricks, Tiles, Masonry Blocks, and Bagged Material

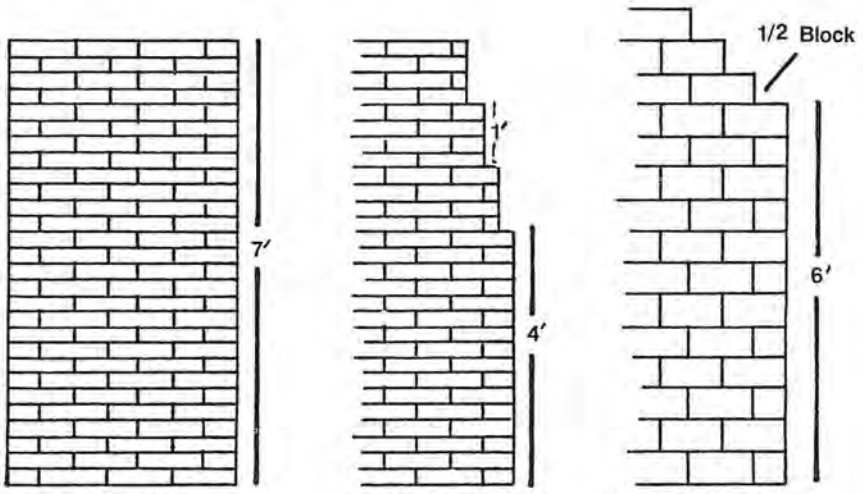
When bricks or masonry blocks are stored on the job, they should be covered to protect them from becoming wet or freezing. Bricks and tiles or pallets should be stored on level, firm surfaces to prevent shifting or tipping.

Loose bricks shall not be stacked higher than 7 feet, and when stacks reach a height of 4 feet, they shall be tapered back 2 inches for every foot above the 4-foot level.

When masonry blocks are stacked higher than 6 feet, they shall be tapered back one-half block per tier above the 6-foot level.

Bagged materials must be stacked by stepping back the layers and crosskeying the bags at least every 10 bags high.

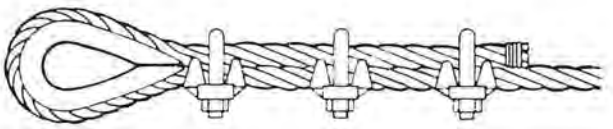
NOTE: Brick, tile, and masonry blocks must not be stored on scaffolds or runways.



Rigging Equipment

The following requirements apply when rigging equipment is used:

- .Hooks must have no cracks or other deformations.
- .The rated capacity of the hook must be equal to that of the chain.
- .It is not permitted to use job or shop hooks or makeshift fasteners constructed from bolts, rods, etc.
- .Rope slings, including end connections, may not have excessive wear, broken wires, kniks, or twists.
- .Rigging equipment must be removed from the immediate work area when not in use.
- .Rigging equipment for material handling must be inspected visually every day for unusual wear and serviceability. A monthly itemized inspection report must be written for all lifting equipment.
- .Protruding ends of strands in splices on slings and bridles on wire rope must be covered or blunted.
- .It is not permitted to tie or secure wire rope with knots.
- .An eye splice made in any wire rope may not have less than three full tucks.
- .When used for eye splices, the 'U' bolt must be applied so that the 'U' section is in contact with the dead end of the wire rope.



- Manila rope must be used in accordance with manufacturer's recommendations. Knots may not be used in lieu of splices.

- Synthetic webbing (nylon, polyester, and polypropylene) and other slings must be marked to show:

  - the name or trademark of manufacturer,

  - rated capacities for the type of hitch (The rated capacity must not be exceeded.), and

  - the type of material.

Slings

Each day before use, the sling and all fastenings and attachments must be inspected by a competent person designated by the employer. A thorough inspection of alloy steel chain slings must be made at regular intervals not to exceed 12 months, and a record kept. Each new, repaired, or reconditioned alloy steel chain sling must be proof tested before use and a certificate of the test must be kept.

Whenever a sling is used, the following safe practices must be observed:

- Slings that are damaged or defective must not be used.

- Slings must not be shortened with knots, bolts, or other makeshift devices.

- Sling legs must not be kinked.

- Slings must be securely attached to the load and must not be loaded in excess of their rated capacities.

- Slings must be padded or protected from the sharp edges of the load.

- Suspended loads must be kept clear of all obstructions and all employees must be kept clear of loads about to be lifted or already suspended.

- Shock loading is prohibited.

- A sling must not be pulled from under a load while the load is resting on the sling.

Disposal of Waste Materials

Whenever materials are dropped 20 feet or more to a point outside the exterior walls of a building, an enclosed disposal chute must be used. When debris is dropped through holes in the floor without chutes, the area onto which material is dropped must be enclosed with barricades not less than 42 inches high and not less than 6 feet back from the projected opening. Warning signs must be posted at every level.

All flammable and combustible waste material, including oily rags, solvents, and thinners, must be kept in fire-resistant waste containers. These waste containers should be emptied daily.

Hand and Power Tools

General Requirements for Guarding

One or more methods of machine guarding must be provided to protect the operator and other employees from hazards created by point of operation, in-running nip points, rotating parts, flying chips, and sparks. All such hazards located 7 feet or less above the ground, floor, or working platform must be guarded to prevent accidental contact. Guards must be attached to the machine, if possible, and secured elsewhere if attachment to the machine is not possible. The guard must not offer an accident hazard in itself. Machines designed for fixed locations must be securely anchored to prevent "walking" or tipping.

A booklet entitled "The Principles and Techniques of Mechanical Guarding," OSHA 2057, can be obtained by contacting OSHA Regional Offices listed in the back of this book. Many equipment representatives can assist in obtaining the necessary protective devices.

The most common methods of guarding a hazard or hazardous machine operation are:

- Enclosing the operation (preferred)
- Interlocking devices
- Moving barriers
- Removal devices
- Remote control
- Two-hand tripping devices
- Electronic safety devices.

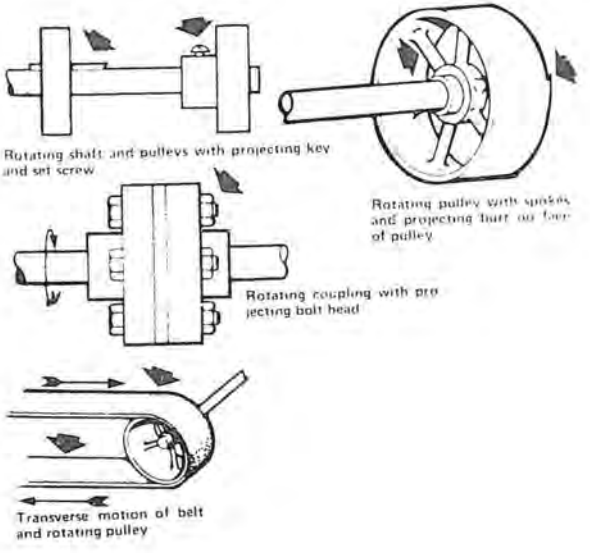
Certain guarding methods are preferable to others. The type of operation, the size or shape of stock, the method of handling, the physical layout, the type of material, and the production requirements or limitations are important considerations. Certain flexibility in operations may also determine the

practicability of the method to be used. As a general rule, however, power transmission apparatus can be protected by fixed enclosure guards.

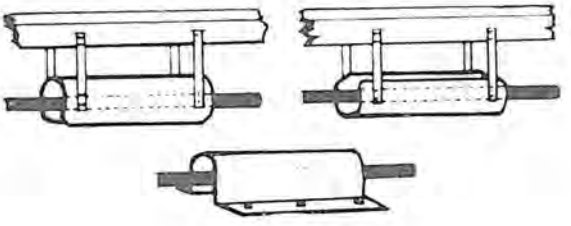
The following pages contain examples of specific equipment and operations that must be guarded. This listing is not intended to include all equipment that may require guarding.

Rotating, Reciprocating, and Transverse Motions

Rotating, reciprocating, and transverse motions create hazards in two general areas--at the point of operation where work is being done and at the point where power or motion is being transmitted from one part of a mechanical linkage to another. Even smooth, slowly rotating shafts can grip clothing or hair, and through mere skin contact, force an arm or hand into a dangerous position.

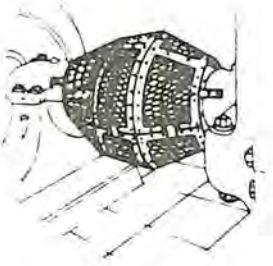


Collars, couplings, cams, clutches, flywheels, shaft ends, spindles, rotating bar stock, lead screws, and horizontal or vertical shafting are typical examples of common rotating mechanism which are hazardous. The danger increases when bolts, oil cups, nicks, abrasions, and projecting keys or screw threads are exposed when rotating.



Horizontal shafting

Sleeve for shaft end



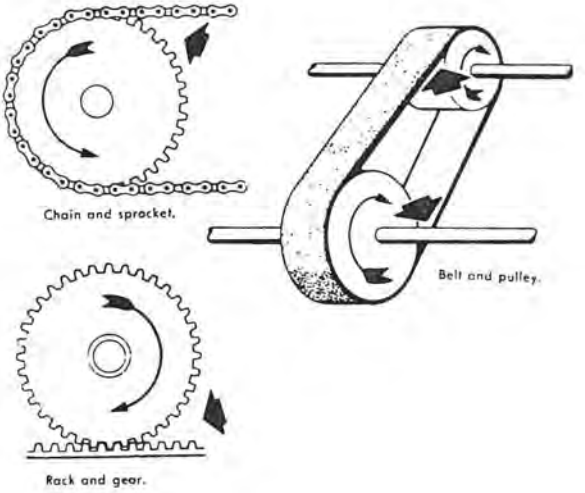
Coupling

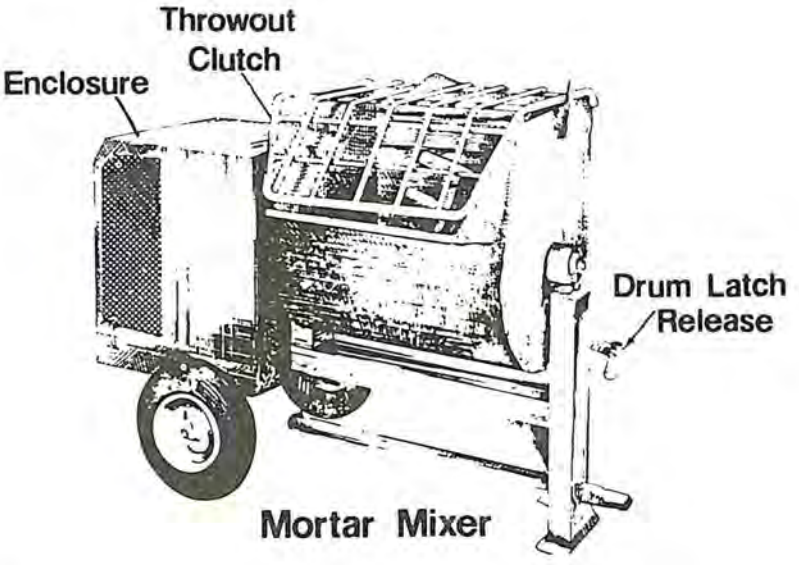
If fans are located within 7 feet of the floor, they must be guarded with grile or mesh, limiting openings to not more than 1/2 inch (least dimension).

In-running Nip Points

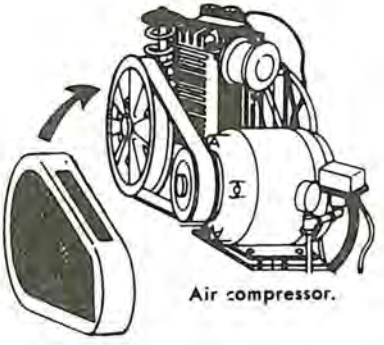
In-running nip points are a special danger which exists through action of rotating objects. Whenever machine parts rotate toward each other, or where one rotates toward a stationary object, an in-running nip point is formed. Objects or parts of the body may be drawn into this nip point and be bruised and crushed.

Typical examples of nip point hazards are rolls used for bending or feeding and conveying stock, the in-running side of a chain and sprocket, belt and pulley, a gear rack, a gear and pinion, and a belt conveyor terminal.





The pulleys and drive belts of air compressors must be fully enclosed.



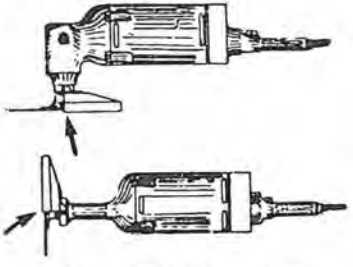
Air compressor.

Cutting Actions

Cutting action results when rotating, reciprocating, or transverse motion is imparted to a tool so that material being removed is in the form of chips. The

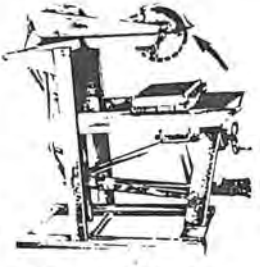
danger of cutting action exists at the movable cutting edge of the machine as it approaches or comes in contact with the material being cut. Such action takes place at the point of operation in cutting wood, metal, or other materials as differentiated from punching, shearing, or bending by press action.

Typical examples of mechanisms involving cutting action include band and circular saws, and grinding machines. Masonry, brick, and tile saws are used extensively in the special construction trades.



Portable Abrasive Wheels

Electric Power Saw



Masonry Table Saw

Punching, Shearing, and Bending Actions

Punching, shearing, or bending action results when power is applied to a ram (plunger) or knife for the purpose of blanking, trimming, drawing, punching, shearing, or stamping metal or other materials as differentiated from removing the material in the form of chips. The danger of this type of action lies at the point of operation where stock is actually inserted, maintained, and withdrawn.

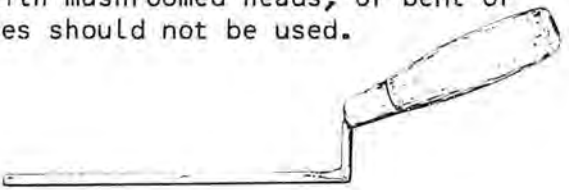
Typical examples of equipment involving punching, shearing, or bending action include power presses, foot and hand presses, bending presses, or brakes, as well as squaring, guillotine, and alligator shears.

Hand Tools

The following is a list of general requirements governing the use of hand tools:

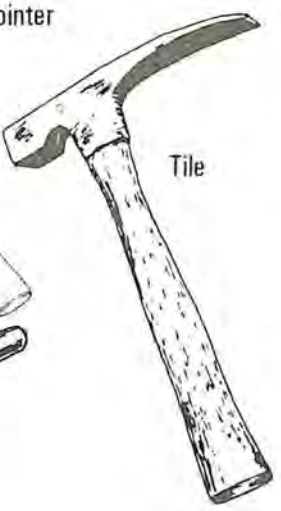
- Each employer is responsible for the safe condition of tools and equipment used by employees, including tools and equipment which may be furnished by employees.

- Hammers with broken or cracked handles, chisels and punches with mushroomed heads, or bent or broken wrenches should not be used.



Tuck Pointer

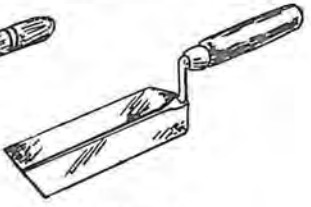
Flat



Tile

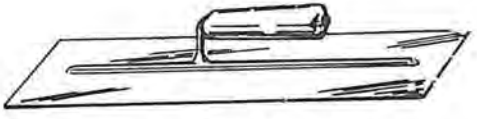
Round

Plug or
Mash Hammer



Pointing Trowel

Margin Trowel

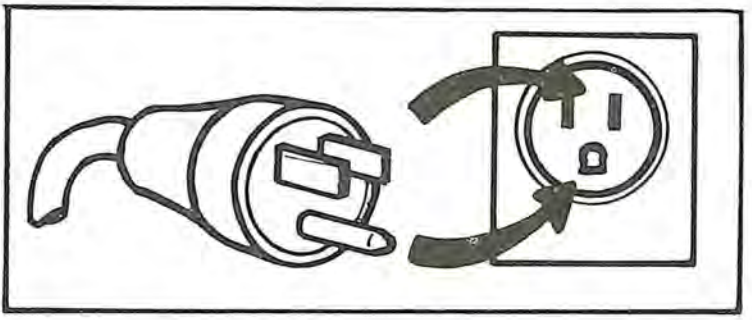


Finishing Trowel

.Wrenches with sprung jaws must not be used by employees.

.Most hand-held electrical power tools must be equipped with a "dead-man" or "quick-release" control, so that the power is automatically shut off whenever the operator releases the control.

.All hand-held portable electrical equipment must have their frames grounded or be double-insulated and identified as such. Ground-fault circuit interrupters are required for all 120 volt, single phase, 15 and 20 ampere receptacle outlets on construction sites which are not part of the permanent wiring of the building, unless an effective program for assuring the integrity of all grounding conductors is followed.



- .All tools must be used with appropriate shields, guards, and attachments and in accordance with recommendations by the manufacturers. Employees must be trained concerning the use of power tools and safety requirements.

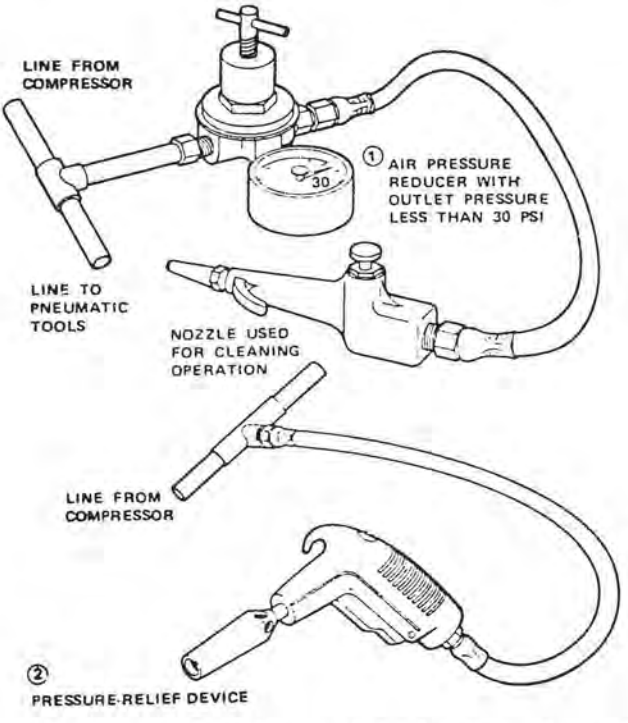
- .Pneumatic power tools must be positively secured to the hose to prevent the tool from becoming disconnected; tool retainers must be used on tools to prevent attachments from being expelled.

- .Nailers, staplers, and similar equipment with auto-feed should have a muzzle to prevent tools from ejecting material unless muzzle is in contact with work surface.

Compressed Air Equipment

NOTE: BEWARE OF COMPRESSED AIR, IT CAN BE DANGEROUS. Alternative methods of cleaning surfaces should be sought. Compressed air must never be used to blow dust and debris from a person. Compressed air may be used for cleaning surfaces if there is no other acceptable method. The downstream pressure of compressed air must remain below 30 psi whenever the nozzle is dead ended; effective chip guarding and

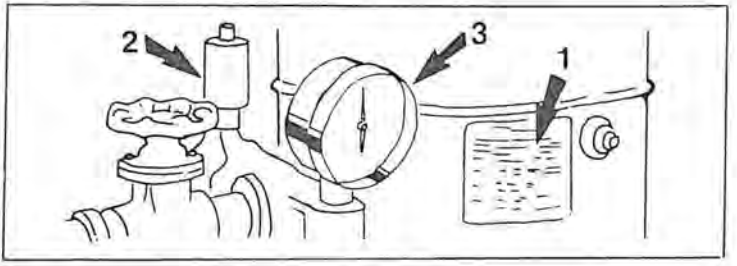
personal protective equipment must be used. Two acceptable methods of meeting the 30 psi requirement are illustrated.



Employees should be familiar with instructions for operating and maintaining the air compressor.

- New air tanks must be constructed in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII. The ASME Code requires this information to be permanently stamped on the air tank(1).

- Air tanks must be protected by adequate safety-relief valves (2). The valves must be tested at regular intervals to be sure they are in good operating condition.



.The pressure controller and guage must be maintained in good operating condition (3).

.There must be no valves between the air tank and safety valve.

.The drain valve on the air tank should be opened frequently to prevent excessive accumulation of liquid.

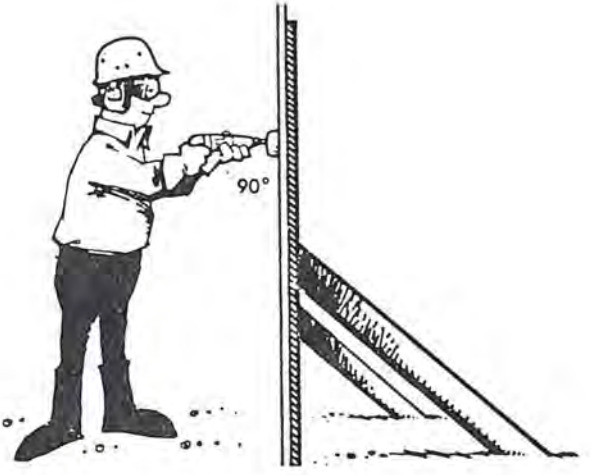
Powder Actuated Tools

Only employees trained in the operation of a particular tool in use must be allowed to operate a powder actuated tool. Some areas require operators to be licensed before using a powder actuated tool.

The tool must be tested each day before loading to see that safety devices are in proper working condition. The testing method used must be in accordance with the manufacturer's recommended procedure. Any tool found not to be in proper working order, or that develops a defect during use, must be immediately removed from service and not used until properly repaired.

Tools must not be loaded until just prior to the intended firing time. Neither loaded nor empty tools are to be pointed at any person. Hands must be kept

clear of the open barrel end. The job supervisor should determine which propellant load to use, always starting with the lightest load possible for the job at hand. Once loaded, the tool must not be left unattended.



Safe Work Practices for Using Powder Actuated Tools

Employees should be instructed to:

- Never fasten closer than 3" from edge of concrete.
- Never fasten closer than 1/2" from edge in steel.
- Not attempt fastenings into brittle, weak, or hollow material, such as thin masonry, ceramic tile, face brick, cast iron, or surface-hardened steel.

.Always keep head and body behind tool when firing.

.Keep other workers out of the line of fire.

.Always wear safety goggles and hard hats.

.Always check for cracks when fastening near the edge of concrete.

.Lean on the tool when firing to keep it at right angles to the work surface.

.Clean and lubricate tool daily.

.Always know the material being fastened into, especially in older buildings where base material may be concealed.

.Never attempt to fasten into spalled or cracked areas or along seam lines in masonry. Do not drive fasteners into spots where a previous fastener has failed.

.Backup the work with a plate capable of preventing the fastener from passing completely through. Clear the area of all personnel when fastening into thin material.

.Never use the tool in an explosive atmosphere.

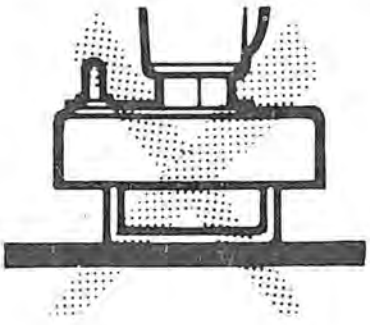
.Always store cartridges in a container used for cartridges only and do not carry cartridges in pockets or mixed with other objects.

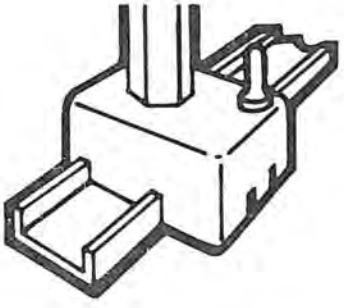
.Never use powder tool cartridges in firearms.

.Use ear plugs when fastening in confined areas such as ships, small rooms, holds, tanks, and vaults.

.Be sure the bore of tool is clear before loading.

.Do not use a standard guard for fastening where this guard will not provide protection. Special guards are available for such applications.





.Never attempt to fasten through a pre-drilled hole unless the tool is equipped with a hole locator.

.Never clean or service a powder actuated tool unless adequate instruction has been received. In case of a misfire, the employee must use the following procedures:

-hold the tool in place for 30 seconds (count slowly).

-pull trigger again--if it still does not fire, wait another 30 seconds--keep tool in place while opening mechanism.

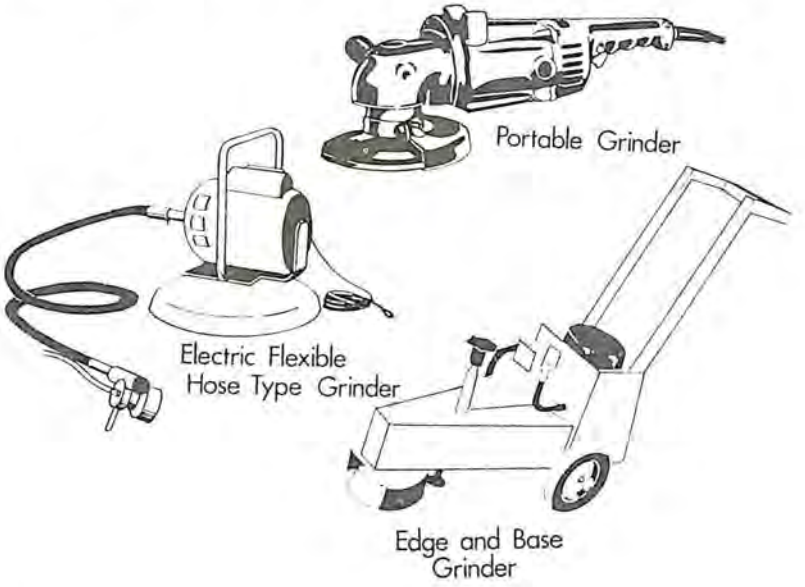
-remove cartridge.

-put cartridge in a bucket of water--never put unfired cartridges in trash that will be burned; never leave cartridges where children can get to them.

-return unfired cartridge to supervisor for disposal.

Portable Abrasive Wheels and Tools

Safety guards on portable abrasive wheels must be of sufficient strength to enclose fragments of a broken wheel. The exposed area of a portable abrasive wheel must not exceed 180 degrees. Operators of portable abrasive wheels must wear eye protection.



Grinders

Wheel safety guards must cover the spindle end, nut, and flange projections. The exposed area of the grinding wheel should not exceed one-fourth of the area of the entire wheel. When the guard opening is measured, the visors and other accessory equipment are not included as part of the guard unless they are as strong as the guard.

Work or tool rests must be of strong construction and designed to be adjustable to compensate for wheel wear. Work rests must be closely adjusted to the wheel, with a maximum clearance of 1/8 inch, to prevent the work from becoming jammed between the wheel and the work rest.

Tongue guards must be constructed so that the tongue guard can be adjusted to the constantly decreasing diameter of the wheel. The distance between the tongue guard and the wheel must never be more than 1/4 inch.

Goggles or a face shield must be worn by the operator.

Prefabricated Brick Panel

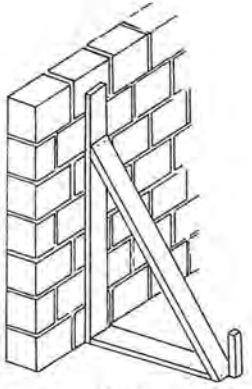
Lift-up and Tilt-up Construction

The following general considerations pertain to the use of precast concrete, prebricked, and pretiled wall and floor sections.

.Design and Planning. Operations shall be designed and planned by a qualified professional engineer or architect. Such plans and designs shall include detailed instructions and sketches indicating the prescribed method of erection.

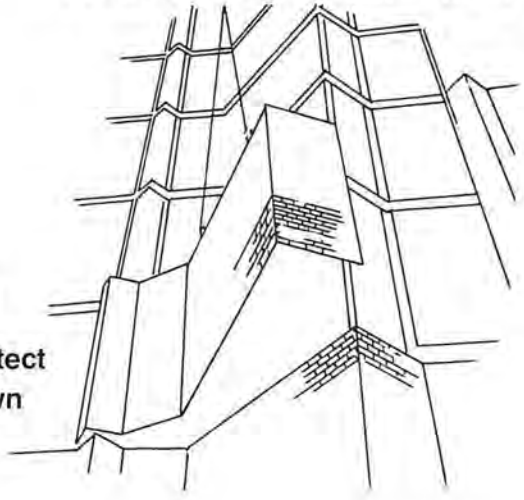
.Lifting Attachments. Lifting attachments shall provide sufficient strength and be designed with a safety factor of at least 5 times the working load. Reinforcing steel shall not be used if the working load exceeds 2,000 pounds. Where reinforcing steel is used, radii of all bends shall not be less than 6 bar diameters and shall have a minimum safety factor of 10 based upon the working load.

.Wall Support and Bracing. Precast walls or vertical concrete panels shall be adequately braced during construction. The temporary support or bracing shall be designed and installed to withstand a minimum wind load of 10 pounds per square foot. Braces or shores shall be securely attached to the concrete member, and the use of slotted or similar type clips is prohibited.



Bracing Wall to Protect From Blowing Down

Prefabricated Brick Panel



Jacking Equipment

.Jacking equipment shall not be loaded beyond its safe working capacity, and the threaded rods and other members that transmit loads to the jacks shall have a minimum safety factor of 2.5. Jacking equipment used in lift-slab operations shall meet the criteria listed below:

-Jacks shall be so designed and installed so that they will not continue to lift when overloaded.

-Jacks shall be installed with a safety device which will enable them to continue to support the load in any position should the jack malfunction and lose its lifting ability.

-The maximum number of manually-controlled jacks on one slab shall be limited to 14, and in no event should the number be too great to permit the operator to maintain the slab level within specified tolerances.

.Uniform Lifting. Jacking operations shall be synchronized in such a manner as to insure even and uniform lifting of the slab. During lifting, all points of the slab support shall be kept within 1/2 inch of that needed to maintain the slab in a level position. If leveling is automatically controlled, a device shall be installed which will stop the operation when the 1/2-inch tolerance is exceeded or when there is a malfunction in the jacking system. If level is maintained by manual controls, such controls shall be located in a central location and attended by a trained operator while lifting is in progress.

- Falling Hazard. No one shall be permitted under the slab during jacking operations, or under precast or similar walls, panels, or sections while they are being lifted or tilted into position.

Electrical

Workers must be protected from accidental contact with energized electric power circuits during construction activities. Before work is begun, the location of any electric power circuit which a worker may contact must be determined. These circuits must be deenergized and grounded, guarded by insulation, or protected by other means.

More fires are caused by electrical malfunction than any other cause, and in all industries, violations of standards pertaining to electrical equipment and use have been cited more frequently than have any others. The National Electrical Code (NEC), (NFPA 70-1971; ANSI C1-1971) has been adopted as a national consensus standard by OSHA (refer to "Information Sources"). The purpose of the NEC is the practical safeguarding of persons and buildings and their contents from hazards arising from the use of electricity. The code contains basic minimum provisions considered necessary for safety. The electrician sould be familiar with these requirements.

It is required that:

- Frames of electrical motors, regardless of voltage, must be grounded.

- Exposed noncurrent-carrying metal parts of fixed equipment that may become energized under

abnormal conditions must be grounded under any of the following circumstances:

-in wet or damp locations,
-if in electrical contact with metal,
-if operated in excess of 150 volts to ground, and
-when in a hazardous location.

.Exposed noncurrent-carrying metal parts of the following plug-connected equipment, which are liable to become energized, must be grounded or double insulated and distinctly marked:

-portable hand-held motor-operated tools,
-appliances, or
-any equipment operated in excess of 150 volts to ground.

.Outlets, switches, junction boxes, etc., must be covered.

.Flexible cords may not be:

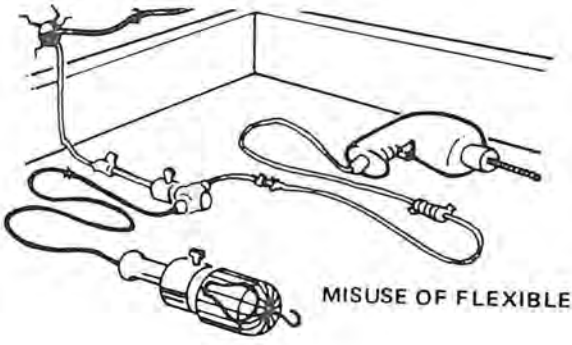
-used as a substitute for fixed wiring,
-run through holes in walls, ceilings, or floors,
-run through doors, windows, etc., or
-attached to building surfaces.

.Flexible cords must be:

-continuous lengths without splices or taps,
-fastened so that there is no pull on joints or terminal screws, and
-replaced when frayed or insulation has deteriorated.

.Each disconnecting means (e.g., circuit breaker, GFCI, or fuse box) must be legibly marked to indicate its purpose unless its purpose is evident.

.Switches or circuit breakers in a wet location or outside a building must be enclosed in a weatherproof enclosure.



MISUSE OF FLEXIBLE CORDS

Temporary Lights

.Exposed bulbs on temporary lights and sockets shall be guarded to prevent accidental contact, except if deeply recessed in the reflector or otherwise inaccessible.

.Temporary lights shall not be suspended by their electrical cords unless they are designed for that use.

Arcing Parts

Parts of electrical equipment which in ordinary operation produce arcs, sparks, etc., must be enclosed unless they are separated and isolated from all combustible materials.

Ladders and Scaffolding

Fixed Ladders

The following general requirements apply to fixed ladders. Fixed ladders must:

- Be designed to withstand a single concentrated load of at least 200 pounds.
- Have rungs with a minimum diameter of 3/4 inches for metal ladders, or 1 1/8 inches for wood ladders.
- Have rungs at least 16 inches wide and uniformly spaced no more than 12 inches apart.
- Be painted (if metal), or otherwise treated to resist deterioration when location demands.
- Have a preferred pitch of 75-90 degrees for safe descent.
- Have 2 1/2-foot clearance for ladders with 90 degree pitch and 3 feet for 75 degree pitch on the climbing side of the ladder (unless caged).
- Have at least a 7 inch clearance in back of the ladder to provide for adequate toe space.
- Be equipped with cages if they are longer than 20 feet.
- Have landing platforms if they are more than 30 feet long. A platform every 30 feet for caged ladders and every 20 feet for unprotected ladders is required.
- Have side rails extend 3 1/2 feet above landings.

- Have a clear width of 15 inches on every side of the center line of the ladder (unless with cages or wells).

Portable Ladders

Ladders that are weak or with missing rungs, improperly repaired, damaged, or appearing unsafe shall be removed from the job or site for repair or disposal.

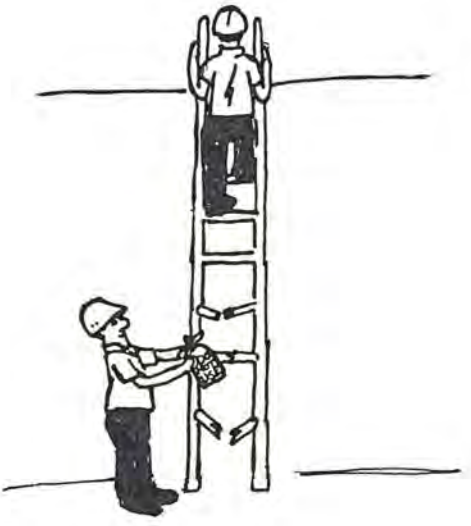
Ladders shall be secured against displacement at the top and bottom of the ladder by blocking strips or other suitable means.

Ladders must not be lashed together to increase their length. They may not be placed on boxes, barrels, or other unstable bases to obtain additional height.

The maximum length limit of portable wooden ladders is:

- single straight ladder--30 feet.
- two section extension and sectional ladders--60 feet.
- step ladders, trestle ladders, and platform step ladders--20 feet.

Metal portable ladders must not exceed: single straight ladder--30 feet, two section extension ladder--48 feet, greater than two section extension ladders--60 feet. The following ladders shall not exceed 20 feet: step ladders, trestle ladders, and platform step ladders. Step ladders must have a metal spreader which securely holds the front and back sections in an open position.



Portable ladders shall be on a firm footing.

Portable ladders must be maintained in good condition at all times, and inspected frequently. Any ladders which have developed defects must be tagged "DANGEROUS - DO NOT USE" and removed from service for repair or destruction.

Metal ladders cannot be used near energized electrical equipment and other electrical hazards.

Scaffolding

The different types of scaffolds that are used in the light and heavy trades addressed in this Guide are numerous. The major types of scaffolds used will be discussed in this section.

General requirements for scaffolds must be followed, if applicable, unless more specific requirements for a particular type of scaffold are more applicable:

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

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

- Guardrails and toeboards shall be installed on all open sides and ends of platforms more than 10 feet above the working surface (floor). Scaffolds 4 feet to 10 feet in height, having a minimum horizontal dimension in either direction of less than 45 inches, shall have standing guardrails installed on all open sides and ends of the platform.

- Guardrails shall be 2x4 inches, or the equivalent, approximately 42 inches high, with a midrail, when required. Supports shall be at intervals not to exceed 8 feet. Toeboards shall be a minimum of 4 inches in height.

- Where persons are required to work or pass under the scaffold, scaffolds shall be provided with a screen between the toeboard and the guardrail, extending along the entire opening, and consisting of No. 18 guage 1/2-inch wire mesh or the equivalent.

- A scaffold or its components shall be capable of supporting without failure at least 4 times the maximum intended load.

.Any scaffold or component of a scaffold that is weakened or damaged must be repaired or replaced immediately.

.All load-carrying timber members of scaffolds shall be a minimum of 1,5000 fiber (Stress Grade) construction grade lumber.

All planking shall be Scaffold Grades, or equivalent. The maximum permissible spans for 2x10-inch or wider planks shall be as shown in the following:

	Full Thickness Undressed Lumber			Nominal Thickness Lumber	
Working load (pounds per square foot)	25	50	75	25	50
Permissible span (ft)	10	8	6	8	6

.The maximum permissible span for 1-1/4x9-inch or wider plank of full thickness shall be 4 feet with medium duty loading of 50 p.s.f.

.All planking of platforms shall be overlapped a minimum of 12 inches or secured from moving.

.An access ladder or equivalent safe access shall be provided.

.Scaffold planks shall extend over their end supports between 6 to 12 inches only.

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

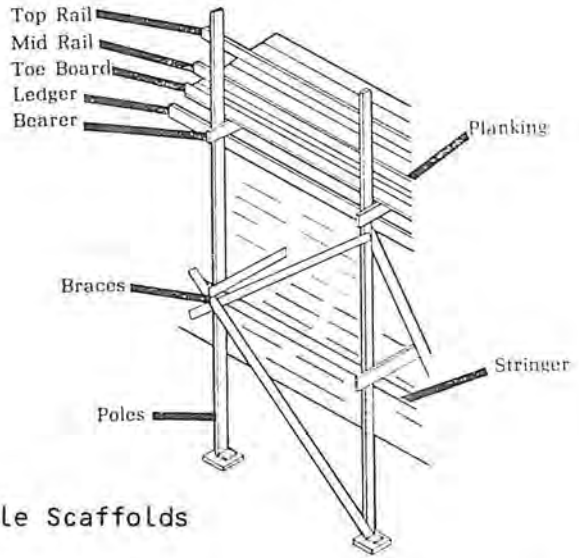
.Overhead protection shall be provided for men where necessary.

.Slippery conditions on scaffolds must be eliminated as soon as they occur.

.Wire, synthetic, or fiber rope used with scaffolds must be capable of supporting at least 6 times the rated load.

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

.Lumber sizes, except where otherwise stated, are nominal sizes.



Wooden Pole Scaffolds

Wooden pole scaffolds are used by both light and heavy trades. For the purposes of this Guide, the light trades would be plasterers, lathers, and other trades not using heavy tools or materials. Heavy trades would include stonemasons, bricklayers, and other heavy trades where heavy tools or materials are used or stored. The following regulations are applicable to both light and heavy trades where wooden pole scaffolds are used:

- Scaffold poles (uprights) must bear on a foundation of sufficient size and strength to spread the load from the pole over a sufficient area which will prevent settlement. All poles must be set plumb.

- Where wood poles are spliced, the ends must be squared and the upper section shall rest squarely on the lower section (square butt joints). Wood splice plates (scabs) at least 4 feet in length must overlap the wooden poles and cannot be less than the cross-sectional width of the wooden pole.

- Independent pole scaffolds shall be set as near to the wall of the building as practicable.

- All pole scaffolds shall be securely guyed or tied to the structure or building. Where the height or length of the scaffold exceeds 25 feet, it must be secured at intervals not greater than 25 feet vertically or horizontally.

- Ledgers (sometimes called ribbons) must be long enough to extend over two pole spaces and cannot be spliced between the poles. Ledgers must be reinforced by bearing blocks securely nailed to the side of the pole to form a support for the ledger.

- Putlogs or bearers must be set in place with their greater dimension vertical and long enough to project over the ledgers of the inner and outer rows of poles at least 3 inches for proper support.

- Every wooden putlog on single pole scaffolds must be reinforced with a 3/16x2-inch steel strip, or equivalent, and secured to its lower edge throughout its entire length.

.Diagonal bracing shall be provided to prevent the scaffold from moving, swaying, or buckling. Diagonal bracing shall be fitted in both directions on the exterior scaffolding face, cover the whole (tieing in each level and pole) in one or more units, and not exceed 45 degrees to the horizontal.

.Cross bracing shall be provided between inner and outer sets of poles in independent pole scaffolds.

.Platform planks must be laid with their edges close enough together so that tools or materials cannot fall through.

.Where planking is lapped, each plank shall lap its end supports at least 12 inches. Where the ends abut, forming flush surfaces, the butt joint shall be at the centerline of a pole. The abutted ends shall rest on separate putlogs. Intermediate beams must be used to prevent dislodgment of planks where necessary and ends shall be secured to prevent dislodgment.

.When a scaffold materially changes direction, the platform planks shall be laid to prevent tipping. The planks that meet the corner putlog at an angle shall be laid first, extending over the diagonally placed putlog far enough to have a good, safe bearing, but not far enough to involve any danger from tipping. The planking running in the opposite direction at an angle shall be laid so as to extend over the rest on the first layer of planking.

.Guardrails made of lumber not less than 2x4 inches (or other material providing equivalent protection), approximately 42 inches high, with a midrail of 1x6-inch lumber or equivalent material, and toeboards at least 4 inches high

shall be installed on all open sides and ends on all scaffolds more than 10 feet above a working surface.

.Wood pole scaffolds greater than 60 feet in height shall be designed by a qualified engineer competent in this field, and it shall be constructed and erected in accordance with such design. All wood pole scaffolds 60 feet or less in height shall be constructed and erected in accordance with the following Table:

DIMENSIONS AND SPACING OF STRUCTURAL MEMBERS OF
WOOD POLE SCAFFOLDS
SINGLE POLE TYPE

Description of Structural Members	Maximum uniform distributed loads (pounds per square foot) Light Duty	Medium Duty	Heavy Duty
Maximum Height	20'	60'	60'	60'
Poles or Uprights	2x4"	4x4"	4x4"	4x6"
Longitudinal Pole Spacing	6'	10'	8'	6'
Maximum Width of Scaffold	5'	5'	5'	5'
Bearer or Putlogs to 3' Width	2x4"	2x4"	--	--
Bearer or Putlogs to Maximum Width of Scaffold	2x6" or 3x4"	2x6" or 3x4" rough	2x10" or 3x4"	2x10" or 3x4"
Ledgers	1x4"	1-1/4x9"	2x10"	2x10"
Planking	1-1/4x9" rough	2x10"	2x10"	2x10"
Vertical Spacing of Horizontal Member	7'	7'	9'	6-1/2'
Bracing: Horizontal	1x4"	1x4"	1x6" or 1-1/4x4"	2x4"
Diagonal				
Tie-ins	1x4"	1x4"	1x4"	1x4"
Toeboards (min. ht.)	4"	4"	4"	4"
Guardrails (top rails only)	2x4"	2x4"	2x4"	2x4"
Spacing of Bearers or Putlogs	--	--	8'	--

Note: Unless otherwise noted, all dimensions are nominal

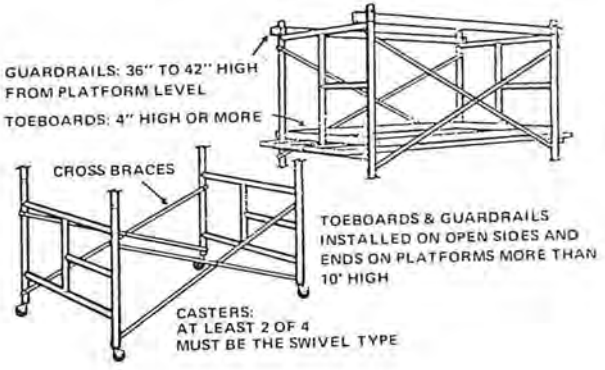
DIMENSIONS AND SPACING OF STRUCTURAL MEMBERS OF
WOOD POLE SCAFFOLDS
INDEPENDENT DOUBLE POLE TYPE

Description of Structural Members	Maximum uniform distributed loads (pounds per square foot) Light Duty (25)	Medium Duty (50)	Heavy Duty (75)
Maximum Height	20'	60'	60'	60'
Poles or Uprights	2x4"	4x4"	4x4"	4x4"
Longitudinal Pole Spacing	6'	10'	8'	6'
Transverse Pole Spacing	6'	10'	8'	6'
Bearer or Putlogs to 3' Width	2x6"	2x10"	2x10"	2x10"
Bearer or Putlogs to Maximum Width of Scaffold	2x6" or 3x4"	2x10" or rough 3x8"	2x10"	2x10" rough
Ledgers	1-1/4x4"	1-1/4x9"	2x10"	2x10"
Planking	1-1/4x9"	2x10"	2x10"	2x10"
Vertical Spacing of Horizontal Member	7'	7'	6'	6'
Bracing: Horizontal	1x4"	1x4"	1x6" or 1-1/4x4"	2x4"
Diagonal			1x4"	
Tie-ins	1x4"	1x4"	1x4"	1x4"
Toeboards (min. ht.)	4"	4"	4"	4"
Guardrails (top rails only)	2x4"	2x4"	2x4"	2x4"
Spacing of Bearers or Putlogs	--	--	8'	--

Tube and Coupler Scaffolds

A light duty tube and coupler scaffold shall have all posts, bearers, runners, and bracing of nominal 2-inch O.D. steel tubing. A medium duty tube and coupler scaffold shall have all posts, runners, and bracing of nominal 2-inch O.D. steel tubing. A heavy duty tube and coupler scaffold shall have all posts, runners, and bracing of nominal 2-inch O.D. steel tubing. When other structural metals are used for these scaffolds, they must be designed to carry an equivalent load. No dissimilar metals can be used together.

All tube and coupler scaffolds shall be limited in heights, working levels, and post spacings as listed in the Table below. All tube and coupler scaffolds shall be constructed and erected to support four times the maximum loads set forth in the same Table. Tube and coupler scaffolds used which are in excess of the limits set forth in the Table must be designed by a qualified professional engineer who is competent in this field.



SPECIFICATIONS FOR TUBE AND COUPLER SCAFFOLDS

Light Duty

Uniformly distributed load.....not to exceed 25 p.s.f.
Maximum post spacing (longitudinal).....10 ft. 0 in.
Maximum post spacing (transverse).....6 ft. 0 in.

Medium Duty

Uniformly distributed load.....not to exceed 50 p.s.f.
Maximum post spacing (longitudinal).....8 ft. 0 in.
Maximum post spacing (transverse).....6 ft. 0 in.

Heavy Duty

Uniformly distributed load.....not to exceed 75 p.s.f.
Maximum post spacing (longitudinal).....6 ft. 6 in.
Maximum post spacing (transverse).....6 ft. 0 in.

- Runners (ribbons) shall be erected along the length of the scaffold, located on both the inside and the outside posts at even height. Runners shall be interlocked to form continuous lengths and coupled to each post. The bottom runners shall be located as close to the base as possible. Runners must not be placed more than 6 feet 6 inches on centers.

- Bearers (putlogs) shall be installed transversely between posts and shall be securely coupled to the posts bearing on the runner coupler. When coupled directly to the runners, the coupler must be kept as close to the posts as possible.

.Bearers (putlogs) shall be at least 4 inches but not more than 12 inches longer than the post spacing or runner spacing.

.Cross bracing shall be installed across the width of the scaffold at least every third set of posts horizontally and every fourth runner vertically. Such bracing shall extend diagonally from the inner and outer runners upward to the next outer and inner runners.

.Longitudinal diagonal bracing on the inner and outer rows of poles shall be installed at approximately a 45 degree angle from near the base of the first outer post upward to the extreme top of the scaffold. Where the longitudinal length of the scaffold permits, such bracing shall be duplicated beginning at every fifth post. In a similar manner, longitudinal diagonal bracing shall also be installed from the last post extending back and upward toward the first post. Where conditions preclude the attachment of this bracing to the posts, it may be attached to the runners.

.The entire scaffold shall be tied to and securely braced against the building at intervals not to exceed 30 feet horizontally and 26 feet vertically.

.Guardrails are required as set forth in the Wood Pole scaffold section.

Tubular Welded Frame Scaffolds

.Metal tubular frame scaffolds, including accessories such as braces, brackets, trusses, screw legs, ladders, etc., shall be designed, constructed, and erected to safely support four times the maximum rated load.

.Spacing of panels or frames shall be consistent with the loads imposed.

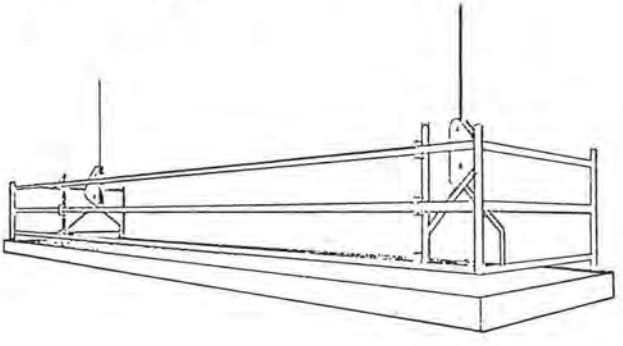
.Scaffolds shall be properly braced by cross or diagonal braces for securing vertical members together laterally, and the cross braces shall be of such length to automatically square and align vertical members so that the erected scaffold is always plumb, square, and rigid.

.The frames shall be placed one on top of the other with coupling or stacking pins to provide proper vertical alignment of the legs.

.Where uplift may occur, panels shall be locked together vertically by pins or other equivalent suitable means.

.Drawings and specifications for all frame scaffolds over 125 feet high above the base plates shall be designed by a registered professional engineer.

.Guardrails are required as set forth in the Wood Pole Scaffold section.



Masons' Adjustable Multiple-Point Suspension Scaffolds

.The scaffold must be capable of sustaining a working load of 50 pounds per square foot and cannot be loaded in excess of this figure.

.The scaffold shall be provided with hoisting machines that meet the Underwriters' Laboratories or Factory Mutual Engineering Corporation requirements.

.The platform must be supported by wire ropes, capable of supporting at least 6 times the intended load, suspended from overhead outrigger beams. The outrigger beams shall consist of structural metal securely fastened or anchored to the floor system of the building or sturcture.

.Each outrigger beam shall be of equivalent strength to at least a standard 7-inch, 15.3-pound steel I-beam, at least 15 feet long, and shall not project more than 6 feet 6 inches beyond the bearing point.

.Where outrigger beams project more than 6 feet 6 inches beyond the bearing point, stronger beams or multiple beams must be used.

.Outrigger beams shall rest on suitable wood bearing blocks and a stop bolt shall be placed at each end of every outrigger beam.

.The use of fiber ropes is prohibited for these types of scaffolds.

.The scaffold platform shall be equivalent to at least 2-inch planking.

.Guardrails are required as set forth in the Wood Pole Scaffold section.

Stone Setters' Adjustable Multiple-Point Suspension Scaffolds

- Scaffolds must be capable of sustaining a working load of 25 pounds per square foot, shall not be overloaded, and must not be used for storage of stone or other heavy material.

- Scaffolds must be provided with hoists which meet the requirements of Underwriters Laboratory or Factory Mutual Engineering Corporation.

- The scaffold shall be supported by wire rope capable of supporting at least 6 times the rated load. All other components shall be capable of supporting at least 4 times the rated load.

- When two or more scaffolds are used, they shall not be bridged one to the other, but shall be maintained at even height with platforms abutting closely.

- Guardrails are required as set forth in the Wood Pole Scaffold section.

Plasterers', Decorators', and Large Area Scaffolds

- Plasterers', lathers', and ceiling workers' inside scaffolds shall be constructed in accordance with the general requirements set forth for independent wood pole scaffolds.

- When independent pole scaffold platforms are erected in sections, such sections shall be provided with connecting runways equipped with substantial guardrails.

.Guardrails are required as set forth in the Wood Pole Scaffold section.

Horse Scaffolds

.Horse scaffolds shall not be constructed or arranged more than two tiers or 10 feet in height.

.Horses shall be spaced not more than 5 feet for medium duty and not more than 8 feet for light duty, and when arranged in tiers, each horse shall be placed directly over the horse in the tier below.

.On all scaffolds arranged in tiers, the legs must be secured to the planks and each tier shall be substantially cross braced.

.The members of the horses which have become weak or defective cannot be used.

.Horizontal members or bearers must not be less than 3x4 inches; the legs not less than 1-1/4x4-1/2 inches; the longitudinal brace between legs not less than 1x6 inches; the gusset brace at the top of the legs not less than 1x8 inches; and half diagonal braces must not be less than 1-1/4x4-1/2 inches.

.Guardrails are required as set forth in the Wood Pole Scaffold section.

Bricklayers' Square Scaffolds

.The squares shall not exceed 5 feet in width and 5 feet in height.

.The minimum dimensions shall be as follows:

Members	Dimensions
Bearers or horizontal members	2x6 inches
Legs	2x6 inches
Braces at corners	1x6 inches
Braces diagonally from center frame	1x8 inches

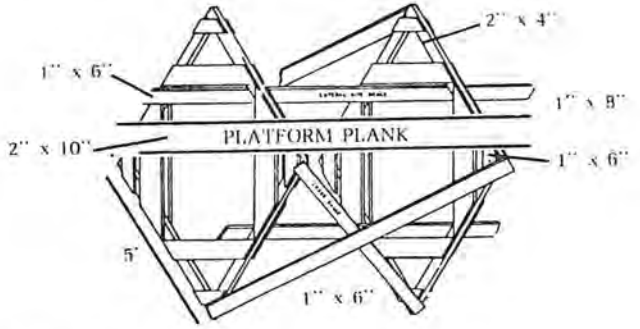
.The squares shall be reinforced on both sides of each corner with 1x6-inch gusset pieces. They shall also have diagonal braces running from center to center of each member, or other means to secure equivalent strength.

.The squares shall be set not more than 5 feet apart for medium duty and 8 feet apart for light duty scaffolds. Bracing extending from the bottom of each square to the top of the next square shall be provided on both front and rear sides of the scaffold.

.Platform planks shall be at least 2x10-inch nominal size. The ends of the planks shall overlap the bearers of the squares and each plank shall be supported by not less than three squares.

.Bricklayers' square scaffolds shall not exceed three tiers in height and shall be so constructed and arranged that one square rests directly above the other. The upper tiers shall stand on a continuous row of planks laid across

the next lower tier and be nailed down or otherwise secure to prevent displacement.



Floor and Wall Openings, and Stairways

- Every open-sided floor or platform 4 feet or more above the adjacent floor or ground level must be railed on all open sides except where there is entrance to a ramp, stairway, or fixed ladder.

- Every stairway floor opening must be guarded on all exposed sides except the entrance to the stairway.

- Floor openings including skylight openings, pits, trapdoors, and manholes must be protected by covers or standard railings.

- Every ladderway floor opening must be guarded by a standard railing and toeboard on all sides, with passage through the railing so constructed as to prevent a person from walking directly into the opening.

- Every runway or catwalk must have railings on all open sides 4 feet or more above ground or floor level.

As a general condition: a standard toeboard and railing are required wherever people walk beneath the open sides of a platform or under similar structures, or where things could fall from the structure (for example, onto workers below).

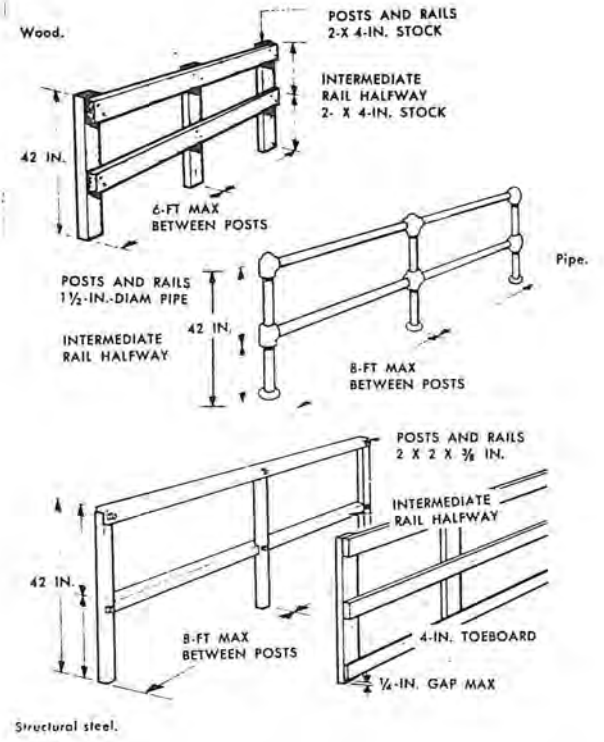
A standard railing consists of a top rail, intermediate rail, and posts. The distance from the upper surface of the top rail to the floor, platform, runway, or ramp must be 42 inches. The intermediate rail must be approximately halfway between the top rail and the floor.

A standard railing can be of any configuration and construction that meets the basic dimension requirements (42 inches high with midrail) and can withstand 200 pounds applied in any direction at any point on the top rail. For wood railings, the rails and posts must be of at least 2 x 4-inch stock with posts spaced not more than 6 feet.

For pipe railings, rails and posts must be at least 1-1/2-inch outside diameter pipe with posts spaced not more than 8 feet.

For structural steel railings, posts and rails must be of 2x2x3/8-inch angles or other metal shapes of equivalent strength with posts spaced not more than 8 feet.

The standard toeboard must be approximately 4 inches in height from the floor to its top edge, with no more than a 1/4-inch gap between the toeboard and the floor. It may be constructed of any substantial material either solid or perforated, as long as the openings are smaller than 1 inch.



Stairways

Riser height and tread width must be uniform throughout any flight of stairs. Stairs and landings with hollow, pan-type treads must be filled to the level of the nosing with solid material during the construction period. Wooden treads in temporary service must be full width.

All treads must be slip resistant, free of hazardous projections such as protruding nails, and kept clear of debris. The angle to the horizontal made by the stairs must be between 30 and 50 degrees. Stairways must be adequately lighted.

The following requirements apply to flights of stairs having four or more risers:

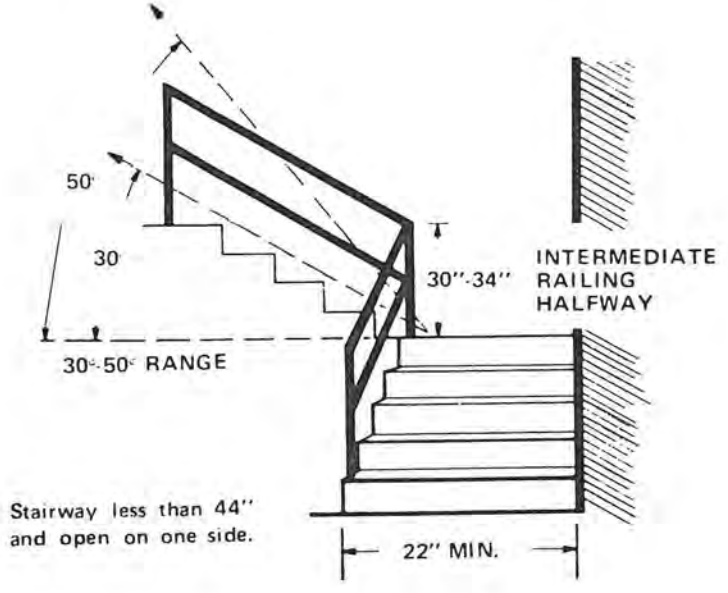
.A stair railing is required on each open side.

.If the stairway is less than 44 inches wide and both sides are enclosed, at least one handrail is required, preferably on the right side descending.

.If the stairway is greater than 44 inches wide, a handrail is required on each enclosed side.

.If the stairway is greater than 88 inches wide, an intermediate stair railing located midway is required.

The vertical height of a stair railing must be 30 to 34 inches, and it must be of construction similar to the standard guard railing.



CRANES AND HOISTS

Cranes

Although the information provided in this section pertains specifically to cranes, these requirements should be applied to all hoisting equipment.

All new cranes constructed and installed or utilized on or after August 31, 1971, must meet the design specifications of the American National Standard Safety Code for Cranes (references in "INFORMATION SOURCES"). Cranes constructed prior to that date should be modified to conform to these design specifications, unless it can be shown that the crane cannot feasibly or economically be altered, and that the crane substantially complies with the requirements. OSHA requirements include:

- Only personnel designated as qualified by the employer shall be permitted to operate cranes.
- The rated load of the crane must be plainly marked on each side of the crane, and be clearly legible to the operator
- Employees should be made aware of the weight of the load.
- Hooks, ropes, chains, brakes, and all functional operating mechanisms must be inspected daily for indications of damage and excessive wear.
- Written and signed inspection reports must be made monthly on critical items such as brakes, hooks, and ropes and be readily available.
- Hand signals to operators should be those prescribed by the applicable ANSI standard for

the type of crane in use (see foldout in back of Guide).

.The hoist chain or rope must be free from kinks or twists and must not be wrapped around the load.

.Hoisting, lowering, swinging, or traveling is not permitted while anyone is on the load or hook.

.Loads must not be carried over the heads of people.

.When the hook is in the extreme low position, at least two complete wraps of rope must remain on the drum. Rope ends must be safely and securely attached to the drum by means of a clamp or socket arrangement approved by the crane or rope manufacturer.

.When making a hookup, the hook must be centered over the load to prevent swinging.

.The trip setting of hoist limit switches must be determined by tests with an empty hook.

.Accessible areas within the swing radius of the rear of the rotating superstructure must be effectively barricaded.

Overhead and Gantry Cranes

OSHA requirements include:

.Access to the cab and/or bridge walkway must be by a conveniently placed fixed ladder, stairway, or platform located so that it is not necessary to step over a gap exceeding 12 inches.

- Exposed moving parts such as gears, set screws, projecting keys, chains, chain sprockets, and reciprocating components which might constitute a hazard under normal operating conditions must be guarded.

- If a service receptacle is provided in the cab or on the bridge of cab-operated cranes, it must be a grounded three-prong type permanent receptacle.

- A carbon dioxide, dry-chemical, or equivalent hand fire extinguisher must be kept in the cab.

- Each independent hoisting unit must be equipped with at least one self-setting holding brake applied directly to the motor shaft or some part of the gear train which is applied automatically when power is removed.

CRAWLER, LOCOMOTIVE AND TRUCK CRANES

OSHA requirements include:

- A substantial and durable rating chart with clearly legible letters and figures must be provided with each crane and securely fixed to the crane cab in a location easily visible to the operator while seated at his control station.

- A carbon dioxide, dry chemical, or equivalent fire extinguisher must be kept in the cab or vicinity of the crane.

- The minimum clearance between cranes and powerlines must be 10 feet except where the powerlines have been deenergized and visibly

grounded at the point of work, or where separate insulating barriers have been erected.

.Any overhead wire must be considered to be an energized line until electrical utility authorities indicate otherwise.

Hoists

These requirements should be applied to all hoisting equipment:

.The rated load must be legibly marked on each side of the hoist. Employees should be made aware of the weight of the load.

.The hoist must be equipped with a self-setting brake, applied to the motor shaft or some part of the gear train.

.For powered hoists, holding brakes must be applied automatically when the power is off.

.Hooks, chains, and all functional operating mechanisms must be visually inspected daily for any indication of damage and wear, and monthly records maintained.

.Loads must not be carried over the heads of people.

.The operator must test the brakes each time a near-capacity load is handled. This test is done by raising the load a few inches and applying the brakes.

.The hoist rope or chain must be free from kinks or twists and not be wrapped around the load.

Hoists used on construction sites:

- The employer must comply with the manufacturer's specifications and limitations.

- Rated load capacities, recommended operating speeds, and special hazard warnings or instructions must be posted on cars and platforms.

- Hoistway entrances must be protected by substantial gates or bars.

- Hoistway doors or gates must be not less than 6 feet 6 inches high, and must be provided with mechanical locks which cannot be operated from the landing side, and must be accessible only to persons on the car.

- Overhead protective coverings must be provided on the top of the hoist cage or platform.

MATERIAL HANDLING EQUIPMENT

General

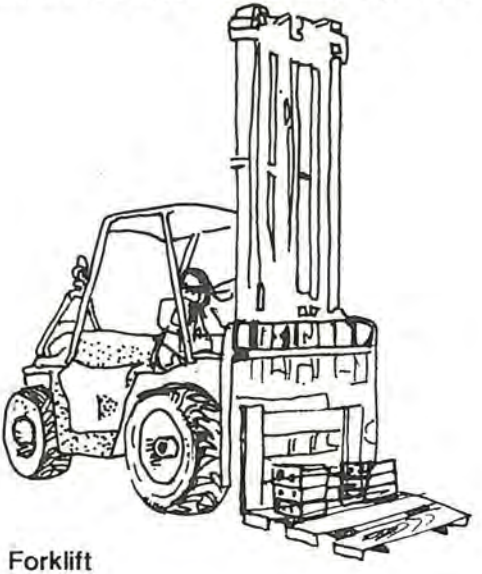
All material handling equipment must be checked at the beginning of each shift to insure that all parts, equipment, and accessories are free from apparent damage and in good operating condition.

Industrial Trucks

Powered industrial trucks are classified into categories for the purpose of determining what type of truck may be used in a certain location. The type of hazard in a location determines whether diesel, electric, gasoline, or LP-gas powered trucks may be used and what additional safeguards must be present. Suppliers can assist in the proper selection.

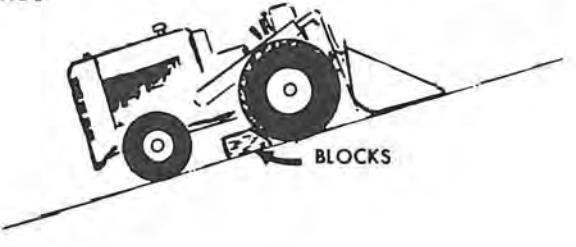
.High-lift-rider trucks must be fitted with an overhead guard to protect the operator from falling objects.

.Operators must be trained in the safe operation of powered industrial trucks, and only trained and authorized operators may operate the truck.



Forklift

.When a powered industrial truck is left unattended (operator 25 feet or more away or truck not in view), the forks must be fully lowered, the control lever positioned in neutral, the power shut off, and the brakes set. The wheels must be blocked if parked on an incline.



.Industrial trucks must be examined daily for any conditions adversely affecting the safety of the vehicle before being placed into service. If the truck is used around the clock, it must be inspected after each shift. Any defects found must be reported and corrected before the truck is placed in service. A record of all maintenance and repairs should be kept.

.If the load being carried obstructs forward view, the operator is required to travel with the load trailing.

.When unloading or loading from trucks, trailers, or railroad cars with forklift trucks, provisions must be made for securing the truck, trailer, or railroad car by setting the brakes and placing wheel chocks under the rear wheels. Portable dock boards must be secured in position with devices which will prevent their slipping during loading and unloading.

.If battery-operated equipment is used, the battery charging area is to be designated with a "NO SMOKING" sign due to the hydrogen gas emitted during the charging process.

Hydraulic Lift Skid Trucks

A hydraulic lift truck that shows signs of leaking should be taken out of service until it can be repaired. The leaking can cause the load to settle.

Hand Trucks

Operators of hand trucks should wear foot protection. Hand trucks should be fitted with knuckle guards to prevent jamming the hands into obstructions.

RECORDKEEPING REQUIREMENTS

Recordkeeping requirements under the OSHA Act provide the statistical basis from which rates of occupational injury and illness are determined. These records provide employers with a measure for evaluating the high-risk areas of their business to which attention should be directed. Employers must report within 48 hours to OSHA (or a state agency in states which have operational safety and health plans) any incident or accident which results in a fatality, or hospitalization of 5 or more employees.

Federal regulations require employers with 11 or more employees at any time during the preceding calendar year to complete OSHA Form 200 (or an equivalent). OSHA Form 200 replaces OSHA Forms 100 and 102, and all data collected after January 1, 1978, must be recorded on the new form. The following information must be recorded on the OSHA Form 200 (Log and Summary of Occupational Injuries and Illnesses): every occupational death, every nonfatal occupational illness or injury which involves loss of consciousness, restriction of work or motion, transfer to another job, or medical treatment (other than first aid). Injuries and illnesses are classified by lost workdays, restriction of duties, and no lost time. The form must be kept current to within 6 days.

OSHA Form 200 also serves as the annual summary, replacing OSHA Form 102. This summary must be completed by February 1 of each year, and copies must be posted in each established workplace for the entire month of February. Employers (such as special trade contractors) whose employees do not primarily work in a single establishment must present or mail a copy of the summary portion of OSHA Form 200 during

the month of February to each employee who receives pay during February.

A supplementary record must be completed for each reportable case. OSHA Form 101 may be used; a state worker's compensation report or other form is acceptable if it contains the same information as the OSHA 101.

All OSHA recordkeeping forms must be maintained for 5 years, excluding the current calendar year.

Employers are also required to maintain accurate records of certain potentially toxic or harmful physical agents which must be monitored or measured and to promptly advise employees of any excessive exposure and the corrective action taken. In certain cases, physical examinations and testing are required. Examples of these agents are asbestos, ionizing radiation, etc. Any OSHA office can supply a list of these hazardous substances and explain what records may be required.

job safety and health protection

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers through the promotion of safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

Employers: **Each employer shall furnish to each of his employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to his employees; and shall comply with occupational safety and health standards issued under the Act.**

Employees: **Each employee shall comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to his own actions and conduct on the job.**

The Occupational Safety and Health Administration (OSHA) of the Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards and its Compliance Safety and Health Officers conduct jobsite inspections to ensure compliance with the Act.

Inspection: The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint: Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or otherwise exercising their rights under the Act.

An employee who believes he has been discriminated against may file a complaint with the nearest OSHA office within 30 days of the alleged discrimination.

Citation: If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty: The Act provides for mandatory penalties against employers of up to $1,000 for each serious violation and for optional penalties of up to $1,000 for each nonserious violation. Penalties of up to $7,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to $10,000 for each such violation.

Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of not more than $10,000 or by imprisonment for not more than six months, or by both. Conviction of an employer after a first conviction doubles these maximum penalties.

Voluntary Activity: While providing penalties for violations, the Act also encourages efforts by labor and management before an OSHA inspection to reduce injuries and illnesses arising out of employment.

More Information: **Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from the nearest OSHA Regional Office in the following locations:**

Atlanta, Georgia
Boston, Massachusetts
Chicago, Illinois
Dallas, Texas
Denver, Colorado
Kansas City, Missouri
New York, New York
Philadelphia, Pennsylvania
San Francisco, California
Seattle, Washington

Telephone numbers for these offices, and additional Area Office locations, are listed in the telephone directory under the United States Department of Labor in the United States Government listing.

Washington, D.C.
1974
OSHA 2203

Peter J. Brennan
Secretary of Labor

U.S. Department of Labor
Occupational Safety and Health Administration

Checklists

Since safe conditions depend on identifying and correcting hazards, periodic inspections are one of the most important aspects of a successful safety and health program.

Management will find a checklist, such as the one presented on the following pages, helpful in performing inspections of the facility. Because businesses vary, it is best that each business develop a customized list from the information in this booklet, other information sources, and a walk-through inspection.

Using this checklist, the manager, supervisor, or employee representative should inspect all new construction sites and make periodic inspections of established worksites to identify potential problem areas so appropriate corrective action may be taken.

References made in the "CHECKLIST" subtitles refer to appropriate sections of "Construction Safety and Health Regulations, Title 29 Code of Federal Regulations Part 1926."

YES NO

GENERAL SAFETY AND HEALTH PROVISIONS

Safety Training and Education (29 CFR 1926.21)

Are employees instructed in the recognition and avoidance of unsafe conditions and operations?

Do employees receive training in safe handling practices of hazardous materials such as acids, caustics, flammables, etc?

YES NO

Housekeeping (29 CFR 1926.25)

Are all worksites kept clean and orderly?

Is combustible scrap, debris, and waste stored safely and removed from the worksite promptly?

YES NO

OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROLS

Medical Services and First Aid (29 CFR 1926.50)

Is there a clinic, hospital, or physician reasonably accessible to the worksite, and are provisions made for transportation of an injured person?

In the absence of an accessible clinic, hospital, or physician, is there a person certified in first aid at the worksite?

Are first aid supplies available, approved by a consulting physician, and stored in a weatherproof container?

Are emergency phone numbers posted?

YES NO

Sanitation (29 CFR 1926.51)

Are adequate supplies of potable water available, stored, and dispensed in a sanitary manner?

Are all outlets for water which is not suitable for drinking clearly posted as "UNSAFE FOR DRINKING, WASHING, AND COOKING"?

Are sufficient numbers of toilets provided for employees at the job site?

YES NO

Occupational Noise Exposure (29 CFR 1926.52)

Have noise levels for powered equipment been determined?

Are workers protected from high noise levels by engineering or hearing protective devices (ear muffs or ear plugs)?

YES NO

Gases, vapors, fumes, dusts, and mists (29 CFR 1926.55)

Are employee exposures to gases, vapors, fumes, dusts, and mists kept below permissable limits by the use of engineering controls or protective equipment?

YES NO

Ventilation (29 CFR 1926.57)

When ventilation systems are used to keep airborne contaminants below hazardous levels, are the systems designed, maintained, and operated to prevent overexposures to workers?

YES NO

PERSONAL PROTECTIVE AND LIFE SAVING EQUIPMENT

Are hard hats worn by all workers in the construction area?

YES NO

Hearing Protection (29 CFR 1926.100)
Are hearing protective devices (ear plugs or ear muffs) available and worn in all high-noise areas?

Eye and Face Protection (29 CFR 1926.102)

Are appropriate goggles, safety glasses, faceshields, and masks available and in use for all operations which may pose hazards to the face and eyes?

Respiratory Protection (29 CFR 1926.103)

Is approved respiratory protective equipment (dust or vapor respirators, gas masks, or air-supplied respirators) available and in use where required?

Are there written standard operating procedures for the selection and use of respirators?

YES NO

Are employees instructed in the proper use, fit, and limitations of respirators?

Where practicable, are respirators assigned for use by employees individually?

Are respirators cleaned and disinfected after use?

Are respirators stored in a convenient, clean, and sanitary location?

Are routinely-used respirators inspected during cleaning?

Safety Belts, Lifelines (29 CFR 1926.104)

Are lifelines and safety belts provided for and used by workmen exposed to the hazard of falling?

Are lifelines attached to a structural member capable of supporting a minimum dead weight of 5,400 pounds?

Do lifelines have a minimum breaking strength of 5,400 pounds?

Is safety belt lanyard of a length to provide for a fall of 6 feet or less?

YES NO

Safety Nets (29 CFR 1926.105)

Are safety nets provided when workplaces are more than 25 feet above ground or water surfaces or other places where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, or safety belts is impractical?

Do safety nets extend 8 feet beyond the edge of the work surface where employees are exposed?

YES NO

FIRE PROTECTION AND PREVENTION

Fire Protection (29 CFR 1926.150)

Has a fire protection plan for all phases of construction work been developed?

Is all firefighting equipment conspicuously located, inspected, and maintained in good operating condition?

Are extinguishers selected for type of materials in areas where they are to be used?

Class A Ordinary combustible material fires

Class B Flammable liquid, gases, grease fires

Class C Energized electrical equipment fires

Are extinguishers fully charged and in designated places?

Are extinguishers free from obstruction or blockage?

Have all extinguishers been hydrostatically tested according to schedules set for the type of extinguisher?

YES NO

Are appropriate fire extinguishers mounted within 75 feet of outside areas containing flammable liquids and within 10 feet of any inside storage for such materials?

Are driveways in and around open storage areas 15 feet wide, and are all such areas 1 foot away from any building or structure?

Is there a suitable water supply for fire fighting?

Is there an emergency alarm system or telephone available?

Fire Prevention (29 CFR 1926.151)

Are potential ignition sources identified and controlled (electrical wiring and fixtures, exhausts from fuel-powered equipment, smoking, flammable, and combustible materials)?

Is proper storage practiced to minimize the risk of fire?

Are fire doors and emergency exits kept clear and unlocked?

YES NO

Flammable and Combustible Liquids (29 CFR 1926.152)

Are approved containers and tanks used for storage and handling of flammable and combustible liquids?

Are approved storage cabinets used for indoor storage of flammable and combustible liquids?

Are all connections on drums and combustible liquid piping vapor- and liquid-tight?

Are flammable liquids kept in closed containers when not in use (e.g., parts cleaning tanks, or pans, etc.)?

YES NO

Are all spills of flammable or combustible liquids cleaned up promptly?

Is combustible waste material (oily rags, etc.) stored in covered metal receptacles and disposed of daily?

Are bulk drums of flammable liquids grounded and bonded to containers during dispensing?

Do storage rooms for flammable and combustible liquids have explosion-proof lights?

Do storage rooms for flammable and combustible liquids have mechanical or gravity ventilation (at least six air changes per hour)?

Are storage cabinets for flammable liquids labeled "FLAMMABLE--KEEP FIRE AWAY"?

Is there never more than 1 day's supply of flammable liquids outside of approved storage cabinets or rooms?

Liquified Petroleum Gas (LP-Gas)(29 CFR 1926.153)

Is liquified petroleum gas stored, handled, and used in accordance with safe practices and standards?

YES NO

Temporary Heating Devices (29 CFR 1926.154)

Is adequate ventilation supplied for temporary heating devices, especially when they are used in confined spaces?

Are heaters provided with adequate clearance, and separated from combustible canvas, tarpaulins, and other coverings by at least 10 feet?

Are solid-fuel salamanders prohibited from use inside buildings and on scaffolds?

YES NO

SIGNS, SIGNALS, AND BARRICADES

Accident Prevention Signs and Tags (29 CFR 1926.200)

Are danger signs used in areas where immediate hazards exist?

Are caution signs used to warn against potential hazards or unsafe work practices?

Are exit signs, safety instruction signs, and directional signs posted as needed?

Are accident prevention tags used to warn employees of hazards such as defective tools and equipment?

YES NO

Barricades (29 CFR 1926.202)

When barricades are used, do they conform to American National Standards Institute D6.1-1971, Manual on Uniform Traffic Control Devices for Streets and Highways?

YES NO

MATERIALS HANDLING, STORAGE, USE, AND DISPOSAL

General Requirements for Storage (29 CFR 1926.250)

Are specifications posted for maximum loads which are approved for floors (except slabs with no basements), roof of a building, or some other structure?

Is there safe clearance for equipment through aisles and doors?

Is stored material stable and secure?

YES NO

Are bagged materials stacked by stepping back the bags and crosskeying at least every 10 bags high?

Are loose brick stacks a maximum of 7 feet high?

Are brick stacks tapered back 2 inches in every foot above the 4-foot level?

Are masonry blocks tapered back one-half block per tier above the 6-foot level?

Are storage areas free from tripping hazards?

YES NO

Rigging Equipment for Material Handling (29 CFR 1926.251)

Is rigging equipment loaded in accordance with maximum allowable working loads and rated capacities?

Is all rigging equipment inspected at least once per shift?

Are all specifications for chains, wire rope, natural and synthetic fiber rope, synthetic webbing, and shackles and hooks observed?

Disposal of Waste Materials (29 CFR 1926.252)

Are chutes enclosed when materials drop over 20 feet?

Are barricades (42 inches high) not less than 6 feet back from projected openings when debris is dropped through holes for a drop of less than 20 feet?

Are all scraps, waste, and rubbish removed promptly from the work area?

Are all solvent wastes, flammable liquids, and oily rags kept in fire-resistant, covered containers until they are removed from the worksite?

YES NO

HAND AND POWER TOOLS (29 CFR 1926.300-.305)

Are tools and equipment (both company and employee-owned) in good condition?

Have mushroomed heads on chisels, punches, etc. been reconditioned or replaced if necessary?

Have broken hammer handles been replaced?

Have worn or bent wrenches been replaced?

Has compressed air used for cleaning been reduced to 30 psi when dead-ended?

Have deteriorated air hoses been replaced?

Are belts, pulleys, and rotating shafts (air compressor, drill presses, etc.) properly guarded?

Are all in-going nip points properly guarded?

Are chains, sprockets, and gears properly guarded?

Are rotating shafts that are not smooth properly guarded?

Are all rotating parts (lubrication fittings, etc.) recessed or covered with collars?

Are all pieces of equipment with an electric motor or any electrical connection effectively grounded?

Are sprockets and V-belt drives within reach of platforms and passageways, or less than 7 feet from the floor completely enclosed?

YES NO

Are fans less than 7 feet above the floor guarded, having openings 1/2 inch or less?

Are machines with cutting actions such as bandsaws and circular saws properly guarded?

Are machines with punching, bending, and shearing actions properly guarded?

On portable abrasive wheel machinery, are guards provided such that the maximum angular exposure of the wheel is 180 degrees?

Are goggles of face shields always worn while grinding?

Are bench and pedestal grinders permanently mounted?

Are jacks checked periodically to see if they are in good condition?

Are loads on jacks cribbed, blocked, or secured at once?

Are all jacks labeled for maximum load capacity?

YES NO

ELECTRICAL

General Requirements (29 CFR 1926.400)

Have exposed wires, frayed cords, and deteriorated insulation been repaired or replaced?

Are exposed bulbs or sockets guarded on temporary lights to prevent accidental contact?

Are junction boxes, outlets, switches, etc., covered?

Is the location of power lines and cables determined before any work is begun on the job site?

YES NO

Grounding and Bonding (29 CFR 1926.401)

Is all metal, fixed equipment grounded?

Does all equipment connected by cord and plug have grounded connections?

Are appliances such as vacuums, polishers, vending machines, etc., grounded?

Do all hand and power tools have double insulation or are they grounded?

Do all extension cords being used have a ground wire?

Are all plugs equipped with ground pins?

Are approved ground-falt circuit interruptors in use on all non-permanent 120 volt, single-phase, 15-20 ampere outlets, or is an assured equipment grounding program in effect?

Equipment Installation and Maintenance
(29 CFR 1926.402)

Are flexible cords and cables free from splices or tape?

Are flexible cords and cables fastened so that there is no direct pull on joints or terminal screws?

Are flexible cords and cables never substituted for fixed wiring?

Are temporary lights suspended by electrical cords which are approved for that use?

Are breaker switches identified as to their use?

Are flexible cords and cables not attached to building surfaces?

YES NO

LADDERS AND SCAFFOLDING

Ladders (29 CFR 1926.450)

Have defective ladders (e.g., broken rungs, side rails, etc.) been removed from service for repair or destruction and tagged as "Dangerous, Do Not Use"?

Is it prohibited to use the top of an ordinary step ladder as a step?

Do fixed ladders have at least 3-1/2 feet extensions at the top of the landing?

Do portable rung ladders have non-slip bases?

Are job-made ladders built according to standards?

Is the distance between the centerline of rungs on a fixed ladder and the nearest permanent object in back of the ladder at least 7 inches or more?

YES NO

Are the maximum lengths of portable wooden and metal ladders being observed?

Do all fixed ladders have a preferred angle of 75-90 degrees?

Scaffolding (29 CFR 1926.451)

Is the footing or anchorage sound and rigid to carry the intended load?

Are guardrails, midrails, and toeboards installed on all open sides and ends of platforms which are higher than 10 feet?

Do planks extend over end supports by 6 to 12 inches?

Are scaffolds secured to permanent structures?

Is there an access ladder or equivalent?

Is the platform width 20 inches or more?

Will the scaffold and its support be capable of supporting the load, by a factor of four, it is designed to carry?

Are there any defective parts?

YES NO

FLOOR AND WALL OPENINGS, AND STAIRWAYS

Guardrails, Handrails, and Covers (29 CFR 1926.500)

Are floor and roof openings and holes guarded by standard railings and toeboards on all exposed sides?

Are wall openings (from which there is a drop of more than 4 feet, and the bottom of the wall opening is less than 3 feet above the floor) guarded with standard or intermediate railings, standard toeboards, or enclosing screens?

Are open sided floors, platforms, and runways more than 6 feet high equipped with standard guardrails?

YES NO

Stairways (29 CFR 1926.501)

Are there standard stair rails or handrails on all stairways having four or more risers?

Are stairways kept free of hazardous projections (such as protruding rails), debris, and waste materials?

Are hollow, pan-type treads of metal stairways and landings filled with solid material?

Do temporary stairs have a landing (not less than 30 inches in the direction of travel) for every 12 feet of vertical rise?

Do stairs angle no more than 50 degrees and no less than 30 degrees?

CRANES, DERRICKS, HOISTS, ELEVATORS, AND CONVEYORS

Cranes and Derricks (29 CFR 1926.550)

Are operators properly trained and are they following the manufacturer's specifications and limitations for the equipment?

Are proper hand signals being used?

Are special hazard warnings or instructions posted on equipment and visible to the operator?

Has equipment been inspected and any deficiencies corrected prior to use of equipment?

YES NO

Are barricades adequate around the swing radius of revolving superstructures?

Is the equipment 10 feet or more (0.4 inches for each 1 kV over 50) away from any line of 50 kV or more?

Have appropriate precautions been taken (de-energizing line) for work which is close to power lines?

Are moving parts on equipment guarded?

Are fire extinguishers provided in cabs or operator stations?

Material Hoists, Personnel Hoists, and Elevators (29 CFR 1926.552)

Are all material hoists, personnel hoists, and elevators constructed, operated, and maintained in accordance with manufacturer's specifications?

Are rated load capacities, recommended operating speeds, and operating instructions posted on cars and platforms?

Are persons prohibited from riding on material hoists, and are hoists posted "NO RIDERS ALLOWED"?

YES NO

MOTOR VEHICLES, MECHANIZED EQUIPMENT, AND MARINE OPERATIONS

Material Handling Equipment (29 CFR 1926.602)

Are only trained operators allowed to operate powered lift trucks?

Are appropriate overhead guards installed on all powered lift trucks?

Are motorized vehicles and mechanized equipment inspected daily or prior to use?

RECORDKEEPING

General Requirements (29 CFR 1903.2, 1904.2-.8)

Is an employee poster (OSHA or equivalent state poster) prominently displayed?

Have occupational injuries and illnesses, except minor injuries requiring only first aid, been recorded on OSHA Form No. 200 or its equivalent?

Has a sumary of all occupational injuries and illnesses been compiled at the conclusion of each calendar year, and been recorded on OSHA Form No. 200? Is this form posted or distributed to all employees during the month of February?

Have all OSHA records been maintained for a period of 5 years, excluding the current year?

LIST OF FIRST AID SUPPLIES

Regardless of the type of work being done, an adequate supply of first aid equipment should be available. Supplies must be packaged in a weatherproof container and checked at least weekly. The specific items and the number of each should be based on the recommendations of a physician. Some suggestions are given in the Table below:

Suggested Minimum First Aid Supplies

ITEM	NUMBER OF EMPLOYEES 1-50	51-100	101-200*
Adhesive bandage, individually packaged	16	32	64
Burn compound, tube or package	1	2	2
Ammonia inhalant	1	1	1
Antiseptic swabs, individually packaged	10	20	30
3" x 3" gauze pads, individually packaged	10	20	30
2" x 10 yd. gauze bandage	2	2	2
Triangular bandage	1	1	1
Adhesive tape, rolls	2	2	3
Scissors	1	1	1
Tweezers	1	1	1
Cleansing tissue, package	1	1	1
Antiseptic solution, aqueous mercury preferred	1	1	1
Mild soap, capped squeeze bottle	1	1	1
Elastic bandage	1	1	1
Rescusitation mouthpiece	1	1	1

*Greater than 200 employees: Provide additional first aid cabinets or increase supplies as demonstrated by past use.

INFORMATION SOURCES

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
1430 Broadway
New York, New York 10018

A10.8	Safety Requirements for Scaffolds
A10.10	Safety Requirements for Temporary Space Heating Devices and Equipment Used in Construction Industry
A10.8,92.1	Scaffolds
A10.20-1977	Safety Requirements for Ceramic Tile, Terrazzo, and Marble Work
A12.1	Floor and Wall Openings
A14.1	Portable Wood Ladders
A58.1	Minimum Design Load
A64.1	Fixed Stairs
B9.1	Mechanical Refrigeration
B11.1	Care and Use of Mechanical Power Presses
B15.1	Mechanical Power Transmission
B30	Cranes and Hoists
B30.16-1973	Overhead Hoists
B30.2.0-1967	Cranes, Overhead and Gantry
B30.6	Safety Code for Cranes, Derricks, Hoists, Jacks, and Slings

B30.9-1971	Slings
C1	National Electrical Code
M11.1	Wire Rope
Z4.1	Sanitation in Places of Employment
Z35.2	Specifications for Accident Prevention Tags
Z41	Safety Shoes
Z49.1	Welding and Cutting
Z87.1	Eye and Face Protection
Z88.1,88.2	Respiratory Protection
Z89.2	Protective Headgear

NIOSH AND OSHA REGIONAL OFFICES

The following pages list NIOSH and OSHA regional offices. Either of these facilities serving the state can provide information on the Occupational Safety and Health Act including questions on standards interpretations, voluntary compliance information, copies of the OSHA Standards, OSH Act, Employee Rights Posting Notice, and other OSHA publications.

NIOSH REGIONAL OFFICES

DHEW, Region I
JFK Federal Bldg.
Room 1401
Boston, Massachusetts 02203
617/223-6668

DHEW, Region II
26 Federal Plaza, Room 3300
New York, New York 10007
212/264-2485

DHEW, Region III
P. O. Box 13716
Philadelphia, PA 19101
215/596-6716

DHEW, Region IV
101 Marietta Tower
Atlanta, GA 30323
404/221-2396

DHEW, Region V
300 South Wacker Dr.
33rd Floor
Chicago, IL 60606
312/886-3651

DHEW, Region VI
1200 Main Tower Bldg.
Dallas, Texas 75202
214/655-3081

DHEW, Region VII
601 E. 12th St.
5th Floor West
Kansas City, Missouri 64106
816/374-5332

DHEW, Region VIII
11037 Federal Bldg.
Denver, Colorado 80294
303/837-3979

DHEW, Region IX
50 United Nation Plaza, Rm. 231
San Francisco, CA 94102
415/556-3781

DHEW, Region X
1321 Second Ave., Mail Stop 502
Seattle, Washington 98101
206/442-0530

OSHA REGIONAL OFFICES

Region I
U.S. Department of Labor
Occupational Safety and Health Administration
JFK Building, Room 1804
Boston, Massachusetts 02203 ..... Telephone: 617/223-6712/3

Region II
U.S. Department of Labor
Occupational Safety and Health Administration
1515 Broadway (1 Astor Plaza), Room 3445
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Trade associations, state and local governmental agencies, and insurance companies can also provide useful information. The Small Business Administration will provide information concerning procedures for securing economic assistance in compliance with the OSHA Standards (if needed).

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HOW TO LIFT SAFELY

The following safe practices should be observed in order to avoid injury.

The factors that contribute to safe lifting are...

DETERMINE IF OBJECTS CAN BE LIFTED AND CARRIED SAFELY.

1. Approach the load and size it up (weight, size and shape.)
Consider your physcial ability to handle the load.

2. Place the feet close to the object to be lifted 8 to 12 inches apart for good balance.

3. Bend the knees to the degree that is comfortable and get a good handhold. Then using both leg and back muscles. . .

4. Lift the load straight up—smoothly and evenly. Pushing with your legs, keep load close to your body.

5. Lift the object into carrying position, making no turning or twisting movements until the lift is completed.

6. Turn your body with changes of foot position after looking over your path of travel making sure it is clear.

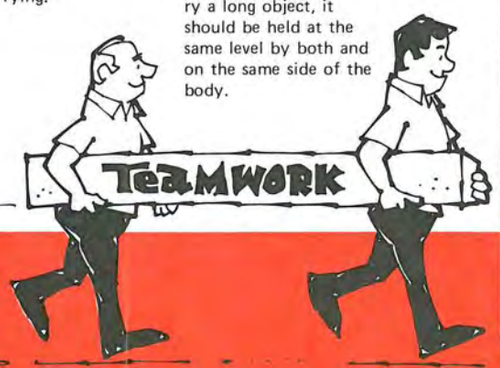
7. Setting the load down, is just as important as picking it up. Using leg and back muscles, comfortably lower load by bending your knees. When load is securely positioned, release your grip.

Stack material in such a manner as to permit full view while carrying.

When lifting and carrying with another person—teamwork is important.

The load should be equally distributed. Movements must be coordinated so you both start and finish the lift action at the same time and perform turning movements together.

When two persons carry a long object, it should be held at the same level by both and on the same side of the body.



Avoid strain by storing heavy objects at least 12 inches above the floor.

Avoid awkward positions or twisting movements while lifting.

Over-reaching and stretching to reach overhead objects may result in strains or falls.

Use a ladder instead of chairs, boxes, etc.

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

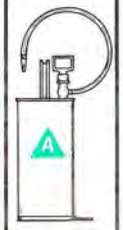
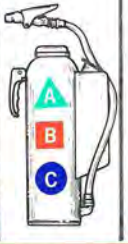
KIND OF FIRE

DECIDE THE CLASS OF FIRE YOU ARE FIGHTING. . .

. . .THEN CHECK THE COLUMNS TO THE RIGHT OF THAT CLASS

APPROVED TYPE OF EXTINGUISHER

MATCH UP PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT

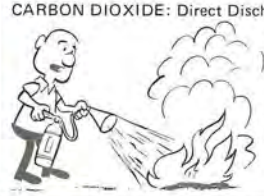
	FOAM Solution of Aluminum Sulphate and Bicarbonate of Soda	CARBON DIOXIDE Carbon Dioxide Gas Under Pressure	SODA ACID Bicarbonate of Soda Solution and Sulphuric Acid	PUMP TANK Plain Water	GAS CARTRIDGE Water Expelled by Carbon Dioxide Gas	MULTI-PURPOSE DRY CHEMICAL	ORDINARY DRY CHEMICAL
CLASS A FIRES USE THESE EXTINGUISHERS ORDINARY COMBUSTIBLES • WOOD • PAPER • CLOTH ETC.							
CLASS B FIRES USE THESE EXTINGUISHERS FLAMMABLE LIQUIDS, GREASE • GASOLINE • PAINTS • OILS, ETC.							
CLASS C FIRES USE THESE EXTINGUISHERS ELECTRICAL EQUIPMENT • MOTORS • SWITCHES ETC.							

IMPORTANT! USING THE WRONG TYPE EXTINGUISHER FOR THE CLASS OF FIRE MAYBE DANGEROUS!

HOW TO OPERATE

FOAM: Don't Play Stream into the Burning Liquid. Allow Foam to Fall Lightly on Fire.

CARBON DIOXIDE: Direct Discharge as Close to Fire as Possible. First at Edge of Flames and Gradually Forward and Upward



SODA-ACID, GAS CARTRIDGE: Direct Stream at Base of Flame

PUMP TANK: Place Foot on Footrest and Direct Stream at Base of Flames

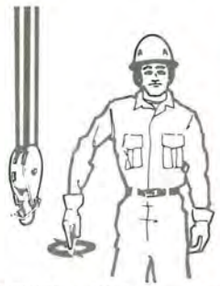
DRY CHEMICAL: Direct at the Base of the Flames. In the Case of Class A Fires, Follow Up by Directing the Dry Chemicals at Remaining Material That is Burning

TABLE I

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

STANDARD HAND SIGNALS FOR CONTROLLING CRAWLER, LOCOMOTIVE, AND TRUCK CRANE OPERATIONS

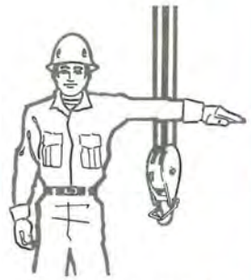
HOIST. With forearm vertical, forefinger pointing up, move hand in small horizontal circle.



LOWER. With arm extended downward, forefinger pointing down, move hand in small horizontal circle.

USE MAIN HOIST. Tap fist on head, then use regular signals.

SWING. Arm extended point with finger in direction of swing of boom.



STOP. Arm extended, palm down, hold position rigidly.

EMERGENCY STOP. Arm extended, palm down, move hand rapidly right and left.

USE WHIPLINE (Auxiliary Hoist). Tap elbow with one hand, then use regular signals.

RAISE BOOM. Arm extended, fingers closed, thumb pointing upward.

LOWER BOOM. Arm extended, fingers closed, thumb pointing downward.

TRAVEL. Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.

DOG EVERYTHING. Clasp hands in front of body.

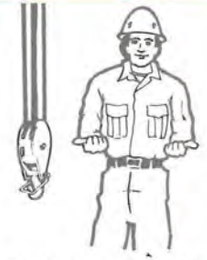
TRAVEL (Both Tracks). Use both fists in front of body, making a circular motion about each other, indicating direction of travel, forward or backward (For crawler cranes only).

MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist slowly shown as example).

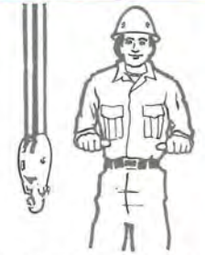
RAISE THE BOOM AND LOWER THE LOAD. With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.

LOWER THE BOOM AND RAISE THE LOAD. With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.

TRAVEL. (One Track) Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body. (For crawler cranes only).



EXTEND BOOM. (Telescoping Booms). Both fists in front of body with thumbs pointing outward.



RETRACT BOOM. (Telescoping Booms). Both fists in front of body with thumbs pointing toward each other.

RETRACT BOOM. (Telescoping Boom). One Hand Signal. One fist in front of chest, thumb pointing outward and heel of fist tapping chest.

EXTEND BOOM. (Telescoping Boom). One hand Signal. One fist in front of chest with thumb tapping chest.

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