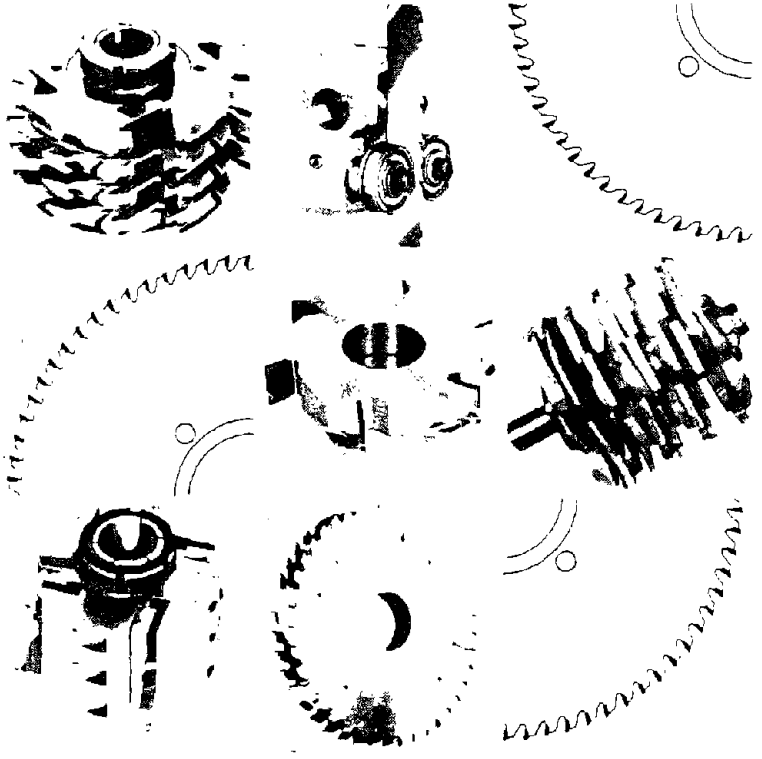
NIOSH

Health and Safety Guide for Manufacturers of Woodworking Machinery



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 MANUFACTURERS OF WOODWORKING MACHINERY

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health
Division of Technical Services
Cincinnati, Ohio

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DISCLAIMER

Mention of company name or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

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This Guide was prepared under the direction of Gerald J. Karches, Chief, Technical Information Development Branch (TIDB), Division of Technical Services, National Institute for Occupational Safety and Health (NIOSH), with the help of individuals from the NIOSH Regional Offices and the industry involved. Information was obtained from state and Federal agencies, trade associations, and insurance companies and through site visits at various locations. P. A. Froehlich, Chief, Technical Publications Development Section, TIDB, had responsibility for preparation of the Guide. Principal contributors to its development were: Thomas F. Bloom, Industrial Hygiene Engineer, TIDB; Paul Roper, Regional Consultant, Region IV, NIOSH; Melvin T. Okawa, Regional Consultant, Region IX, NIOSH; Gregory M. Coffey, Writer-Editor, TIDB; and Jeffrey R. Waddle, Editorial Assistant, TIDB.

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 authorizes the 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 Guide was developed for manufacturers of woodworking machinery or components of woodworking machinery.

While the aim of this Guide is to assist in providing a safe and healthful workplace by describing both safe practices and some of the more frequently encountered violations of the 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).

The words "must," "shall," "required," and "necessary" appearing in the text indicate requirements under the Federal Regulations. Procedures indicated by "should" and "suggested" constitute generally accepted good practices.

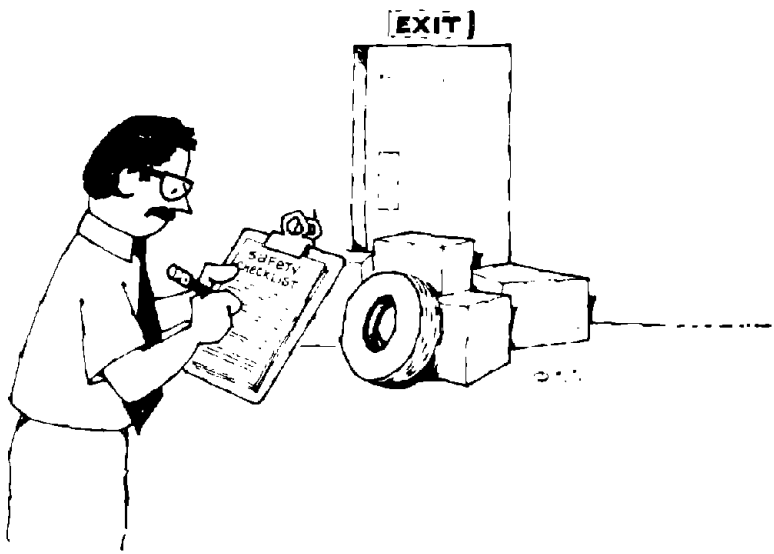
In some states, the federal government has delegated enforcement authority for occupational safety and health to the state government. Although state standards sometimes differ from federal standards, they must be at least as effective as the federal standards.

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

HEALTH AND SAFETY GUIDELINES

Health and Safety Program

A valuable aid to the employer in the identification of health and safety hazards is the establishment of a health and safety program. Such a program might include inspecting premises, interviewing employees for suggestions and complaints, promptly investigating accidents, reviewing injury and illness records, and using material from this Guide and other sources.



Management may assign certain safety and health responsibilities in the development of a health and safety program. Health and safety hazard identification, corrective procedures, and maintenance of injury and illness records can be discussed in regular or informal meetings. In addition, management leadership and support are necessary to ensure program success. Those assigned responsibility for the program must have the authority to carry it out. Everyone in the establishment should be made aware of the program, because well-informed employees will more likely show interest and a desire to participate.

General Philosophy for Health and Safety Compliance

A thorough analysis of the workplace for health and safety hazards may reveal unsafe acts or conditions. Many conditions and practices are covered by specific OSHA standards. For those hazardous conditions or practices that arise during the manufacturing of woodworking machinery and are <u>not</u> 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."

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 that the intent of the law is being met, a variance from the applicable standard may be requested from OSHA.

Employee Training

An important part of a health and safety program is employee training. Although specific training needs will vary depending on the type of woodworking machinery manufactured, the following general training suggestions apply to all woodworking machinery manufacturers:

Instruct employees in the proper handling and storage of hazardous substances, such as solvents and paints. In many cases, this information is available from the supplier's Material Safety Data Sheet (MSDS).

Train employees in the proper use and maintenance of protective equipment (see section on Personal Protective Equipment).

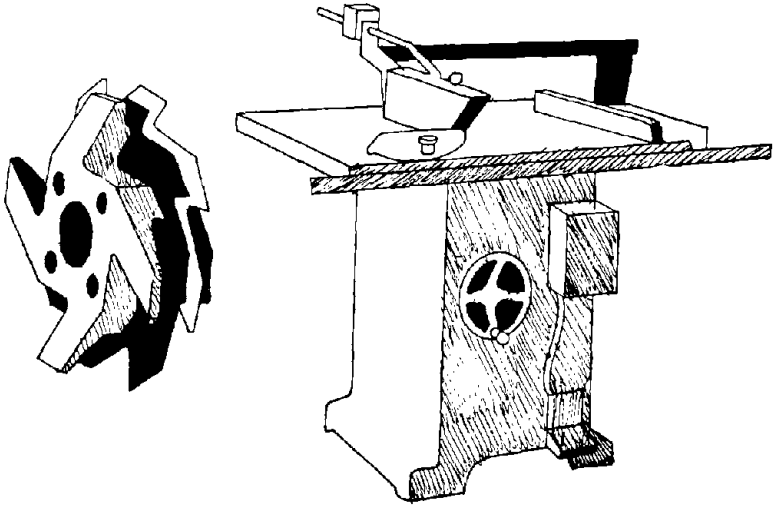
Promote good housekeeping. It can reduce accidents and fire hazards, and develop in employees a sense of pride in their surroundings. All employees should take part in clean-up activities. They should know the hazards involved and proper clean-up procedures.

Train employees in the use of forklifts, cranes, trucks, and other powered equipment. This should include safety precautions, signals, etc.

Instruct employees in the use of portable fire extinguishers. (Refer to the fold-out chart in the back of this Guide.) Post the telephone number of the local fire department. Also, develop emergency procedures in case of fire (see section on Fire Protection).

Provide first aid training for at least one worker on each shift. (American Red Cross, Bureau of Mines, etc., is acceptable.)

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



The woodworking machinery manufacturing industry is made up of those companies manufacturing machinery and/or components that are used primarily in the fabrication of wood products. Typical products manufactured are cutters, knife grinders, mortising

machines, tenoners, lathes, clamping machines, and cut-off saws (of varying configurations). While relatively few companies are engaged solely in the manufacturing of woodworking machinery or related components, a large number of companies manufacture these products on a job-shop basis.

In collecting information pertaining to woodworking machinery manufacturers, Occupational Injury and Illness Incidence Rates--as reported by the Bureau of Labor Statistics--were reviewed. These data showed that for both Total Cases and Lost Workdays (per 100 full-time workers) the rates for woodworking machinery manufacturing were more than 50% above that of the national average for all manufacturing. A review of illness and injury data pertaining to woodworking machinery manufacturing from one industrial state showed that the major injuries were muscle strains, cuts, lacerations, bruises, and foreign particles in the eye. This information correlates well with the predominance of the handling of heavy and bulky materials and machines, and the drilling, grinding, and cutting of steel bar stocks and sheet steel in this industry.

Safety and Health Considerations

The safety hazards associated with the manufacturing of woodworking machinery usually vary in number more than type, depending on whether the company manufactures a complete woodworking machine or a component of a woodworking machine. Each of these manufacturers typically uses drill presses, lathes, shapers, milling machines, grinders (bench, hand, and table), and radial saws for fabrication. These machines present the traditional point-of-operation and electrical hazards, and eye hazards from flying metal chips. Material handling hazards, including

those causing cuts, scrapes, and injuries from lifting materials, accompany the machine hazards. However, the number of mechanical operations required to manufacture a whole machine versus a component of a whole machine would expose the complete machine manufacturer to a higher number of hazards.

The health hazards, on the other hand, will vary primarily in hazard type from company to company for both whole machine and component manufacturers. Most manufacturers use a variety of cutting and cooling oils, which can potentially cause dermatitis, and cleaning solvents, which can potentially cause dermatitis and create inhalation hazards. Some woodworking machine manufacturers utilize welding and cutting processes for frame fabrication--producing potential fume and ultraviolet radiation hazards--and spray painting of machine frames--resulting in potential paint mist and solvent vapor hazards. Some component manufacturers, most notably those manufacturing cutter blades, do torch soldering (with tin-lead solders) and torch and resistance brazing (with cadmium containing filler metals) for fastening carbide bits to the cutter hull. Noise, generated from the various metal working processes, also presents a potential hazard to employees.

Some larger companies manufacturing woodworking machinery equipment have their own foundries. Since an in-depth discussion of foundry hazards is beyond the scope of this publication, the reader is advised to obtain a copy of the NIOSH Health and Safety Guide for Foundries (Publication Number 76-124).

Job Safety Analysis

To identify safety and health hazards in the woodworking machinery manufacturing industry, a Job Safety Analysis (JSA) should be made. Information to

be collected should include: the operation in question (drill press, welding, etc.), the number of employees involved, the potential safety and/or health hazard(s) present at the operation in question, and the recommended safe job procedure or environmental control method to alleviate the hazard. Make note of any safety precautions, procedures, guards, or environmental controls that are "in-place." (Later, you should evaluate the adequacy of those items.) The information should be obtained during a walk-through survey covering all operations. Don't forget to include maintenance and service operations.

The following sample JSA shows a survey of three operations found in one plant manufacturing woodworking machinery.

JOB SAFETY ANALYSIS

Operation	Number of Employees	Potential Safety or Health Hazards	Recommended Safety Job Procedure/Environmental Control
Bench Grinder	2	a. sheet steel can get caught between workrest and wheel	use tongue guards
		b. steel and grinding wheel dust	eye protection
		c. fingers could get scraped by wheel or cut by sheet metal	gloves
		d. could grind on side of wheel	safe work practice
Shear Press	1	a. operator can get finger/hand crushed at the point of operation	install two hand trip switches
		b. flying metal chips could get in eye	eye protection
Spray Painting (#4 Spray Booth)	2	a. potential fire hazard with flammable solvents and paints	keep only one day's paint supply next to spray booth; use high flash point solvent (greater than 100 F); fire extinguisher close by; good housekeeping
		b. inhalation toxicity hazard from paint mist and solvent	check operation of local exhaust fan daily; change filters when dirty to maintain adequate flow of air; use respirator approved for both organic solvents and paint mist as appropriate
		c. skin irritation from paint and solvent on skin	use gloves, apron, other protective clothing as appropriate

HEALTH HAZARD CONTROL TECHNIQUES

As discussed earlier, the primary potential health hazards found in woodworking machinery manufacturing arise from the use of cutting oils (dermatitis) and cleaning solvents (dermatitis, inhalation hazards), spray painting (dermatitis, inhalation hazards), metals joining processes (inhalation hazards, infrared radiation, ultraviolet radiation), and noise. Some general suggestions for control and/or alleviation of these hazards are:

Cutting and Cooling Oils

*Personal Hygiene: Employees should keep hands, arms, legs, and face free, to the extent possible, from these oils.

*Oil Monitoring: The oils used should be monitored periodically for the pH content. Acid pH enhances the ability of the oil to cause dermatitis.

*Oil Filtering: Remove metal filings and chips from oil on a scheduled basis.

Cleaning Solvents

*Toxicity Information: Obtain a Materials Safety Data Sheet (MSDS), if available, from the supplier for each solvent used (see Figure I). Follow any specific precautions listed.

*Personal hygiene.

*Ventilation: Use the cleaning solvent in well ventilated areas. Use either local exhaust ventilation to remove solvent vapor at the point of generation if the solvent has a high toxicity rating or general dilution ventilation if the vapor has a low order of toxicity. (See later discussion of Ventilation).

*Process Control: If you are using a vapor degreaser with cooling coils, periodically check the coils for any visible residue on the surface. Such residue could reduce the efficiency of vapor condensation.

*Substitution: If possible, use a low toxicity solvent (e.g., a safety solvent instead of a lacquer thinner).

*Training and Education: Inform employees of the potential hazards of any solvents they will be using.

*Personal Protective Equipment: When necessary use protective clothing (gloves, apron, etc.) and respiratory protective equipment (see Personal Protective Equipment section).

Figure 1.

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

SECTION I

MANUFACTURER'S NAME	EMERGENCY TELEPHONE NO.
ADDRESS *(Number, Street, City, State, and ZIP Code)*	
CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS
CHEMICAL FAMILY	FORMULA

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)		SPECIFIC GRAVITY (H_2O=1)	
VAPOR PRESSURE (mm Hg.)		PERCENT, VOLATILE BY VOLUME (%)	
VAPOR DENSITY (AIR=1)		EVAPORATION RATE (_____ =1)	
SOLUBILITY IN WATER			
APPEARANCE AND ODOR			

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	Lel	Uel
EXTINGUISHING MEDIA			
SPECIAL FIRE FIGHTING PROCEDURES			
UNUSUAL FIRE AND EXPLOSION HAZARDS			

PAGE (1)

(Continued on reverse side)

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Figure 1 (cont.).

SECTION V - HEALTH HAZARD DATA
THRESHOLD LIMIT VALUE
EFFECTS OF OVEREXPOSURE
EMERGENCY AND FIRST AID PROCEDURES

SECTION VI - REACTIVITY DATA			
STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE		
INCOMPATABILITY *(Materials to avoid)*			
HAZARDOUS DECOMPOSITION PRODUCTS			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR		

SECTION VII - SPILL OR LEAK PROCEDURES
STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
WASTE DISPOSAL METHOD

SECTION VIII - SPECIAL PROTECTION INFORMATION		
RESPIRATORY PROTECTION *(Specify type)*		
VENTILATION	LOCAL EXHAUST	SPECIAL
	MECHANICAL *(General)*	OTHER
PROTECTIVE GLOVES	EYE PROTECTION	
OTHER PROTECTIVE EQUIPMENT		

SECTION IX - SPECIAL PRECAUTIONS
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
OTHER PRECAUTIONS

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Spray Painting

*Ventilation: Conduct spray painting in well ventilated areas, preferably in a spray booth.

*Toxicity Information: Obtain MSDS.

*Personal Protective Equipment (see section on Personal Protective Equipment).

*See section on Spray Paint Operations.

Metals Joining Process (Welding, Brazing, Soldering)

*Protective Clothing: Use safety glasses, face shield, gloves, and apron when welding, soldering, or brazing.

*Ventilation: Conduct processes in well ventilated areas, using local exhaust and/or dilution ventilation as appropriate (see the section on Ventilation under Occupational Health and Environmental Control).

*See the section on Welding, Cutting, and Brazing.

Noise

*Engineering Controls (See section on Occupational Noise Exposure).

*Protective Equipment: Use earplugs, ear muffs (see Personal Protective Equipment).

Other general control methods which can be used, depending upon feasibility, are:

*Isolation: Place the hazardous process in a separate room or in a corner of the building to reduce the number of persons exposed.

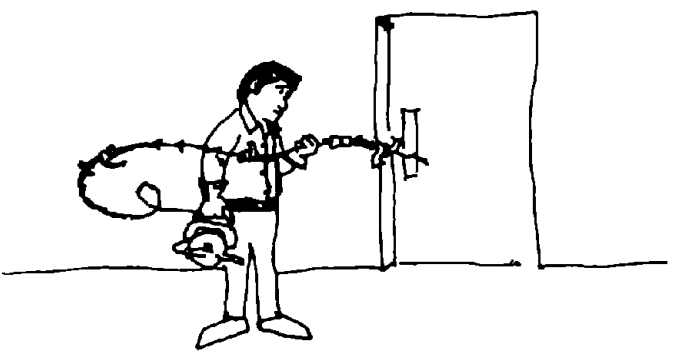
*Administrative Control: As a temporary measure, limit the total amount of time an individual is exposed to a health hazard or rotate two or more workers each shift.

Power Tools

*Operation of Tools: Know the application and potential hazards of the tool used. Remove adjusting keys and wrenches before turning on tools.

*Selection: Select the proper tool for the job.

*Electrical Dangers: Do not use tools with frayed cords or loose or broken switches.



*Guards: Keep the guards (if appropriate) in place and in working order.

*Electrical Shock: Have ground prongs in place or use tools marked "double-insulated" to prevent electrical shocks.

*Hazards: Keep alert to potential hazards in the working environment, such as damp locations or the presence of highly combustible materials and flammable vapors.

*Dress: Dress properly to prevent loose clothing from getting caught in moving parts.

*Protective Clothing and Equipment: Use safety glasses, dust or face masks, and other protective clothing and equipment when necessary.

*Power Source: Disconnect the power source before changing or adjusting tools, guards, etc.

*Caution: Do not surprise or distract anyone using a power tool.

FREQUENTLY VIOLATED REGULATIONS

This section outlines the OSHA regulations that are most applicable to plant conditions and operations found in the woodworking machinery manufacturing industry. The first part of the section discusses the "safety" regulations, with suggestions for problem correction; the latter part concerns the "health" regulations, with a toxicologic discussion on some of the general classes of hazardous substances. An elaboration on control measures mentioned previously is also made.

The regulations discussed apply to a representative setting in a woodworking machinery manufacturing facility. Your plant operations may vary, so some of these standards may not apply. Additional standards may also be applicable. Woodworking machinery requirements are itemized under the "vertical" standard 29 CFR 1910.213. The control methods presented are only brief, general suggestions on how hazards can be corrected. For detailed information on hazard control problems, such as noise, air contaminants, and machine guarding, where specific designs must be implemented, you may need the services of a professional consultant.

Walking and Working Surfaces

All work areas, passageways, storerooms, and service rooms must be kept clean, orderly, sanitary, and as dry as possible. Every floor, working surface, and passageway must be maintained free from protruding nails, splinters, holes, and loose boards. All spills should be cleaned up promptly, and floors in work areas must be kept free of scrap, chips, oil and coolant spills, and other debris. Areas that are constantly wet should have non-slip surfaces or mats where employees must walk or work.

All permanent aisles must be marked and easily recognizable. No obstructions that could create a hazard are permitted in the aisles. Where mechanical handling equipment (such as lift trucks) is used, sufficient safe clearance must be provided for foot and vehicular traffic.

Floorload capacities must be posted in a readily visible location (except for slab floors with no basement). The floorload capacity is the maximum weight that can be safely supported by a floor, expressed in pounds per square foot. If this

information is not available, or when floorload capacity is in doubt, a competent engineer should be consulted.

The Standard Guardrail and Toeboard

Generally a standard guardrail and toeboard are required in situations where people walk beneath the open sides of a platform or similar structure or where material, tools, etc. could fall from the structure (for example, into machinery below).

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

The guardrail 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. The following are additional requirements for guardrails:

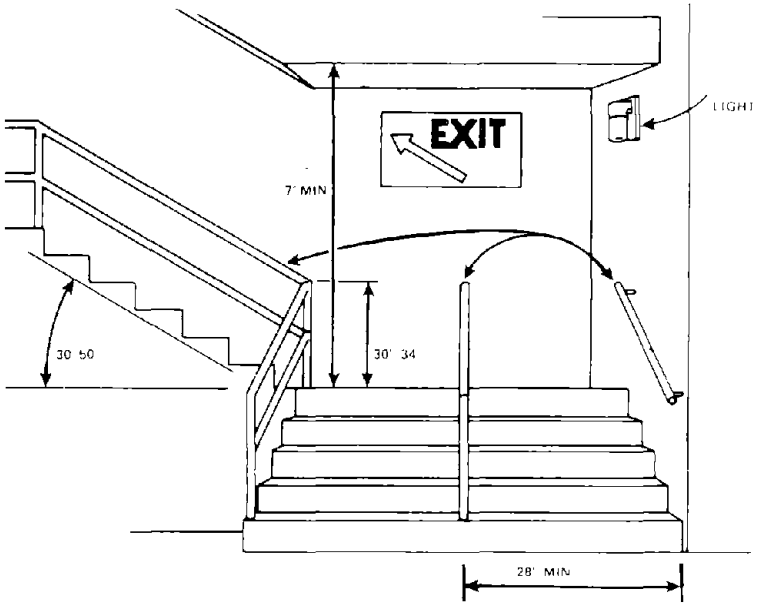
*For wood railings, the rails and posts must be of at least 2 x 4-inch stock with posts spaced not more than 6 feet apart.

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

*For structural steel railings, the posts and rails must have 2 x 2 x 3/8-inch angles or other metal shapes of equivalent strength with posts spaced not more than 8 feet apart.

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

Fixed Industrial Stairs



The riser height and tread width of fixed industrial stairs must be uniform throughout any flight of stairs, and all treads must be reasonably slip resistant. The minimum permissible width of a stairway is 22 inches. If the stairway is a path to an exit, it must be at least 28 inches wide. If the stair tread is less than 9 inches wide, the risers should be open.

Vertical clearance above any stair tread to any overhead obstruction must be at least 7 feet, measured from the leading edge of the tread. The angle to the horizontal made by the staircases must be between 30 and 50 degrees. All stairs should 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, only 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, a stair railing located midway is required.

*A stair railing must be 30 to 34 inches high, and it must be of construction similar to the standard guardrail.

Portable Ladders

Portable ladders must be maintained in good condition at all times with tight joints, securely attached hardware and fittings, and freely operating movable parts. They should be kept coated with a suitable protective material if their construction or location makes them susceptible to decay.

Ladders must be inspected frequently. Defective ladders must be tagged "Dangerous -- Do Not Use" and be removed from service for repair or destruction.

Ladders with broken or missing steps, rungs, or cleats, cracked or broken side rails, or other faulty parts must not be used.

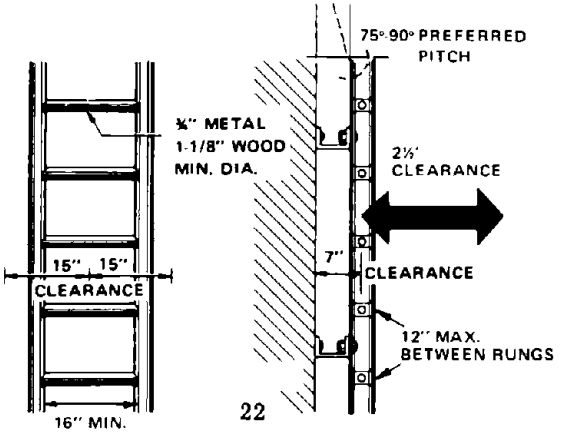
Ladders should be stored where they will not be exposed to the elements; in addition, wood ladders should be stored where there is good ventilation. Metal ladders must not be used near energized electrical equipment. Metal ladders should be so labeled with a warning against use near electrical wires or equipment.

All ladders must be placed so that they have a secure footing. They may not be placed on boxes, barrels, boards, bricks, or other unstable bases to obtain additional height. Nonslip bases should be attached to the bottom of each ladder and maintained in good working condition.

Fixed Ladders

Fixed ladders must be designed to withstand a single concentrated load of at least 200 pounds.

Rungs of metal ladders must have a minimum diameter of 3/4 inch. Rungs of wood ladders must have a minimum diameter of 1 1/8 inches.



Rungs must be at least 16 inches wide, be spaced no more than 12 inches apart, and be free of splinters and burrs.

The preferred pitch for safe descent is 75 to 90 degrees. Unless caged, or equipped with a ladder safety device, ladders with 90 degree pitch must have a 2 1/2-foot clearance on the climbing side.

There must be at least a 7-inch clearance in back of the ladder to provide adequate toe space.

Vertical ladders must have either cages or a ladder safety device if they are more than 20 feet long.

Unless a ladder safety device is used, landing platforms must be provided on ladders greater than 20 feet long. A platform is required every 30 feet for caged ladders and every 20 feet for unprotected ladders (when no ladder safety device is used).

Side rails must extend at least 3 1/2 feet above landings.

*There must be a clean width of 15 inches on each side of the center line of the ladder, unless the ladder is equipped with a cage or well.

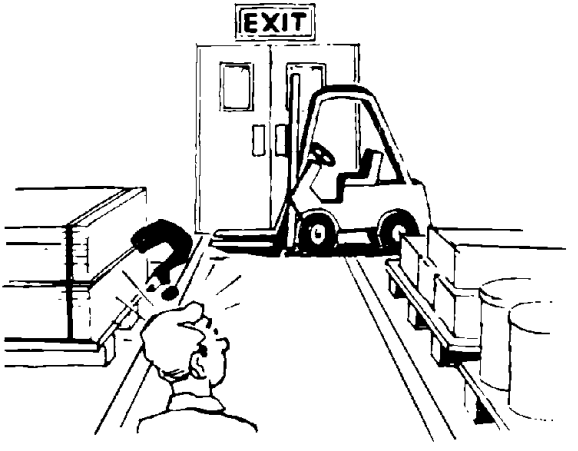
Exits and Exit Markings

Every exit must have the word "EXIT" in plain, legible letters not less than 6 inches high with the strokes of the letters not less than 3/4 inch wide. The visibility of the exit sign must not be impaired by decorations, furnishings, or other signs.

Doors, passageways, or stairways that are neither exits nor ways to an exit, but may be mistaken for an exit, must be clearly marked "NOT AN EXIT" or have a

sign indicating their actual use, e.g., "TO BASEMENT." In areas where the direction to the nearest exit may not be apparent, an exit sign with a directional arrow must be used. Exit signs must be illuminated by a reliable light source if the building is occupied at night, or if normal lighting levels are reduced at times during working hours.

Exit access must be arranged so that it is unnecessary to travel through any highly hazardous area in order to reach the nearest exit (unless the path of travel is effectively shielded by suitable partitions or other barriers).



The exit route must lead to a public way. Areas around exit doors and passageways leading to and from the exit must be kept free of obstructions. A door from a room to an exit or to a way of exit access must be of the side-hinged, swinging type. It must swing out in the direction of travel if 50 or more persons occupy the room or if it is an exit from a highly hazardous area. No lock or fastening may be used which prevents escape from inside a building. Where occupants may be endangered by the blocking of any single exit due to fire or smoke, there must be at least two means of exit remote from each other.

Machine Guarding

One or more methods of machine guarding must be provided to protect the operator and other employees from hazards such as those 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. Guards must be attached to the machine if possible and secured elsewhere if attachment to the machine is not possible. The guard must not be an accident hazard in itself. Machines designed for fixed locations must be securely anchored to prevent "walking" or tipping.

A booklet entitled "The Essentials of Mechanical Guarding", OSHA 2227, can be obtained by contacting the nearest OSHA Regional Office. A list of offices appear in the back of this book. Many equipment representatives also 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
. Two-hand tripping devices
. Automatic guards

Enclosure guards

Fixed enclosure guards are preferred to all other types. This type of guard prevents access to dangerous parts by completely enclosing a hazardous operation, and also helps control dust or chips generated by the operation. The enclosure guards may be adjustable to different sets of tools and dies or varying thicknesses of stock, but once adjusted, they must be fixed. As a general rule, power transmission apparatus can be protected by enclosure guards.

Interlocking guards

When a fixed enclosure guard is not practicable, an interlocking enclosure or barrier should be considered as the first alternative.

An interlocking enclosure guard is not fixed; it can be opened to feed stock and adjusted as the operation requires. This guard uses an electrical or mechanical interlock that prevents the operation of the machine until the guard is returned to a closed position and the operator can no longer reach the point of danger.

Two-handed operating devices

Two-handed operating devices, another category of guarding mechanisms, are also designed to protect a machine operator from point-of-operation hazards.

Although they are not guards in the technical sense, they serve the same purpose.

The two-handed "type" of guard requires the simultaneous action of both of the operator's hands on electrical switch buttons, control valves, mechanical levers, etc. The location of the actuating controls must make it impossible for the operator to move either or both of his hands from the controls to the danger zone before the machine has completed its closing cycle. The two-handed controls must be designed to prevent the blocking, tying down, or holding down of one control to allow one hand free access to the danger zone.

Automatic guards

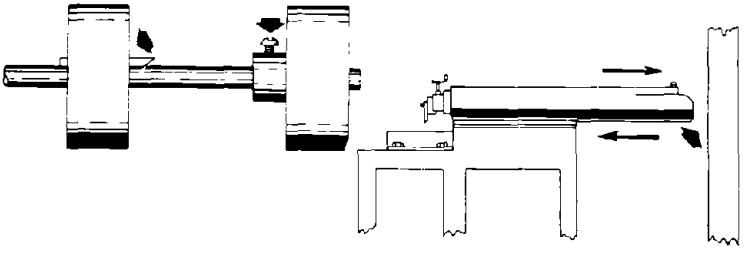
When neither an enclosure guard nor an interlocking guard is practicable, an automatic guard may be used. An automatic guard acts independently of the operator, repeating its cycle as long as the machine operates. This type of guard removes the operator's hands, arms, or body from the danger zone as the machine cycles. It is operated by the machine itself through a system of linkages connected to the operating mechanism. A common type of automatic guard is the pull-away guard, sometimes used on punch presses. This device pulls the operator's hands away from the point of operation as the ram descends (see illustration in this section).

Machine Processes Requiring Guards

Certain guarding methods are preferable to others. The type of operation, the size and shape of stock, the method of handling stock, the physical layout, the type of material, and the production requirements or limitations are important considerations when deciding what type of guard to use. Many equipment manufacturers' representatives will assist in the design and installation of proper guards. Some typical machining and process actions that will require appropriate guarding are:

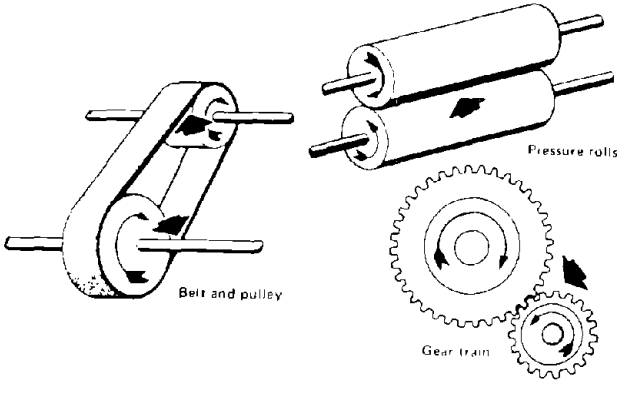
Rotating and reciprocating motion

Collars, couplings, cams, clutches, flywheels, shaft ends, spindles, lead screws, and horizontal or vertical shafting are examples of rotating mechanisms that are hazardous. The danger from these mechanisms increases when rotating bolts, oil cups, nicks, abrasions, and projecting keys or screw threads are exposed.



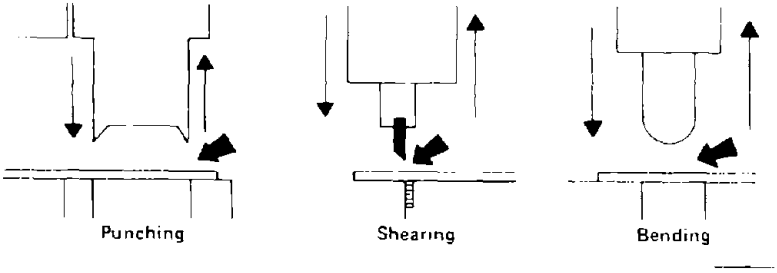
In-running nip points

In-running nip points are a special danger created by rotating objects. Wherever 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 can be drawn into this nip point and be bruised or crushed. Gears, feed rolls, conveyor terminals, forming rolls, and printing press rolls are examples of nip points.



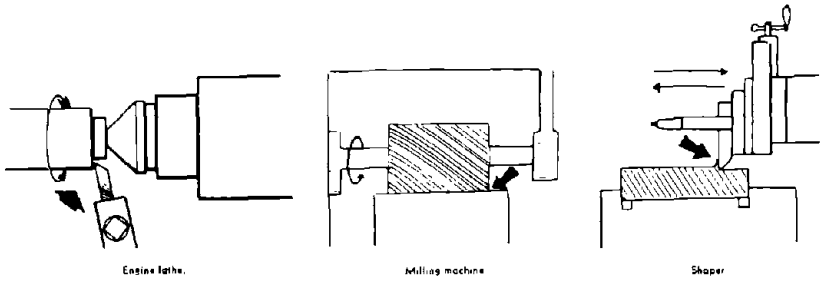
Punching, shearing, and bending action

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 material, as differentiated from removing the material in the form of chips. The danger from punching, shearing, or bending action lies at the point of operation, where stock is manually inserted, held, and withdrawn. Typical examples of equipment involving punching, shearing, or bending action include power presses, shears, embossing presses, and stamping presses.

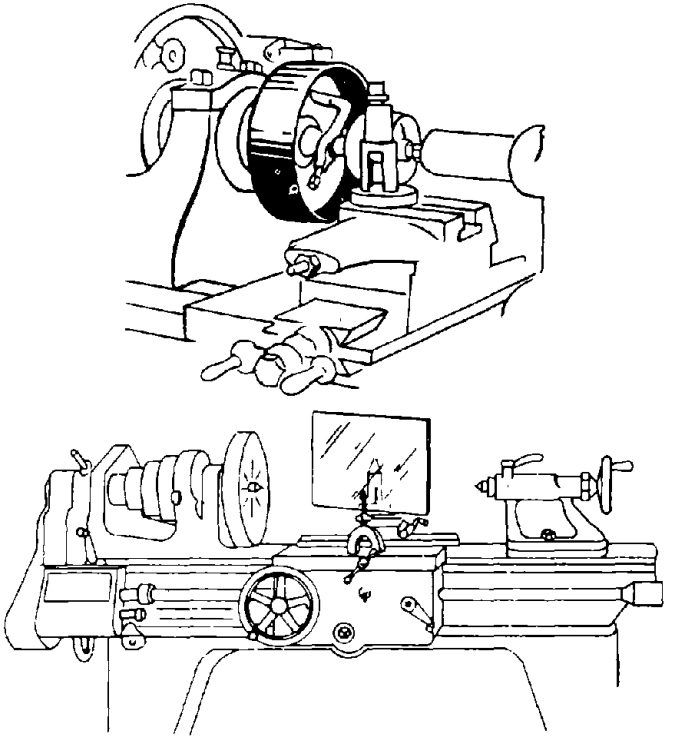


Cutting action

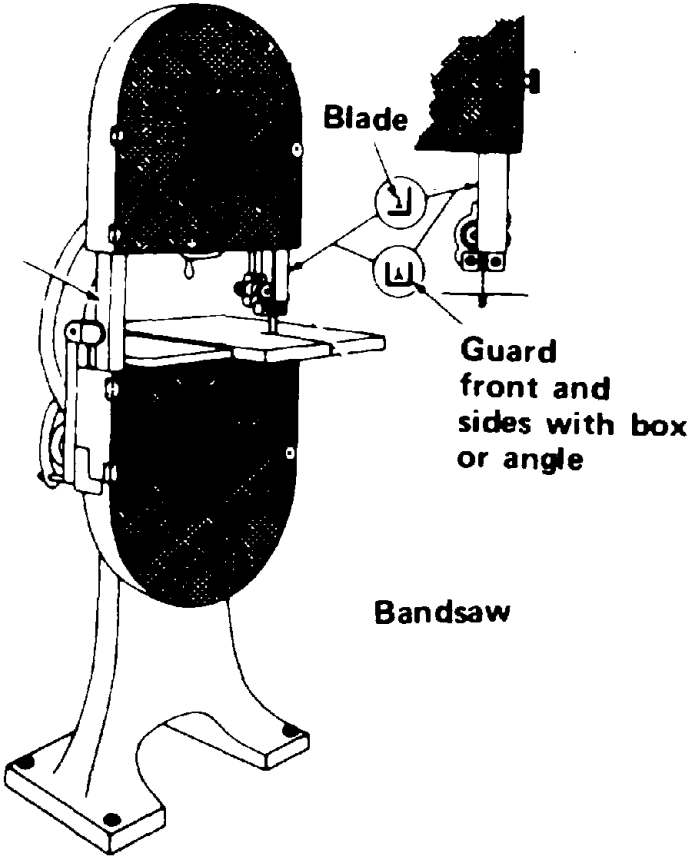
Cutting action results when rotating, reciprocating, or transverse motion is imparted to a tool so that the material removed is in the form of chips. The danger from cutting action exists at the movable cutting edge of the machine, as the edge approaches or comes in contact with the material being cut. 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 equipment that use cutting action are band and circular saws, milling machines, planing or shaping machines, turning machines, boring or drilling machines, and grinding machines.



The following pages contain examples of guarding machinery and processes that are found in the manufacture of woodworking machinery. This listing is not intended to include all equipment that may require guarding, nor are the guarding methods suggested the only ones that may be effective.



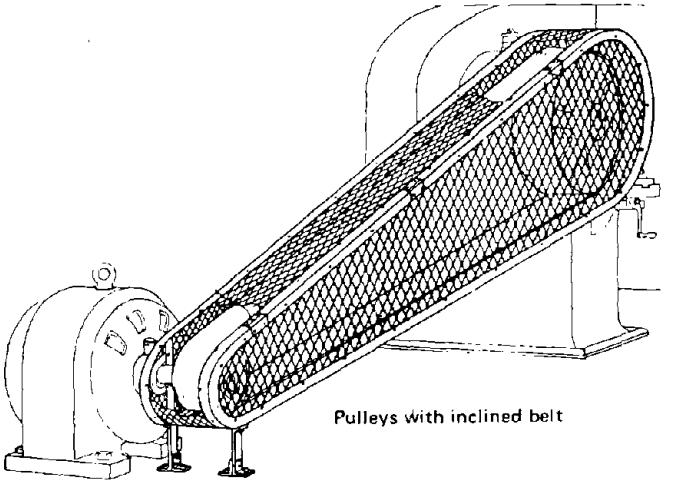
Lathe. Transparent guard encloses point of operation.



Band or band resaw wheels should be completely enclosed and all portions of the blade should be guarded, except that portion between the guide rolls and the table.

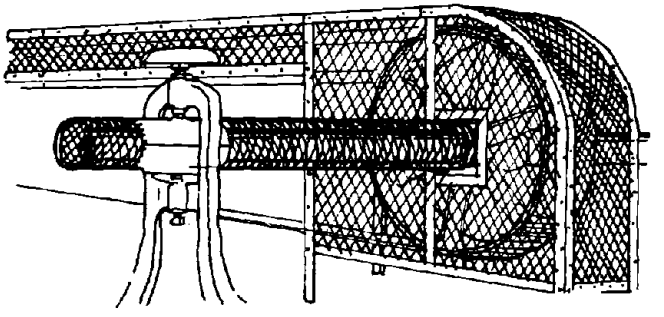
Guarding Rotating and Transverse Motions by Enclosure Guards

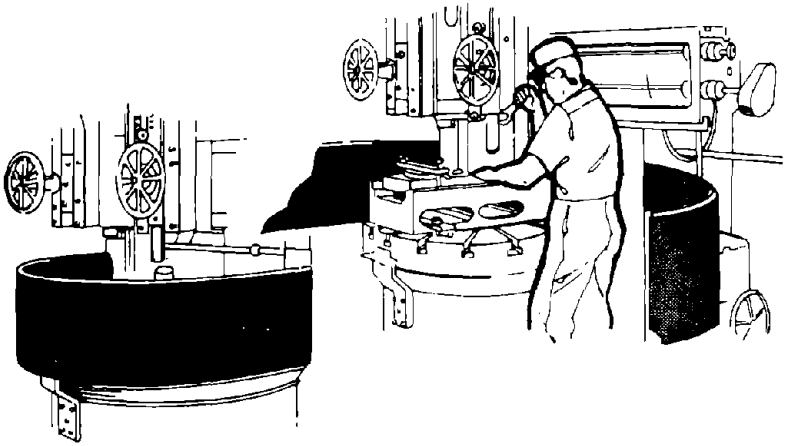
Pulleys with inclined belt.



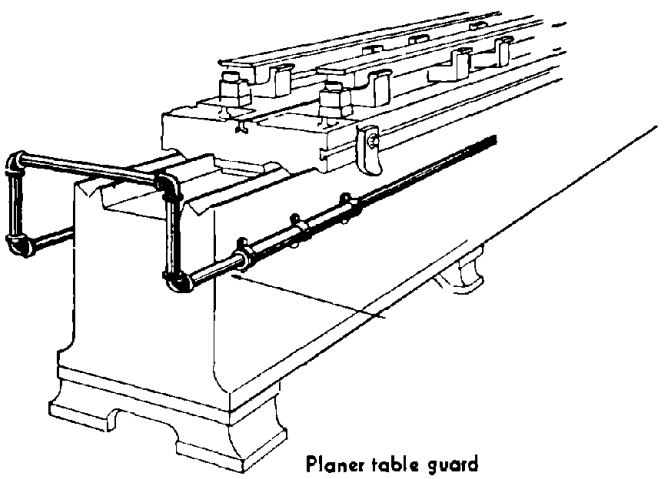
Pulleys with inclined belt

Overhead horizontal belt and pulley.

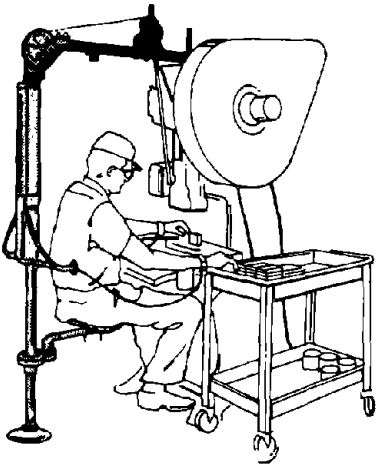




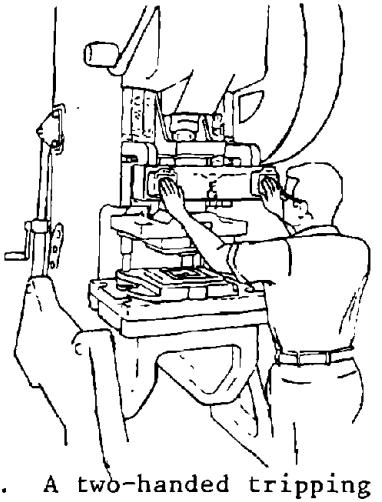
Barrier guard for vertical boring mill--guard is made in two sections, hinges to the machine, and is easily opened.



Planer table guard

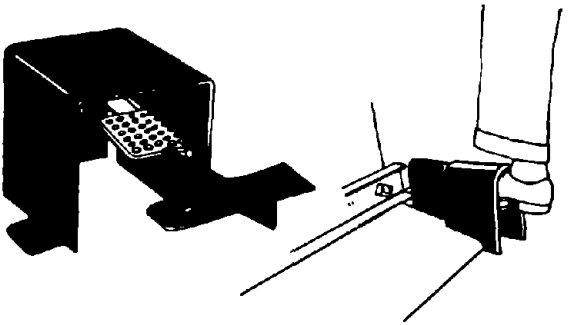


Pull-out device. Operator's hands are pulled away from danger zone before ram descends.



Punch press. A two-handed tripping device requires the simultaneous use of both hands to trip the press. On presses with noninterrupting stroke, the device should require continuous pressure on the controls so that the operator cannot reach into the press.

Treadle guards for presses and shears to prevent unintentional tripping.



The widespread use and lack of proper guarding place these devices high on the list of items covered by more frequently violated regulations.

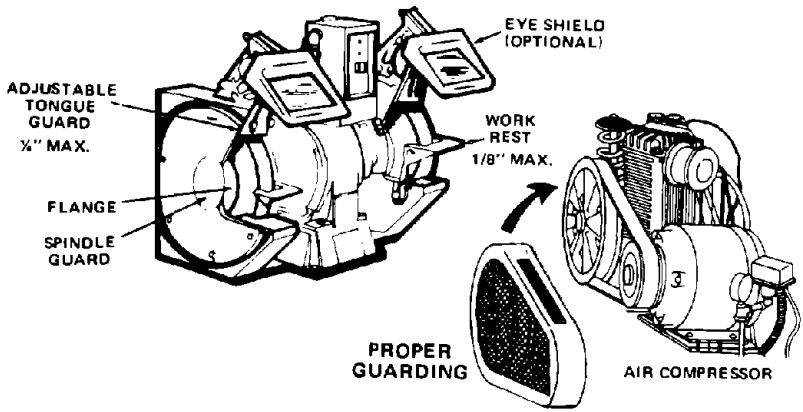
Grinders

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 periphery 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 must be adjustable to compensate for wheel wear. Work rests must be kept closely adjusted to the wheel to prevent the work from becoming jammed between the wheel and the work rest. The maximum clearance allowed is 1/8-inch.

Tongue guards (upper peripheral guards) must be constructed so that they adjust to the wheel as it wears down. A maximum clearance of 1/4-inch is allowed between the wheel and the tongue guard.

Goggles or a face shield must be worn by grinder operators.



Air compressors

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

Fans

If fans are located within 7 feet of the floor, they must be guarded by grills or mesh with openings not more than 1/2-inch.

Hand and Portable Power 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 that may be furnished by employees.

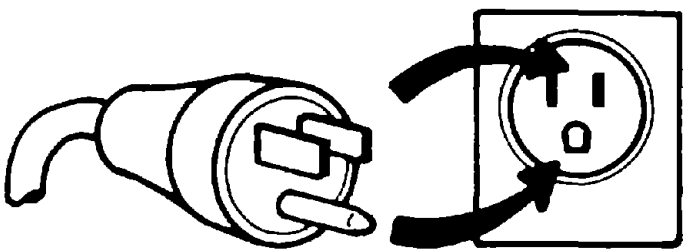
Hammers with broken or cracked handles, chisels and

punches with mushroomed heads, wrenches with sprung jaws, and bent or broken wrenches should not be used.

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

Portable circular saws must be equipped with guards above and below the base plate or shoe. The lower guard must retract when the blade is in use, and automatically return to the guarding position when the tool is withdrawn from the work.

All hand-held portable electrical equipment must have its frame grounded or be double-insulated and identified as such.



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

Jacks must be inspected for wear and general condition at least once every six months.

Jacks must be appropriately blocked or cribbed when necessary to provide a firm foundation.

Pneumatic power tools must be secured to the hose to prevent the tool from becoming disconnected. A tool

retainer must be used on such tools to prevent the attachment from being expelled.

Nailers, staplers, and similar equipment with automatic feed should have a muzzle to prevent the tool from ejecting a piece unless the muzzle is in contact with a work surface.

Use of Compressed Air

Beware of compressed air--it can be dangerous. Alternate methods of cleaning surfaces should be sought. Compressed air must never be used to blow 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.

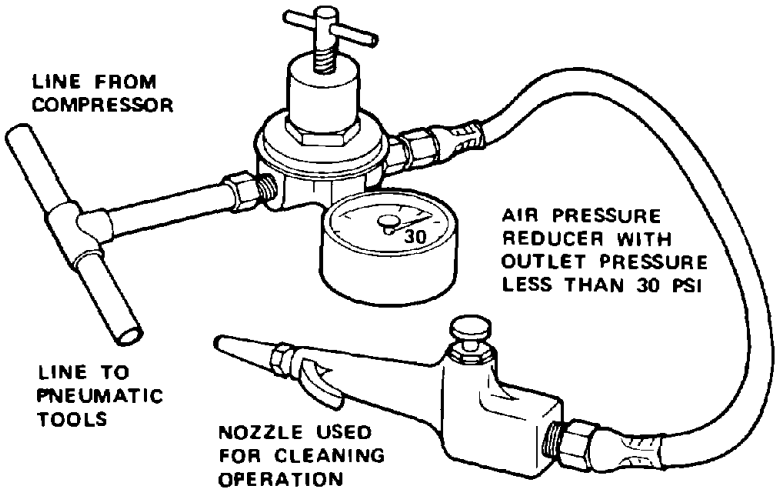
Designated employees should be familiar with the air compressor's operating and maintenance instructions.

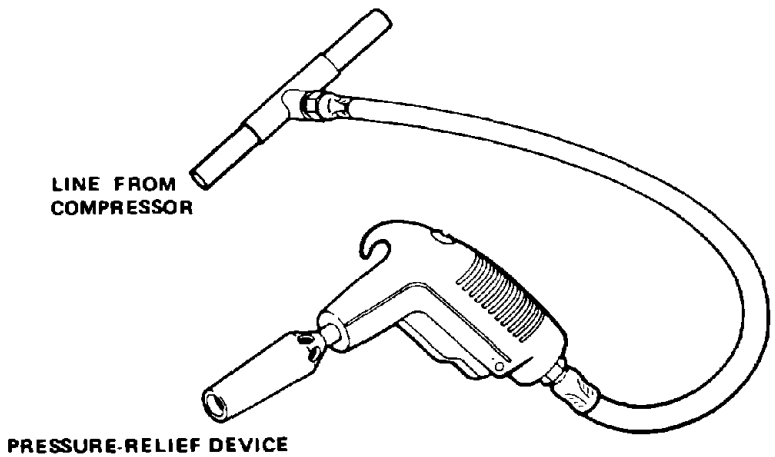
New air tanks must be constructed in accordance with the American Society of Mechanical Engineers (A.S.M.E.) Boiler and Pressure Vessel Code, Section VIII. The A.S.M.E. Code requires this information to be permanently stamped on the air tank.

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

Air tanks must be protected by safety-relief valves. These 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. There must be no shut-off valves between the air tank and the safety valve.





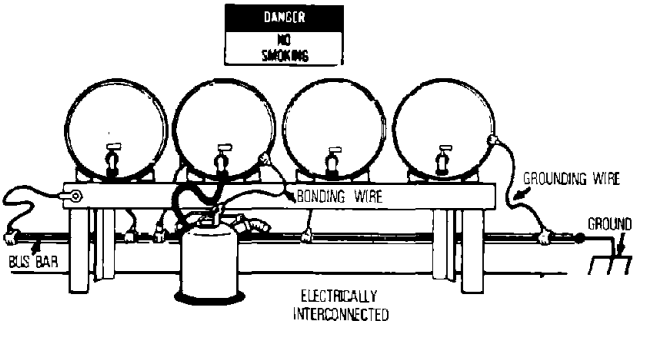
Flammable and combustible liquids

Flammable and combustible liquids are identified by how easily they ignite, using the flashpoint as an indicator. Flammable liquids are defined as those liquids having a flashpoint below 100 degrees F; combustible liquids are defined as those liquids having a flashpoint above 100 degrees F. Flammable liquids ignite more readily than combustible ones. Examples of flammables are gasoline, acetone, and lacquer thinner; examples of combustibles are kerosene, fuel oil, and Stoddard Solvent. The flash point of a liquid is the primary determinant of the storage requirements of the liquid.

Some general requirements pertaining to flammable and combustible liquids are:

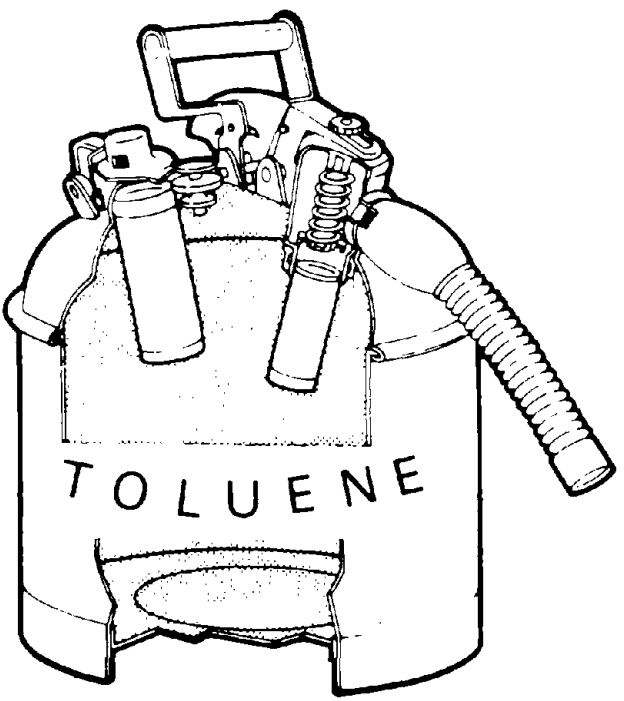
*Connections on all drums and piped systems of flammable and combustible liquids must be vapor and liquid tight.

*When flammable liquids are transferred from one container to another (e.g., from a bulk container to a portable container), the containers must be bonded and grounded. This practice prevents electrical discharge (i.e., sparks) due to the accumulation of static charge which "accumulates" during the transfer process.



*All spills of flammable and combustible liquids must be cleaned up promptly. Cleanup personnel must use appropriate personal protective equipment. (Check the MSDS for any recommended appropriate equipment.) These liquids must never be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion resulting from the accumulation of vapors.

*Supplies of flammable and combustible liquids must be stored in approved, fire-resistant safety containers equipped with self-closing lids. These containers can be purchased from an industrial supply house.



An approved safety container.

*All flammable liquids must be kept in closed containers when not in use.

*Combustible waste material, such as oily shop rags and paint rags, must be stored in covered metal containers and be disposed of daily.

*All storage areas for flammable and combustible liquids must be posted as "NO SMOKING" areas.

Storage cabinets

Storage cabinets must be distinctly labeled "FLAMMABLE - KEEP FIRE AWAY," and meet standards established by the National Fire Protection Association.

Metal cabinets must be constructed of at least no. 18 gauge sheet iron, double-walled with a 1 1/2-inch air space, and have leak-proof joints. Doors must have three-point locks and the sill must be at least 2 inches above the bottom of the cabinet.

Wooden cabinets must be constructed of at least 1-inch plywood. All joints must be rabbetted and fastened in two directions with flathead screws.

Inside storage areas

Each inside storage area must be prominently designated as a "NO SMOKING" area. Openings to other rooms or buildings must have noncombustible, liquid-tight raised sills or ramps at least 4 inches high. An open-grated trench inside the room which drains to a safe location may be used as an alternative to a sill or ramp. General exhaust ventilation (either gravity or mechanical) that provides for a complete change of air within a room at least six times each hour is required. All lights, electrical equipment, and wiring must be approved for use in hazardous locations (i.e., explosion-proof fixtures).

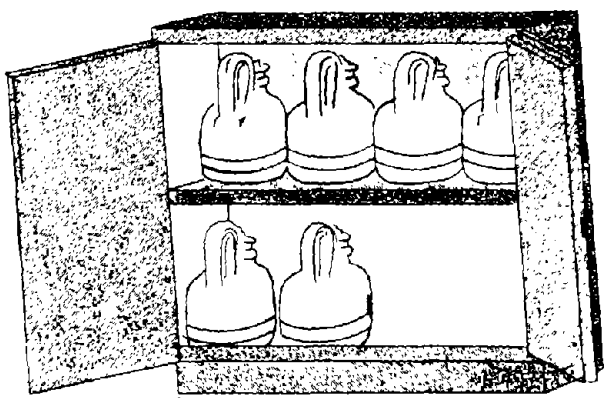
A fire extinguisher (12B minimum) must be located within 10 feet of the door. An explanation of fire extinguisher codes is provided in material published by the National Fire Protection Association.

Outside storage areas

If flammable and combustible liquids are stored outside, the storage area must be graded to divert spills away from buildings. The storage area must be designated as a "NO SMOKING" area and must be kept free of combustible material. There must be an appropriate fire extinguisher available at the storage area.

LPG storage areas

LPG storage tanks must be guarded to protect them from vehicular damage. The tank area must be designated as a "NO SMOKING" area and there must be an appropriate fire extinguisher available in the area. Engines on vehicles must be shut down while being fueled.



DOOR SILL RAISED 2" TO FORM LIQUID TIGHT BOTTOM WELL

SAFETY CABINET

Spray paint operations

When spray painting, the following regulations apply:

Portable lamps must be removed during spraying.

The fire control sprinkler heads must be kept clean and free of paint build-up.

"NO SMOKING" signs must be posted wherever paint is sprayed or stored.

Spray areas

The spray area must be at least 20 feet from flames, sparks, electric motors, or other ignition sources.

The spray area must be free from hot surfaces such as heat lamps.

The electric lights in the spray area must be covered and guarded from accidental breakage.

The spray area must be kept free of combustible residue.

Mechanical ventilation must be operating to remove vapors during painting.

Spray booths

Spray booths must be made of metal, masonry, or other suitable noncombustible material, and be smooth on the inside to aid in cleaning.

The floors and baffles must be noncombustible and easily cleaned.

Spray-booth lights must be explosion proof or enclosed in sealed panels.

Ventilation

Mechanical ventilation must be operating during spraying.

The ventilation rate must be at least 100 linear feet per minute at the open face of the booth. A visible gauge or audible alarm must be installed to verify the face velocity.

The electric motor(s) for the exhaust fan(s) must be placed outside the booth, and ducts and the belts and pulleys fully enclosed.

The air exhausted from the paint booth must be discharged outside where it cannot reenter the building.

Ducts connected to the booth must have access doors to allow for cleaning.

When temperatures are below 55 degrees, the make-up air for the paint booth must be heated to at least 65 degrees. The heater for the make-up air must be located outside the spray booth.

Mechanical ventilation must be left on while the paint is drying. A warning sign to this effect must be attached to the drying apparatus.

Paint drying apparatus

The area used for drying with portable heaters or lights must be free of overspray residues. Heat lamps, etc. used for drying must be kept out of the spray area during spray operations. The electrical drying apparatus must be properly grounded.

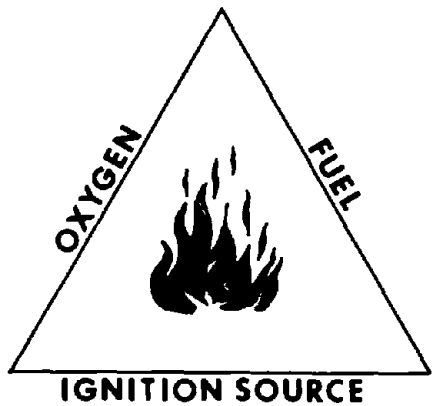
Fire Protection

Your plant has everything a fire needs:

FUEL -- Fuel, gas, hydrogen generated during battery charging operations, packing and cleaning materials, paint and solvents, sealing compounds, plastic, trash.

OXYGEN -- Oxygen for burning, liquid oxygen, air.

IGNITION SOURCE -- Flame, spark, heat, hot metal, spontaneous and electrical sources.



IF THESE ESSENTIALS COMBINE, A FIRE WILL START.

Scheduled maintenance checks of electrical machinery and ventilation systems, proper storage and disposal of combustible sweeping compounds, oil mops and rags, flammable solvents, good housekeeping, and periodic facility inspection rank as the best safeguards against fire. However, even the best maintained facility can have a fire.

Of primary concern in the event of a SIGNIFICANT fire is the safe evacuation of plant personnel from the scene of the fire. Regardless of size, each plant should be equipped with a fire protection system and have developed an emergency evacuation plan in case of fire.

Fire protection system

Generally, the fire protection system includes three "subsystems":

Detection system

The fire protection system must include detection devices--each designed for the area it is to protect. Typical detection devices are smoke detectors, flame detectors, and heat detectors. Decisions regarding the type of detector to use should be made in consultation with the local fire department.

Extinguishing system

The extinguishing system, activated by the detection system, can be a water system (e.g., automatic sprinkler system), a gas system (e.g., carbon dioxide), or powder system (e.g., sodium bicarbonate). The most effective system may vary from one plant area to another depending on the type of fire likely to break out. Consultation with the local fire department is advised.

Warning system

The warning system should include warning bells or buzzers and wall-mounted fire alarm activators located strategically throughout the facility. The warning system should be connected into the local fire department.

Emergency procedures

Make sure the fire department is notified before any attempt is made to fight the fire. While the fire department is being notified, an orderly evacuation from the facility should begin.

Building evacuation

A plan for orderly evacuation should include the following:

*an evacuation signal.

*a well planned evacuation route for employees in all areas of the facility.

*designation of a re-assembly area for personnel--well away from the plant.

*an accounting procedure for personnel after re-assembly. A daily list of plant personnel on travel or absent should be maintained to facilitate accounting.

*a provision to ensure searching the building for complete evacuation. A floor or area "warden" should be designated--so all plant areas are covered.

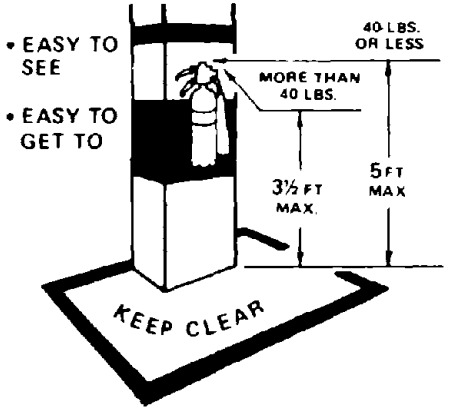
Notification

A list of telephone numbers for local fire departments should be posted in prominent places throughout the plant--and all employees advised of this posting.

Floor plans for designated plant areas should be posted showing the locations of fire alarm activators, fire extinguishers, and exits.

Fire extinguishers

Several employees in each area of the facility should be trained in the use of fire extinguishers.



Fire extinguishers must:

*Be kept fully charged and in their designated places.

*Be located along normal paths of travel.

*Not be obstructed or obscured from view.

*Be inspected by management or a designated employee at least monthly to ensure that:

-they are in their designated places;

-they have not been tampered with or actuated; and

-there is no corrosion or other impairment.

*Be examined at least yearly and/or recharged or repaired to ensure 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, except factory-sealed, disposable units and pump-type units. (Extinguisher sales representatives usually can perform this service at appropriate intervals.)

*Be selected on the basis of the type of hazard, degree of hazard, and area to be protected (see chart in back of this Guide).

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

Automatic sprinkler system

When automatic sprinkler systems are provided, they must meet design requirements of the National Fire Protection Association's Standard for the Installation of Sprinkler Systems (NFPA No. 13-1969). (OSHA requirements are extracted from the NFPA Standard.)

The following are important provisions of these requirements:

*Every automatic sprinkler system must have at least one automatic water supply of adequate pressure, capacity, and reliability.

*One or more fire department connections through which the fire department can pump water is required.

*The employer is responsible for the condition of the sprinkler system and must keep it in good operating order. Functional tests are required at least once each year.

*The clearance between sprinkler deflectors and the top of combustible storage normally must be at least 36 inches. If the material is in solid piles less than 15 feet high or in piles less than 12 feet high with horizontal channels, a minimum clearance of 18 inches is allowed. Commodities containing only small amounts of combustible material may be stored up to 18 inches from the sprinkler deflectors.

*Alarm systems, audible to all employees, should be provided on all automatic sprinkler installations.

An elaboration of requirements pertaining to automatic sprinkler systems can be found in the "General Industry Standards," 29 CFR 1910.159.

MATERIALS HANDLING AND STORAGE

General

The storage of materials must not, of itself, create a hazard. Materials stored in tiers (bags, containers, bundles, or pallets) must be stacked, strapped, blocked, or interlocked and limited in height so that they are stable and secure against sliding or collapse. Stored material must not obstruct fire extinguishers, alarm boxes, sprinkler system controls, electrical switch boxes, emergency lighting, first aid equipment, or exits.

All containers should be kept closed and all drums sealed. If any leakage occurs, the damaged container must be removed and any fire or slipping hazard eliminated.

Aisles in the storage area must be free of obstructions and have sufficient clearance for foot and vehicular traffic. Where limited clearance exists (e.g., low overhead clearance), clearance limit warning signs must be posted. Proper drainage must be provided throughout the storage area.

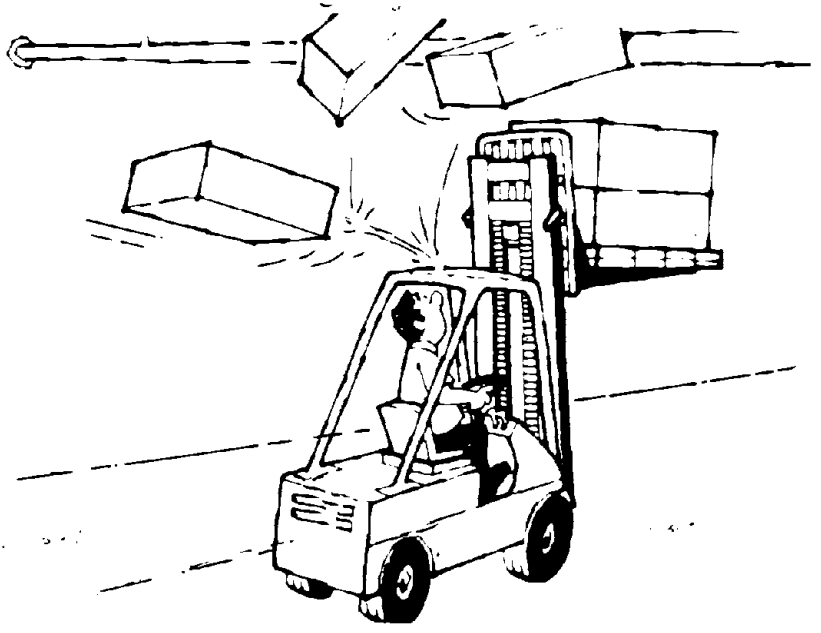
Powered Industrial Trucks

Powered industrial trucks are classified into categories for the purpose of determining what type

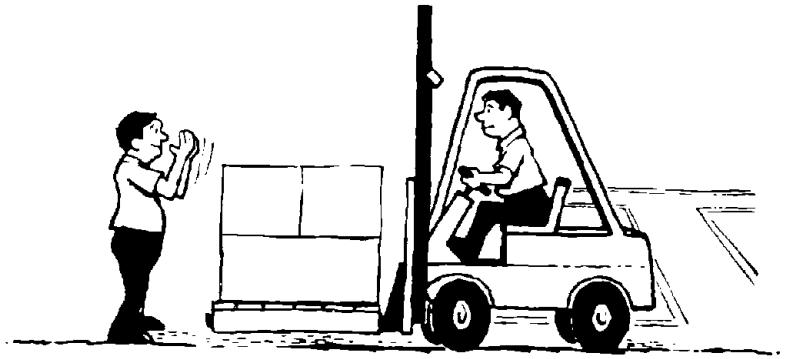
of truck may be used in a certain location. The type of hazard in a location determines whether diesel, electric, gasoline, or LP-gas powered trucks may be used and what additional safeguards must be present. Suppliers can assist in the proper selection.

The following requirements apply to the operation of powered industrial trucks:

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

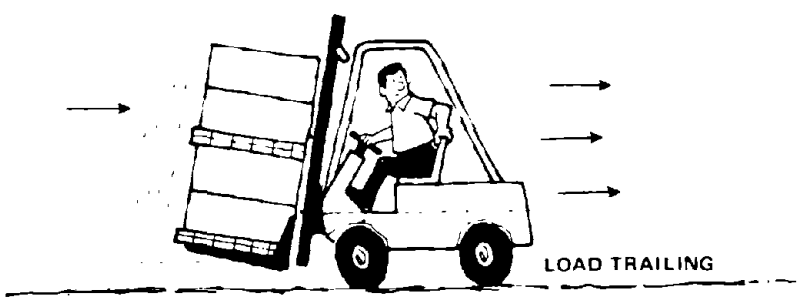


Operators must be trained in the safe operation of powered industrial trucks, and only trained and authorized employees may operate a truck. Truck manufacturers and suppliers may provide training courses.



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

Industrial trucks must be examined daily before being placed into service for any conditions adversely affecting the safety of the vehicle. If the truck is used around the clock, it must be inspected after each shift.



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 that will prevent their slipping during loading and unloading.

Due to the hydrogen gas emitted during the charging process of battery-operated equipment, the battery charging area is to be designated as a non-smoking area and a "NO SMOKING" sign posted.

Although the information provided in this section on hoists pertains specifically to cranes, 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 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 inspected daily for damage and wear, and monthly records of inspections 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.

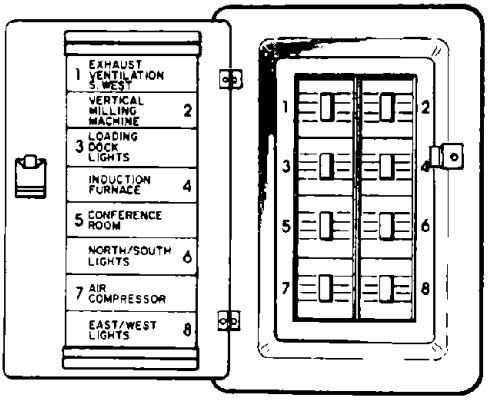
The National Electrical Code (NEC)

Electrical requirements

More fires are caused by electrical malfunction than any other cause, and standards pertaining to electrical equipment and its use in all industries have been violated more frequently than any others.

The National Electrical Code (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 the minimum provisions considered necessary for safety. Your electrician or maintenance personnel should be familiar with the following requirements:

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



*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

-when in a hazardous location.

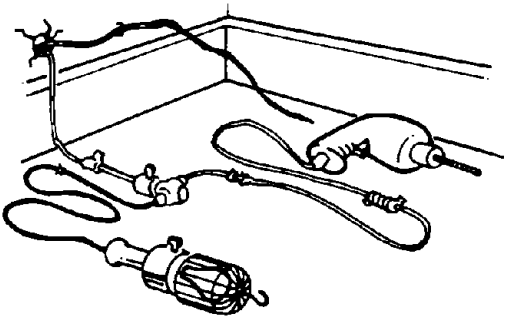
*Exposed noncurrent-carrying metal parts of the following equipment, which are liable to become energized, must be grounded or double-insulated and properly marked:

-portable hand-held motor-operated tools

-appliances

-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.

-attached to building surfaces.

*Flexible cord must be fastened so that there is no pull on joints or terminal screws. It must be replaced when frayed or when the insulation has deteriorated.

*All splices in flexible cord must be brazed, welded, soldered or joined with suitable splicing devices. Any splices, joints, and free ends of conductors must be properly insulated.

Occupational Health and Environmental Control

OSHA has set maximum exposure standards for many airborne toxic materials and for noise. If employee exposure exceeds the standard, feasible engineering controls and/or administrative controls must be installed/instituted to reduce the level of employee exposure to below the standard. If these controls do not prove feasible, or while they are being installed or instituted, the employer must provide appropriate personal protective equipment--which may include protective clothing, ear protection, and respiratory protection.

Some products used in the woodworking machinery manufacturing industry, most notably the cleaning solvents and paints, may contain substances that are regulated by OSHA standards; or the product by

itself, (e.g., 1,1,1-trichloroethane) may be regulated by a standard. In either case, the employer should first find out from the product vender what the chemical makeup of the product is, or at the very least, any regulated substance contained in the product. The employer should then contact any OSHA area or regional office to find out the exposure limit for the substance or product. After consultation with OSHA, an observation of the work procedure involving the substance, and a determination of employee exposure time, a formal environmental evaluation of the substance (with measurement of the exposure) should be made. Based on these investigations, engineering or administrative controls or personal protective equipment usage can be implemented as appropriate.

A brief discussion covering the major health hazards found in companies manufacturing woodworking machinery related components and a short discussion on ventilation principles is presented below.

Cutting oils

Cutting oils are widely used in machine shop operations to dissipate heat and lubricate metal surfaces during metal cutting and machining processes. Cutting fluids (both oil base and synthetic) can remove oils and fats from the skin, causing the skin to become dry, cracked, and susceptible to infections. Suspended particles or shavings in the cutting fluids have an abrasive action on the skin, causing cuts or scratches. Bacteria can then enter the tissue and cause infections. Prevention of skin problems from cutting oils can be accomplished through personal hygiene and personal protective clothing. Skin should be cleansed with mild soap and lukewarm water. Waterless hand cleaners can also be used, but sometimes these cleaners can irritate the skin. Raw

solvents should never be used for skin cleansing. To prevent skin contact with cutting oil, protective clothing, including shirts with long sleeves, and gloves should be worn. Splash shields on machinery can also help reduce employee exposure to cutting oils. Another method of preventing oil dermatitis is the proper filtering of the oil to remove abrasive particles and the treatment of the oil with germicidal agents to reduce bacterial count.

Although surveys of the many machining operations in woodworking machinery manufacture did not indicate a significant problem from oil mist exposure, the inhalation of oil mists may cause irritation of the mucous membranes of the respiratory tract. In high concentrations, inhalation of oil mists can lead to lipid pneumonia, a lung inflammation caused by direct contact of the lung surface with the oil. As a precaution, the employer should survey all machining operations that use cutting oil to check for visible oil mist. Operations generating excessive oil mist should employ local exhaust ventilation to remove the mist at the point of generation.

Solvents

Employees may be exposed to the vapors of various organic solvents (e.g., 1,1,1-trichloroethane, lacquer thinners, petroleum spirits) used for cleaning metal parts and vapor degreasers. Organic solvents can dissolve the natural protective skin oils, causing primary irritation dermatitis and localized skin injury. This makes the skin vulnerable to other harmful substances. Some solvents can enter the body directly by skin absorption, which may cause systemic poisoning. Employees who handle solvents should wear protective gloves that are impervious to the solvents, and should use other suitable protective clothing to reduce skin contact with the solvent. Good personal

hygiene is also important in preventing skin problems associated with solvent contact.

Adverse health effects of airborne vapor exposure to organic solvent vapors include irritation of the eyes, nose, throat, and lungs; dizziness; headache; and sensations of drunkenness.

All solvent cleaning should be done in well-ventilated areas. Those vapor degreasing tanks using cooling coils to condense vapors should be checked periodically for proper operation.

Some degreasing agents (most notably trichloroethylene) can decompose under the influence of ultraviolet radiation from welding operations and form phosgene, a highly toxic gas. As such, all welding operations should be conducted well away from any degreasing operations.

The use of organic solvents also presents a fire and explosion hazard due to the flammability and volatility of these materials. Cleaning operations should be conducted in well-ventilated areas. All electrical equipment used near cleaning operations should be properly grounded to reduce the potential of sparks.

Carbon monoxide

This colorless, odorless gas can be produced by industrial trucks using gasoline or liquefied petroleum. Symptoms of excessive carbon monoxide exposure include headache, fatigue, poor judgement, shortness of breath, weakness, and dizziness. Properly maintained combustion equipment can help prevent the generation of carbon monoxide. The use of battery-powered industrial trucks to reduce CO exposure should also be considered.

Welding fumes and by-products

Certain hazards are common to most arc welding processes. Principally, these are: damage to the eyes and skin from infrared and ultraviolet radiation, from molten metal and electric arc; burns from contact with hot metal or sparks; adverse physiological effects from breathing metal fumes and gases; accidents from material handling; and electrical shock.

Eye exposure to ultraviolet radiation from the arc can result in a condition known as "welder's flash" or "arc eye"--an irritation with a sensation of sand in the eyes. These flash burns are very painful and repeated exposure can result in permanent eye injury. Overexposure to ultraviolet radiation can also cause severe skin burns. Infrared radiation from the molten metal produces a sensation of burning on the skin, but is usually not of sufficient intensity to cause permanent skin damage.

The hazard potential from the fumes and gases generated by a welding operation depends upon the chemical composition of the materials being welded, the concentrations of the chemicals in the worker's breathing zone, and the duration of exposure. Ozone and the oxides of nitrogen are the principal toxic gases produced by the arc welding process. Ozone is produced by the action of the electric arc through air. Both ozone and oxides of nitrogen produce irritation of the deep lung and upper respiratory tract.

Arc welding hazards can be controlled by using effective ventilation, by following safe working practices, and by using respirators and personal protective equipment. Welders' helmets and goggles with proper filter plates and filter lenses must be worn during arc welding to protect workers from harmful rays and from flying sparks and debris. All

welders should wear flameproof gauntlet-style gloves. Flameproof aprons made of leather or other suitable material may also be desirable as protection against radiant heat and sparks.

Soldering and brazing

These metal joining processes are conducted at much lower operating temperatures than the arc welding process. As such, the amount of hazardous fume and gas generation is much less. Also, no ultraviolet radiation is generated in these processes. Nevertheless, the filler metals used in these processes may contain lead, cadmium, and zinc. Lead is a systemic toxin, whose signs of overexposure range from headache, fatigue, muscle and joint pains, and sleeplessness, to disruption of liver and kidney functions. Mild exposure to cadmium fume (especially in silver soldering operations) may result in cough, headache, dryness of throat, and shortness of breath; severe exposure may cause pulmonary edema (excessive secretion of water in the lung). Exposure to zinc oxide fumes can result in metal fume fever, a condition similar to influenza. The symptoms usually occur a few hours after exposure and include a metallic taste in the mouth, dryness of nose and throat, weakness, fatigue, muscular and joint pains, fever, chills, and nausea. The symptoms usually last less than 24 hours. OSHA has set specific requirements for ventilation and respiratory protection when brazing (or soldering and welding) on metals or with filler metals containing lead, zinc, or cadmium. The employer should check the section on Welding, Cutting, and Brazing for this information (see page 75).

Although site surveys indicated that the amount of soldering and brazing carried out in woodworking machinery manufacturing would not under normal circumstances present a major hazard to employees,

these operations should nevertheless be carried out in well-ventilated areas, perferably using local exhaust ventilation.

Spray paints

Two major spraying methods are used in applying paint: the compressed air method and the airless method. In the compressed air method, paint and air are combined in a spray gun, with the air pressure breaking up the paint into a fine spray. In the airless method paint is forced through small holes in the head of the spray gun at high pressure, breaking it into small particles. This method produces little overspray because the paint particles have just enough speed to carry to the surface being painted, but not enough to rebound. The smaller amounts of solvent used and mists produced in this process reduce health and fire hazards.

The major substances of concern in spray paint are the solvent (vapor) and the pigment (mist). The solvent is usually organic in nature and has the potential to cause irritation of the respiratory passages as well as to affect the central nervous system. Common pigments used in solvents are titanium or iron oxide compounds. Few health problems, however, have been reported from the use of these pigments. The employer should, nonetheless, obtain a MSDS for all paints used to determine any hazardous substances present.

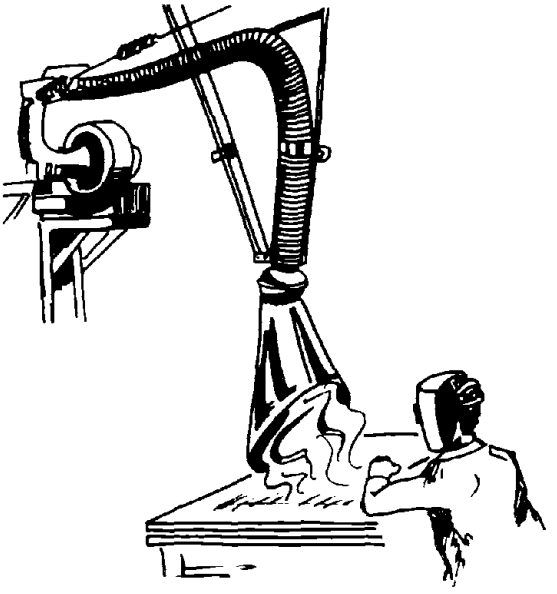
Ventilation

Mechanical exhaust ventilation is the best choice for control of hazardous air contaminants in many cases. A properly designed local exhaust or dilution ventilation system can either remove air contaminants which may be present, or lower the concentration of

fumes, vapors, dusts, mists, or other contaminants generated in the working environment. These functions can also reduce or eliminate health or fire hazards.

Local exhaust ventilation

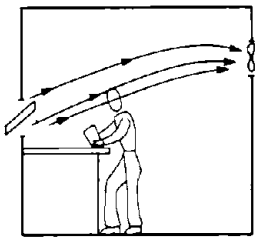
In general, local exhaust systems should be installed wherever a large amount of air contaminant is generated, or wherever a small amount of an extremely hazardous substance may become airborne. Local exhaust ventilation removes the hazardous substance at or near its point of origin, and prevents it from being drawn through the breathing zone of the worker. Local exhaust ventilation is recommended since it usually performs more efficiently than general dilution ventilation and prevents air contaminants from being circulated throughout the work area. An example of a local exhaust ventilation system for a welding, cutting, or brazing process is shown below:

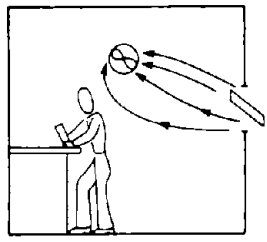


General dilution ventilation

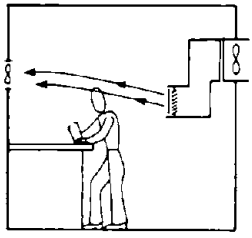
General dilution ventilation systems pull air through the work area to dilute air contaminants to a lower, non-hazardous level. They require a greater volume of air flow to be effective than do local exhaust systems. General dilution ventilation may be an effective control for areas where low concentrations of hazardous substances are generated. It may also be used effectively in some flammable liquid storage areas or where employees are exposed to substances with low hazard potential. The effectiveness of dilution ventilation as a control mechanism depends on the air inlet and fan location and their special relationship to one another. The figures below illustrate air inlet configurations with good and poor fan locations.

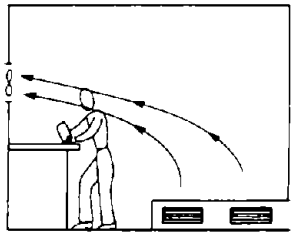
General Ventilation





Poor General Ventilation and Fair General Ventilation





Good General Ventilation and Best General Ventilation

Occupational noise exposure

Excessive noise can cause permanent hearing damage, yet the noise standard is one of the most commonly violated standards--and one of the most difficult problems to correct. The employer must 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 the noise level is increased, the permissible exposure time decreases (e.g., if the level is 100 dBA, the permissible exposure time is 2 hours). As a rule, the permissible exposure is halved for every 5 dBA increase above 90 dBA.

If an employee's noise exposure is in excess of the standard, a hearing conservation program must be implemented to protect employee hearing and to reduce noise levels or exposure times to comply with the standard. A hearing conservation program includes periodic noise measurements, engineering or administrative controls, hearing protection, and audiometric testing.

The goal of the hearing conservation program should be to develop engineering controls to reduce noise exposure. Engineering controls could include machine tool design modification, process alteration or elimination, increased automation, enclosure of noisy equipment, acoustical treatment of walls to reduce noise reflection, vibration damping of noisy machines, and replacement of metal to metal contact with synthetic material to metal contact.

A noise source identification survey by qualified personnel should be made before engineering or administrative controls are implemented or a hearing conservation program is established.

Administrative controls designed to limit exposure time to the excessive noise level in some cases can be a part of a hearing conservation program.

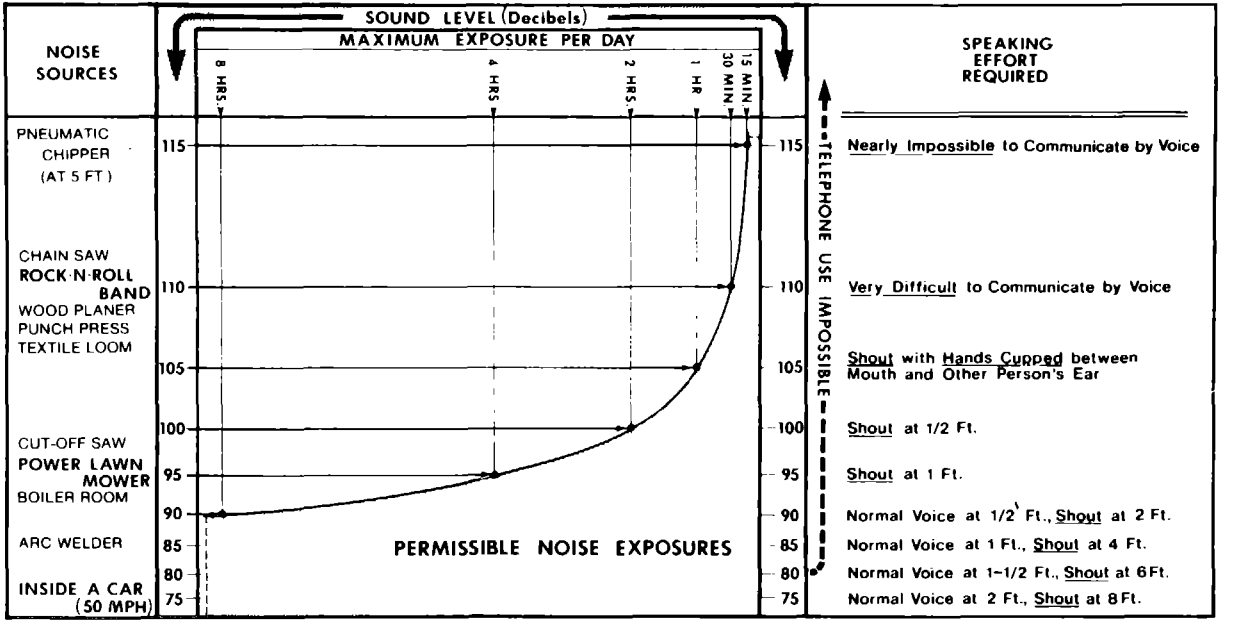
If engineering controls or administrative controls do not prove feasible or while these controls are being implemented, hearing protection is required.

There are many forms and types of ear protection that can be used, e.g., ear muffs or ear plugs. Some are more effective than others, depending on the noise level, the frequency of the noise, and the fit of the protector. (Because of their fitting characteristics, ear muffs generally afford greater protection than do ear plugs.) It is also 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 the table indicates that noise levels and exposure time in your plant require corrective action, professional help should be sought to correct the problem.

PERMISSIBLE NOISE EXPOSURES

NIOSH

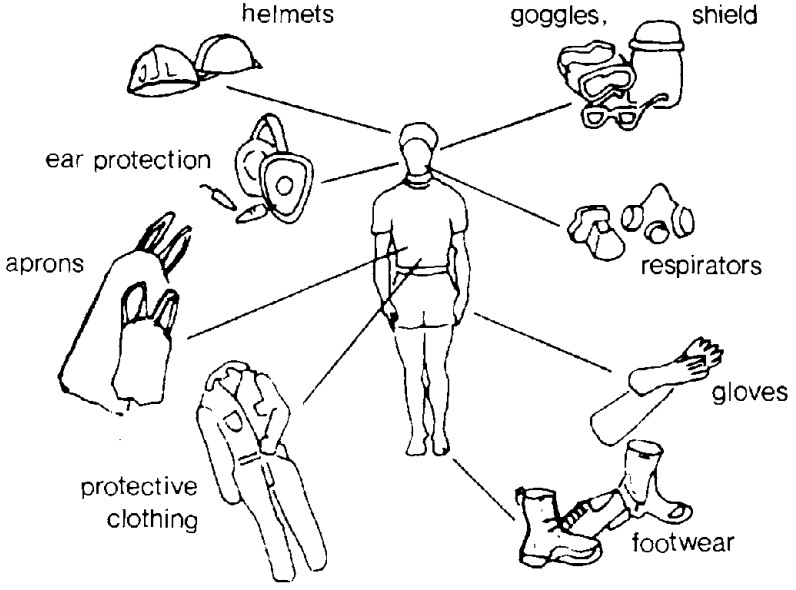


Personal Protective Equipment

General requirements

Personal protective equipment is required whenever there are hazards that can do bodily harm through absorption, inhalation, or physical contact. This equipment includes protective devices for the eyes, face, head, and extremities, protective clothing, and respiratory protection.

All personal protective equipment must be of safe design and reliable condition.



Eye and face protection

Eye protection and/or face shields are required where there is a possibility of any injury from flying particles, chips, sparks, and splashes from liquids such as caustics, solvents, and hot or molten metals.

Employees must wear this equipment when they use grinders, power drills, or other equipment that produces dust and chips.

Eye and face shields must be designed to provide adequate protection against the particular hazards to which the employee is exposed. If the eye and face shields must be worn by employees who wear glasses, the equipment must fit over the glasses.

Gloves

When handling hazardous liquids, acids, or irritating powders, employees must wear gloves that are impervious to such materials. Gloves are also very useful in preventing cuts from the handling of sharp-edged or burred metals. The gloves should be long enough to protect the forearms. A decision regarding the use of a glove type for specific applications should be made in consultation with the supplier. The following table suggests glove types for exposure to the listed substances:

CHEMICAL	NEO-PRENE	NATURAL RUBBER OR LATEX	POLY-VINYL ALCOHOL	BUNA-N	POLY-D	VINYL
Degreasing fluids	F	P	E	G	E	P
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
Nitric acid	G	F	NR	F	F	F
Paint thinners	G	F	E	G	G	F
Petroleum spirits	E	F	E	E	G	P
Stoddard solvent	E	F	E	E	G	F
Toluene	F	P	E	E	G	P
Trichloroethylene	F	P	E	F	G	P
Xylene	P	P	E	E	G	P

*KEY: E = excellent; G = good; F = fair; P = poor; NR = not recommended

Head protection

Protective head covering (hard hat) is required in situations where workers may be struck in the head by falling or flying objects.

Foot protection

Safety shoes are recommended to prevent injury to the feet from falling objects and other hazards. They should be worn particularly where heavy stock is handled. They should also be worn in parts-handling, shipping, or receiving operations. In areas that may be slippery (e.g., battery charging and acids areas), appropriate footwear that provides good traction, such as rubber boots, should be worn.

Aprons

When aprons are used as protection from acids and other hazardous materials, the apron must be impervious to such materials.

Coveralls, caps, etc.

Coveralls, caps, and other types of protective clothing (rubber suits, etc.) should be worn while working under special conditions (e.g., where caustic liquid splashing is a potential problem). This clothing should be removed at the end of the shift and placed in appropriate hampers. If necessary, the employee should shower before changing into street clothes. It may also be necessary to have a separate laundry facility or have the clothing sent to a commercial laundry, depending on the nature of the hazardous substances used at the work site.

Respiratory protection

When engineering and/or administrative control

methods can not feasibly prevent or reduce a potential respiratory health hazard, or while such controls are being installed/instituted, the employer must provide appropriate respiratory protective equipment to the employee. Respiratory protection may also be required for routine but infrequent operations, for nonroutine operations, and for emergency operations in which the employee is exposed briefly to high concentrations of a hazardous substance.

When respiratory protective equipment is used for any of the above reasons, a written respirator program must be established. The program must describe the following aspects of respirator usage:

*The basis for selection of a specific type of respiratory protective equipment. All respiratory protective equipment selected must be NIOSH approved.

*Provisions for medical screening of each employee assigned to wear respiratory equipment to determine if he/she is physically or psychologically able to do the work and to wear a respirator at the same time.

*An employee training program in which the employee can become familiar with the respiratory protective equipment, and be trained in its proper use and limitations.

*Provisions for assigning respiratory protective equipment to employees for their exclusive use, where practical.

*Provisions for testing the proper fit of the employee's respiratory protective equipment.

*Provisions for regularly cleaning and disinfecting the respiratory protective equipment.

*Provisions for periodic inspection and repair of respiratory protective equipment.

*A periodic evaluation of the above program to assure its continued functioning and effectiveness.

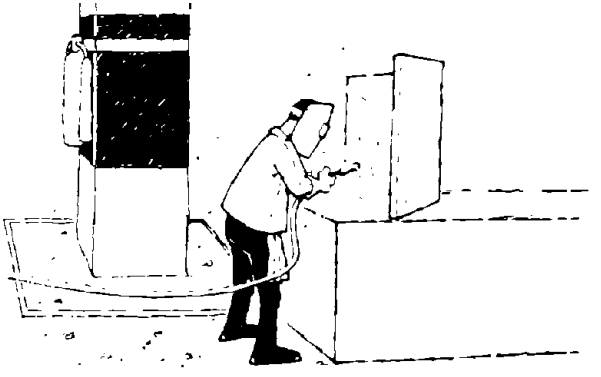
Surveys of manufacturers of woodworking machinery and related components indicated that, for the most part, respiratory protection usage was confined to non-routine operations (maintenance) and routine infrequent operations (some spray paint operations). Concerning frequent usage, provisions for the storage, cleaning, and inspection of filters and facepiece components and proper fitting of the facepiece are especially important. Filters should be replaced when the respirator has been used for the specified lifetime of the cartridge, when an employee can smell vapors in the facepiece, or when breathing becomes difficult. A good fit between the facepiece and face is necessary. Beards, sideburns, and glasses will interfere with the fit. A more in-depth discussion of respiratory usage is available in "Respiratory Protection...An Employer's Manual," (DHEW [NIOSH] Pub. No. 78-193A).

Welding, Cutting, and Brazing

General requirements

Management must establish areas for welding, cutting, and brazing operations based on the fire hazard potential of the plant. Preferably, cutting or

welding should be done in an area with no surrounding combustible material. If combustibles in the immediate vicinity are unavoidable, they must be protected with flameproof covers. Suitable fire extinguishing equipment must be maintained for instant use.



Torch cutters and welders must be trained in the safe operation of their equipment. Printed rules and instructions (supplied by the manufacturers) covering the operation of equipment must be strictly enforced.

No welding, cutting, or other hot work may be performed on used drums, barrels, tanks, or other containers until they have been cleaned so thoroughly that it is absolutely certain that there are no traces of flammable materials or substances which, when subjected to heat, might produce flammable or toxic vapors.

The atmosphere in the welding area must be free of flammable gases, liquids, and vapors.

Goggles or other suitable eye protection (e.g., helmets) must be used during welding or cutting operations as a protection against the intense heat, ultraviolet and infrared radiation, and splattering metal.

Employees adjacent to the welding areas must be protected from ultraviolet rays by noncombustible or flameproof screens or shields, or they must be required to wear appropriate goggles.

Employees exposed to hazards created by cutting and welding must wear personal protective equipment. For example:

*Flameproof gauntlet gloves (except when engaged in light work) should be worn.

*Flameproof aprons (leather, for example) may be desirable as protection against sparks and radiant heat.

*Fire resistant leggings or high boots should be worn.

The potential health hazard to a welder or cutter from gases or metal fumes depends on the toxicity of the materials used in the welding process (including types of metals, fluxes, coatings, etc.), the duration and location of the process, and ventilation.

There are specific requirements concerning ventilation and respirators when welding or cutting is performed with:

*stainless steel, lead, zinc, or cadmium.

*metals coated with lead or mercury-containing materials, such as paint.

*fluxes or other materials containing fluorides.

These requirements are summarized here:

WELDING OR CUTTING MATERIALS CONTAINING OR COATED WITH	LOCATION OF OPERATION CONFINED SPACES	INDOORS	OUTDOORS
Lead	A or B	A	C
Zinc	A or B	A	
Fluorides†	A or B		
Cadmium†	A or B	A or B	C
Beryllium†	A and B	A and B	A and B
Mercury†	A or B	A or B	C
Stainless Steels	A	A	A

A = Mechanical local exhaust by means of hoods or booths with sufficient airflow to maintain a velocity, away from the worker, of at least 100 linear feet per minute.

B = NIOSH-approved supplied-air respirator, or equivalent.

C = NIOSH-approved respiratory protective equipment, or equivalent.

† Unless atmospheric tests under the most adverse conditions have established that the workers' exposures are within acceptable concentrations defined by 1910.1000.

Mechanical ventilation must be provided when welding or cutting is done on metals not covered in the table when:

*the volume of space per welder is less than 10,000 cubic feet, or

*the ceiling is less than 16 feet high, or

*work is done in confined spaces.

Such mechanical ventilation must be at the minimum rate of 2,000 cubic feet per minute per welder, unless hoods or booths are provided with sufficient airflow to maintain an air velocity flowing away from the worker of at least 100 linear feet per minute. Alternatively, NIOSH-approved, supplied-air respirators may be used.

Gas welding

The following are general requirements governing gas welding:

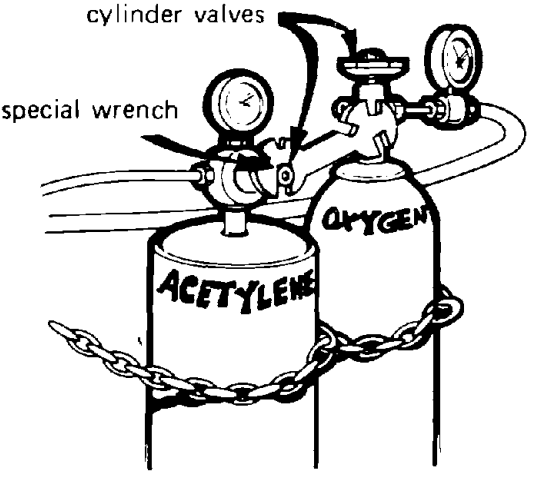
*All cylinders must be stored and used away from radiators and other sources of heat.

*All cylinders stored inside buildings must be located in a well-protected, well-ventilated, dry location at least 20 feet from highly combustible materials and away from elevators, stairs, or gangways. They must not be kept in unventilated enclosures such as lockers.

*Valve protection caps must be used on cylinders designed to accept a cap except when the cylinders are in use or connected for use.

*Stored oxygen cylinders must be kept separated from stored fuel gas cylinders or combustible materials (especially oil or grease) by a minimum distance of 20 feet or by a non-

combustible barrier at least 5 feet high and having a 1/2-hour fire resistance rating. A sheet metal partition is not an acceptable method of separating cylinders.



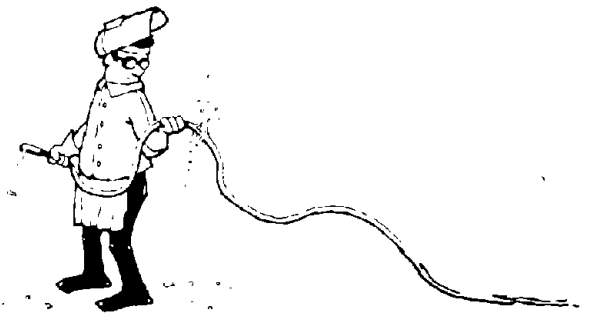
*All cylinder valves must be closed when work is finished. Where a special wrench is required, it must be left in position on the stem of the valve while the cylinder is in use so that the fuel-gas flow can be quickly turned off in case of emergency. In the case of manifolded or coupled cylinders, at least one such wrench must always be available for immediate use.

*All cylinders must be legibly marked to identify contents.

*No cylinder should be permitted to stand alone without being secured by lashing or chaining to prevent it from toppling over.

*Acetylene must not be used at a pressure in excess of 15 psi guage (or 30 psi absolute). Above this pressure, acetylene may become unstable.

*Indoor storage of fuel gas is limited to a total capacity of 2,000 cubic feet or 300 pounds of liquified petroleum gas.



*Hoses showing leaks, burns, or worn places which make them unfit for service must be replaced or repaired.

Electric arc welding

The following requirements apply to electric arc welding operations:

*If the welding machine is wet, it must be thoroughly dried and tested before it is used again.

*Coiled welding cable must be spread out and the ground lead must be firmly attached to the work.

*Cables must be inspected for damage and loss of insulation and be repaired immediately, if necessary.

*Ground and electrode cables may only be joined together with connectors specifically designed for that purpose.

*Cables with splices within 10 feet of the operator may not be used; neither may the operator coil cables around his body.

*A welding helmet must be worn by the operator. Persons close by must also wear eye protection.

*Shields or screens must protect others in the vicinity from arc welding rays.

*Arc welders should wear clean, fire-resistant gloves and clothing, with collars and sleeves buttoned.

*Electrode holders that are not in use must be placed in a safe place away from conductive objects.

Sanitation

The following are general requirements governing sanitation:

*Safe drinking water must be provided in all places of employment. The use of a common drinking cup is forbidden.

*Receptacles for waste food must be covered and kept in a clean and sanitary condition.

*Restrooms must be kept in a clean and sanitary condition.

*Separate toilet facilities must be provided for each sex. If only one person at a time uses a toilet room and the door can be locked from the inside, separate facilities are not required.

*One toilet and one lavatory must be provided for approximately every 15 employees.

*Each lavatory must have hot (or tepid) and cold running water,hand soap, and individual hand towels or warm air blowers.

*Beverages or food must not be stored or consumed in a toilet room or in any area exposed to toxic materials.

*Employees working with toxic substances should wash and, if necessary, change from contaminated clothing before eating, drinking, or smoking.

MEDICAL AND FIRST AID

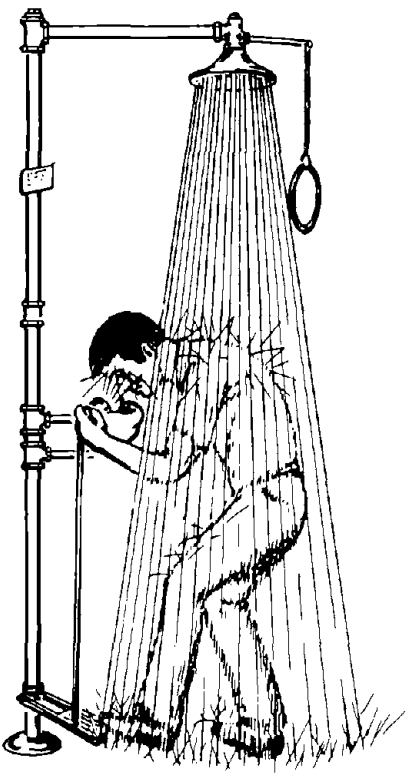
An important part of the company safety and health activity is a medical and first aid program. This program can help prevent lost work time and achieve good morale among employees. Medical personnel must be readily available -- by phone or in the plant -- for advice and consultation on employee health matters. A good policy is to require a medical examination before hiring and placement to ensure that prospective employees are physically able to do their specific job, and to determe if employees have some medical problem which could be aggravated by the assigned work. Periodic health evaluations for employees assigned to hazardous jobs and early treatment of any illness or injury should also be encouraged.

Hospital emergency phone numbers must be posted near telephones. The Emergency Information Chart printed inside the back cover of this Guide may be helpful. Stretchers and blankets should be available to transport injured or ill employees to a hospital.

If no infirmary, clinic, or hospital for the treatment of injured employees is located near your plant, the following are required:

*At least one employee (but preferably more) on each shift must be trained in first aid. The American Red Cross, the U.S. Bureau of Mines, some insurance carriers, and local safety councils provide acceptable training.

*First aid supplies approved by a consulting physician must be readily available. The supplies should be in sanitary containers with individually sealed packages for material that must be sterile, such as guaze, bandages, and dressings. Other items often needed in emergencies are adhesive tape, triangular bandages (to be used as slings), inflatable plastic splints, scissors, and mild soap for cleansing wounds or cuts.



*Suitable facilities for quickly flushing the eyes and drenching the body must be provided within the work area when a person may be exposed to a corrosive substance.

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

First aid is immediate, temporary treatment given in the event of accident or illness -- before the doctor arrives. IMMEDIATE FIRST AID (WITHIN FOUR MINUTES) MAY PREVENT DEATH OR PERMANENT IMPAIRMENT AND MAY LEAD TO COMPLETE RECOVERY.

RECORDKEEPING REQUIREMENTS

OSHA recordkeeping requirements call for factual information about accidents. Employers can use these records to evaluate the success of their safety and health activities and to identify high risk areas of their businesses to which attention should be directed. Employers must report within 48 hours to OSHA (or a state agency in states which have an approved occupational safety and health plan) any incident or accident which results in a fatality or hospitalization of five or more employees.

Federal regulations require that employers with 11 or more employees at any time during the preceding calendar year complete OSHA Form 101 (or equivalent), and OSHA Form 200 which replaces Forms 100 and 102. (The new OSHA Form 200 is available from any OSHA Area or Regional Office). The following cases must be recorded on the OSHA Form 200 (Log and Summary of Occupational Injuries and Illnesses): every death, every illness, and any injury which results in loss of consciousness, loss of worktime, restriction of work or motion, temporary or permanent transfer to another job, or medical treatment other than first aid. Illnesses and injuries are classified according to lost workdays, restriction of duties or "light duty,"and no lost time.

A supplementary record must be completed for each recordable case. OSHA Form 101 may be used; a state workers' compensation report or other form is

acceptable if it contains the equivalent information as the OSHA 101. Forms 200 and 101 must be kept current to within six days.

Bureau of Labor Statistics
Log and Summary of Occupational
Injuries and Illnesses

NOTE: **This form is required by Public Law 91-596 and must be kept in the establishment for *5 years*. Failure to maintain and post can result in the issuance of citations and assessment of penalties.** *(See posting requirements on the other side of form.)*

RECORDABLE CASES. You are required to record information about every occupational death, every nonfatal occupational illness, and those nonfatal occupational injuries which involve one or more of the following: loss of consciousness, restriction of work or motion, transfer to another job, or medical treatment (other than first aid). *(See definitions on the other side of form.)*

Case or File Number	Date of Injury or Onset of Illness	Employee's Name	Occupation	Department	Description of Injury or Illness
Enter a nonduplicating number which will facilitate comparisons with supplementary records.	Enter Mo./day.	Enter first name or initial, middle initial, last name	Enter regular job title, not activity employee was performing when injured or at onset of illness. In the absence of a formal title, enter a brief description of the employee's duties.	Enter department in which the employee is regularly employed or a description of normal workplace to which employee is assigned, even though temporarily working in another department at the time of injury or illness.	Enter a brief description of the injury or illness and indicate the part or parts of body affected. Typical entries for this column might be: Amputation of 1st joint right forefinger; Strain of lower back; Contact dermatitis on both hands; Electrocution—body
(A)	(B)	(C)	(D)	(E)	(F)
					PREVIOUS PAGE TOTALS →
					TOTALS (Instructions on other side of form.)

OSHA No. 200

U.S. Department of Labor

For Calendar Year 19 ____ Page ___ of ___

Company Name

Establishment Name

Establishment Address

Form Approved
O M B No 44R 1453

Extent of and Outcome of INJURY

Type, Extent of, and Outcome of ILLNESS

Fatalities	Nonfatal Injuries					Fatalities	Nonfatal Illnesses				
Injury Related	Injuries With Lost Workdays				Injuries Without Lost Workdays	Illness Related	Illnesses With Lost Workdays				Illnesses Without Lost Workdays
Enter DATE of death	Enter a CHECK if injury involves days away from work, or days of restricted work activity, or both	Enter a CHECK if injury involves days away from work	Enter number of DAYS away from work	Enter number of DAYS of restricted work activity	Enter a CHECK if no entry was made in columns 1 or 2 but the injury is recordable as defined above	Enter DATE of death	Enter a CHECK if illness involves days away from work, or days of restricted work activity, or both	Enter a CHECK if illness involves days away from work	Enter number of DAYS away from work	Enter number of DAYS of restricted work activity	Enter a CHECK if no entry was made in columns 8 or 9
Mo./day/yr.	(2)	(3)	(4)	(5)	(6)	Mo./day/yr.	(9)	(10)	(11)	(12)	(13)

CHECK Only One Column for Each Illness (See other side of form for examples of permanent cases.)

Occupational skin disease or disorder	Dust diseases of the lungs	Respiratory conditions due to toxic agents	Poisoning (systemic effects of toxic materials)	Disorders due to physical agents	Disorders associated with repeated trauma	All other occupational illnesses
(a)	(b)	(c)	(d)	(e)	(f)	(g)

(7)

INJURIES

ILLNESSES

Certification of Annual Summary Totals By _____ Title _____ Date _____

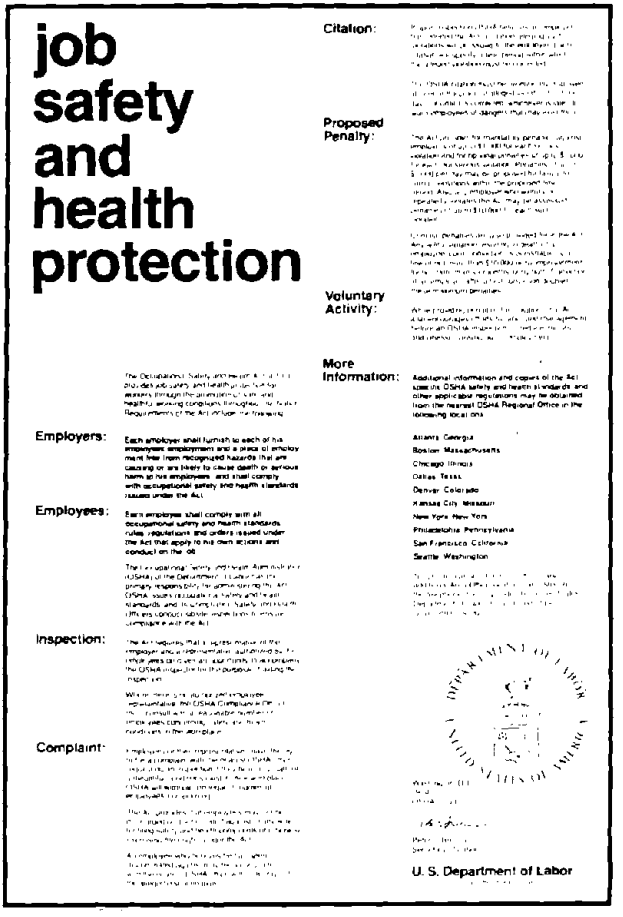
OSHA No. 200

POST ONLY THIS PORTION OF THE LAST PAGE NO LATER THAN FEBRUARY 1.

OSHA Form 200 must be posted for the entire month of February in a place where all employees are likely to see it. Forms 101 and 200 must be retained for five years, excluding the current calendar year.

A booklet, "Recordkeeping Requirements Under the Williams-Steiger Occupational Safety and Health Act of 1970", is available from OSHA regional or area offices or from the regional offices of the Bureau of Labor Statistics.

Employers should consult with their state occupational safety and health agency to determine what records are required by the state.



job safety and health protection

Citation:

Proposed Penalty:

Voluntary Activity:

More Information:

Employers:

Employees:

Inspection:

Complaint:

U. S. Department of Labor

CHECKLIST

Since the success of a safety and health program depends on identifying hazards and taking immediate remedial action, periodic inspections of the plant are a necessity.

A checklist, such as the one presented on the following pages, can be helpful to management in performing an inspection of the facility. Because businesses vary, it is best that each business develop a customized list from the information in this Guide and a walk-through inspection.

Using this checklist, the manager, supervisor, or employee representative can make periodic inspections (preferably at least once each month) and identify problem areas so that corrective action may be taken.

References made in this checklist's subtitles refer to appropriate sections of Occupational Safety and Health Standards, Code of Federal Regulations, Title 29, Part 1910, which are the OSHA "General Industry Standards."

WALKING AND WORKING SURFACES -- GENERAL (29 CFR 1910.22)	YES	NO
Are all places of employment kept clean and orderly?	___	___
Are floors, aisles, and passageways kept clean and dry? Are all spills cleaned up immediately?	___	___
Are floor holes, such as drains, covered?	___	___
Are permanent aisles appropriately marked?	___	___
If mechanical handling equipment is used, is sufficient clearance allowed for aisles?	___	___
Are wet surface areas covered with nonslip materials?	___	___

STORAGE LOFTS, SECOND FLOORS, ETC. (29 CFR 1910.22,.23)		
Are signs present showing floor load capacity?	___	___

	YES	NO
Are platforms, storage lofts, balconies, etc., that are more than 4 feet above the floor protected with standard guardrails?	___	___
Are all platforms, lofts, and balconies (from which people or machinery below could be struck by falling objects) guarded with standard 4-inch toeboards?	___	___

FIXED INDUSTRIAL STAIRS
(29 CFR 1910.24)

Are there standard stair rails or handrails on all stairways having four or more risers?	___	___
Are all stairways at least 22 inches wide?	___	___
Do stairs have at least a 7-foot overhead clearance?	___	___
Do stairs angle no more than 50 and no less than 30 degrees?	___	___

PORTABLE AND FIXED LADDERS
(29 CFR 1910.25,.26,.27)

Have defective ladders (broken rungs, side rails, etc.) been tagged as "DANGEROUS, DO NOT USE" and removed from service for repair or destruction?	___	___
Do fixed ladders have at least 3 1/2 feet of extension at the top of the landing?	___	___
Do all fixed ladders have a preferred pitch of 75 degrees to 90 degrees?	___	___

EXIT AND EXIT MARKINGS (29 CFR 1910.36-.38)	YES	NO
Are all exits marked with an exit sign and illuminated by a reliable light source?	___	___
Is the lettering on exit signs at least 6 inches high with the principal letter strokes at least 3/4 of an inch wide?	___	___
Is the direction to exits, when not immediately apparent, marked with visible signs?	___	___
Are doors or other passageways that are neither exits nor access to an exit, and located where they may be mistaken for exits, appropriately marked "NOT AN EXIT," "TO BASEMENT," etc.?	___	___
Are exit doors side-hinged?	___	___
Are all doors that must be passed through to reach an exit, or ways to an exit, always free to access with no possibility of a person being locked inside?	___	___
Are all exit routes always kept free of obstructions?	___	___

OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL (29 CFR 1910.1000)		
Is management aware of the hazards caused by various chemicals used in the plant (solvents, cutting oils, paints, etc.)?	___	___
Is management aware of the hazards associated with the inhalation of cadmium fumes from silver solder?	___	___

	YES	NO
Are eye-wash fountains and safety showers provided in areas where chemicals such as caustics are used?	___	___
Are the contents of all containers, such as safety cans, vats, and storage tanks, clearly labeled?	___	___
Are employees required to wear personal protective equipment (gloves, eye protection, respirators, etc.) when handling hazardous materials?	___	___
If internal combustion engines are used, is carbon monoxide kept within acceptable levels?	___	___
Is the vacuuming, rather than the blowing or sweeping, of dust used wherever possible?	___	___

OCCUPATIONAL NOISE EXPOSURE (29 CFR 1910.95)

If a noise problem is suspected, have the sources been identified and have the noise levels been measured?	___	___
Have all feasible engineering controls been implemented properly and evaluated?	___	___
If a noise problem exists, have plans to reduce noise levels by engineering methods been made (e.g., enclosure, design modifications, maintenance, different methods of processing)?	___	___

	YES	NO
If engineering controls cannot reduce the noise to safe levels:		
Have administrative controls, such as limiting worker exposure in a given area, been considered?	___	___
Are affected employees given annual audiometric tests, if necessary?	___	___
Do all employees in high-noise areas wear hearing protection?	___	___
Are annual noise surveys made to reevaluate the problem?	___	___

FLAMMABLE AND COMBUSTIBLE LIQUIDS
(29 CFR 1910.106)

Are all connections vapor- and liquid-tight on drums and combustible liquid piping?	___	___
Are flammable liquids kept in closed containers (e.g., parts cleaning tanks and pans) when not in use?	___	___
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? Are flammable liquids (e.g., gasoline) stored in approved containers?	___	___

	YES	NO
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?	___	___

PERSONAL PROTECTIVE EQUIPMENT
(29 CFR 1910.132-.137)

If necessary, is personal protective equipment provided, used, and maintained?	___	___
Is employee-owned personal protective equipment, such as gloves, protective shoes, etc., adequate and properly maintained?	___	___
Is eye protection available where debris or flying objects could be a hazard?	___	___
Is slip-resistant footwear worn?	___	___
Are hard hats or safety shoes available where falling objects could be a hazard?	___	___

RESPIRATORY PROTECTION DEVICES
(29 CFR 1910.134)

Are respirators provided when necessary?	___	___

	YES	NO
Are there written standard operating procedures for the selection and use of respirators?	___	___
Is the user instructed and trained in the proper use of respirators?	___	___
Where practicable, is each employee assigned an individual respirator?	___	___
Are respirators cleaned and disinfected after each use?	___	___
Are respirators stored in a convenient, clean, and sanitary location?	___	___
Are routinely used respirators inspected during cleaning?	___	___
Is the proper respirator in use for the hazard present? (For example, dust masks do not protect against solvent vapors.)	___	___

GENERAL ENVIRONMENTAL CONTROLS -- SANITATION (29 CFR 1910.141-.149)

Are restrooms and washrooms kept in clean and sanitary condition?	___	___
Are covered receptacles for sanitary napkins provided in the women's restroom?	___	___
Are covered receptacles for waste food kept in clean and sanitary condition?	___	___
Is all water provided for drinking, washing, and cooking suitable for drinking?	___	___

	YES	NO
Are all outlets for water not suitable for drinking clearly posted as "UNSAFE FOR DRINKING, WASHING, OR COOKING"?	___	___
Are employees prohibited from eating in areas where toxic materials are present?	___	___
Has pest and rodent control been exercised?	___	___
If employees are permitted to eat on the premises, are they provided with a suitable space for that purpose?	___	___

MEDICAL AND FIRST AID
(29 CFR 1910.151)

Is at least one employee on each shift currently qualified to render first aid in the absence of a nearby clinic or hospital? (Some states require first aid trained persons regardless of nearby clinics or hospitals.)	___	___
Are first aid supplies readily available, regularly inspected, and promptly replenished?	___	___
Are first aid supplies approved by a consulting physician, indicating that they are adequate?	___	___
Are medical personnel readily available for advice and consultation on matters of employee health?	___	___
Is there a first aid kit easily accessible to the work area?	___	___

	YES	NO
Are emergency phone numbers posted?	___	___
Where employees may be exposed to injurious corrosive materials, are they provided with quick-drenching and flushing facilities for immediate emergency use?	___	___

FIRE PROTECTION
(29 CFR 1910.157,.159,.160)

Are extinguishers selected for the types of combustibles and flammables in the areas where they are to be used?		___	___
Class A.	Ordinary combustible material fires	___	___
Class B.	Flammable-liquid or grease fires	___	___
Class C.	Energized electrical equipment fires	___	___
Are extinguishers fully charged and in designated places?		___	___
Are extinguishers located along normal paths of travel?		___	___
Are extinguisher locations free from obstruction or blockage?		___	___
Have all extinguishers been serviced, maintained, and tagged at intervals not exceeding 1 year?		___	___
Are all extinguishers checked monthly to see if they are in place or if they have been discharged, etc.?		___	___

	YES	NO
Have all extinguishers been hydrostatically tested according to schedules set for the type of extinguisher?	___	___

Automatic Sprinkler (if applicable)

Is there at least one automatic water supply of adequate pressure, capacity, and reliability?	___	___
Are water-flow alarms provided on all sprinklers?	___	___
Are the sprinkler systems periodically inspected and continuously maintained?	___	___
Is combustible material never piled within 36 inches of the sprinkler system, except as mentioned below?	___	___
1. Solid piles 15 feet high or in piles 12 feet high with horizontal channels.	___	___
2. Commodities containing only small amounts of combustible material.	___	___

COMPRESSED AIR EQUIPMENT
(29 CFR 1910.169)

Are pulleys and belts on compressors and motors completely guarded?	___	___
Are flexible cords or plugs on electric motors periodically checked and replaced if in a deteriorated condition?	___	___
Are air tanks drained regularly?	___	___

	YES	NO
Are pressure-relief devices and gauges in good operating condition?	___	___

MATERIAL HANDLING AND STORAGE
(29 CFR 1910.176-.181)

Is there safe clearance for equipment through aisles and doors?	___	___
Is stored material stable and secure?	___	___
Are storage areas free from tripping hazards?	___	___
Are only trained operators allowed to operate powered industrial trucks?	___	___
Are appropriate overhead guards installed on powered lift trucks?	___	___
Is battery charging on electric units performed only in designated areas?	___	___
Are "NO SMOKING" signs posted near electric battery charging units?	___	___
Are dock boards (bridge plates) used when loading or unloading from dock to truck or dock to rail car?	___	___
Are all vehicles shut off prior to loading with the fork lift?	___	___
Are all containers (especially those containing combustibles or flammables), when stacked one upon the other, always separated by dunnage sufficient to provide stability?	___	___
Are racks and platforms loaded within the limits of their capacity?	___	___

	YES	NO
Is all storage secured against sliding or collapse?	___	___
Have aisles been designated and kept clear to allow unhindered passage?	___	___
Are specifications posted for maximum, approved loads for floors (except slabs with no basements)?	___	___

MACHINERY AND MACHINE GUARDING
(29 CFR 1910.212)

Are belts, pulleys, and rotating shafts (air compressor, saws, etc.) properly guarded?	___	___
Are chains, sprockets, and gears properly guarded?	___	___
Are all in-going nip points properly guarded?	___	___
Are all rotating parts (lubrication fittings, etc.) recessed or covered with collars?	___	___
Is all equipment with an electric motor or any electrical connection effectively grounded?	___	___
Are sprockets and V-belt drives that are within reach of platforms and passageways or less than 7 feet from the floor completely enclosed?	___	___
Are fans less than 7 feet above floors protected with a guard having openings 1/2 inch or less?	___	___

ABRASIVE WHEEL MACHINERY (GRINDERS) (29 CFR 1910.215)	YES	NO
Is the work rest used and kept adjusted to within 1/8 inch of the wheel?	___	___
Is the adjustable tongue on the top side of grinder used and kept adjusted to within 1/4 inch of the wheel?	___	___
Do side guards cover the spindle, nut, flange, and 75% of the wheel diameter?	___	___
Are bench and pedestal grinders permanently mounted?	___	___
Are goggles or face shields always worn when grinding?	___	___

HAND AND PORTABLE POWER TOOLS (29 CFR 1910.242-.244)		
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?	___	___
Have deteriorated air hoses been replaced?	___	___
Has compressed air used for cleaning been reduced to 30 psi when dead-ended?	___	___

	YES	NO
Have employees been instructed that the use of compressed air to blow debris from clothing or body is prohibited because it can enter the body and cause serious harm?	___	___
Are portable abrasive wheels appropriately guarded?	___	___
Have employees been made aware of the hazards caused by faulty or improperly used hand tools?	___	___

WELDING, CUTTING, AND BRAZING (29 CFR 1910.252)

Are fuel gas cylinders and oxygen cylinders separated by 20 feet or a barrier 5 feet high having a 1/2-hour fire resistance rating?	___	___
Are cylinders secured and stored where they cannot be knocked over?	___	___
Are valve protective caps in place except when the cylinder is in use?	___	___
Are compressed gas cylinders kept away from sources of heat, elevators, stairs, or gangways?	___	___
Are only trained employees, who are judged competent by the employer, allowed to use oxygen or fuel gas equipment?	___	___
Do all cylinders (except those with fixed hand wheels) have nonadjustable wrenches, keys, or handles in place on valve stems while cylinders are in use?	___	___

	YES	NO
Is welding always conducted at a safe distance from flammable liquids or dusty areas?	___	___
Are all compressed gas cylinders legibly marked for identifying the contents?	___	___
Are the valves shut off when the cylinder is not in use?	___	___
Are precautions taken to be sure that barrels, tanks, or other containers have been cleaned thoroughly to remove all flammable or toxic vapors or residues before cutting, welding, or other hot work is permitted on them?	___	___
Is eye protection (goggles, helmets, hand shields, etc.) provided and worn as a protection against sparks or other debris?	___	___
Is appropriate protective clothing (gloves, aprons, legging, etc.) worn as a protection against sparks and other debris?	___	___
Are nearby workers protected from welding flash?	___	___
Are employee exposures to welding and cutting fumes kept within acceptable limits?	___	___

NATIONAL ELECTRICAL CODE -- ELECTRICAL WIRING (29 CFR 1910.309)

Have exposed wires, frayed cords, and deteriorated insulation been repaired or replaced?	___	___
Are junction boxes, outlets, switches, and fittings covered?	___	___

	YES	NO
Is all fixed metal electrical equipment grounded?	___	___
Does all equipment connected by cord and plug have grounded connections?	___	___
Are electrical appliances, such as vacuums, blowers, and vending machines, grounded?	___	___
Are all portable electrical hand tools grounded or doubly insulated?	___	___
Are flexible cords and cables run only in appropriate places (not through holes in wall or ceiling, or through doorways or windows, or attached to building surfaces)?	___	___
Are flexible cords and cables free from splices or taps?	___	___
Are flexible cords and cables never substituted for fixed wiring?	___	___
Are flexible cords and cables fastened so that there is no direct pull on joints or terminal screws?	___	___
Are electrical equipment controls accessible?	___	___

RECORDKEEPING
(29 CFR 1904.2-.8)

Is employee poster (OSHA or equivalent state poster) prominently displayed?	___	___
Have occupational injuries or illnesses, except minor injuries requiring only first aid, been recorded on OSHA Form Nos. 101 and 200, or equivalent?	___	___

	YES	NO
Has a summary of all occupational injuries and illnesses been compiled at the conclusion of each calendar year and been recorded on OSHA Form No. 200, and was it posted during the month of February?	___	___
Are all OSHA records retained for a period of 5 years, excluding the current year?	___	___

INFORMATION SOURCES

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

B11.1	Care and Use of Mechanical Power Presses
B15.1	Mechanical Power Transmission
B30	Cranes and Hoists
B30.9-1971	Slings
B30.16-1973	Overhead Hoists
C1	National Electrical Code
Z49.1	Welding and Cutting
Z87.1	Eye and Face Protection
Z88.1,88.2	Respiratory Protection

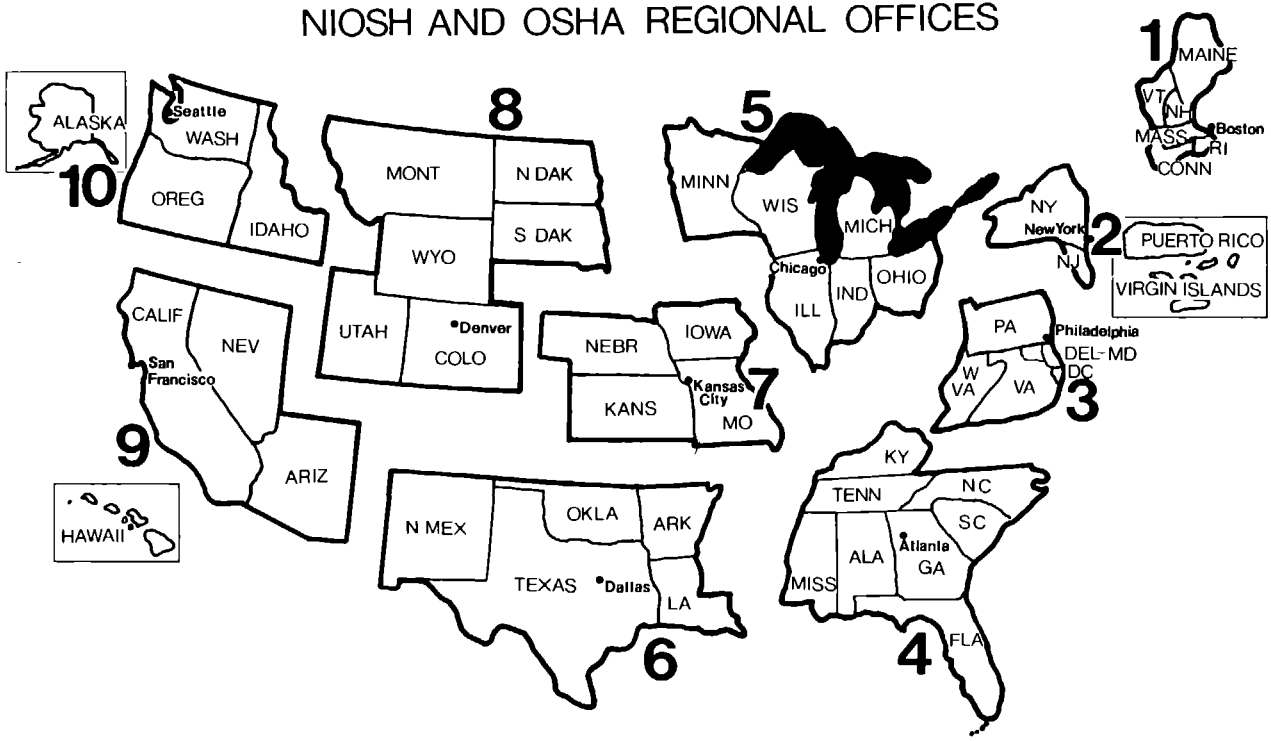
NATIONAL FIRE PROTECTION ASSOCIATION
470 Atlantic Avenue
Boston, Massachusetts 02110

NFPA-10-1970	Installation of Portable Fire Extinguishers
NFPA-101-1970	Life Safety Code
NFPA-13A-1971	Sprinkler Systems, Maintenance
NFPA-70-1971	National Electrical Code

NATIONAL SAFETY COUNCIL
444 North Michigan Avenue
Chicago, Illinois 60611

NIOSH and OSHA regional directors, state and local governmental agencies, trade associations, and insurance companies can provide useful information The Small Business Administration will provide information concerning procedures for securing economic assistance in complying with the OSHA standards, if needed.

NIOSH AND OSHA REGIONAL OFFICES



NIOSH AND OSHA REGIONAL OFFICES

Listed below are NIOSH and OSHA Regional Offices. These offices can answer questions about the Occupational Safety and Health Act, including where to get copies of standards, criteria documents, and other occupational safety and health 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, Pennsylvania 19101
215/596-6716

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

DHEW, Region V
300 South Wacker Dr.,
33rd Floor
Chicago, Illinois 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 W.
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, Room 231
San Francisco, California 94102
415/556-3781

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

OSHA REGIONAL OFFICES

U.S. Dept. of Labor, Region I
JFK Bldg., Room 1804
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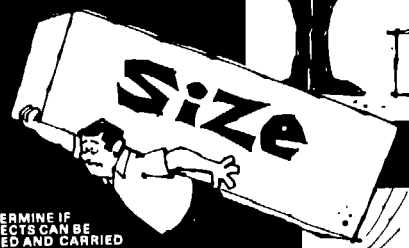
PRINTED MATTER

HOW TO LIFT SAFELY

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

The factors that contribute to safe lifting are...



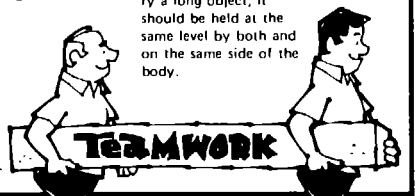
DETERMINE IF OBJECTS CAN BE LIFTED AND CARRIED SAFELY.

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

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

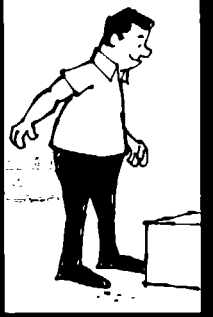
The load should be equally distributed. Movements must be coordinated so you both start and finish the lift action at the same time and perform turning movements together.

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.



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

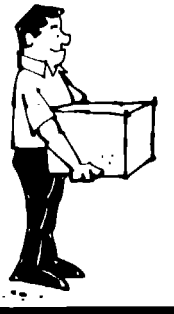
2. Place the feet close to the object to be lifted 8 to 12 inches apart for good balance.



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.

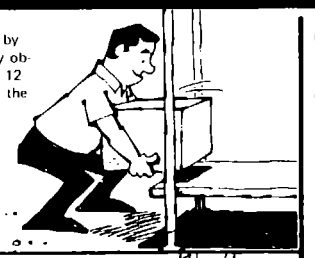
5 Lift the object into carrying position, making no turning or twisting movements until the lift is completed



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.

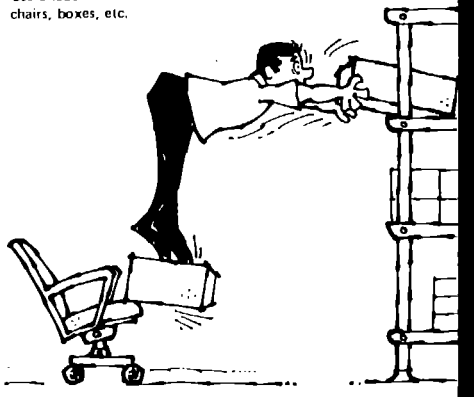
Avoid strain by storing heavy objects at least 12 inches above the floor.



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.



KIND OF FIRE

DECIDE THE CLASS OF FIRE YOU ARE FIGHTING. . .

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

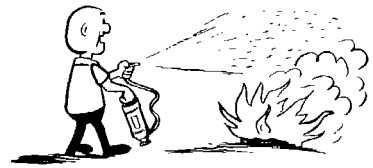
APPROVED TYPE OF EXTINGUISHER

MATCH UP PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT

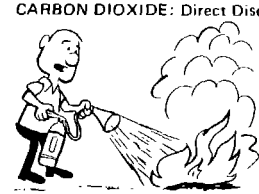
	FOAM Solution of Aluminum Sulphate and Bicarbonate of Soda	CARBON DIOXIDE Carbon Dioxide Gas Under Pressure	SODA ACID Bicarbonate of Soda Solution and Sulphuric Acid	PUMP TANK Plain Water	GAS CARTRIDGE Water Expelled by Carbon Dioxide Gas	MULTI-PURPOSE DRY CHEMICAL	ORDINARY DRY CHEMICAL
CLASS A FIRES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

HOW TO OPERATE

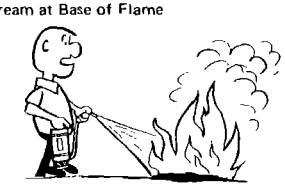
FOAM: Don't Play Stream into the Burning Liquid. Allow Foam to Fall Lightly on Fire.



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

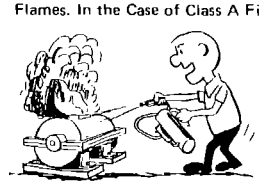


SODA-ACID, GAS CARTRIDGE: Direct Stream at Base of Flame



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



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

TABLE I

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH