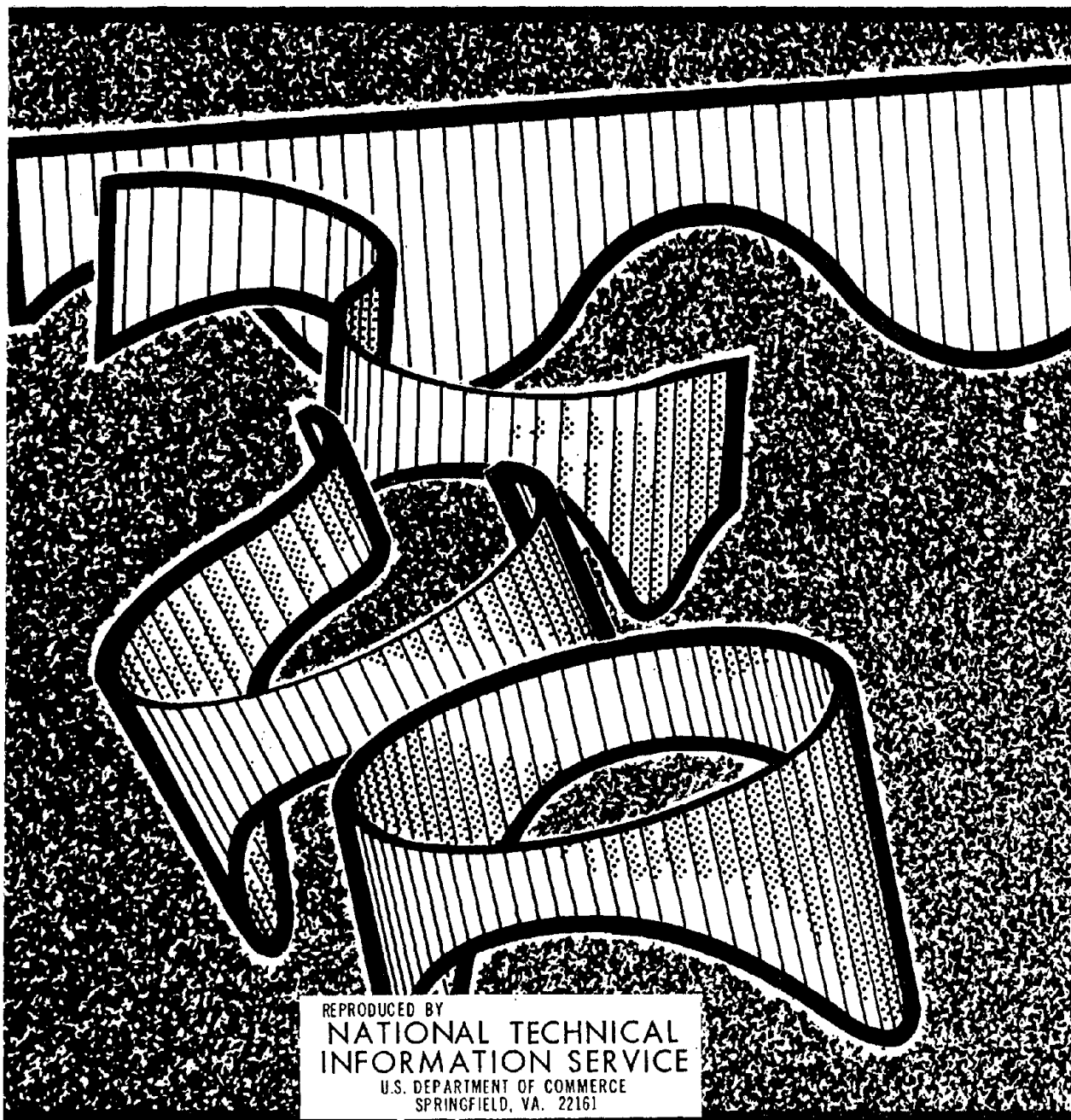


PB83174722

**NIOSH**

# Health and Safety Guide for **FABRICATED STRUCTURAL METAL PRODUCTS INDUSTRY**



REPRODUCED BY  
**NATIONAL TECHNICAL  
INFORMATION SERVICE**  
U.S. DEPARTMENT OF COMMERCE  
SPRINGFIELD, VA. 22161

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



## **NIOSH HEALTH AND SAFETY GUIDES**

- ☐ Bulk Petroleum Plants, Pub. No. 75-112
- ☐ Grocery Stores, Pub. No. 75-134
- ☐ Retail Bakeries, Pub. No. 75-135
- ☐ Auto Repair and Body Shops, Pub. No. 75-136
- ☐ Service Stations, Pub. No. 75-139
- ☐ Sporting Goods Stores, Pub. No. 75-141
- ☐ Grain Mills, Pub. No. 75-144
- ☐ Electroplating Shops, Pub. No. 75-145
- ☐ Retail Lumber and Building Materials, Pub. No. 75-146
- ☐ Plastic Fabricators, Pub. No. 75-150
- ☐ Laundries and Dry Cleaners, Pub. No. 75-151
- ☐ Fluid Milk Processors, Pub. No. 75-152
- ☐ The Printing Industry, Pub. No. 75-155
- ☐ Bottled and Canned Soft Drink Facilities, Pub. No. 75-156
- ☐ Concrete Products Industry, Pub. No. 75-168
- ☐ Food Processors, Pub. No. 75-166
- ☐ Wooden Furniture Manufacturers, Pub. No. 75-167
- ☐ Metal Stamping Operations, Pub. No. 75-174
- ☐ Paint and Allied Products, Pub. No. 75-179
- ☐ Paperboard-Container Industry, Pub. No. 76-102
- ☐ Millwork Shops, Pub. No. 76-111
- ☐ Hotels and Motels, Pub. No. 76-112
- ☐ Auto and Home Supply Stores, Pub. No. 76-113
- ☐ Farm and Garden Machinery and Equipment Manufacturers, Pub. No. 76-119
- ☐ Foundries, Pub. No. 76-124
- ☐ Scrap Processors, Pub. No. 76-125
- ☐ Signs and Advertising Displays, Pub. No. 76-126
- ☐ Plumbing, Heating, and Air Conditioning Contractors, Pub. No. 76-127
- ☐ Prefabricated Wooden Bldg. Manufacturers, Pub. No. 76-159
- ☐ Eating and Drinking Places, Pub. No. 76-163
- ☐ Manufacturers of Toys, Games, Amusements, and Recreational Goods, Pub. No. 76-165
- ☐ Screw Machine Products, Pub. No. 76-174
- ☐ Pesticide Formulators, Pub. No. 77-100
- ☐ Tanning Industry, Pub. No. 77-101
- ☐ Meat Packing, Poultry Dressing, and Sausage Manufacturers, Pub. No. 77-127
- ☐ Plywood and Veneer Mills, Pub. No. 77-186
- ☐ Metal Coating and Allied Services, Pub. No. 77-187
- ☐ Storage Battery Manufacturers, Pub. No. 77-190
- ☐ Miscellaneous Chemical Products Industry, Pub. No. 77-194
- ☐ Tool, Die, and Precision Machining Industry, Pub. No. 77-198
- ☐ Manufacturers of Lighting Fixtures, Pub. No. 77-228
- ☐ Fabricated Structural Metal Products Industry, Pub. No. 78-100

Single copies are available from:

Division of Technical Services  
Publications Dissemination  
National Institute for  
Occupational Safety and Health  
4676 Columbia Parkway  
Cincinnati, Ohio 45226

Please enclose a self-addressed mailing label to assist in answering your request.



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                         |                 |                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------|-----------------|--------------------------------------------------------------|
| <b>REPORT DOCUMENTATION PAGE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  | <b>1. REPORT NO.</b>                                    | <b>2.</b><br>NA | <b>3. Recipient's Accession No.</b><br>PB83-174 722          |
| <b>4. Title and Subtitle</b><br>Health and Safety Guide for Fabricated Structural Metal Products Industry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |                                                         |                 | <b>5. Report Date</b><br>October 1977                        |
| <b>7. Author(s)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                                         |                 | <b>6.</b><br>NA                                              |
| <b>9. Performing Organization Name and Address</b><br>NIOSH<br>4676 Columbia Parkway<br>Cincinnati, Ohio 45226                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                                         |                 | <b>8. Performing Organization Rept. No.</b><br>78-100        |
| <b>12. Sponsoring Organization Name and Address</b><br>NIOSH<br>4676 Columbia Parkway<br>Cincinnati, Ohio 45226                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                         |                 | <b>10. Project/Task/Work Unit No.</b><br>NA                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                         |                 | <b>11. Contract(G) or Grant(G) No.</b><br>(C)<br>(G)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                         |                 | <b>13. Type of Report &amp; Period Covered</b><br>NIOSH Rep. |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                         |                 | <b>14.</b><br>NA                                             |
| <b>15. Supplementary Notes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                                         |                 |                                                              |
| <b>16. Abstract (Limit: 200 words)</b><br><br>In this industry, both physical hazards and health problems exist -- physical hazards when large, heavy sections are moved to various locations, and adverse health effects from (1) noise from welding, burning, chipping, riveting, and sawing; (2) exposure to lead particulate from the paint spraying operation; and (3) exposure to welding gases and metal fumes. Some of the fabricators also install their products; when employees do this work, they may be exposed to construction hazards and construction standards would apply (29 CFR, Part 1926).<br><br>Cuts from the sharp edges of the metal and glass are the predominant hazard. Welding and spray painting operations may be a health hazard if proper procedures are not followed. Noise from the sawing and riveting operations may be a hazard. Often these plants are located in small, crowded buildings where the housekeeping is poor. Although companies in this classification may do their own extruding, extrusion operations are not covered in this Guide. |  |                                                         |                 |                                                              |
| <b>17. Document Analysis a. Descriptors</b><br><br>metalworking, safety, occupational-hazards, noise, welding, gases, fumes<br><br><b>b. Identifiers/Open-Ended Terms</b><br><br><br><br><b>c. COSATI Field/Group</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                         |                 |                                                              |
| <b>18. Availability Statement:</b><br><br>AVAILABLE TO THE PUBLIC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  | <b>19. Security Class (This Report)</b><br>UNCLASSIFIED |                 | <b>21. No. of Pages</b><br>103                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  | <b>20. Security Class (This Page)</b><br>UNCLASSIFIED   |                 | <b>22. Price</b>                                             |



**NIOSH  
HEALTH AND SAFETY GUIDE**

**FABRICATED STRUCTURAL  
METAL PRODUCTS INDUSTRY**

**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  
October 1977**



## **ACKNOWLEDGMENT**

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: Walter J. Chrostek, Industrial Hygienist, Region III; Frank W. Godbey, Industrial Hygienist, NIOSH; and Marion Curry, Writer-Editor, Information Support Services Section, TIDB. Comments on this Guide would be appreciated.

**DHEW (NIOSH) Publication No. 78-100**



## **CONTENTS**

|                                                                                                |  |
|------------------------------------------------------------------------------------------------|--|
| <b>Acknowledgment, ii</b>                                                                      |  |
| <b>Introduction, 1</b>                                                                         |  |
| <b>Health and Safety Guidelines, 2</b>                                                         |  |
| General Philosophy Regarding Health and Safety, 2                                              |  |
| Health and Safety Program, 3                                                                   |  |
| Employee Training, 4                                                                           |  |
| The Fabricated Structural Metal Products Industry and Its Hazards, 4                           |  |
| Safety Rules for Operating Power Tools, 7                                                      |  |
| Machine Guarding, 7                                                                            |  |
| Good Housekeeping Helps Prevent Fires, 7                                                       |  |
| Controls to Promote Occupational Safety and Health, 8                                          |  |
| Automatic Sprinkler Systems, 10                                                                |  |
| <b>Frequently Violated Regulations, 11</b>                                                     |  |
| Walking and Working Surfaces, 11                                                               |  |
| Exit and Exit Markings, 19                                                                     |  |
| Occupational Health and Environmental Control, 20                                              |  |
| Personal Protective Equipment, 29                                                              |  |
| Sanitation, 31                                                                                 |  |
| Medical and First Aid, 33                                                                      |  |
| Fire Protection, 34                                                                            |  |
| Compressed Air Equipment, 36                                                                   |  |
| Materials Handling and Storage, 37                                                             |  |
| Machinery and Machine Guarding, 43                                                             |  |
| Hand and Portable Power Tools, 53                                                              |  |
| Welding, Cutting, and Brazing, 59                                                              |  |
| The National Electrical Code (NEC), 63                                                         |  |
| <b>Recordkeeping Requirements, 66</b>                                                          |  |
| <b>Checklists, 68</b>                                                                          |  |
| <b>Information Sources, 86</b>                                                                 |  |
| NIOSH and OSHA Regional Offices, 87                                                            |  |
| <b>Charts,</b>                                                                                 |  |
| Fire Extinguisher Chart, Foldout                                                               |  |
| How-to-Lift Safely Chart, Foldout                                                              |  |
| Standard Hand Signals for Controlling Crawler, Locomotive, and Crane Truck Operations, Foldout |  |
| Emergency Information Chart,                                                                   |  |
| <i>Inside Back Cover</i>                                                                       |  |



## INTRODUCTION

The Williams-Steiger "Occupational Safety and Health Act of 1970" was enacted "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. As part of NIOSH activities in research, information, education, and training in the fields of occupational safety and health, surveys are made to determine the most common health and safety problems in small businesses. From these surveys, a continuing series of guides has been developed for distribution to management and other persons interested in occupational safety and health.

This Guide presents guidelines for an effective health and safety program. It also lists some of the frequently encountered violations of the safety and health standards promulgated by the Department of Labor's Occupational Safety and Health Administration (OSHA). This Guide is not intended to provide total information in all areas of compliance. Additional information can be found in Title 29 of the Code of Federal Regulations, particularly Part 1910. In some states, the Federal government has delegated enforcement authority for occupational safety and health to the state government. Although state standards sometimes may be different from Federal standards, they must be at least as effective as the Federal standards.

Additional information and assistance can be obtained from NIOSH and OSHA regional offices whose addresses are given at the end of this Guide. Consultations resulting from requests for assistance will not precipitate a compliance visit by OSHA.

## **HEALTH AND SAFETY GUIDELINES**

### **GENERAL PHILOSOPHY REGARDING HEALTH AND SAFETY**

Through the use of a continuing health and safety program—one that is actively supported by management and that provides employee training—existing unsafe acts or conditions should become apparent. Although there may not be specific standards for many of these recognized problems, it is, nevertheless, important to find a solution.

During the analysis of the workplace for health and safety problems, it may also become apparent that "the letter of the law" is not being met. This may be particularly noticeable where dimensions are given for ladders, stairs, railings, etc. If it is apparent to all concerned that the "intent of the law" is being met, instead of making changes, a variance may be requested. The application for a variance must show that the variance is "as effective as" the OSHA standards. Considerable discretion must be exercised in this area, and the decision not to make changes should be made with the concurrence of OSHA.

When new buildings are being constructed, renovations are being made, or new equipment is obtained, the standards must be followed.

Even when a citation is issued, it is desirable that the employer have demonstrated willingness to comply with the intent of the law by operating effective, on-going safety and health programs, by correcting imminent dangers in the workplace, and by maintaining records of purchases, installations, and other compliance-promoting activities. After an OSHA compliance visit and a citation, the manager can then substantiate his intent to provide a safe and healthy workplace for his employees by demonstrating records that document his purpose, and he may be given the benefit of having shown "good faith," which can serve to reduce penalties.

## **HEALTH AND SAFETY PROGRAM**

Hazardous conditions or practices not covered in the OSHA standards are covered under the general duty clause of the Act that states "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."

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

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

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

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

## **EMPLOYEE TRAINING**

The following suggestions can reduce unsafe acts and practices:

- Impress on the worker the need for constant awareness of all aspects of safety, particularly good housekeeping and the elimination of slipping, tripping, and other hazards.
- Be sure that employees operating or working with forklifts, cranes, trucks, ditch diggers, and other powered equipment are appropriately trained as to their use, safety precautions, and signals. (See "Standard Hand Signals for Controlling Crawler, Locomotive, and Truck Crane Operations" in the back of this book.)
- Be sure all employees know how to use and do use appropriate personal protective and safety equipment, such as safety belts and lifelines.
- Develop and maintain check points to be observed as part of the standard and emergency procedures during each shift.
- Instruct employees in the use of portable fire extinguishers. (Refer to fold-out chart in the back of this booklet; post the chart in a conspicuous place.)
- Have at least one person trained in first aid on each site and each shift.
- Instruct employees in safe lifting practices. An easily understood chart, "How to Lift Safely," is included in the back of this book for posting where it may be seen by employees.

## **THE FABRICATED STRUCTURAL METAL PRODUCTS INDUSTRY AND ITS HAZARDS**

Most of the safety and health hazards common to all industries are common to the fabricated structural metal products industry. Because of the size of the fabricating machinery, the items fabricated, and the sharp edges on the products, the accident rates are, however, much higher.

### **Fabricated Structural Metal**

In this industry, both physical hazards and health problems exist—physical hazards when large, heavy sections are moved to various locations, and adverse health effects from (1) noise from welding, burning, chipping, riveting, and sawing; (2) exposure to lead particulate from the paint spraying operation; and (3) exposure to welding gases and metal fumes. Some of the fabricators also install their products; when employees do this work, they may be exposed to construction hazards and construction standards would apply (29 CFR, Part 1926).

## **Metal Door, Sashes, Frames, Molding, and Trim**

Cuts from the sharp edges of the metal and glass are the predominant hazard. Welding and spray painting operations may be a health hazard if proper procedures are not followed. Noise from the sawing and riveting operations may be a hazard. Often these plants are located in small, crowded buildings where the housekeeping is poor. Although companies in this classification may do their own extruding, extrusion operations are not covered in this Guide.

## **Fabricated Plate Work (Boiler Shops)**

In fabricated plate work, metal is sheared, rolled, punched, burned, and assembled. Chipping and burning may be done in the interior of vessels (confined spaces). Many workers have become ill and some have even perished in these confined spaces because of lack of oxygen and exposure to contaminants. Welding on aluminum and stainless steel not only produces the common contaminants of welding but also produces ozone gas. Since these operations consume oxygen, the oxygen concentration available to the worker in the vessel may be reduced to dangerously low levels unless there is adequate ventilation, or respirator protection, or both. When companies repair boilers and work is done inside the vessel, there may be a hazard from carbon monoxide and carbon dioxide gases as well as from a lack of oxygen.

When grinding and chipping must be done on the welds, noise levels can reach 110 dBA or more and hearing protection is required.

Some of these vessels must be painted, and if proper protection is not provided, there is a potential for overexposure to lead, solvent vapors, and other harmful substances.

If the tanks or boilers are to be installed, construction standards apply.

## **Sheet Metal Work**

Sheet metal work is involved with manufacturing such sheet metal products as ducts for heating and cooling, gutters, hoods, casings, and curtain walls. The chief hazard is cuts from the sharp edges. Another hazard arises from welding on galvanized metal, which can cause metal fume fever. The hazards associated with asbestos are also present for it is sometimes used for

insulation. In all these cases, personal protective equipment such as gloves and respirators can eliminate or reduce the problems.

### **Architectural and Ornamental Metal Work**

The workplaces involved in architectural and ornamental metal work produce stairs and staircases, open steel flooring (grating), fire escapes, grills, railings, and fences. Stock is cut into desired lengths, rolled, welded, and painted. Welding or burning on galvanized metal exposes the employee to zinc oxide fumes, which cause metal fume fever. Other characteristic hazards are noise during grinding and sawing and exposure to lead and to solvent vapors during painting. Proper ventilation or personal protective equipment are required. In many instances, installation is also performed and construction standards also apply.

### **Miscellaneous Metal Products**

In the production of miscellaneous metal products such as wire and metal canopies, the principal hazards are noise, welding fumes, and solvent vapors from paint spraying.

### **Excavation and Trenching**

When structural steel is erected or tanks are installed, excavation is often necessary. Trench cave-ins are one of the greatest causes of death in construction activities. Cave-ins are caused by inadequate shoring resulting from use of defective lumber, changing weather conditions, and heavy loads adjacent to the excavation. Soil structure has a direct bearing on the type and amount of shoring required.

Before excavation, a competent person should determine if underground utilities will create a hazard. The persons operating the trenching and excavation equipment should be well trained and familiar with the potential hazards. OSHA requires that all trenches deeper than 5 feet be sloped, shored, sheeted, braced, or otherwise supported.

When employees are required to be in trenches 4 feet or more deep, adequate means of exit, such as ladders or steps, must be provided. The ladders must be in good condition and extend 3 feet above the excavation. The shoring must be inspected daily and after changes in the weather. If gas seepage is a possibility, the trenching should be suspected of having a hazardous at-

mosphere, and no employee should enter the excavated area until the work atmosphere is determined to be safe.

## **SAFETY RULES FOR OPERATING POWER TOOLS**

Employees should be instructed to:

- Know the application, limitations, and potential hazards of the tool used.
- Select the proper tool for the job.
- Remove adjusting keys and wrenches before turning on tools.
- Never use electrically powered tools with frayed cords or with loose or broken switches.
- Keep guards in place and in working order.
- Have ground prongs in place.
- Maintain working areas free of clutter.
- Keep alert to potential hazards in the working environment, such as damp locations or the presence of highly combustible materials.
- Dress properly to prevent loose clothing from getting caught in the moving parts of machinery.
- Use safety glasses, dust or face masks, or other protective clothing and equipment when necessary.
- Never surprise or distract anyone using a power tool.

## **MACHINE GUARDING**

It is generally recognized that machine guarding is of the utmost importance in protecting the employee. In fact, it could be said that the degree to which machines are guarded in an establishment is a reflection of management's interest in providing a safe workplace.

Personnel cannot always be relied upon to act safely enough around machinery in motion to avoid accidents. From time to time, people will react differently to the same environment because of physical, mental, or emotional changes—sometimes reacting safely, sometimes not. It follows that even the well-coordinated and highly trained individual may at times perform unsafe acts that could lead to injury and death. Therefore, machine guarding is important.

## **GOOD HOUSEKEEPING HELPS PREVENT FIRES**

Maintaining a clean and orderly workplace reduces the danger of fires. Rubbish should be disposed of regularly. If it is neces-

sary to store combustible waste materials, a covered metal receptacle is suggested.

Cleaning materials can create hazards. Combustible sweeping compounds such as oil-treated sawdust can be a fire hazard. Floor coatings containing low-flash-point solvents can be dangerous, especially near sources of ignition. All oily mops and rags must be stored in closed metal containers.

Some common causes of fires in all businesses are electrical malfunctions, friction, open flames, sparks, hot surfaces, and smoking. Proper maintenance and awareness of these conditions through a safety program can reduce these fire hazards.

## **CONTROLS TO PROMOTE OCCUPATIONAL SAFETY AND HEALTH**

In the work environment, employees may be exposed to excessive levels of harmful contaminants, including gases, dusts, mists, vapors, noise, heat, and cold. Environmental standards for these contaminants and physical agents are listed in the Federal Register, "Occupational Safety and Health" standards (29 CFR, Parts 1910 and 1926). The most prevalent complaints reported are respiratory problems due to exposure to dusts, fumes, and other toxic agents.

Often health hazards are not recognized because the air contaminants are not visible and the agent involved is only identifiable by its trade name. A further complication arises from the fact that these materials tend to contain a mixture of substances or their decomposition products are very toxic.

To begin identifying occupational health hazards, a hazardous material analysis (product inventory) is made and all hazardous substances are listed and evaluated. If the composition or decomposition products cannot be determined, the information should be requested from the manufacturer or supplier who will often provide "Material Safety Data Sheets" for their products. These sheets contain safety information about materials, such as toxicity levels, physical characteristics, personal protective equipment requirements, emergency procedures, and incompatibilities with other substances.

A process analysis should be performed noting all chemicals used and all products and byproducts formed. When doing such

an analysis, allied activities such as maintenance and service operations should be included.

Examples of such operations would be:

- Welding performed around chlorinated materials that may cause the formation of toxic gases in addition to welding fumes.
- Using internal combustion engines, such as on a forklift truck, that would generate exhaust gases including carbon monoxide.
- Mixing certain cleaning agents (alkali and acids) that sometimes form poisonous gases, such as chlorine.

Various control methods must be used to prevent or reduce employee exposure to harmful contaminants.

1. Substitute less toxic materials—use methyl chloroform for carbon tetrachloride.
2. Change the process—change from gas-operated forklift trucks to electric lift trucks.
3. Isolate the hazardous process in a separate room or in a corner of the building to reduce the number of persons exposed.
4. Provide ventilation—have either local exhaust ventilation, where contamination is removed at the point of generation, or general mechanical ventilation (see "Occupational Health and Environmental Control" section).
5. Employ administrative controls—limit the total amount of time an individual is exposed to a health hazard; rotate two or more workers each day.
6. Train and educate employees—tell employees what hazards they are exposed to and how to reduce or limit exposure (see "Employee Training" section).
7. Emphasize personal hygiene—educate workers to wash their hands before eating; to wash chemicals such as caustics, epoxies, resins, etc., from their skin; not to eat around toxic chemicals or in contaminated areas; to change and wash clothing daily if it becomes contaminated with toxic chemicals, dusts, fumes, or liquids (some of these chemicals may be absorbed through the skin).
8. Provide personal protective equipment—use such items as respirators, hearing protection devices, protective clothing, and protective equipment (see "Personal Protective Equipment" section). Note that skin conditions such as chemical burns, skin rashes, and dermatitis constitute over half of all occupational health problems and that using protective creams or lotions, personal protective equipment, and good personal hygiene practices can often prevent the problems.

## **AUTOMATIC SPRINKLER SYSTEMS**

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 as well as OSHA 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. No shut-off valve is allowed in this connection.
- The employer is responsible for the condition of the sprinkler system and must keep it in good operating order. At least annual functional tests are required.
- The clearance between sprinkler deflectors and the top of combustible storage must be at least 36 inches unless the material is in solid piles less than 15 feet high or in piles less than 12 feet high with horizontal channels, in which case 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, must be provided on all automatic sprinkler installations.

## **FREQUENTLY VIOLATED REGULATIONS**

### **WALKING AND WORKING SURFACES**

#### **General Requirements**

- The workplace should be maintained clean, orderly, sanitary, and as far as possible, dry (especially in areas where chemicals that react with water, such as acid chlorides, are stored or processed). Spills should be cleaned up promptly.
- Areas that are constantly wet should have nonslip surfaces where personnel normally walk or work.
- Every floor, working place, and passageway must be maintained free from protruding nails, splinters, holes, and loose boards.
- Where mechanical handling equipment, such as lift trucks, is used, sufficient safe clearances must be provided for aisles at loading docks, through doorways, and wherever turns or passage must be made. Aisles must not be obstructed.
- All permanent aisles must be easily recognizable. Usually aisles are identified by painting or taping lines on the floor.
- The floor load capacity is the maximum weight, expressed in pounds per square foot, that can be safely supported by the floor. When this information is not available and when floor load capacity is in doubt, it is suggested that a competent engineer be consulted. These floor load capacities must be posted in a readily visible location (except for slab floors with no basement).

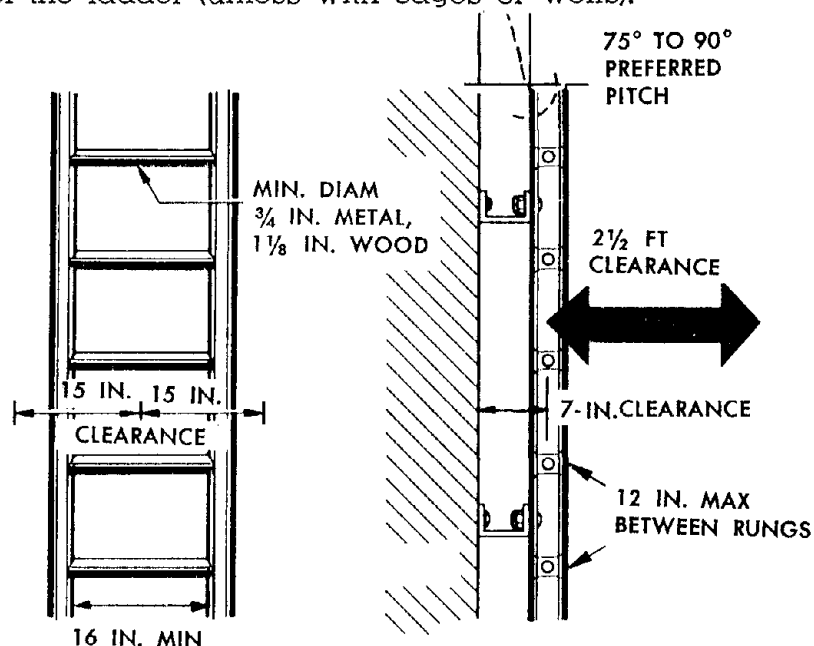
#### **Portable Ladders:**

- Must be maintained in good condition at all times.
- Should be kept coated with a suitable protective material. Wood ladders can be painted if carefully inspected before painting, providing the ladder is not for resale.
- Must be inspected frequently. Those which have developed defects must be tagged "DANGEROUS—DO NOT USE" and be removed from service for repair or destruction.
- If wooden, should be stored where they will not be exposed to the elements, and where there is good ventilation.

- If metal, should not be used near energized electrical equipment.
- Must be so placed that the side rails have a secure footing. They may not be placed on boxes, barrels, or other unstable bases to obtain additional height. Nonslip bases should be used.

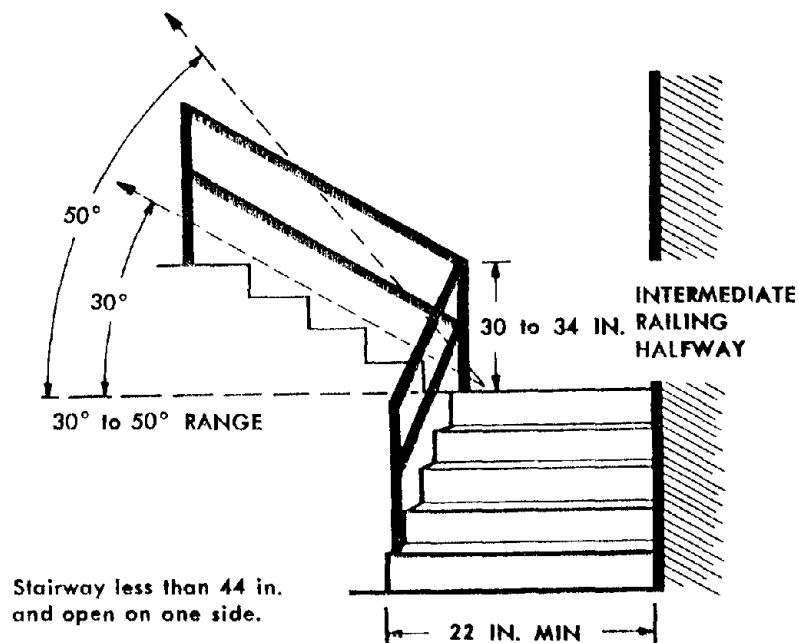
#### **Fixed Ladders Must:**

- Be designed to withstand a single concentrated load of at least 200 pounds.
- Have rungs with a minimum diameter of  $\frac{3}{4}$  inch for metal ladders, or  $1\frac{1}{8}$  inches for wood ladders.
- Not have rungs spaced more than 12 inches apart and must be at least 16 inches wide.
- Be painted (if metal), or otherwise treated to resist deterioration when location demands.
- Have a preferred pitch of  $75^\circ$  to  $90^\circ$  for safe descent.
- Have  $2\frac{1}{2}$ -foot clearance for ladders with  $90^\circ$  pitch and 3 feet for  $75^\circ$  pitch on the climbing side of ladder (unless caged).
- Have at least 7 inches clearance in back of the ladder to provide for adequate toe space.
- Be equipped with cages if they are longer than 20 feet.
- Have landing platforms if they are more than 30 feet long. A platform every 30 feet for caged ladders and every 20 feet for unprotected ladders is required.
- Have side rails extend  $3\frac{1}{2}$  feet above landings.
- Have a clear width of 15 inches on each side of the center line of the ladder (unless with cages or wells).



## Fixed Industrial Stairs

- Rise height and tread width must be uniform throughout any flight of stairs.
- All treads must be reasonably slip resistant.
- 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 minimum permissible width is 22 inches (if a means of exit access, at least 28 inches).
- The angle to the horizontal made by the stairs must be between  $30^\circ$  and  $50^\circ$ .
- All stairs should be adequately lighted.
- If the tread is less than 9 inches wide, the risers should be open.
- Certain conditions applied to flights of stairs having four or more risers.
  - A stair railing is required on each open side.
  - If the stairway is less than 44 inches wide, and both sides are enclosed, at least one handrail is required, preferably on the right side descending.
  - If the stairway is more than 44 inches wide, a handrail is required on each enclosed side.
  - Furthermore, if the stairway is 88 or more inches wide, an intermediate stair railing located midway is also required.
- The vertical height of the railing must be 30 to 34 inches. The construction must be similar to the standard railing described later in this section.



## **Standard Railing and Toeboard**

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

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

For pipe railings, rails and posts must be at least 1½-inch outside diameter pipe with posts spaced not more than 8 feet.

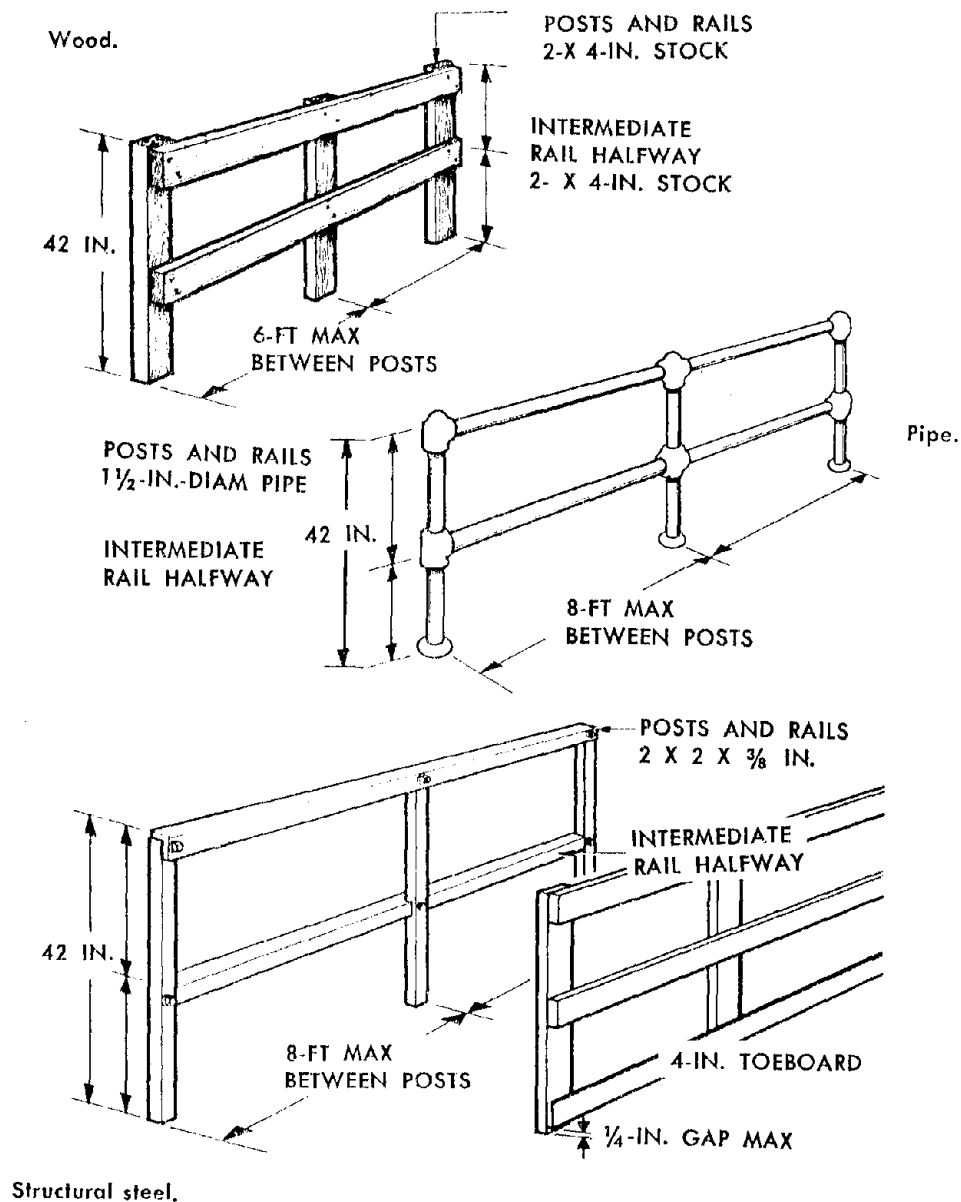
For structural steel railings, posts and rails must be of 2 x 2 x ⅜-inch angles or other metal shapes of equivalent strength with posts spaced not more than 8 feet.

The standard toeboard must be approximately 4 inches in height from the floor to its top edge, with no more than a ¼-inch gap between the toeboard and the floor. It may be constructed of any substantial material either solid or perforated, as long as the openings are smaller than 1 inch.

Standard railings are required at:

- Every open-sided floor or platform 4 feet or more above the adjacent floor or ground level must be railed on all open sides except where there is entrance to a ramp, stairway, or fixed ladder.
- Every stairway floor opening must be guarded on all exposed sides except the entrance to the stairway.
- Every ladderway floor opening must be guarded by a standard railing and toeboard on all sides, with passage through the railing so constructed as to prevent a person from walking directly into the opening.
- Every runway or catwalk must have railings on all open sides 4 feet or more above ground or floor level.

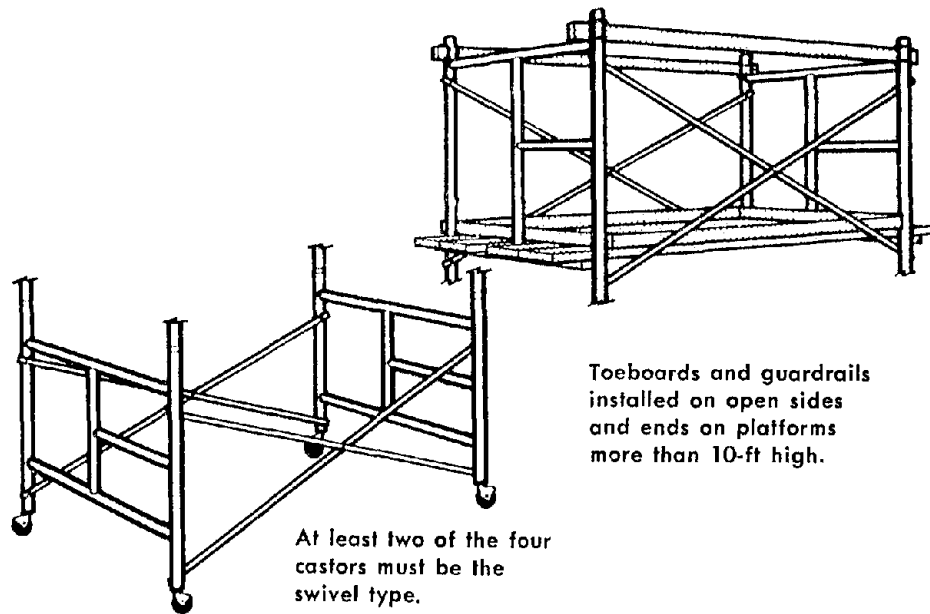
As a general condition, a standard toeboard and railing are required wherever people walk beneath the open sides of a platform or under similar structures or where things could fall from the structure (for example, into machinery below).



Standard railings and toeboards.

### General Requirements for All Scaffolds

- All scaffolding must have solid footing or anchoring capable of holding the intended load without settling or shifting. Unstable objects such as barrels, or loose bricks, blocks, or boxes must not be used to support scaffolds or planks.
- Guardrails and toeboards must be used on all open sides and ends of platforms that are over 10 feet above the ground or floor (except needle beam scaffolds and floats). Scaffolds 4 to 10 feet high that are less than 45 inches wide must also have guardrails.
- Scaffolds and their components must be able to support at least four times the maximum intended load. Wire or fiber rope



used for scaffold suspension must be capable of supporting at least six times the intended load.

- All planking or platforms must be overlapped at least 12 inches or secured from movement.
- Planks must extend over the end supports at least 6 inches but no more than 18 inches (12 inches at construction sites) and should be secured from falling off the platform.
- Planks must not be placed on guardrails for the purpose of obtaining greater height for employees.
- All scaffolds must be maintained in a safe condition at all times. Unsafe scaffolds should be removed from site for disposal, or the defective parts should be immediately replaced or repaired.
- The poles, legs, or uprights of scaffolds must be plumb, and securely and rigidly braced to prevent swaying and displacement.
- Planking must be scaffold grade for the species of wood used. The maximum permissible spans for 2- x 10-inch or wider planks are as follows:

| Scaffolding                            | Working load<br>(pounds per square<br>foot, p.s.f.) | Permissible<br>span<br>(feet) |
|----------------------------------------|-----------------------------------------------------|-------------------------------|
| Full-thickness (un-<br>dressed) lumber | 25                                                  | 10                            |
|                                        | 50                                                  | 8                             |
|                                        | 75                                                  | 6                             |
| Nominal-thickness<br>lumber            | 25                                                  | 8                             |
|                                        | 50                                                  | 6                             |

- The height of rolling scaffolds or any free standing tower must not exceed four times the base dimension and, as necessary, have positive locking devices to keep them in place.
- Scaffolds must be secured when in use and must not be moved when in use or occupied.
- Wheels of rolling scaffolds must be provided with an effective locking device, and kept locked when workers are on the scaffold.
- At least two of the four casters or wheels on rolling scaffolds must be the swivel type.

### **Disposal Chutes**

- Disposal chutes must be enclosed when materials are dropped over 20 feet.
- The area onto which material is dropped must be enclosed with barricades not less than 42 inches high and not less than 6 feet back from the projected opening.

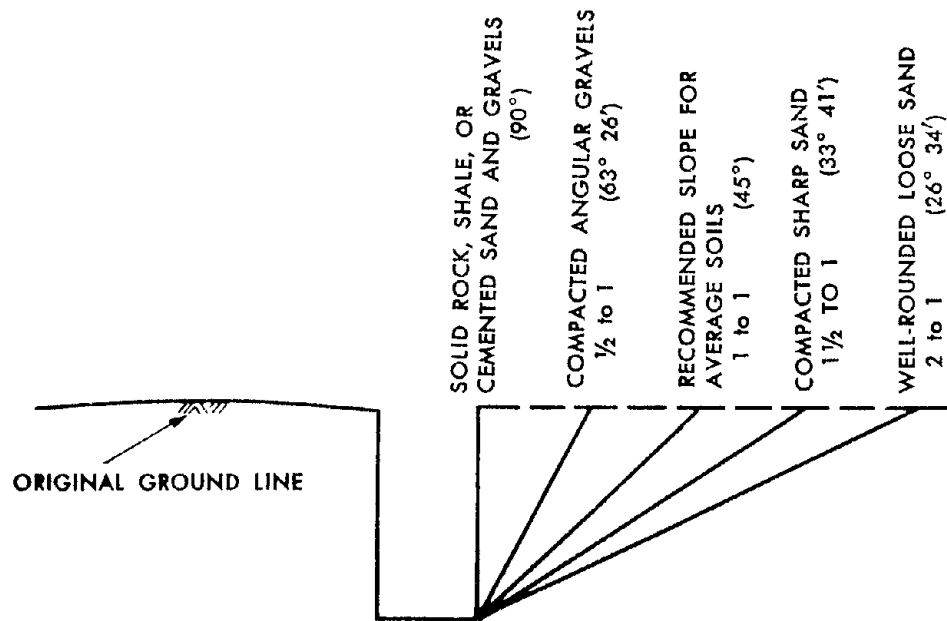
### **Safety Belts, Lifelines, Lanyards, and Nets**

- All safety belts, lifelines, and lanyards must have a breaking strength of 5,400 pounds, and the hardware must be capable of withstanding a minimum tensile loading of 4,000 pounds without breaking, ripping, or any permanent deformation; when used, such equipment must be anchored to a structural member capable of supporting 5,400 pounds of dead weight.
- Where the use of scaffolds, ladders, safety lines, or belts is impractical and workers are exposed to heights greater than 25 feet, safety nets must be provided.
- Where nets are required, the operation must not be undertaken until the net is in place and tested.

### **Excavating and Trenching**

- Before excavating, efforts must be made to determine if there are any underground utilities in the area. The appropriate utility companies and/or local regulatory agencies must be contacted, and the appropriate permits or approvals must be obtained. The utilities must be located and protected during any excavation operation.
- The walls and faces of excavations and trenches over 5 feet deep, where workers may be exposed to danger, must be guarded by a shoring system, sloping of the ground, or some other equivalent means. Trenches less than 5 feet deep with hazardous soil

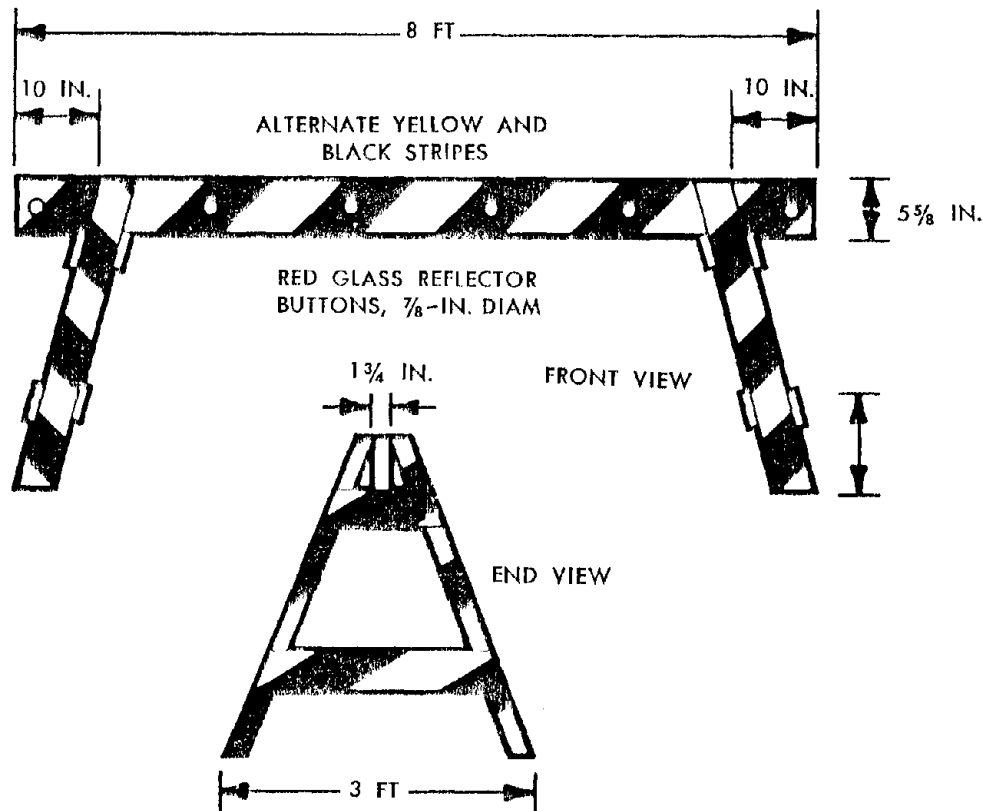
conditions also must be effectively protected. The information below may be used for sloping purposes.



Approximate angle of repose for sloping of sides of excavations. Note: Clays, silts, loams, or nonhomogenous soils require shoring and bracing. The presence of ground water requires special treatment.

- Appropriate trench boxes, or shields, or both may be used in lieu of shoring or sloping.
- Tools, equipment, and excavated material must be kept 2 feet or more from the lip of the trench.
- A competent person must inspect trenches and excavations daily to ensure that slopes, shoring, and bracing are adequate and that there is no evidence of possible slides or cave-ins. More frequent inspections may be necessary as work progresses or after inclement weather conditions, such as rain.
- In trenches 4 feet or more deep, ladders or steps must be so located that no more than 25 feet of lateral travel is needed to exit.
- All runways and sidewalks must be kept free of debris and, if undermined, must be adequately shored to prevent a cave-in from any maximum loading.
- Appropriate barricades and warning signs must be used to prevent employees and the general public from falling in. (See page 19.)

See "Information Sources" at the back of the book for additional material available concerning trenching and excavation.

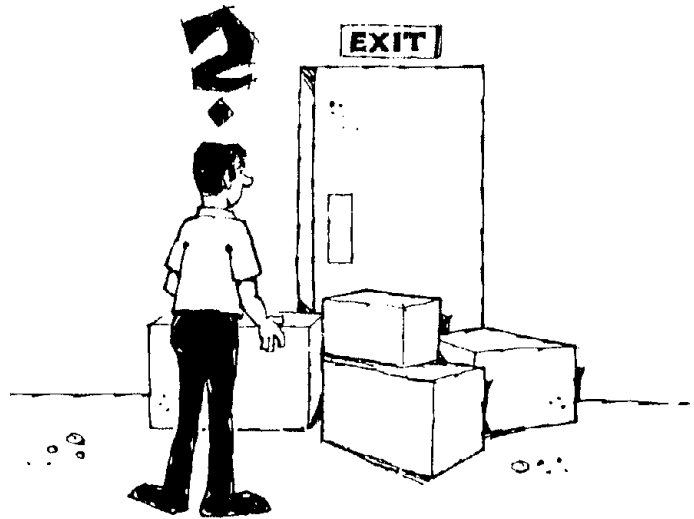


Example of an acceptable barricade.

## EXIT 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.
- 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 must be marked by a sign indicating their actual use, e.g., "STORAGE ROOM" or "TO BASEMENT."
- When the direction to the nearest exit may not be apparent to an occupant, an exit sign with an arrow indicating direction should be used.
- Exit access must be arranged so that it is unnecessary to travel toward any area of high hazard potential to reach the nearest exit (unless the path of travel is effectively shielded by suitable partitions or other physical barriers).
- Nothing may impair the visibility of the exit sign, such as decorations, furnishings, or other signs.
- A door from a room to an exit or to a way of exit access must be of the side-hinged swinging type. The door must swing out in the direction of travel if:

- 50 or more persons occupy a room, or
- the exit is for an area of high hazard potential.
- Areas around exit doors and passageways leading to and from the exit must be free of obstructions. The exit route must lead to a public way.



- If occupancy is permitted at night, or if normal lighting levels are reduced at times during working hours, exit signs must be suitably illuminated by a reliable light source.
- No lock or fastening may be used to prevent escape from inside the 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.

## **OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL**

Persons working in the fabricated metal products industry may be exposed to a wide variety of gases, dusts, vapors, mists, fumes, and noise. Some of the most common exposures are discussed below.

### **Fibrous Material**

#### **Asbestos—**

The installation or modification of insulation around piping, boilers, and ventilation systems may generate toxic amounts of airborne fibrous materials. Perhaps the most hazardous is asbestos, exposure to which may result in asbestosis, lung cancer, or both.

Work with asbestos must be done in accordance with 1910.93a of the General Standards.

Employees must not be exposed to unsafe levels of airborne asbestos. It is required that:

- Asbestos waste and debris be collected in impermeable bags or containers.
- All asbestos and asbestos-bearing materials be so labeled.
- Protective clothing and approved respirators be worn when handling asbestos.
- Employees handling asbestos be given regular physical checkups.

Methods to limit employee exposure to asbestos include:

- Isolating and ventilating dust-producing operations.
- Wetting the material before handling.

Note: Asbestos workers who smoke have almost 90 times greater risk of cancer than the nonsmoking general population.

#### ***Glass and Other Fibrous Materials—***

Glass and other fibrous materials that are less hazardous have recently replaced asbestos; these, too, must be used with good industrial hygiene practices when there is a possibility of the fibers becoming airborne.

#### **Carbon Monoxide**

Propane, diesel, or gasoline-powered equipment (e.g., forklifts, material handling, cars) and some hot work operations (welding, etc.) produce carbon monoxide. The employee's exposure to carbon monoxide may be excessive if such operations are conducted in low ceiling or confined areas, such as loading or unloading semi-trailers and welding operations. Action must be taken if the levels exceed the standards. Substituting electric forklifts or modifying existing equipment and/or appropriate ventilation may be necessary to lower carbon monoxide concentrations to satisfactory levels. Local ventilation is recommended for hot work operations in confined areas.

#### **Caustics, Solvents, Paints, Glues, Adhesives, and Cement**

Caustics, acids, and solvents are widely used for cleaning operations. Epoxy paints and adhesives are used with regularity in pipeline and other construction operations.

Various types of cements are used to bind PVC and other pipes together. Some of the more common organic chemicals may result in dizziness, headaches, and sensations of drunkenness as well as affect the eyes and respiratory tract. The use of many chemicals in this industry results in various types of skin irritations and, in extreme cases, dermatitis. Proper use and availability of appropriate protective equipment (e.g., gloves, goggles, face shields, aprons, respirators) should be enforced. Any materials that are hazardous to the skin should be washed off immediately. In addition, an eye wash fountain and safety shower may be required. Ventilation may be necessary to avoid excessive exposure to fumes and vapors during operations in confined spaces. Spray booths are recommended for production spray operations involving adhesives and paints.

### **Heat and Cold**

Provisions should be made to keep employees' temperatures within narrow limits when they are exposed to extreme heat and cold. Such exposures can result in fatigue, discomfort, job inefficiency, sunburn, collapse, and other health problems.

### **Potential Oxygen Deficient Atmosphere**

If proper precautions are not observed, many operations such as the repair and cleaning of tanks and work in other confined spaces can be very dangerous. Not only may an employee be exposed to various toxic gases, but the atmosphere may also be deficient in oxygen, which would be immediately dangerous to life. Such entries should be made only when proper precautions and safeguards (e.g., airline respirator, periodic checking of the work atmosphere, lifeline, buddy system) can be followed.

### **Rodents, Snakes, Animals, Parasites, and Infectious Diseases**

Some construction sites (e.g., new or modification of old sewers) present hazards that are not always common through this industry. Bites from rats, snakes, and animals can lead to a very badly infected wound or disease, such as rabies. Cuts and abrasions become infected, and parasitic infections may, upon occasion, be a problem. Bacteria may also infect cuts and abrasions; these may need medical treatment, even if the original wound did not require first aid. General protective measures (e.g., rodent control, personal hygiene and clothing, and vaccination) should be implemented to control such problems.

## **Welding, Burning, and Soldering—Hot Work Operations**

Fumes from welding and other hot work operations contain the metals (e.g., cadmium, zinc, lead, iron, copper) being welded together, the filler material, flux, and the coating on the welding rods. Such operations may also generate other gases (carbon monoxide, arsine, ozone, etc.) at concentrations which may be hazardous to the health of workers. When extensive hot work operations are done, particularly in confined areas, there could be an excessive fume exposure to these materials. Ventilation or respiratory protection may be needed for certain operations. Protection for the welder (eye glasses) and for employees (curtain, etc.) working in the near vicinity of welding operations should be provided because of the ultraviolet light produced during such operations.

When effective engineering controls are not feasible or while they are being instituted, personal protective equipment is required.

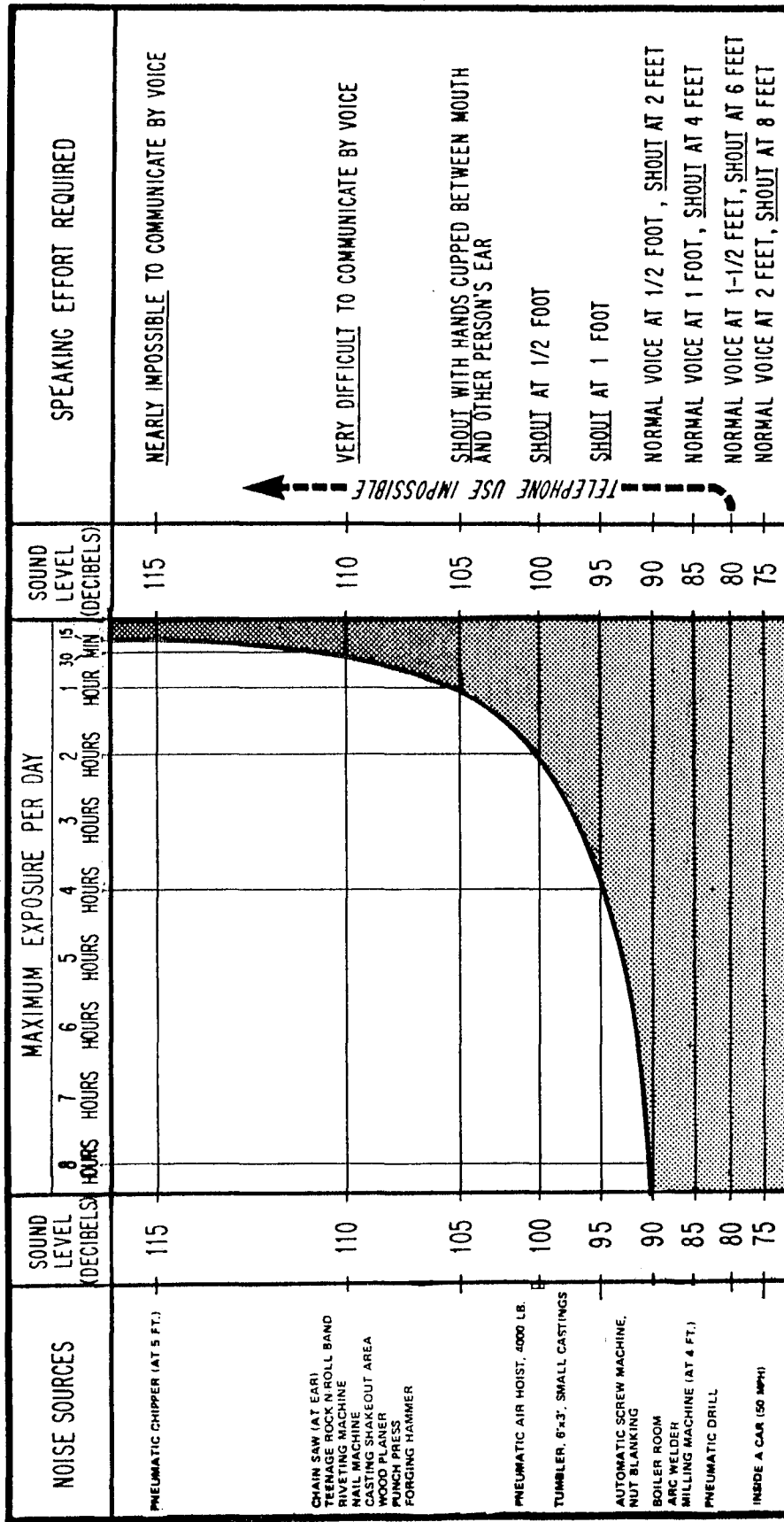
## **Occupational Noise Exposure**

Although excessive noise exposure can cause permanent hearing damage, it is one of the most commonly violated standards. Management's responsibility is to make sure employees are not exposed to noise levels that exceed the standards.

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. It may soon be a requirement, and it is considered good practice, to have an annual hearing check (audiometric testing) of all employees exposed to 85-90 dBA noise levels for 8 hours a day.

If no hearing loss is observed, ear protection is not required.

At greater than 90 dBA exposure (8 hours per day) or for higher noise levels exceeding the allowable time (e.g., 100 dBA for more than 2 hours), a continuing, effective hearing conservation program must be administered. Reference to the following illustration gives estimates of noise levels and the maximum allowable exposure times. It is required that either engineering controls (e.g., enclosing noisy equipment) or administrative controls (e.g., limiting time of exposure) be used to reduce noise levels or exposure times to comply with the standard. If these control measures are not feasible, then effective personal protective equipment is required.



Permissible noise exposures.

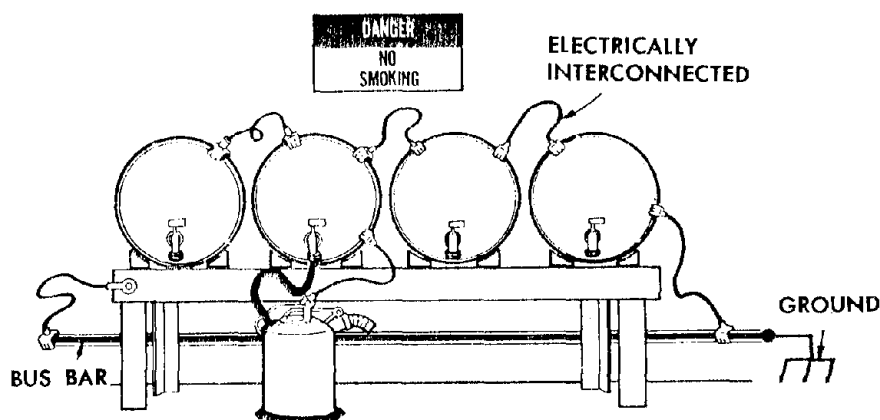
Many forms and types of ear protection (from ear muffs to ear plugs) can be used. Some are more useful than others, depending on the noise level, the frequency of the noise, and how well they fit the individual. It is necessary to provide protection that is effective and reasonably comfortable to the wearer.

If referral to the table indicates that levels and time of exposure are such that corrective action is needed, professional help should be sought to correct the problem. A noise survey by adequately equipped and trained personnel should be made before engineering and administrative controls are implemented or a hearing conservation program is established.

### Flammable and Combustible Liquids

Flammable and combustible liquids are categorized by their ease of ignition. Flammable liquids are more easily ignited than combustible ones. Some examples of flammable liquids are gasoline, acetone, lacquer thinner. Examples of combustible liquids are kerosene, fuel oil, and Stoddard solvent.

- The connections on all drums and piped 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 effectively bonded and grounded. This practice prevents electrical discharge (e.g., sparks) from the accumulation of static charge because of the transfer process.

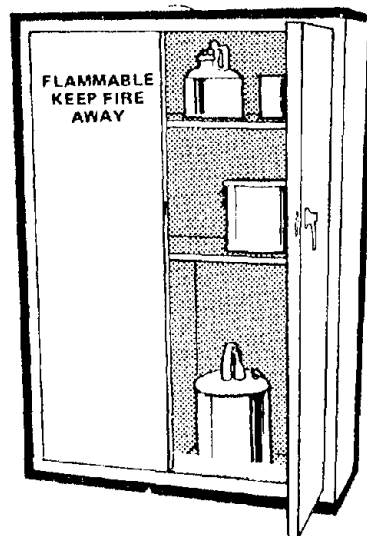


- All spills of flammable or combustible liquids must be cleaned up promptly. With major spills, remove ignition sources, ventilate the area, and provide respirators if needed. These liquids must not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

- 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.
- All flammable liquids must be kept in closed containers when not in use.
- Combustible waste materials, such as oily shop rags, or paint rags, must be stored in covered metal containers and be disposed of daily.
- On construction sites, flammable liquids may not be used within 50 feet of open flames or other sources of ignition.

#### **Storage Cabinets—**

Cabinets must be distinctly labeled "FLAMMABLE—KEEP FIRE AWAY."



Metal cabinets must be constructed of at least No. 18 gauge sheet iron, and be double-walled, with a 1½-inch air space and tight joints. Doors must have three-point locks with the sill raised 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 two-directionally with flathead screws.

#### **Inside Storage Areas—**

Each inside storage area must be prominently posted as a "NO SMOKING" area. Openings to other rooms or buildings must be provided with noncombustible, liquid-tight, raised sills or ramps

at least 4 inches in height. An open-grated trench inside the room that drains to a safe location is a permissible alternative to a sill or ramp. General exhaust ventilation (either gravity or mechanical), which provides for a complete change of air within a room at least six times each hour, is required.

#### ***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 posted as a "NO SMOKING" area and must be kept free of debris and other combustible materials not necessary for storage.

In construction areas, driveways between and around open areas used for storing combustible materials must be at least 15 feet wide; no combustible materials shall be stored outdoors within 10 feet of a building or structure; combustible materials must not be stacked more than 20 feet high and must be in stable piles. Outdoor storage of containers (less than 60-gallon containers) must not exceed 1,100 gallons in any one pile or area; piles must be separated by 5 feet and must be 20 feet from a building. The storage area must be graded or diked in a manner to divert spills away from buildings or other exposures; and such areas must be free of weeds, debris, and other combustible materials not necessary to storage.

#### ***LPG Storage Areas—***

- "NO SMOKING" signs must be posted in storage tank areas.
- Units to be fueled must be turned off while filling.
- The LP tank must be guarded to protect it from vehicular damage.
- Electrical connections, pumps, switches, etc., must be vapor- and-explosion proof.

#### ***Spray Painting***

##### ***General Spray Operations—***

- Portable lamps must be removed during spraying.
- Low flash-point thinners (less than 100°F) may only be used for cleaning purposes if used in a well-ventilated area such as a spray booth.
- The fire control sprinkler heads must be kept clean and free of paint buildup.

- "NO SMOKING" signs must be posted wherever flammable liquids are sprayed or stored.
- Parts to be painted should be arranged so that overspray and fumes are not drawn through the breathing zone.
- Protective clothing, such as gloves, aprons, and cloth caps, should be worn.
- Respirators must be cleaned and maintained regularly.
- There should never be more than 1 day's supply of paint outside of storage rooms or cabinets.

#### ***Spray Areas—***

- The spray area must be at least 20 feet from flames, sparks, spark producing 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 clean of combustible residue.
- Mechanical ventilation must be provided and operating to remove vapors during the 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 with lights located outside the booth.
- Ventilation:
  - Mechanical ventilation must be installed and operating during spraying.
  - The average ventilation rate over the face of the booth must be at least 100 linear feet per minute.
  - Electric motors for the exhaust fans must be placed outside the booth or ducts, and the belts and pulleys must be 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.
- Air supply for paint booths:
  - Plugged overspray filters must be replaced.

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

#### ***Paint Drying Apparatus—***

- Mechanical ventilation must be left on while the paint is drying. A warning sign to this effect must be attached to the drying apparatus.
- The area used for drying with portable heaters or lights must be kept clean of overspray products.
- Heat sources must be kept out of the spray area during spray operations.
- The electrical drying apparatus must be properly grounded.

## **PERSONAL PROTECTIVE EQUIPMENT**

### **General**

Personal protective equipment is not to be used as a substitute for feasible administrative or engineering controls. While control methods are being implemented or if control methods are not feasible, personal protective equipment is required whenever there are hazards that can do bodily harm through absorption, inhalation, or physical contact. This equipment includes respiratory and protective hearing devices, clothing, and protective devices for the eyes, face, head, and extremities. All personal protective equipment must be of safe design and construction for the work to be performed and maintained in a sanitary and reliable condition.

### **Eye and Face Protection**

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

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

over glasses, or constructed so that the corrective lenses can be mounted behind the protective lenses.

### **Head Protection**

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



### **Foot Protection**

Safety shoes are recommended to prevent injury to the feet from falling objects and other hazards.

### **Gloves, Leggings, Aprons**

Aprons, leggings, and gloves may be necessary for welders depending upon the extent of the hazard generated by the operations. Gloves and arm protectors should be used to prevent lacerations from handling sheet metal.

### **Clothing**

Appropriate clothing should be worn by workers who are exposed to extreme heat or cold. Boots with good traction may be necessary when wading in pools of water or mud.

### **Ear Protection**

Noise levels above 90 dBA are somewhat frequent at many fabrication and construction operations. If noise levels cannot be reduced to a safe level of exposure, hearing protection must be

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

### **Respiratory Protection**

NIOSH-approved respirators must be provided by the employer when air is contaminated with excessive concentrations of harmful dusts, fumes, mists, gases, or vapors. When respirators are used they must be approved for protection against the particular contaminant, (for example, dust-fumes approved, organic-vapor approved). Respirators are acceptable only when engineering or administrative controls are not feasible or while they are being implemented. When respirators are used, a respirator program must be established in accordance with 29 CFR, 1910.134 and include the following requirements:

- Respirators must be designed to protect against the specific hazards to which the worker is exposed.
- Written instructions covering selection and use of respirators must be available.
- Employees must be trained in the use of respirators, their limitation, proper fitting, and maintenance.
- Respirators should be cleaned at the end of each day's use: taken apart, washed, dried, and defective parts replaced.
- Two people must never wear the same respirator unless it has been cleaned and disinfected between uses.
- All straps must be tied and adjusted when worn.
- A good face seal is necessary; beards, sideburns, glasses may interfere.
- Filters must be replaced when the respirator has been used for the specified lifetime of the cartridge, when an employee can smell vapors or sense irritation of the eyes or face in the mask, or when breathing becomes difficult.

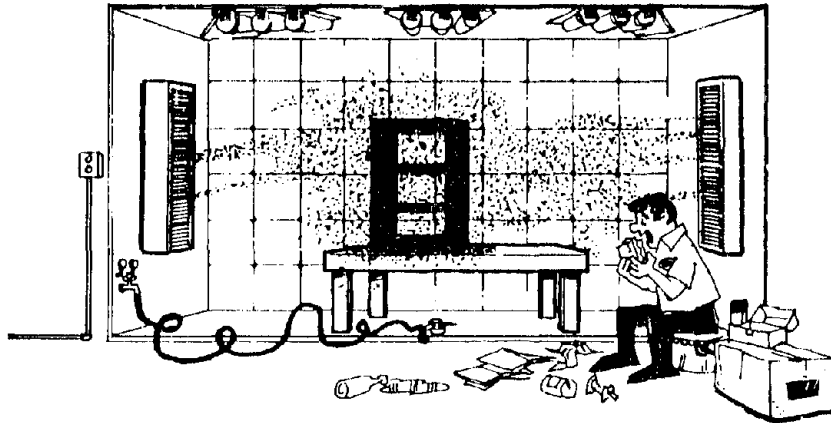
## **SANITATION**

### **General**

Federal standards for occupational safety and health which apply to your place of business require that:

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

- Receptacles for waste food are to be covered and kept in a clean and sanitary condition.
- Restrooms must be kept in a clean and sanitary condition, including covered containers for sanitary napkins.
- Separate toilet facilities must be provided for each sex. The exception to this is if only one person at a time uses a toilet room and the door can be locked from the inside.
- One toilet and one lavatory must be provided for approximately every 15 employees.
- Each lavatory must have hot and cold or tepid running water, hand soap, individual hand towels, or warm air blowers.
- Beverages or food must not be stored or consumed in a toilet room or in an area exposed to toxic materials.



- Employees working with toxic substances should wash and remove contaminated clothing before eating, drinking, or smoking.

### **Sanitation at Construction Sites**

#### **Potable Water—**

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

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

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

### **Toilets—**

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

### **Washing Facilities—**

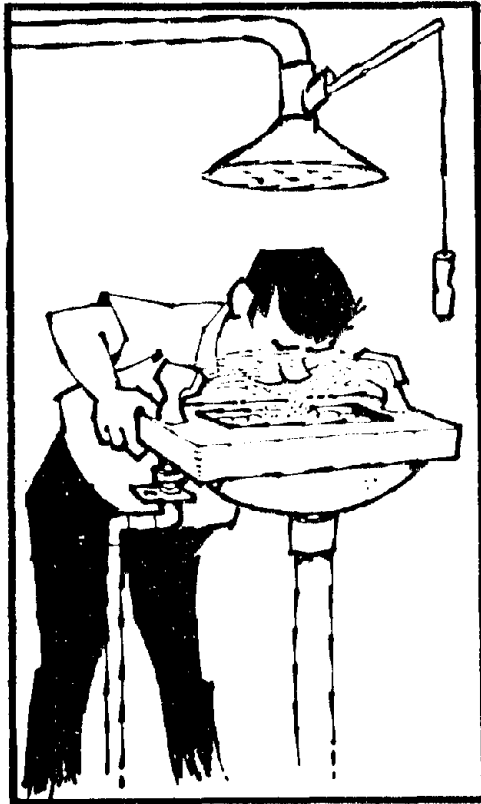
Adequate washing facilities must be provided for employees engaged in operations involving harmful contaminants; washing facilities must be equipped to remove harmful substances. Such facilities must be in close proximity to the work site.

## **MEDICAL AND FIRST AID**

The employer who is interested in maintaining production, preventing loss of work time, and receiving efficient employee performance and good morale should adopt ways to maintain the health of the employees. A good practice is to require preplacement medical examinations to ensure that prospective employees are physically able to do the specific work. Periodic health evaluations for hazardous jobs and early treatment of any illness or injury should also be encouraged. Medical personnel must be readily available by phone or on-site for advice and consultation. Emergency phone numbers must be posted near telephones. (See EMERGENCY INFORMATION CHART on the back cover.) Stretchers and blankets should be available for prompt transportation of injured or ill employees to a hospital.

In the absence of an infirmary, clinic, or hospital near the workplace, the following are required:

- At least one and preferably more employees on each shift must be adequately trained to render first aid. The American Red Cross, the U.S. Bureau of Mines, some insurance carriers, local safety councils, and others with OSHA-approved programs 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 such as gauze, bandages, and dressings that must be sterile. Other items often needed are adhesive tape, triangular bandages (to be used as slings), inflatable plastic splints, scissors, and mild soap for cleansing of wounds or cuts.
- Suitable facilities for quick drenching or flushing of the eyes and body must be provided within the work area when a person may be exposed to injurious corrosive materials.

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

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

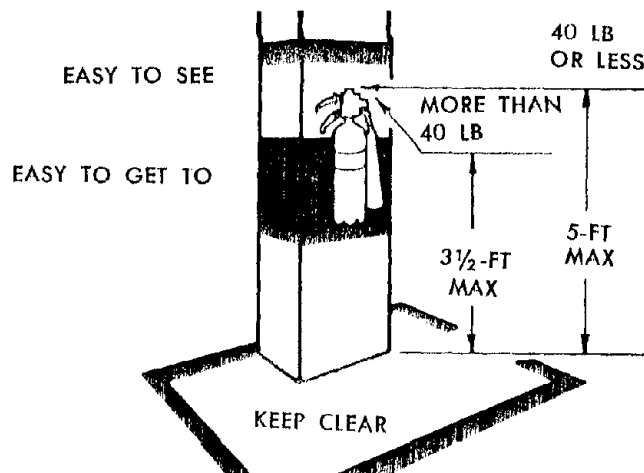
Reference to "Recordkeeping Requirements" (found toward the back of this Guide) gives a discussion of records that must be maintained for occupational injuries and illnesses.

## **FIRE PROTECTION**

### **Portable Fire Extinguishers**

Portable 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.
- Not be mounted higher than 5 feet (to the top of the extinguisher) if 40 pounds or less, or 3½ feet if heavier.



- Be inspected by management or a designated employee at least monthly to insure that they:
  - are in their designated places,
  - have not been tampered with or actuated, and
  - do not have corrosion or other impairments.
- Be inspected at least yearly and recharged or repaired to insure operability and safety. A tag must be attached to show the maintenance or recharge date and signature or initials of the person performing the service.
- Be hydrostatically tested. The extinguisher sales representative usually will perform this service at appropriate intervals.
- Be selected on the basis of type of hazard, degree of hazard, and area to be protected.
- Be placed so that the maximum travel distances, unless there are extremely hazardous conditions, do not exceed 75 feet for Class A or 50 feet for Class B extinguishers.

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

### **Fire Protection at Construction Sites**

- The employer is responsible for establishing an adequate fire protection program covering all phases of construction and/or demolition work. Effective fire fighting equipment must be promptly available to effectively meet all fire hazards.
- Fire fighting equipment must be conspicuously located, inspected monthly, appropriately maintained, and readily accessible; it must be promptly replaced if found defective. Carbon tetrachloride and other toxic vaporizing liquid fire extinguishers

are prohibited. Appropriate fire extinguishers must be readily available for hot work operations such as welding. A fire extinguisher must be readily accessible for each stairway on multi-story buildings, and a fire extinguisher rated 2A or equivalent must be provided within 100 feet and for each 3,000 square feet of protected building. The employer is responsible for having a fire alarm or other system to warn employees of a fire and for having means available (phone number posted) to promptly obtain the services of the local fire department. Smoking is prohibited in areas of potential fire hazards and "NO SMOKING" signs must be conspicuously posted.

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

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

- Appropriate ventilation must be provided to supply fresh air sufficient to maintain the health and safety of the workmen when temporary heating devices are used. A liquid-fired heater must be equipped with a safety device to stop the flow of fuel in the event of flame failure. Solid fuel salamanders are prohibited in buildings and on scaffolds. Such heating devices should be used and repaired according to the manufacturer's recommendations.

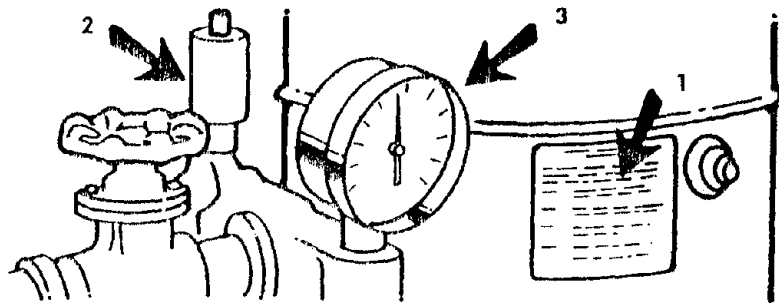
## **COMPRESSED AIR EQUIPMENT**

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

- New air tanks must be constructed in accordance with the American Society of Mechanical Engineers (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 (1).

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

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



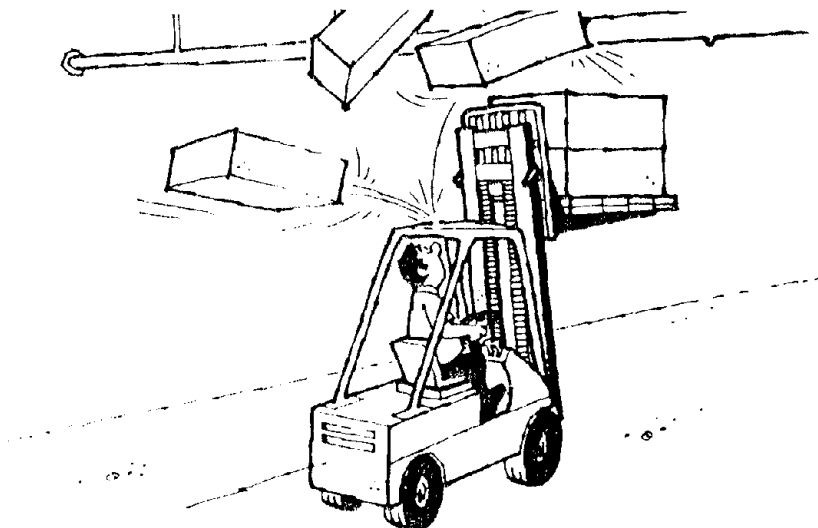
- The pressure controller and gauge must be maintained in good operating condition (3).
- There must be no valves between the air tank and safety valve.

## **MATERIALS HANDLING AND STORAGE**

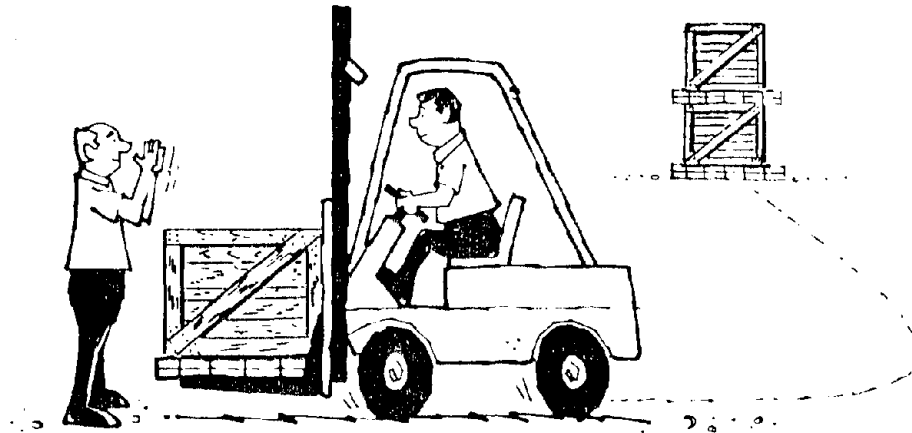
### **Powered Industrial Trucks**

Locations in which powered industrial trucks are used must be classified according to their fire hazard potential (1910.178 (c) (2)). Since the powered industrial truck may provide the spark or hot surface needed to start a fire, the type of truck should be selected with reference to where it is to be used.

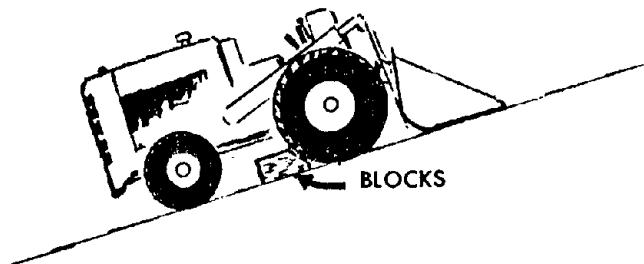
- High-lift-rider trucks must be fitted with an overhead guard to protect the operator from falling objects.



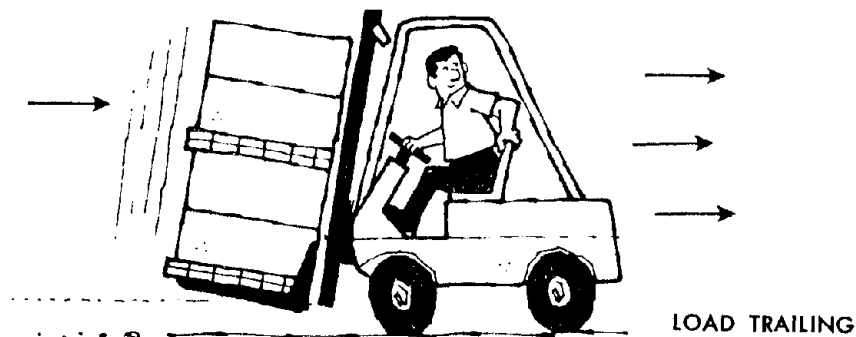
- Operators must be effectively trained in the safe operation of powered industrial trucks, and only trained and authorized operators may operate the truck.



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



- Industrial trucks must be examined daily for any conditions adversely affecting the safety of the vehicle before being placed into service. If the truck is used around the clock, it must be inspected after each shift.
- If the load being carried obstructs forward view, the operator is required to travel with the load trailing.



- When forklift trucks are used to unload or load from trucks, trailers, or railroad cars, set the brakes and place wheel chocks under the rear wheels to secure the truck, trailer, or railroad car. Portable dock boards must be secured in position with devices which will prevent their slipping during loading and unloading.
- If battery-operated equipment is used, the battery charging area is to be designated with a "NO SMOKING" sign because of the hydrogen gas emitted during the charging process.

### **Hydraulic Lift Skid Trucks**

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

### **Hand Trucks**

Operators of hand trucks should wear hand and foot protection. The most frequent injuries of hands and feet may then be easily avoided. Also, hand trucks should be fitted with knuckle guards to prevent jamming the hands into obstructions.

### **Motor Vehicles and Mechanized Equipment**

All motor vehicles and mechanized equipment in use must be checked at the beginning of each shift to assure that all parts, equipment, and accessories are in safe operating condition and free of apparent damage that could cause failure while in use.

### **Hoists**

Although the following information 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 made aware of the weight of the load.
- The hoist must be equipped with a self-setting brake, applied to the motor shaft or some part of the gear train.
- For powered hoists, holding brakes must be applied automatically when the power is off.
- Hooks, chains, and all functional operating mechanisms must be visually inspected daily for any indication of damage and wear, and monthly records maintained.
- Loads must not be carried over the heads of people.
- The operator must test the brakes each time a near-capacity load is handled 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.

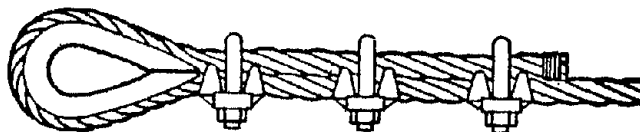
The following requirements apply when using hoists in the construction site:

- The employer must comply with the manufacturer's specifications and limitations.
- Rated load capacities, recommended operating speeds, and special hazard warnings or instructions must be posted on cars and platforms.
- Hoistway entrances must be protected by substantial gates or bars.
- Hoistway doors or gates must be not less than 6½ feet high, must be provided with mechanical locks that cannot be operated from the landing side, and must be accessible only to persons on the car.
- Overhead protective coverings must be provided on the top of the hoist cage or platform.

### **Rigging Equipment**

The following requirements apply when using rigging equipment:

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



- Synthetic webbing (nylon, polyester, and polypropylene) and other slings must be marked to show:
  - the name or trademark of manufacturer,
  - the rated capacities for the type of hitch (the rated capacity must not be exceeded), and
  - the type of material.

## **Slings**

Each day before use, the sling and all fastenings and attachments must be inspected by a competent person designated by the employer. A thorough inspection of alloy steel chain slings must be made at regular intervals, not exceeding 1 year, and a record of the inspection must be kept. Each new, repaired, or reconditioned alloy steel chain sling must be proof tested before use, and a certificate of the proof test must be kept.

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

- Slings that are damaged or defective must not be used.
- Slings must not be shortened with knots, bolts, or other make-shift devices.
- Sling legs must not be kinked.
- Slings must be securely attached to their loads and must not be loaded in excess of their rated capacities.
- Slings must be padded or protected from the sharp edges of their loads.
- Suspended loads must be kept clear of all obstructions, and all employees must be kept clear of loads about to be lifted or already suspended.
- Shock loading is prohibited.
- A sling must not be pulled from under a load while the load is resting on the sling.

## **Cranes**

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

All new cranes constructed and installed or used on or after August 31, 1971, must meet the design specifications of the American National Standard Institute safety code for cranes (references in "INFORMATION SOURCES"). Cranes constructed before that date should be modified to conform to these design specifications, unless it can be shown that the crane cannot feasibly or econom-

ically be altered and that the crane substantially complies with the requirements. Other OSHA requirements include:

- Only personnel designated as qualified by the employer shall be permitted to operate cranes.
- The rated load of the crane must be plainly marked on each side of the crane, and be clearly legible to the operator.
- Employees should be made aware of the weight of the load.
- Hooks, ropes, chains, brakes, and all functional operating mechanisms must be inspected daily for indications of damage and excessive wear.
- Written and signed inspection reports must be made monthly on critical items such as brakes, hooks, and ropes and be readily available.
- Hand signals to operators should be those prescribed by the applicable ANSI standard for the type of crane in use (see fold-out in back of Guide).
- The hoist chain or rope must be free from kinks or twist and must not be wrapped around the load.
- Hoisting, lowering, swinging, or traveling is not permitted while anyone is on the load or hook.
- Loads must not be carried over the heads of people.
- The operator must test the brakes each time a near-capacity load is handled, by raising it a few inches and applying the brakes.
- The operator must not leave his position at the controls while the load is suspended.
- All cranes using a lifting magnet must have a switch in the magnet circuit with provisions for locking the switch in the open position.
- When the hook is in the extreme low position, at least two complete wraps of rope must remain on the drum. Rope ends must be safely and securely attached to the drum by means of a clamp or socket arrangement approved by the crane or rope manufacturer.
- When hooking up a load, the hook must be centered over the load to prevent swinging.
- The trip setting of hoist limit switches must be determined by tests with an empty hook.

### **Overhead and Gantry Cranes**

OSHA requirements also include the following information for overhead gantry cranes:

- Access to the cab, or bridge walkway, must be by a conveniently placed fixed ladder, stairway, or platform that doesn't require stepping over a gap exceeding 12 inches.

- Exposed moving parts such as gears, set screws, projecting keys, chains, chain sprockets, and reciprocating components that might constitute a hazard under normal operating conditions must be guarded.
- If a service receptacle is provided in the cab or on the bridge of cab-operated cranes, it must be a grounded, three-prong-type permanent receptacle.
- A carbon dioxide or dry-chemical fire extinguisher, or its equivalent, should be kept in the cab.
- Each independent hoisting unit must be equipped with at least one self-setting holding brake applied directly to the motor shaft or some part of the gear train; it must be automatically activated when power is removed.

### **Crawler, Locomotive, and Truck Cranes**

OSHA requirements also include the following information specifically applicable to crawler, locomotive, or truck cranes:

- A substantial and durable rating chart with clearly legible letters and figures must be provided with each crane. It must be securely fixed to the crane cab in a location easily visible to an operator seated at the control station.
- A carbon dioxide or dry-chemical fire extinguisher, or its equivalent, must be kept in the cab or vicinity of the crane.
- The minimum clearance between cranes and powerlines must be 10 feet except where the powerlines have been deenergized and visibly grounded at the point of work, or where separate insulating barriers have been erected.
- Any overhead wire must be considered to be an energized line unless and until the electrical utility authorities indicate that it is not an energized line.

## **MACHINERY AND MACHINE GUARDING**

### **General Requirements**

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

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

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

- enclosing the operation (preferred),
- interlocking devices,
- moving barriers,
- removal devices,
- remote control,
- two-hand tripping devices, and
- electronic safety devices.

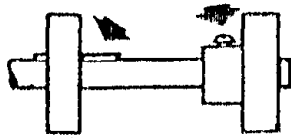
Certain guarding methods are preferred depending on the type of operation, the size or shape of stock, the method of handling, the physical layout, the type of material, and the production requirements or limitations. A certain flexibility in operations may also determine the method of guarding to be used. As a general rule power transmission apparatus can be protected by fixed enclosure guards.

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

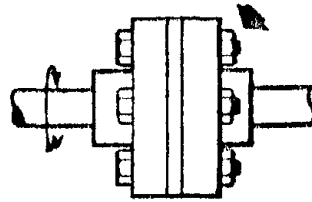
### **Rotating, Reciprocating, and Transverse Motion**

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

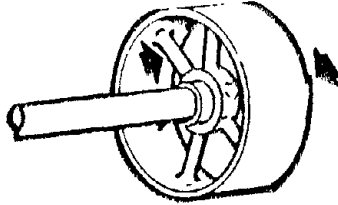
Collars, couplings, cams, clutches, flywheels, shaft ends, spindles, rotating bar stock, lead screws, and horizontal or vertical shafting are typical examples of common rotating mechanisms that are hazardous. The danger increases when bolts, oil cups, nicks, abrasions, and projecting keys or screw threads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



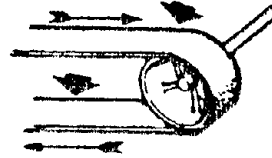
Rotating shaft and pulleys with projecting key and set screw.



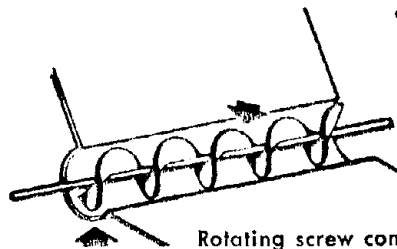
Rotating coupling with projecting bolt head.



Rotating pulley with spokes and projecting burr on face of pulley.

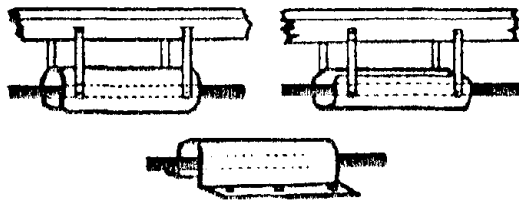


Transverse motion of belt and rotating pulley.

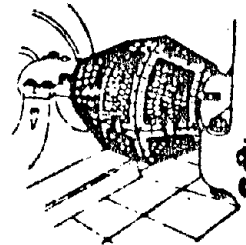


Rotating screw conveyor.

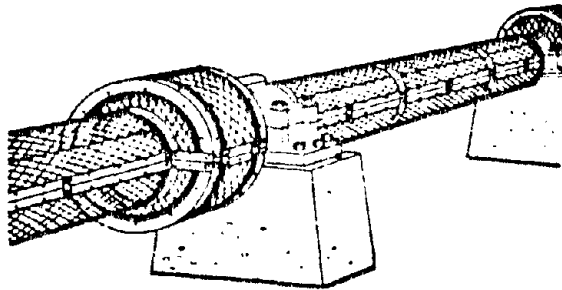
#### Examples of hazards.



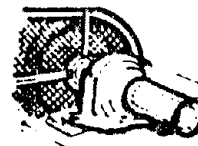
Horizontal shafting.



Coupling.



Horizontal shafting.



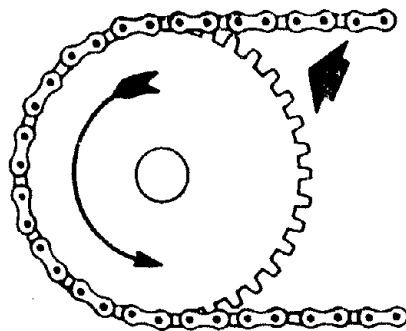
Sleeve for shaft end.

#### Examples of guarding rotating motion.

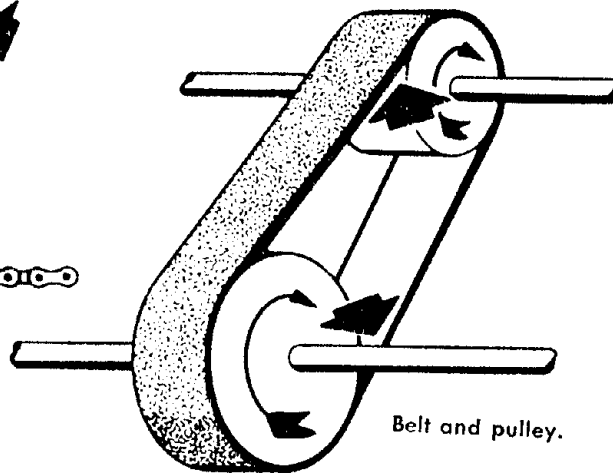
## In-Running Nip Points

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

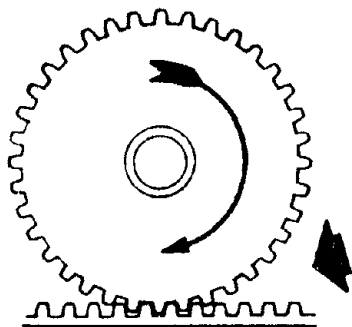
Typical examples of nip point hazards are the inside of rolling mills and calenders, rolls used for bending or feeding and conveying stock, the in-running side of a chain and sprocket, belt and pulley, a gear rack, a gear and pinion, and a belt conveyor terminal.



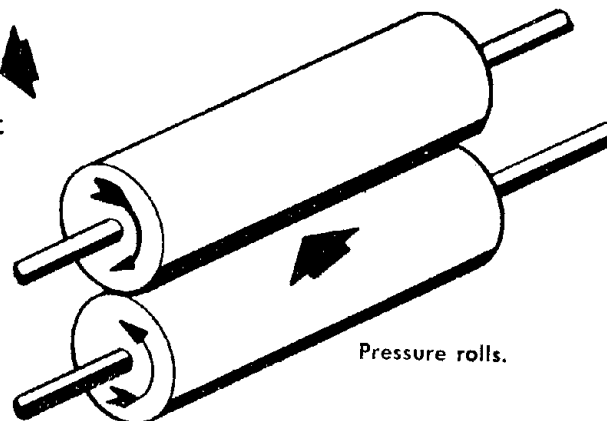
Chain and sprocket.



Belt and pulley.

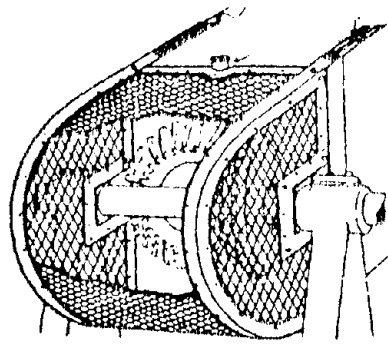


Rack and gear.

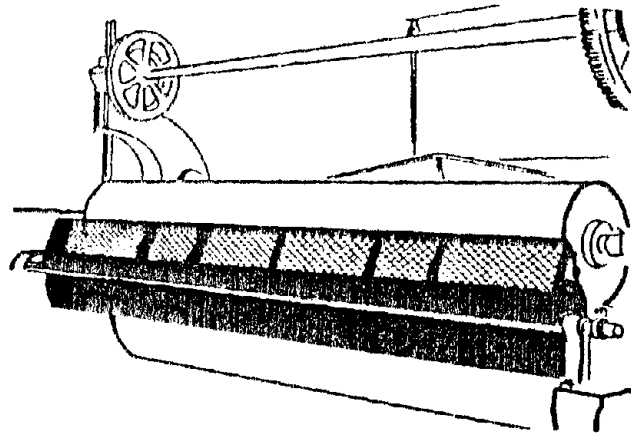


Pressure rolls.

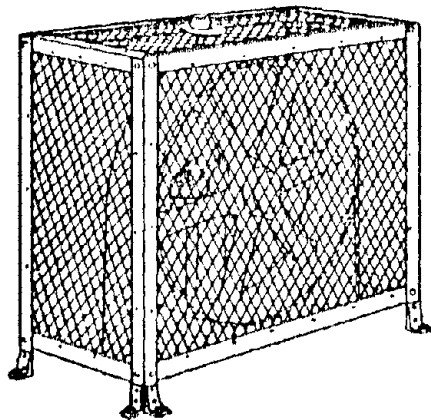
Examples of hazards.



Bevel gear guards.



Guard is hung so that it can be swung down and out of the way when roll is being started or removed.



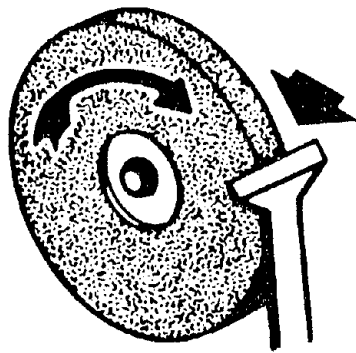
Belt and pulley guard.

Examples of guarding in-running nip points.

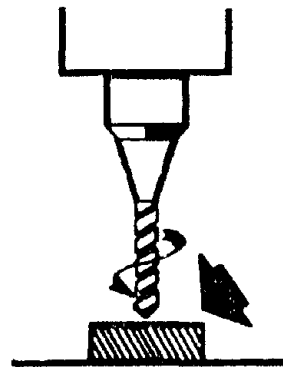
## Cutting Actions

Cutting action results when rotating, reciprocating, or transverse motion is imparted to a tool so that material being removed is in the form of chips. The danger of cutting action exists at the movable cutting edge of the machine as it approaches or comes in contact with the material being cut. Such action takes place at the point-of-operation in cutting wood, metal, or other materials as differentiated from punching, shearing, or bending by press action.

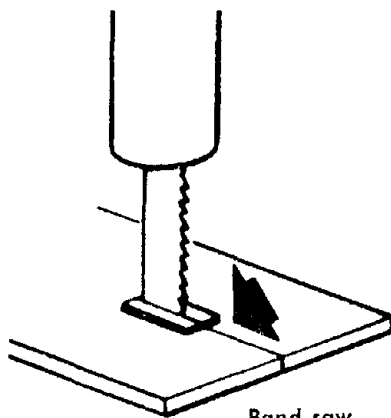
Typical examples of mechanisms involving cutting action include band and circular saws, milling machines, planing or shaping machines, turning machines, boring or drilling machines, and grinding machines.



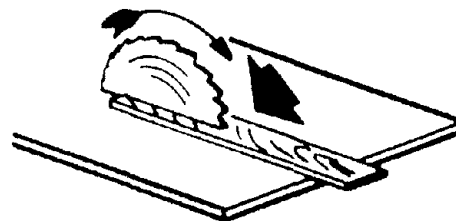
Abrasive wheel.



Drill.

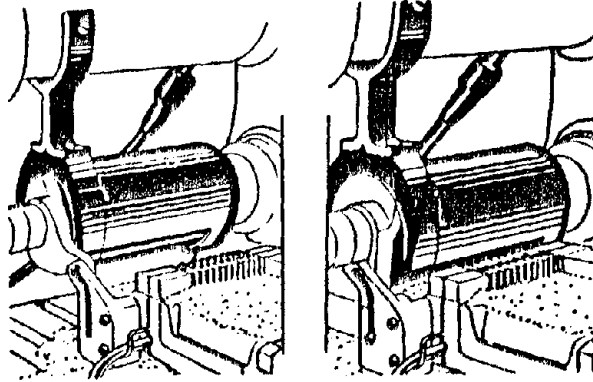


Band saw.



Circular saw.

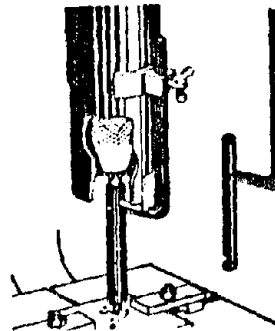
Examples of hazards.



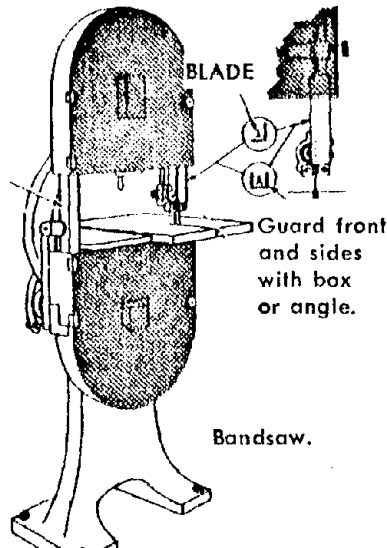
Milling machines. Cutter is entirely enclosed when table is withdrawn, and the guard opens automatically as the table moves forward.



Portable abrasive wheel must also be guarded by as complete an enclosure as practical.

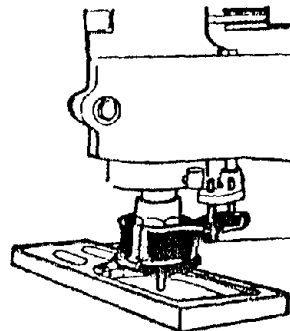


Drill. Enclosure covers spindle and drill.



Bandsaw.

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



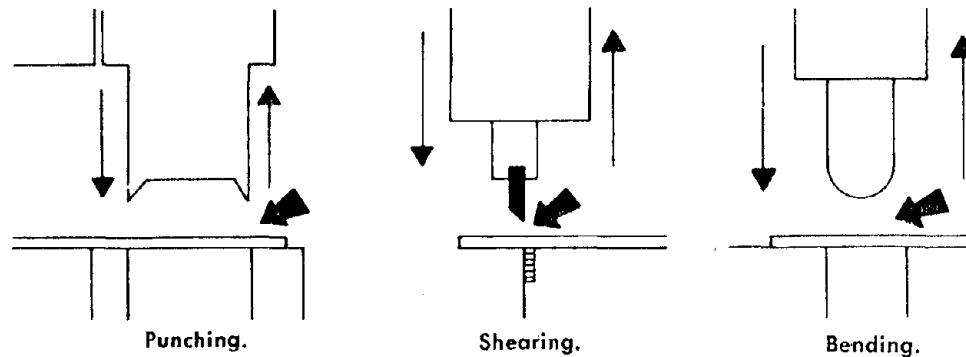
Router. Enclosure covers top and sides of router.

Examples of guarding cutting actions.

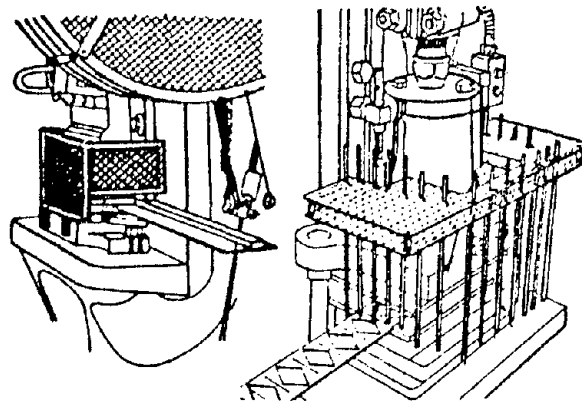
## Punching, Shearing, and Bending Actions

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

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

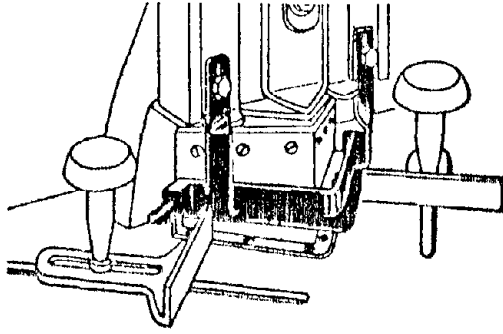


Examples of hazards.

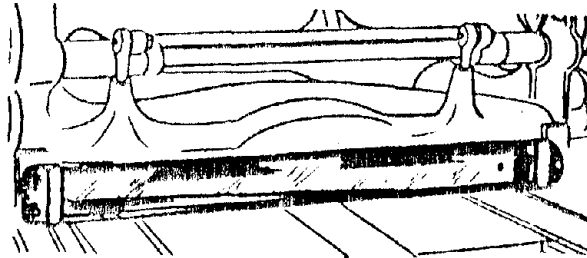


Enclosure guards for notching, punching, or forming presses for use with strip feeding.

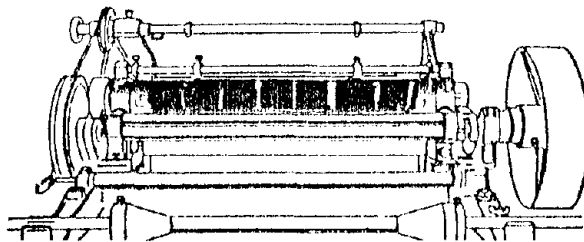
Examples of guarding, punching, or bending actions.



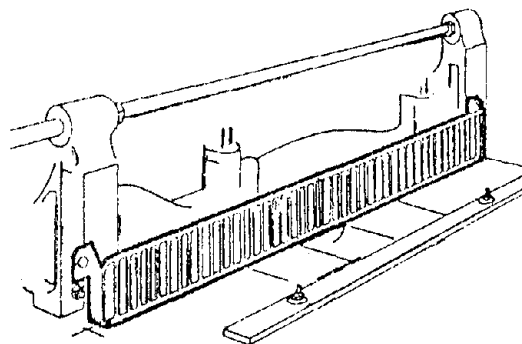
Barrier guard on corner cutter.



Fixed transparent barrier guard for shear.



Barrier guard on/feed side of slitter.



Adjustable barrier guard for feed side of squaring shear.

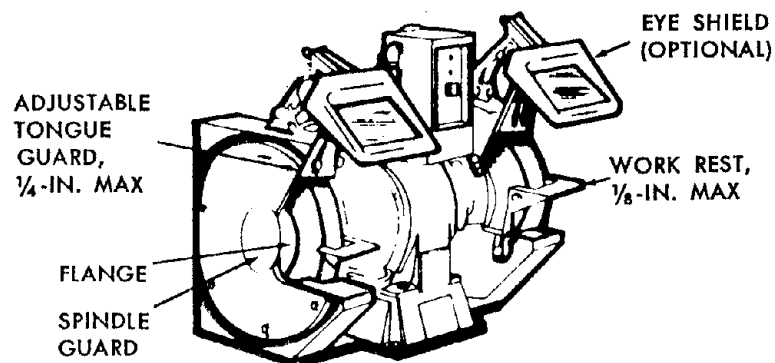
Examples of guarding shearing action.

## Special Examples of Machine Guarding

Grinders, fans, and air compressors are found in most plants. Their widespread use and lack of proper guarding place them high on the list of more frequently violated regulations.

### Grinders—

- Wheel safety guards must cover the spindle end, nut, and flange projections. The exposed area of the grinding wheel and sides for the safety guards should not exceed one-fourth of the entire wheel. When measuring the guard opening, the visors or other accessory equipment is not included as a part of the guard unless this accessory equipment is as strong as the guard.
- Work or tool rests must be strongly constructed and designed to be adjustable to compensate for wheel wear. Work rests must be closely adjusted to the wheel, with a maximum clearance of  $\frac{1}{8}$  inch, to prevent the work from becoming jammed between the wheel and the work rest.



Grinder.

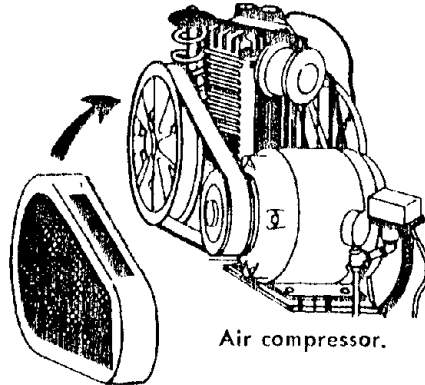
- Tongue guards must be constructed so that the tongue guard can be adjusted to the constantly decreasing diameter of the wheel. The distance between the tongue guard and the wheel must never be more than  $\frac{1}{4}$  inch.
- Goggles or a face shield must be worn by the operator.

### Fans—

Fans located within 7 feet of the floor must be guarded with grille or mesh, with openings no greater than  $\frac{1}{2}$  inch.

### **Air Compressors—**

Air compressors must have their flywheel and drive fully enclosed.

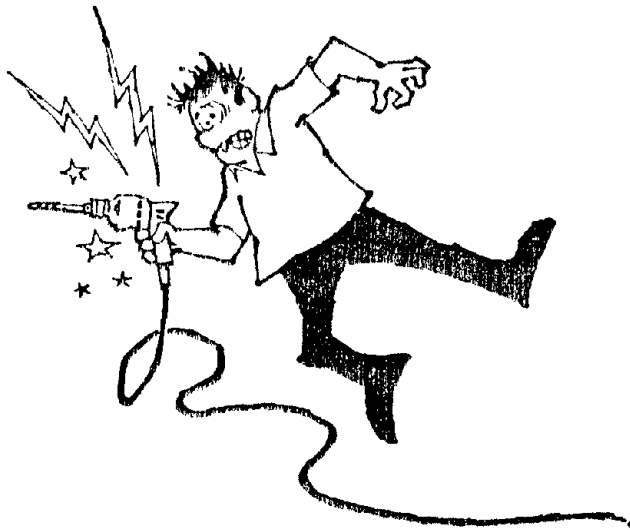


Air compressor.

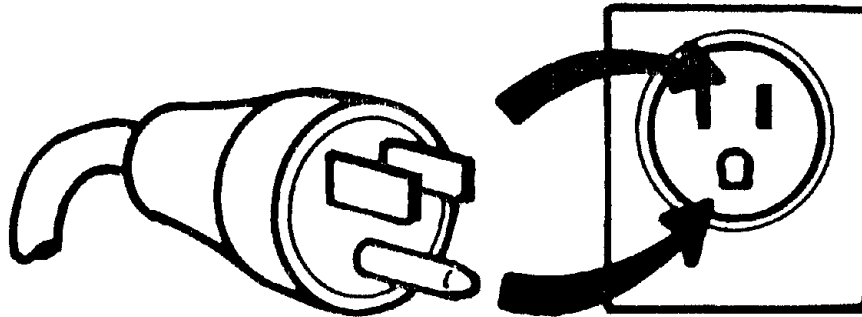
## **HAND AND PORTABLE POWER TOOLS**

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

- Each employer is responsible for the safe condition of tools and equipment used by employees, including tools and equipment which may be furnished by employees.
- Hammers with broken or cracked handles, chisels and punches with mushroom heads, or bent or broken wrenches should not be used.
- Wrenches with sprung jaws must not be used by employees.
- Most hand-held electrical power tools must be equipped with a "dead man" or "quick release" control, so that the power is automatically shut off whenever the operator releases the control.



- 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 recover the guarding position when the tool is withdrawn from the work.
- All hand-held portable electrical equipment must have its frame grounded or be doubly insulated and identified as such.



- All power tools must be used with appropriate shields, guards, and attachments and in accordance with recommendations by the manufacturers. Employees must be trained concerning the use of power tools and safety requirements. The rated load of all jacks must be permanently marked on the jack. Jacks must be inspected at least once every 6 months. Jacks must be appropriately blocked or cribbed when necessary to provide a firm foundation.
- Pneumatic power tools must be positively secured to the hose to prevent the tool from becoming disconnected; also a tool retainer must be used on tools to prevent attachment from being disconnected.
- Nailers, staplers, and similar equipment with automatic feed should have a muzzle to prevent the tool from ejecting material unless muzzle is in contact with the work surface.

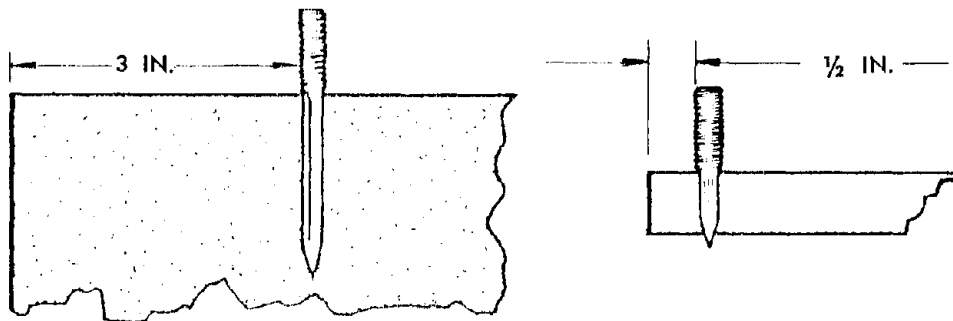
#### **Safety Requirements for Powder-Actuated Tools**

- Only employees who have been trained in the operation of powder-actuated tools shall be permitted to operate them.
- The tool must be tested each day before loading to see that safety devices are in proper working condition. The testing method must be in accordance with the manufacturer's recommended procedure.
- Any tool that is not in proper working order, or that develops a defect during use, must be immediately removed from service and not used until properly repaired.

- Tools must not be loaded until just prior to the intended firing time. Neither loaded nor empty tools are to be pointed at any employees. Hands must be kept clear of the open barrel end.
- Loaded tools must not be left unattended.
- Fasteners must not be driven into very hard or brittle materials, including, but not limited to, cast iron, glazed tile, surface-hardened steel, glass block, live rock, face brick, or hollow tile.
- Driving into easily penetrated materials must be avoided unless such materials are backed by a substance that will prevent the pin or fastener from passing completely through and creating a flying missile hazard on the other side.
- No fastener is to be driven into a spalled area caused by an unsatisfactory fastening.
- Tools must not be used in an explosive or flammable atmosphere.
- All tools must be used with the correct shield, guard, or attachment recommended by the manufacturer.
- Powder-actuated tools used by employees must meet all other applicable requirements of American National Standards Institute, A10.3-1970, Safety Requirements for Explosive-Actuated Fastening Tools.
- In many states, a license is required before a worker can operate powder-actuated tools.

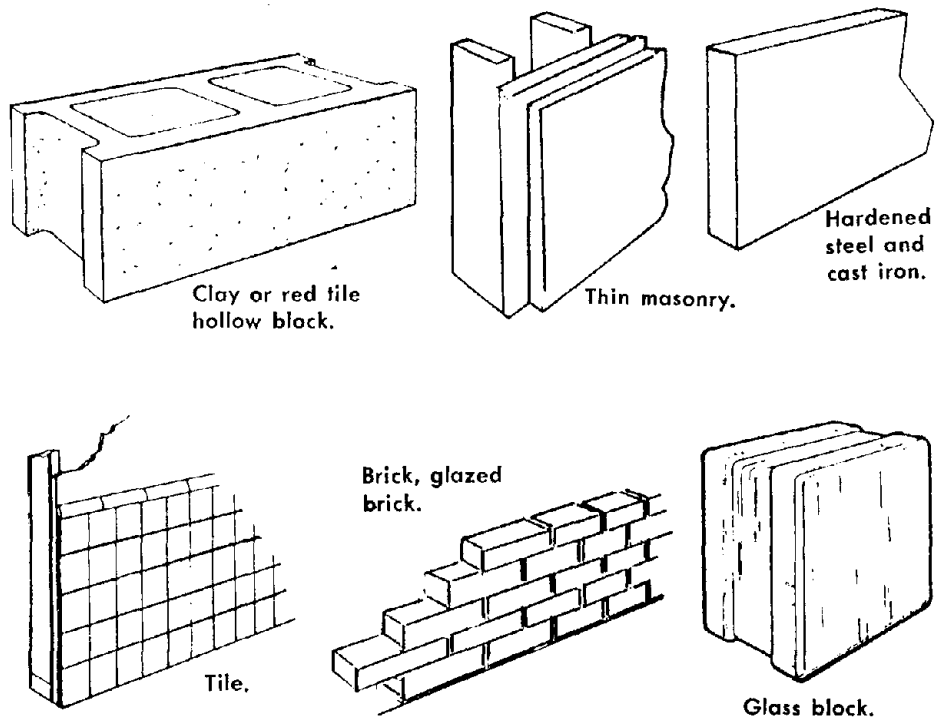
Safe use of powder-actuated tools requires employee-operators to:

- Never fasten closer than 3 inches from edge of concrete.
- Never fasten closer than  $\frac{1}{2}$  inch from edge in steel.

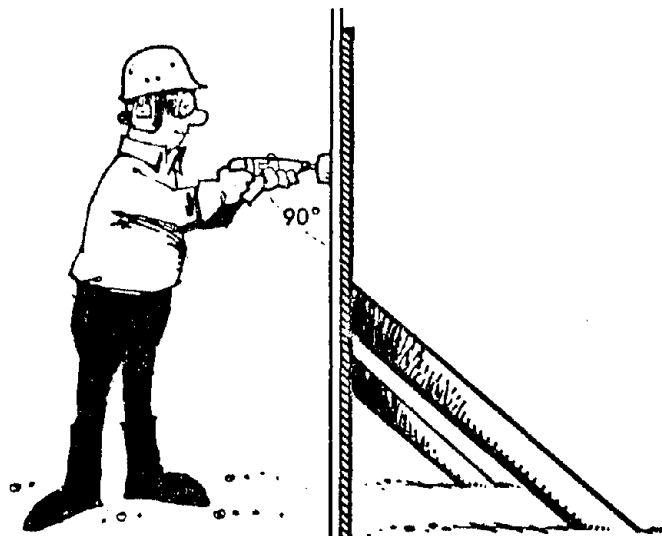


- Always keep head and body behind tool when firing.
- Keep other workers out of the line of fire.
- Always wear safety goggles and hard hats.
- Always check for cracks when fastening into the edge of concrete.
- Lean on the tool when firing to keep it at right angles to the work surface.

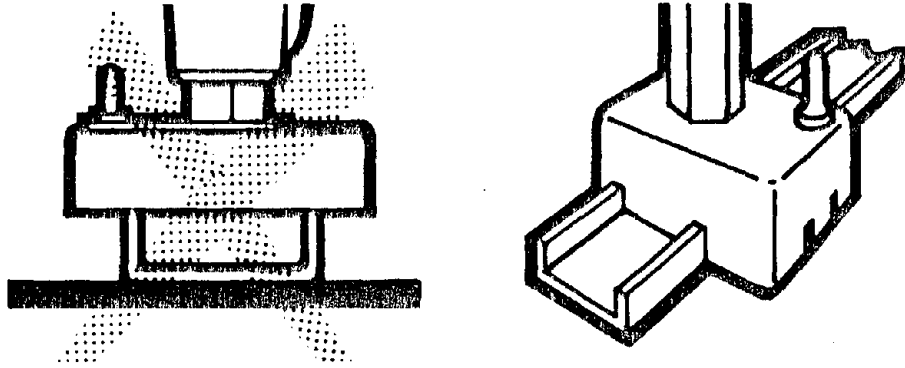
- Not attempt fastenings into brittle, weak, or hollow material such as:



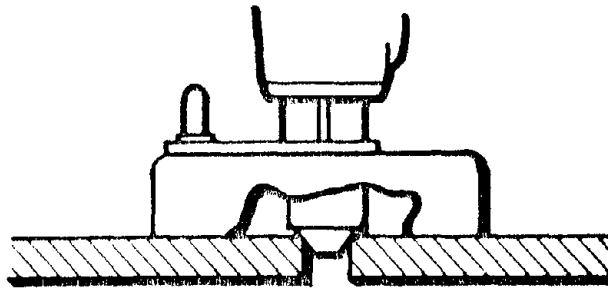
- Clean and lubricate tool daily.
- Always know the material being fastened into, especially in older buildings where base material may be concealed.
- Backup the work with a ½-inch steel plate and clear the area of all personnel when fastening into thin material.



- Never use the tool in an explosive atmosphere.
- Always store cartridges in a container used for cartridges only and not carry cartridges in pockets or mixed with other objects.
- Never use power tool cartridges in firearms.
- Use ear plugs when fastening in confined areas such as ships, small rooms, holds, tanks, vaults.
- Be sure the bore of tool is clear before loading.
- Never fasten where the standard guard will not give protection. Special guards are available for such applications.



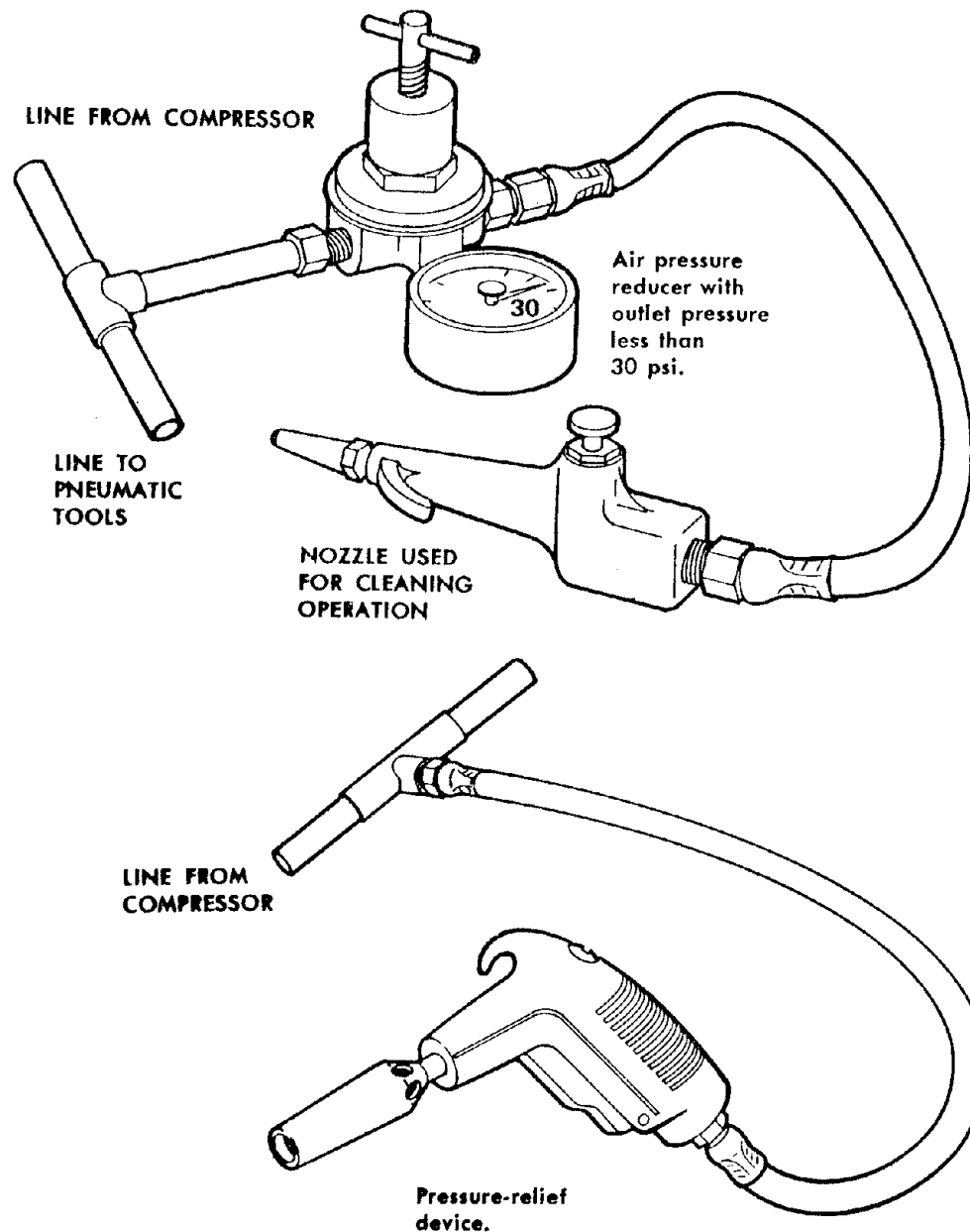
- Never attempt to fasten through a predrilled hole unless the tool is equipped with a hole locator.



- Never clean or service a powder-actuated tool unless adequate instruction has been received. In case of a misfire, the employee must use the following procedures:
  - Hold the tool in place for 30 seconds (count slowly).
  - Pull trigger again—if it still does not fire, wait another 30 seconds — keep tool in place while opening mechanism.
  - Remove cartridge.
  - Put cartridge in a bucket of water — never put unfired cartridge in trash that will be burned or leave cartridges where children can get to them.
  - Return unfired cartridge to supervisor for disposal.

## Compressed Air

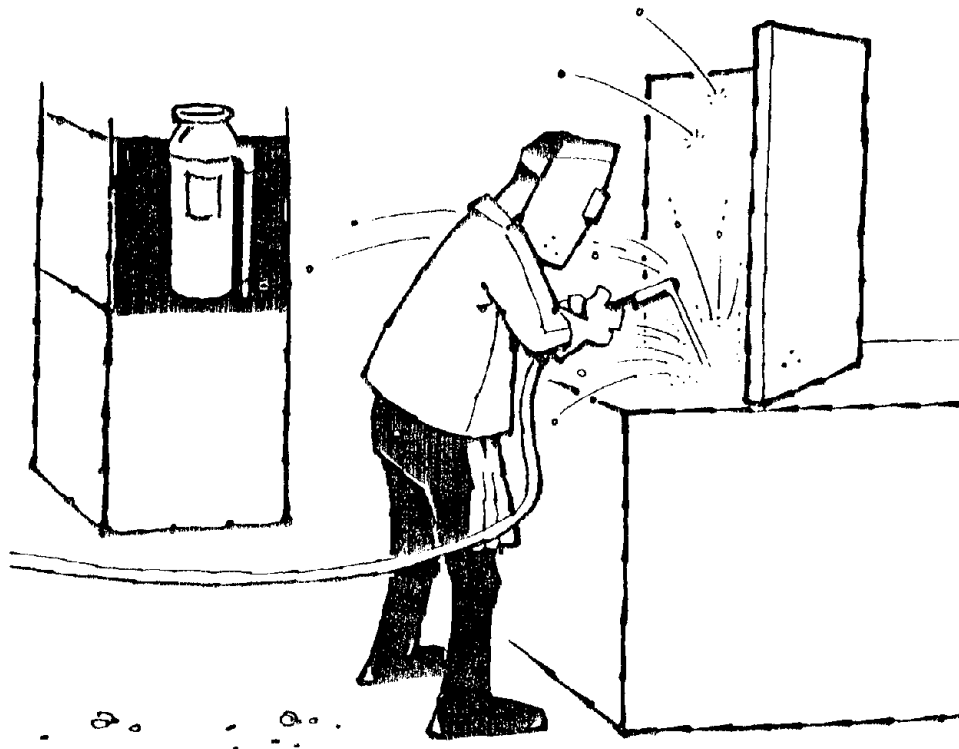
BEWARE OF COMPRESSED AIR, IT CAN BE DANGEROUS. Alternative methods of cleaning surfaces should be sought. Compressed air must never be used to blow debris from a person. Compressed air may be used for cleaning surfaces if there is no other acceptable method. The downstream pressure of compressed air 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.



## WELDING, CUTTING, AND BRAZING

### General

Management must establish areas for cutting and welding based on the fire potentials of the plant and establish procedures for welding and cutting in other areas. Cutting or welding should preferably be done in an area with no surrounding combustible materials. If combustibles in the immediate vicinity are unavoidable, guards must be erected to protect the fire hazards from the heat and sparks of the welding or cutting operations. Suitable fire extinguishing equipment (pails of water, buckets of sand, hose, or portable extinguisher) must be available for instant use.



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

Employees exposed to hazards created by cutting and welding must be protected by personal protective equipment such as flameproof gauntlet gloves (except when engaged in light work); flameproof aprons (e.g., leather) to protect against sparks and radiant heat; or fire resistant leggings or high boots.

Goggles or other suitable eye protection (helmets, hand shields) must be used during cutting operations as a protection against sparks and debris. Workers adjacent to the welding areas must be protected from ultraviolet rays by noncombustible or flame-proof screens or shields or must be required to wear appropriate goggles.

No welding, cutting, or other hot work shall be performed on used drums, barrels, tanks, or other containers until they have been cleaned so thoroughly as to make absolutely certain that there are no flammable materials present or any substances such as greases, tars, acids, or other materials that 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. The potential health hazard to a welder or cutter from gases or metal fumes depends on the toxicity of the materials involved (types of metals, fluxes, coatings, etc.), duration, location, and ventilation. There are specific requirements concerning ventilation and respirators when welding or cutting stainless steel, lead, zinc, or cadmium; metals coated with paint containing lead or mercury or other toxic substances; or fluxes or other materials containing fluorides.

The table below summarizes these requirements.

#### REQUIREMENTS FOR VENTILATION AND RESPIRATORS WHEN WELDING OR CUTTING

| Welding or cutting on materials<br>containing or coated with: | Location of operation |         |          |
|---------------------------------------------------------------|-----------------------|---------|----------|
|                                                               | Confined spaces       | Indoors | Outdoors |
| Lead                                                          | A or B                | A       | C        |
| Zinc                                                          | A or B                | A       |          |
| 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        |
| Fluorine†                                                     | A or B                |         |          |
| Stainless steels                                              | A                     | A       | A        |

\*A = Mechanical local exhaust ventilation by means of either 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.

C = NIOSH approved respiratory protective equipment.

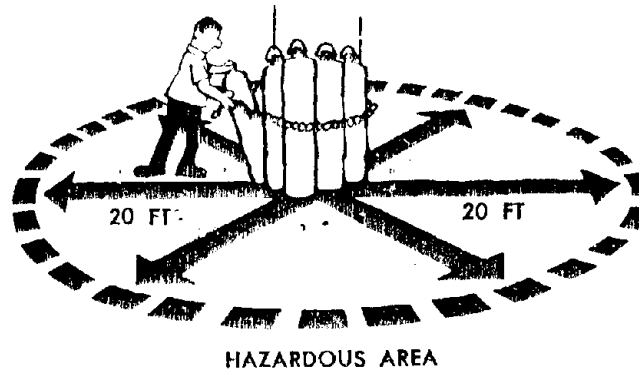
†Unless atmospheric tests under the most adverse conditions have established that the workers' exposures are within acceptable concentrations defined by 1910.1000.

When welding or cutting is done on metals not covered in the table, mechanical ventilation must be provided if there is less than 10,000 cubic feet of volume per welder, the ceiling is less than 16 feet high, or the work is 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 a velocity, away from the worker, of at least 100 linear feet per minute. As an alternative, NIOSH approved supplied-air respirators must be used.

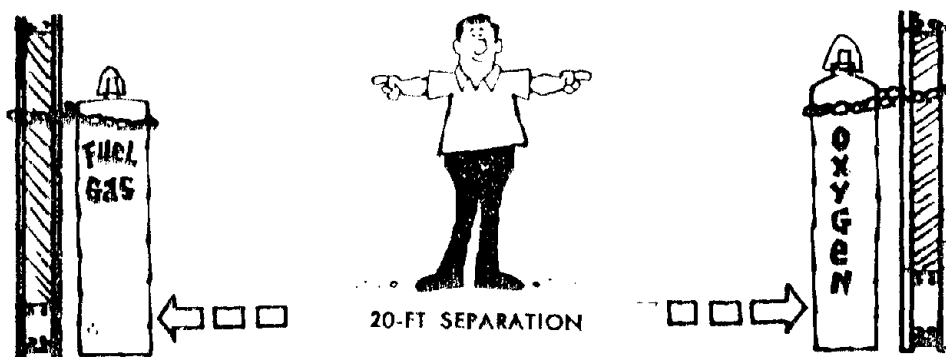
### Gas Welding

It is required that:

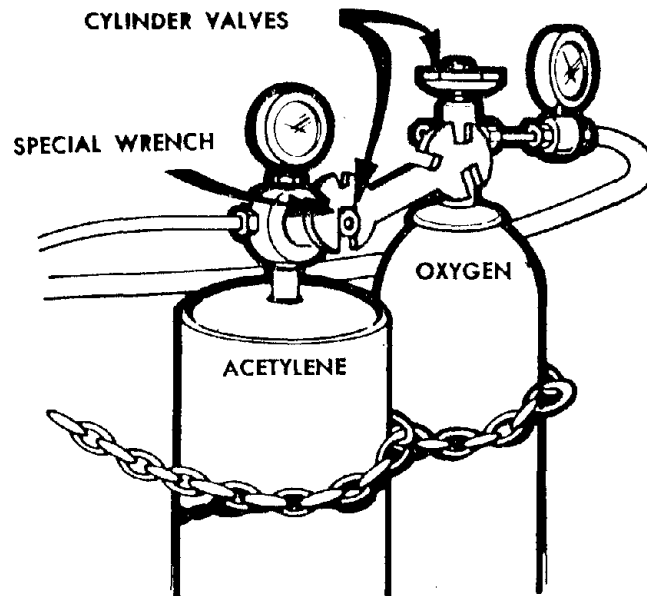
- All cylinders are away from radiators and other sources of heat.
- All cylinders stored inside buildings are located in a well-protected, well-ventilated, dry location at least 20 feet from highly combustible materials and away from elevators, stairs, or gangways. They are not to be kept in unventilated enclosures such as lockers and cupboards.



- Stored oxygen cylinders are separated from stored fuel gas cylinders or combustible materials (especially oil or grease) by a minimum distance of 20 feet or by a noncombustible barrier at least 5 feet high and having a ½-hour fire resistance rating.



- Valve protection caps are utilized where the cylinder is designed to accept a cap except when cylinders are in use or connected for use.
- 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 shall 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 with lashing or chain to prevent it from toppling over.
- Acetylene must not be utilized at a pressure in excess of 15 psi gauge (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 render them unfit for service must be replaced or repaired.

### **Electric Arc Welding**

- If the welding machine is wet, it must be thoroughly dried and tested before it is used again.
- Coiled welding cable is to be spread out; the ground lead must be firmly attached to the work.

- Cables must be inspected for damage and loss of insulation and be repaired immediately.
- Ground and electrode cables may be joined together only 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.
- Welding helmets or hand shields must be worn by the operator. Persons close by must wear eye-protection.
- Shields 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 which are not in use must be placed in a safe place, for example, away from conducting objects.

## **THE NATIONAL ELECTRICAL CODE (NEC)**

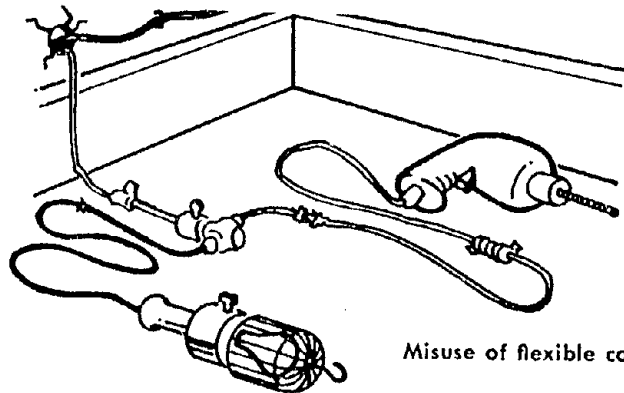
### **Electrical Requirements**

MORE FIRES ARE CAUSED BY ELECTRICAL MALFUNCTION THAN ANY OTHER CAUSE, and in all industries, violations of standards pertaining to electrical equipment and use have been cited more frequently than have any others. The National Electrical Code (NEC), (NFPA 70-1971; ANSI C1-1971) has been adopted as a national consensus standard by OSHA (refer to "Information Sources"). The purpose of the NEC is the practical safeguarding of persons and buildings and their contents from hazards arising from the use of electricity. The code contains basic minimum provisions considered necessary for safety. The electrician should be familiar with these requirements.

It is required that:

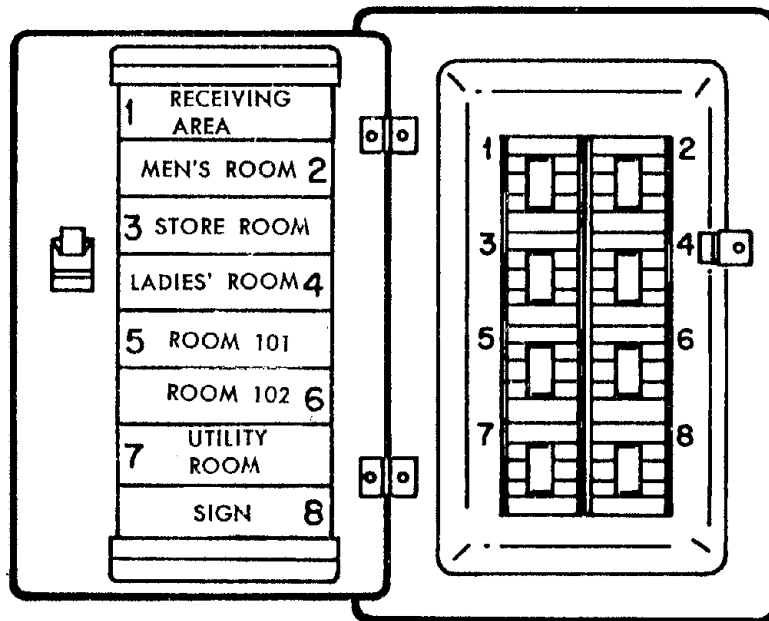
- Frames of electrical motors, regardless of voltage, must be grounded.
- Exposed noncurrent-carrying metal parts of fixed equipment that may become energized under abnormal conditions must be grounded under any of the following circumstances:
  - in wet or damp locations,
  - if in electrical contact with metal,
  - if operated in excess of 150 volts to ground, and
  - when in a hazardous location.
- Exposed noncurrent-carrying metal parts of the following plug-connected equipment, which are liable to become energized, must be grounded or double insulated and distinctly marked:
  - portable hand-held motor-operated tools,

- appliances, or
- any equipment operated in excess of 150 volts to ground.
- Outlets, switches, junction boxes, etc., must be covered.
- Flexible cords may not be:
  - used as a substitute for fixed wiring,
  - run through holes in walls, ceilings, or floors,
  - run through doors, windows, etc., or
  - attached to building surfaces.
- Flexible cords must be:
  - continuous lengths without splices or taps,
  - fastened so that there is no pull on joints or terminal screws,
  - replaced when frayed or insulation has deteriorated.



Misuse of flexible cords.

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



Proper labeling of circuit breakers.

### **Damp or Wet Locations**

A switch or circuit breaker in a wet location or outside of a building must be enclosed in a weatherproof enclosure.

In damp or wet locations, surface type cabinets and cutout boxes must be weatherproof and so placed or equipped as to prevent moisture or water from entering and accumulating within the cabinet or cutout box. They must also be mounted so there is at least ¼-inch of air space between the enclosure and the wall or other supporting surface. It is recommended that boxes of non-conductive material be used with nonmetallic-sheathed cable.

In locations where walls are frequently washed or where there are surfaces of absorbent materials, such as damp paper or wood, the entire wiring system, including all boxes, fittings, conduits, and cable must be mounted so that there is at least a ¼-inch air space between it and the wall or supporting surface.

### **Temporary Lights**

- Exposed bulbs on temporary lights and sockets shall be guarded to prevent accidental contact except if deeply recessed in the reflector or otherwise inaccessible.
- Temporary lights shall not be suspended by their electrical cords unless they are designed for that use.

### **Arcing Parts**

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

## **RECORDKEEPING REQUIREMENTS**

OSHA recordkeeping requirements are used to compile factual information about accidents that have happened. These records provide employers with a measure for evaluating the success of their health and safety activities and for identifying high risk areas of the business to which attention should be directed. Federal regulations require that employers with 11 or more employees at any time during the previous calendar year are required to complete OSHA Forms 101 (or its equivalent) and Form 200 during the current calendar year. OSHA Form 200 must also be kept current to within 6 days. These records must be maintained for 5 years, excluding the current year.

The types of work-related injuries and illnesses that must be recorded are those involving fatalities, lost workdays, or those which are nonfatal and do not cause lost workdays for the employee but that do require medical treatment, job transfer or termination, or resulted in loss of consciousness.

Any occurrence of a work-related fatal accident or an accident requiring the hospitalization of five or more employees must be reported to OSHA within 48 hours. An annual summary, Form 200, must be posted for the entire month of February.

Employers are required to maintain accurate records of certain potentially toxic or harmful physical agents that must be monitored or measured and to promptly advise any employee of any excessive exposure and the action undertaken to prevent recurrence of such exposure. Examples are asbestos and ionizing radiation.

For more detailed information, the booklet "Recordkeeping Requirements Under the Williams-Steiger Occupational Safety and Health Act of 1970" is available from OSHA.

# job safety and health protection

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

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

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

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

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

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

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

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

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

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

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

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

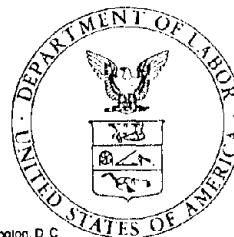
Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of not more than \$10,000 or by imprisonment for not more than six months, or by both. Conviction of an employer after a first conviction doubles these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

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

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

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

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



Washington, D. C.  
1974  
OSHA 2203

*Peter J. Brennan*  
Peter J. Brennan  
Secretary of Labor

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

OSHA 2203-10-77

Employers must post one of the full size versions (10x16) of this type of OSHA poster or a state-approved poster where required.

## CHECKLISTS

Since safe conditions depend on vigilance for possible hazards and immediate remedial action, periodic inspections are one of the most important aspects of a successful safety and health program.

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

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

Reference made in the "Checklist" subtitles refers to appropriate sections of "General Industry Standards," Title 29 CFR, Part 1910 and "Construction Industry Standards" Part 1926.



## **WALKING AND WORKING SURFACES**

### **Aisles and Floors (29 CFR 1910.22)**

|                                                                                                   | Yes                      | No                       |
|---------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are all places of employment kept clean and orderly?                                              | <input type="checkbox"/> | <input type="checkbox"/> |
| Are scrap pieces of sheet metal stored so that they do not present a slipping hazard?             | <input type="checkbox"/> | <input type="checkbox"/> |
| Are floors, aisles, and passageways kept clean and dry and are all spills cleaned up immediately? | <input type="checkbox"/> | <input type="checkbox"/> |
| Are floor holes, such as drains, covered?                                                         | <input type="checkbox"/> | <input type="checkbox"/> |
| Are permanent aisles appropriately marked?                                                        | <input type="checkbox"/> | <input type="checkbox"/> |
| Are wet surface areas covered with nonslip materials?                                             | <input type="checkbox"/> | <input type="checkbox"/> |

### **Storage Lofts, Second Floors, Etc. (29 CFR 1910.22, .23)**

|                                                                                                                                             |                          |                          |
|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are signs showing floor load capacity present (except ground floors with no basements)?                                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| Are storage lofts, balconies, etc., that are more than 4 feet above the floor protected with standard guardrails?                           | <input type="checkbox"/> | <input type="checkbox"/> |
| Are all lofts and balconies (beneath which people or machinery could be exposed to falling objects) guarded with standard 4-inch toeboards? | <input type="checkbox"/> | <input type="checkbox"/> |

### **Stairs (29 CFR 1910.24)**

|                                                                             |                          |                          |
|-----------------------------------------------------------------------------|--------------------------|--------------------------|
| Are there standard stair rails on all stairways having four or more risers? | <input type="checkbox"/> | <input type="checkbox"/> |
| Are there standard stair rails on all stairways having open sides?          | <input type="checkbox"/> | <input type="checkbox"/> |
| Are all stairways at least 22 inches wide?                                  | <input type="checkbox"/> | <input type="checkbox"/> |
| Do stairs have at least a 7-foot overhead clearance?                        | <input type="checkbox"/> | <input type="checkbox"/> |

|                                                        |                          |                          |
|--------------------------------------------------------|--------------------------|--------------------------|
| Do stairs angle no more than 50° and no less than 30°? | Yes                      | No                       |
|                                                        | <input type="checkbox"/> | <input type="checkbox"/> |

|                                                                                               |                          |                          |
|-----------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are stairs of hollow-pan type treads and landings filled to nosing level with solid material? | <input type="checkbox"/> | <input type="checkbox"/> |
|-----------------------------------------------------------------------------------------------|--------------------------|--------------------------|

**Ladders (29 CFR 1910.25., .26, .27)**

|                                                                                                                                                          |                          |                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Have defective ladders (e.g., broken rungs, side rails, etc.) been removed from service for repair or destruction and tagged as "DANGEROUS, DO NOT USE"? | <input type="checkbox"/> | <input type="checkbox"/> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|

|                                                                       |                          |                          |
|-----------------------------------------------------------------------|--------------------------|--------------------------|
| Is it prohibited to use the top of an ordinary step ladder as a step? | <input type="checkbox"/> | <input type="checkbox"/> |
|-----------------------------------------------------------------------|--------------------------|--------------------------|

|                                                                                |                          |                          |
|--------------------------------------------------------------------------------|--------------------------|--------------------------|
| Do fixed ladders have at least 3½ feet of extension at the top of the landing? | <input type="checkbox"/> | <input type="checkbox"/> |
|--------------------------------------------------------------------------------|--------------------------|--------------------------|

|                                              |                          |                          |
|----------------------------------------------|--------------------------|--------------------------|
| Do portable rung ladders have nonslip bases? | <input type="checkbox"/> | <input type="checkbox"/> |
|----------------------------------------------|--------------------------|--------------------------|

|                                                                                                                                                     |                          |                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Is the distance between the centerline of rungs on a fixed ladder and the nearest permanent object in back of the ladder at least 7 inches or more? | <input type="checkbox"/> | <input type="checkbox"/> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|

|                                                                              |                          |                          |
|------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are the maximum lengths of portable wooden and metal ladders being observed? | <input type="checkbox"/> | <input type="checkbox"/> |
|------------------------------------------------------------------------------|--------------------------|--------------------------|

|                                                         |                          |                          |
|---------------------------------------------------------|--------------------------|--------------------------|
| Do all fixed ladders have a preferred angle of 75°-90°? | <input type="checkbox"/> | <input type="checkbox"/> |
|---------------------------------------------------------|--------------------------|--------------------------|

**Scaffolds (29 CFR 1926.451)**

|                                                                           |                          |                          |
|---------------------------------------------------------------------------|--------------------------|--------------------------|
| Is the footing or anchorage sound? Rigid? Can it carry the intended load? | <input type="checkbox"/> | <input type="checkbox"/> |
|---------------------------------------------------------------------------|--------------------------|--------------------------|

|                                                                                                                         |                          |                          |
|-------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are guardrails, midrails, or toeboards installed on all open sides and ends of platforms which are higher than 10 feet? | <input type="checkbox"/> | <input type="checkbox"/> |
|-------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|

|                                                       |                          |                          |
|-------------------------------------------------------|--------------------------|--------------------------|
| Do planks extend over end supports by 6 to 12 inches? | <input type="checkbox"/> | <input type="checkbox"/> |
|-------------------------------------------------------|--------------------------|--------------------------|

|                                                |                          |                          |
|------------------------------------------------|--------------------------|--------------------------|
| Are scaffolds secured to permanent structures? | <input type="checkbox"/> | <input type="checkbox"/> |
|------------------------------------------------|--------------------------|--------------------------|

|                                          |                          |                          |
|------------------------------------------|--------------------------|--------------------------|
| Is there an access ladder or equivalent? | <input type="checkbox"/> | <input type="checkbox"/> |
|------------------------------------------|--------------------------|--------------------------|

|                                                                                                                    | Yes                      | No                       |
|--------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Is the platform width 20 inches or more?                                                                           | <input type="checkbox"/> | <input type="checkbox"/> |
| Will the scaffold and its support be capable of supporting the load (by a factor of four) it is designed to carry? | <input type="checkbox"/> | <input type="checkbox"/> |
| Are there any defective parts?                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> |

**Safety Belts, Lifelines (29 CFR 1926.104)**

|                                                                                                           |                          |                          |
|-----------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are lifelines and safety belts provided for and used by workmen exposed to the hazard of falling?         | <input type="checkbox"/> | <input type="checkbox"/> |
| Are lifelines attached to a structural member capable of supporting a minimum dead weight of 5400 pounds? | <input type="checkbox"/> | <input type="checkbox"/> |
| Do lifelines have a minimum breaking strength of 5400 pounds?                                             | <input type="checkbox"/> | <input type="checkbox"/> |
| Is the safety belt lanyard short enough to provide for a fall of 6 feet or less?                          | <input type="checkbox"/> | <input type="checkbox"/> |

**Safety Nets (29 CFR 1926.105)**

|                                                                                                                                                                                                                        |                          |                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are safety nets provided when workplaces are more than 25 feet above ground or water surfaces or where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, or safety belts is impractical? | <input type="checkbox"/> | <input type="checkbox"/> |
| Do safety nets extend 8 feet beyond the edge of the work surface where employees are exposed?                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> |

**Disposal Chutes (29 CFR 1926.252)**

|                                                                                                                                                              |                          |                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are chutes enclosed when materials drop over 20 feet?                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> |
| Are barricades (42 inches high) not less than six feet back from the projected opening when debris is dropped through holes for a drop of less than 20 feet? | <input type="checkbox"/> | <input type="checkbox"/> |

**Excavating-Trenching (29 CFR 1926.652)****Yes    No**

Prior to excavation, has a check been made to determine whether underground installations (i.e., sewer, telephone, water, fuel, electric lines, etc.) will be encountered?

☐    ☐

Are the walls and faces of all excavations in which men are exposed to danger from moving ground, guarded by a shoring system, sloping of the ground, or some equivalent means?

☐    ☐

Are excavations inspected by a competent person after every rainstorm or other hazard-increasing occurrence?

☐    ☐

Is excavated or other material stored at least 2 feet from edge of excavation?

☐    ☐

Do trenches more than 5 feet deep have ladders or steps located within 25 feet of employees?

☐    ☐

**EGRESS (29 CFR 1910.36, .37, .38)**

Are all exits marked with an exit sign and illuminated by a reliable light source?

☐    ☐

Is the lettering at least 6 inches high with the principal letter strokes at least 3/4 of an inch wide?

☐    ☐

Are the directions to exits, when not immediately apparent, marked with visible signs?

☐    ☐

Are doors or other passageways, which are neither exits nor access to an exit, and located where they may be mistaken for exits, appropriately marked "NOT AN EXIT," "TO BASEMENT," "STOREROOM," etc.?

☐    ☐

Are exit doors side-hinged?

☐    ☐

Are all doors that must be passed through to reach an exit, or way to an exit, always free to access with no possibility of a person being locked inside?

☐    ☐

Are all exits always kept free of obstructions?

☐    ☐

## **OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL**

**(29 CFR 1910.94, .95, .1000)**

|                                                                                                                                  | <b>Yes</b>               | <b>No</b>                |
|----------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Is management aware of hazards caused by various chemicals used in the plant such as ammonia, chlorine, epoxies, caustics, etc.? | <input type="checkbox"/> | <input type="checkbox"/> |
| Is employee exposure to these chemicals kept within acceptable levels?                                                           | <input type="checkbox"/> | <input type="checkbox"/> |
| Are eye wash fountains and safety showers provided in areas where chemicals, such as caustics, are used?                         | <input type="checkbox"/> | <input type="checkbox"/> |
| Are all containers, such as vats, storage tanks, etc. labeled as to their contents, e.g., "CAUSTICS"?                            | <input type="checkbox"/> | <input type="checkbox"/> |
| Is it required to wear personal protective equipment when handling chemicals (gloves, eye protection, respirators, etc.)?        | <input type="checkbox"/> | <input type="checkbox"/> |
| If fork lifts and other vehicles are used, are the carbon monoxide levels kept below 50 ppm?                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| Are steps being taken to use engineering controls to reduce the noise levels?                                                    | <input type="checkbox"/> | <input type="checkbox"/> |
| Are proper precautions being taken when handling asbestos and other fibrous materials?                                           | <input type="checkbox"/> | <input type="checkbox"/> |
| Are all areas properly illuminated?                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> |
| Is employee exposure to welding fumes controlled by ventilation, use of respirators, exposure time, or other means?              | <input type="checkbox"/> | <input type="checkbox"/> |
| Are annual physical examinations given to employees working with asbestos?                                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| Is vacuuming used wherever possible rather than blowing or sweeping dust?                                                        | <input type="checkbox"/> | <input type="checkbox"/> |

### **Occupational Noise Exposure (29 CFR 1910.95)**

|                                                                              |                          |                          |
|------------------------------------------------------------------------------|--------------------------|--------------------------|
| If a noise problem is suspected, have noise levels been accurately measured? | <input type="checkbox"/> | <input type="checkbox"/> |
|------------------------------------------------------------------------------|--------------------------|--------------------------|

|                                                                                                                                                                                                                                                                                                                                                                     | Yes                      | No                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| If a noise problem exists, have plans to reduce noise levels by engineering methods been formulated (e.g., enclosure, maintenance, different methods of processing)?                                                                                                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> |
| If engineering controls cannot reduce the noise to safe levels: 1. Have administrative controls, such as limiting worker-exposure in a given area, been started? 2. Are affected employees given annual audiometric tests, if necessary? 3. Have all high noise areas or jobs been identified? 4. Do all employees in the high noise areas wear hearing protection? | <input type="checkbox"/> | <input type="checkbox"/> |

## **HAZARDOUS MATERIALS**

### **Flammable and Combustible Liquids (29 CFR 1910.106)**

|                                                                                                                                    |                          |                          |
|------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are all connections vapor and liquid tight on drums and combustible liquid piping?                                                 | <input type="checkbox"/> | <input type="checkbox"/> |
| Are flammable liquids kept in closed containers when not in use (e.g., parts cleaning tanks, pans, etc.)?                          | <input type="checkbox"/> | <input type="checkbox"/> |
| Are all spills of flammable or combustible liquids cleaned up promptly?                                                            | <input type="checkbox"/> | <input type="checkbox"/> |
| Is combustible waste material (oily rags, etc.) stored in covered metal receptacles and disposed of daily?                         | <input type="checkbox"/> | <input type="checkbox"/> |
| Are bulk drums of flammable liquids grounded and bonded to containers during dispensing?                                           | <input type="checkbox"/> | <input type="checkbox"/> |
| Are gasoline and other flammable liquids stored in approved containers?                                                            | <input type="checkbox"/> | <input type="checkbox"/> |
| Do storage rooms for flammable and combustible liquids have explosion-proof lights?                                                | <input type="checkbox"/> | <input type="checkbox"/> |
| Do storage rooms for flammable and combustible liquids have mechanical or gravity ventilation (at least six air changes per hour)? | <input type="checkbox"/> | <input type="checkbox"/> |
| Are LP gas storage tanks guarded to prevent damage from vehicles?                                                                  | <input type="checkbox"/> | <input type="checkbox"/> |

|                                                                                                    |                                 |                                |
|----------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------|
| Are "NO SMOKING" signs posted on LP gas tanks?                                                     | Yes<br><input type="checkbox"/> | No<br><input type="checkbox"/> |
| Are storage cabinets for flammable and combustible liquids labeled "FLAMMABLE—KEEP FIRE AWAY"?     | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Is there never more than one day's supply of paint outside of approved storage cabinets or rooms?  | <input type="checkbox"/>        | <input type="checkbox"/>       |
| <b>Spray Operations (29 CFR 1910.107)</b>                                                          |                                 |                                |
| Are portable lamps removed during spray operations?                                                | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Do solvents used for cleaning have high flash points (not less than 100°F)?                        | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are fire control sprinkler heads kept clean?                                                       | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are "NO SMOKING" signs posted in the spray area, paint room, paint booth, and paint storage area?  | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are the electric motors for exhaust fans placed outside booths or ducts?                           | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are belts and pulleys inside the booth fully enclosed?                                             | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Do ducts have access doors to allow cleaning?                                                      | <input type="checkbox"/>        | <input type="checkbox"/>       |
| At low temperatures (below 55°) is make-up air heated to at least 65°?                             | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Is the make-up air heater located outside the spray booth?                                         | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Do all drying spaces have adequate ventilation?                                                    | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Is the spray area at least 20 feet from flame, sparks, electric motors, or other ignition sources? | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Is the spray area free of hot surfaces?                                                            | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Is the spray area kept clean of combustible residue?                                               | <input type="checkbox"/>        | <input type="checkbox"/>       |

|                                                                                               |                                 |                                |
|-----------------------------------------------------------------------------------------------|---------------------------------|--------------------------------|
| Are spray booths constructed of metal, masonry, or other substantial noncombustible material? | Yes<br><input type="checkbox"/> | No<br><input type="checkbox"/> |
| Are spray booths floors and baffles noncombustible and easily cleaned?                        | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Do spray booths have explosion-proof lights or are they lighted through sealed clear panels?  | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Is mechanical ventilation on during spray operations?                                         | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Is infra-red drying apparatus kept out of the spray area during spraying operations?          | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Is the spray area completely ventilated before using the drying apparatus?                    | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Is the electric drying apparatus properly grounded?                                           | <input type="checkbox"/>        | <input type="checkbox"/>       |

**PERSONAL PROTECTIVE EQUIPMENT  
(29 CFR 1910.132-.137)**

|                                                                                                                                       |                          |                          |
|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Is personal protective equipment provided, used, and maintained wherever it is necessary?                                             | <input type="checkbox"/> | <input type="checkbox"/> |
| Is employee-owned personal protective equipment, such as gloves, protective shoes, etc., adequate, sanitary, and properly maintained? | <input type="checkbox"/> | <input type="checkbox"/> |
| Is eye protection available where debris or flying objects could be a hazard?                                                         | <input type="checkbox"/> | <input type="checkbox"/> |
| Are ear plugs or muffs provided and worn during noisy conditions?                                                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| Is slip resistant footwear provided and worn?                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> |
| Are employees wearing appropriate helmets where there is a danger from falling objects?                                               | <input type="checkbox"/> | <input type="checkbox"/> |

**Respiratory Protection Devices  
(29 CFR 1910.134)**

|                                          |                          |                          |
|------------------------------------------|--------------------------|--------------------------|
| Are respirators provided when necessary? | <input type="checkbox"/> | <input type="checkbox"/> |
|------------------------------------------|--------------------------|--------------------------|

|                                                                                           | Yes                      | No                       |
|-------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are there written standard operating procedures for the selection and use of respirators? | <input type="checkbox"/> | <input type="checkbox"/> |
| Is the user instructed and trained in the proper use of respirators?                      | <input type="checkbox"/> | <input type="checkbox"/> |
| Where practicable, are respirators assigned for individual use by employees?              | <input type="checkbox"/> | <input type="checkbox"/> |
| Are respirators cleaned and disinfected after use?                                        | <input type="checkbox"/> | <input type="checkbox"/> |
| Are respirators stored in a convenient, clean, and sanitary location?                     | <input type="checkbox"/> | <input type="checkbox"/> |
| Are routinely-used respirators inspected during cleaning?                                 | <input type="checkbox"/> | <input type="checkbox"/> |

### **SANITATION (29 CFR 1910.141-.149)**

|                                                                                                                    |                          |                          |
|--------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are restrooms and washrooms kept clean and sanitary?                                                               | <input type="checkbox"/> | <input type="checkbox"/> |
| Are covered receptacles for waste food kept in clean and sanitary condition?                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| Are covered sanitary napkin receptacles provided in the women's restroom?                                          | <input type="checkbox"/> | <input type="checkbox"/> |
| Is all water that is provided for drinking, washing, and cooking suitable for drinking?                            | <input type="checkbox"/> | <input type="checkbox"/> |
| Are all outlets for water not suitable for drinking, clearly posted as "UNSAFE FOR DRINKING, WASHING, OR COOKING"? | <input type="checkbox"/> | <input type="checkbox"/> |
| Are employees prohibited from eating in areas where toxic materials are present?                                   | <input type="checkbox"/> | <input type="checkbox"/> |

### **MEDICAL AND FIRST AID (29 CFR 1910.151)**

|                                                                                                                                                                                                                                                |                          |                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Is at least one employee on each shift and construction site 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.) | <input type="checkbox"/> | <input type="checkbox"/> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|

|                                                                                                                                                              | Yes                      | No                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are physician-approved first aid supplies readily available, inspected, and replenished and in a weather proof container?                                    | <input type="checkbox"/> | <input type="checkbox"/> |
| Are first aid supplies approved by a consulting physician indicating that the first aid supplies are adequate?                                               | <input type="checkbox"/> | <input type="checkbox"/> |
| Are medical personnel readily available for advice and consultation on matters of plant health?                                                              | <input type="checkbox"/> | <input type="checkbox"/> |
| Is there a first aid kit easily accessible to the work area?                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> |
| Are emergency phone numbers posted?                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> |
| Where employees may be exposed to injurious corrosive materials, are they provided with quick-drenching and flushing facilities for immediate emergency use? | <input type="checkbox"/> | <input type="checkbox"/> |

### **FIRE PROTECTION (29 CFR 1910.157)**

|                                                                                                                                                                                                                  |                          |                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are extinguishers selected for the types of materials in areas where they are to be used?                                                                                                                        |                          |                          |
| Class A. Ordinary combustible material fires                                                                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| Class B. Flammable-liquid, gas, or grease fires                                                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> |
| Class C. Energized-electrical-equipment fires                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> |
| Are extinguishers fully charged and in designated places (e.g., unmounted)?                                                                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> |
| Are extinguishers located along normal paths of travel?                                                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> |
| Are extinguishers free from obstruction or blockage?                                                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> |
| Are extinguishers at the correct height? (If not exceeding 40 pounds, the top must be no higher than 5 feet above the floor; if greater than 40 pounds, the top must be no higher than 3½ feet above the floor.) | <input type="checkbox"/> | <input type="checkbox"/> |
| Have all extinguishers been serviced, maintained, and tagged at intervals not to exceed 1 year?                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> |

|                                                                                                                                                                           | Yes                      | No                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are all extinguishers checked (by management or designated employee) monthly to see if they are in place or if they have been activated, etc.?                            | <input type="checkbox"/> | <input type="checkbox"/> |
| Have all extinguishers been hydrostatically tested according to schedules set for the type of extinguisher?                                                               | <input type="checkbox"/> | <input type="checkbox"/> |
| Is housekeeping adequate?                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> |
| Are appropriate fire extinguishers mounted within 75 feet of outside areas containing flammable liquids and within 10 feet of any inside storage area for such materials? | <input type="checkbox"/> | <input type="checkbox"/> |

### **COMPRESSED AIR (29 CFR 1910.169)**

|                                                                                                                  |                          |                          |
|------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are pulleys and belts on compressors and motors completely guarded?                                              | <input type="checkbox"/> | <input type="checkbox"/> |
| Are flexible cords or plugs on electric motors periodically checked and replaced if in a deteriorated condition? | <input type="checkbox"/> | <input type="checkbox"/> |
| Do the relief valves operate properly?                                                                           | <input type="checkbox"/> | <input type="checkbox"/> |
| Are air tanks drained regularly?                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> |
| Is the pressure-relief device and gauge in good operating condition?                                             | <input type="checkbox"/> | <input type="checkbox"/> |

### **MATERIALS HANDLING AND STORAGE (29 CFR 1910.176-.181)**

|                                                                    |                          |                          |
|--------------------------------------------------------------------|--------------------------|--------------------------|
| Is there safe clearance for equipment through aisles and doors?    | <input type="checkbox"/> | <input type="checkbox"/> |
| Is stored material stable and secure?                              | <input type="checkbox"/> | <input type="checkbox"/> |
| Are storage areas free from tripping hazards?                      | <input type="checkbox"/> | <input type="checkbox"/> |
| Are only trained operators allowed to operate powered lift trucks? | <input type="checkbox"/> | <input type="checkbox"/> |
| Are appropriate overhead guards installed on powered lift trucks?  | <input type="checkbox"/> | <input type="checkbox"/> |

|                                                                                                                                                   |                                 |                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------|
| Is battery charging on electric units performed only in designated areas?                                                                         | Yes<br><input type="checkbox"/> | No<br><input type="checkbox"/> |
| Are "NO SMOKING" signs posted near electric battery charging units?                                                                               | <input type="checkbox"/>        | <input type="checkbox"/>       |
| On units using internal combustion engines, do the exhaust gases in the room not exceed allowable limits for carbon monoxide?                     | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are dock boards (bridge plates) used when loading or unloading from dock to truck or dock to rail car?                                            | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are containers of combustibles or flammables, when stacked one upon the other, always separated by dunnage sufficient to provide stability?       | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are racks and platforms loaded within the limits of their capacity?                                                                               | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Is all storage secured against sliding or collapsing?                                                                                             | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are all vehicles shut off prior to loading?                                                                                                       | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Have aisles been designated and kept clear to allow unhindered passage?                                                                           | <input type="checkbox"/>        | <input type="checkbox"/>       |
| If motorized equipment, such as lift trucks, is used, are aisles permanently marked, providing sufficient clearance for passage of the equipment? | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are specifications posted for maximum approved loads for floors (except slabs with no basements), roof of a building, or some other structure?    | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are chain hoists, ropes, slings adequate for the job?                                                                                             | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are motorized vehicles and mechanized equipment inspected daily or prior to use?                                                                  | <input type="checkbox"/>        | <input type="checkbox"/>       |

#### **Cranes**

**(29 CFR 1926.550, 1910.179-.180)**

Are operators properly trained and are they fol-

|                                                                                                        |                                 |                                |
|--------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------|
| lowing the manufacturer's specifications and limitations for the equipment?                            | Yes<br><input type="checkbox"/> | No<br><input type="checkbox"/> |
| Are proper hand signals being used?                                                                    | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are special hazard warnings or instructions posted on equipment and visible to the operator?           | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Has equipment been inspected and any deficiencies corrected prior to use of equipment?                 | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are barricades adequate around the swing radius of revolving superstructures?                          | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Is the equipment 10 feet or more (0.4 inch for each 1 kV over 50) away from any line of 50 kV or more? | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Have appropriate precautions been taken (de-energizing line) for work which is close to power lines?   | <input type="checkbox"/>        | <input type="checkbox"/>       |

**MACHINERY AND MACHINE GUARDING  
(29 CFR 1910.212)**

|                                                                                                                                            |                          |                          |
|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are belts, pulleys, and rotating shafts (air compressor, drill presses, etc.) properly guarded?                                            | <input type="checkbox"/> | <input type="checkbox"/> |
| Are chains, sprockets, and gears properly guarded?                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> |
| Are all in-going nip points properly guarded?                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> |
| Are rotating shafts that are not smooth, properly guarded?                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> |
| Are all rotating parts (lubrication, fittings, etc.) recessed or covered with collars?                                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| Are all pieces of equipment with an electric motor or any electrical connection effectively grounded?                                      | <input type="checkbox"/> | <input type="checkbox"/> |
| Are sprockets and V-belt drives that are within reach of platforms and passageways or less than 7 feet from the floor completely enclosed? | <input type="checkbox"/> | <input type="checkbox"/> |
| Are fans less than 7 feet above floor protected with a guard having openings ½ inch or less?                                               | <input type="checkbox"/> | <input type="checkbox"/> |

|                                                                                         |                          |                          |
|-----------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are machines with cutting actions such as band-saws and circular saws properly guarded? | Yes                      | No                       |
|                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> |

|                                                                             |                          |                          |
|-----------------------------------------------------------------------------|--------------------------|--------------------------|
| Are machines with punching, bending, and shearing actions properly guarded? | <input type="checkbox"/> | <input type="checkbox"/> |
|-----------------------------------------------------------------------------|--------------------------|--------------------------|

**Abrasive Wheel Machinery (Grinders)**  
**(29 CFR 1910.215)**

|                                                                          |                          |                          |
|--------------------------------------------------------------------------|--------------------------|--------------------------|
| Is the work rest used and kept adjusted to within 1/8 inch of the wheel? | <input type="checkbox"/> | <input type="checkbox"/> |
|--------------------------------------------------------------------------|--------------------------|--------------------------|

|                                                                                                             |                          |                          |
|-------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Is the adjustable tongue on the top side of grinder used and kept adjusted to within 1/4 inch of the wheel? | <input type="checkbox"/> | <input type="checkbox"/> |
|-------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|

|                                                                                  |                          |                          |
|----------------------------------------------------------------------------------|--------------------------|--------------------------|
| Do side guards cover the spindle, nut, and flange and 75% of the wheel diameter? | <input type="checkbox"/> | <input type="checkbox"/> |
|----------------------------------------------------------------------------------|--------------------------|--------------------------|

|                                                      |                          |                          |
|------------------------------------------------------|--------------------------|--------------------------|
| Are bench and pedestal grinders permanently mounted? | <input type="checkbox"/> | <input type="checkbox"/> |
|------------------------------------------------------|--------------------------|--------------------------|

|                                                        |                          |                          |
|--------------------------------------------------------|--------------------------|--------------------------|
| Are goggles or face shields always worn when grinding? | <input type="checkbox"/> | <input type="checkbox"/> |
|--------------------------------------------------------|--------------------------|--------------------------|

**Other Portable Tools and Equipment**  
**(29 CFR 1910.244)**  
**Jacks**

|                                                                      |                          |                          |
|----------------------------------------------------------------------|--------------------------|--------------------------|
| Are jacks checked periodically to see if they are in good condition? | <input type="checkbox"/> | <input type="checkbox"/> |
|----------------------------------------------------------------------|--------------------------|--------------------------|

|                                                          |                          |                          |
|----------------------------------------------------------|--------------------------|--------------------------|
| Are loads on jacks cribbed, blocked, or secured at once? | <input type="checkbox"/> | <input type="checkbox"/> |
|----------------------------------------------------------|--------------------------|--------------------------|

**HAND AND PORTABLE POWER TOOLS**  
**(29 CFR 1910.242-.244)**  
**(29 CFR 1926.300-.305)**

|                                                                              |                          |                          |
|------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are tools and equipment (both company and employee-owned) in good condition? | <input type="checkbox"/> | <input type="checkbox"/> |
|------------------------------------------------------------------------------|--------------------------|--------------------------|

|                                                                                               |                          |                          |
|-----------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Have mushroomed heads on chisels, punches, etc., been reconditioned or replaced if necessary? | <input type="checkbox"/> | <input type="checkbox"/> |
|-----------------------------------------------------------------------------------------------|--------------------------|--------------------------|

|                                           |                          |                          |
|-------------------------------------------|--------------------------|--------------------------|
| Have broken hammer handles been replaced? | <input type="checkbox"/> | <input type="checkbox"/> |
|-------------------------------------------|--------------------------|--------------------------|

|                                                                                               | Yes                      | No                       |
|-----------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Have worn or bent wrenches been replaced?                                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| Has compressed air used for cleaning been reduced to 30 psi when dead ended?                  | <input type="checkbox"/> | <input type="checkbox"/> |
| Have deteriorated air hoses been replaced?                                                    | <input type="checkbox"/> | <input type="checkbox"/> |
| Are portable abrasive wheels appropriately guarded?                                           | <input type="checkbox"/> | <input type="checkbox"/> |
| Have employees been made aware of the hazards caused by faulty or improperly used hand tools? | <input type="checkbox"/> | <input type="checkbox"/> |

**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 ½-hour fire resistance rating?                        | <input type="checkbox"/> | <input type="checkbox"/> |
| Are cylinders secured and stored where they cannot be knocked over?                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> |
| Are cylinder protective caps in place except when the cylinder is in use?                                                                                | <input type="checkbox"/> | <input type="checkbox"/> |
| Are compressed gas cylinders kept away from sources of heat, elevators, stairs, or gangways?                                                             | <input type="checkbox"/> | <input type="checkbox"/> |
| Are only instructed employees, who are judged competent by the employer, allowed to use oxygen or fuel gas equipment?                                    | <input type="checkbox"/> | <input type="checkbox"/> |
| 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? | <input type="checkbox"/> | <input type="checkbox"/> |
| Is welding always conducted at a safe distance from flammable liquids?                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> |
| Is there a fire extinguisher nearby?                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| Do the electrical leads not contain a splice within 10 feet of the electrode holder?                                                                     | <input type="checkbox"/> | <input type="checkbox"/> |

|                                                                                                             |                                 |                                |
|-------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------|
| Are all compressed gas cylinders legibly marked for identifying the content?                                | Yes<br><input type="checkbox"/> | No<br><input type="checkbox"/> |
| Are the valves shut off when the cylinder is not in use?                                                    | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are flash shields provided to protect nearby workers from the welding flash?                                | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are electrode holders with the electrodes removed, away from conducting objects when not in use?            | <input type="checkbox"/>        | <input type="checkbox"/>       |
| Are the welders protected from excessive amounts of welding fumes by the use of ventilation or respirators? | <input type="checkbox"/>        | <input type="checkbox"/>       |

**NATIONAL ELECTRICAL CODE (29 CFR 1910.308, .309)**

|                                                                                         |                          |                          |
|-----------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Is electrical equipment accessible?                                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| Have exposed wires, frayed cords, deteriorated insulation been repaired or replaced?    | <input type="checkbox"/> | <input type="checkbox"/> |
| Are exposed bulbs or sockets guarded on temporary lights to prevent accidental contact? | <input type="checkbox"/> | <input type="checkbox"/> |
| Are junction boxes, outlets, switches, etc., covered?                                   | <input type="checkbox"/> | <input type="checkbox"/> |
| Are temporary lights suspended by electrical cords which are approved for that use?     | <input type="checkbox"/> | <input type="checkbox"/> |
| Are breaker switches identified as to their use?                                        | <input type="checkbox"/> | <input type="checkbox"/> |
| Is all metallic, fixed equipment grounded?                                              | <input type="checkbox"/> | <input type="checkbox"/> |
| Does all equipment connected by cord and plug have grounded connections?                | <input type="checkbox"/> | <input type="checkbox"/> |
| Are electrical appliances such as vacuums, polishers, vending machines, etc., grounded? | <input type="checkbox"/> | <input type="checkbox"/> |
| Do all hand and power tools have double insulation or are they grounded?                | <input type="checkbox"/> | <input type="checkbox"/> |
| Do all extension cords being used have a ground wire?                                   | <input type="checkbox"/> | <input type="checkbox"/> |

|                                                                                                      | Yes                      | No                       |
|------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Are all plugs equipped with ground pins?                                                             | <input type="checkbox"/> | <input type="checkbox"/> |
| Do flexible cords and cables not run through holes in wall or ceiling?                               | <input type="checkbox"/> | <input type="checkbox"/> |
| Are flexible cords and cables free from splices or taps?                                             | <input type="checkbox"/> | <input type="checkbox"/> |
| Are flexible cords and cables fastened so that there is no direct pull on joints or terminal screws? | <input type="checkbox"/> | <input type="checkbox"/> |
| Are flexible cords and cables never substituted for fixed wiring?                                    | <input type="checkbox"/> | <input type="checkbox"/> |
| Are flexible cords and cables not attached to building surfaces?                                     | <input type="checkbox"/> | <input type="checkbox"/> |

### **RECORDKEEPING (29 CFR 1904.2-.8)**

|                                                                                                                                                                                                   |                          |                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| Is employee poster (OSHA or equivalent state poster) prominently displayed?                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| Have occupational injuries or illnesses, except minor injuries requiring only first aid, been recorded on OSHA Form Nos. 200 and 101, or equivalent?                                              | <input type="checkbox"/> | <input type="checkbox"/> |
| 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? Was it posted during the month of February? | <input type="checkbox"/> | <input type="checkbox"/> |
| Have all OSHA records been retained for a period of 5 years, excluding the current year?                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> |

## INFORMATION SOURCES

### **AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) 1430 Broadway, New York, N.Y. 10018**

- ☐ A10.8 Safety Requirements for Scaffolds
- ☐ A10.10 Safety Requirements for Temporary Space Heating Devices and Equipment Used in Construction Industry
- ☐ A10.8, 92.1 Scaffolds
- ☐ A12.1 Floor and Wall Openings
- ☐ A14.1 Portable Wood Ladders
- ☐ A58.1 Minimum Design Load
- ☐ A64.1 Fixed Stairs
- ☐ B11.1 Care and Use of Mechanical Power Presses
- ☐ B15.1 Mechanical Power Transmission
- ☐ B30 Cranes and Hoists
- ☐ B30.16-1973 Overhead Hoists
- ☐ B30.2.0-1967 Cranes, Overhead and Gantry
- ☐ B30.6 Safety Code for Cranes, Derricks, Hoists, Jacks and Slings
- ☐ B30.9-1971 Slings
- ☐ C1 National Electrical Code
- ☐ M11.1 Wire Rope
- ☐ Z4.1 Sanitation in Places of Employment
- ☐ Z35.2 Specifications for Accident Prevention Tags
- ☐ Z41 Safety Shoes
- ☐ Z49 Welding and Cutting
- ☐ Z87.1 Eye and Face Protection
- ☐ Z88.1, 88.2 Respiratory Protection
- ☐ Z89.2 Protective Headgear

### **NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 470 Atlantic Avenue Boston, Mass. 02110**

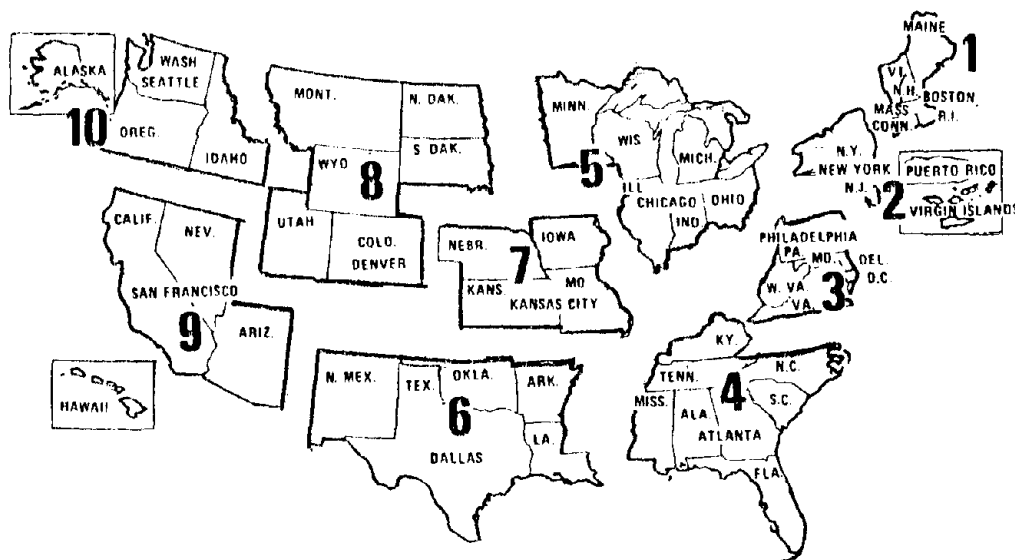
**NATIONAL SAFETY COUNCIL**  
**444 North Michigan Avenue**  
**Chicago, Illinois 60611.**

NIOSH and OSHA Regional Directors, trade associations, state and local governmental agencies, and insurance companies can also provide useful information. The Small Business Administration will provide information concerning procedures for securing economic assistance in compliance with the OSHA Standards (if needed).

OSHA 2085 Excavation and Trenching Operations  
OSHA 2086 Excavation, Trenching, and Backfilling  
OSHA 2089 Trenching and Excavations—A Checklist

**NIOSH AND OSHA REGIONAL OFFICES**

The following pages list NIOSH and OSHA regional offices; these offices can provide information on the Occupational Safety and Health Act, standards interpretations, and voluntary compliance. Copies of the **OSHA Standards**, **OSHA Act**, **Employee Rights Posting Notice**, and other publications can also be obtained at these locations.



Regions

DHEW, Region I  
Government Center  
(JFK Fed. Bldg.)  
Boston, Massachusetts 02203  
Tel.: 617/223-6668/9

DHEW, Region II  
26 Federal Plaza  
New York, New York 10007  
Tel.: 212/264-2485/8

DHEW, Region III  
3525 Market Street,  
P.O. Box 13716  
Philadelphia, Pennsylvania 19101  
Tel.: 215/596-6716

DHEW, Region IV  
50 Seventh Street, N.E.  
Atlanta, Georgia 30323  
Tel.: 404/881-4474

DHEW, Region V  
300 South Wacker Drive  
Chicago, Illinois 60607  
Tel.: 312/886-3881

DHEW, Region VI  
1200 Main Tower Building  
Room 1700-A  
Dallas, Texas 75245  
Tel.: 214/655-3081

DHEW, Region VII  
601 East 12th Street  
Kansas City, Missouri 64106  
Tel.: 816/374-5332

DHEW, Region VIII  
19th & Stout Streets  
9017 Federal Building  
Denver, Colorado 80202  
Tel.: 303/837-3979

DHEW, Region IX  
50 Fulton Street (223 FOB)  
San Francisco, California 94102  
Tel.: 415/556-3781

DHEW, Region X  
1321 Second Avenue  
(Arcade Bldg.)  
Seattle, Washington 98101  
Tel.: 206/442-0530

## **OSHA REGIONAL OFFICES**

NOTE: For an office close to you, check your telephone directory under United States Government or dial 800-555-1212 and ask for the toll-free number of the OSHA office nearest you.

### **Region I**

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

### **Region II**

U.S. Department of Labor  
Occupational Safety and Health Administration  
1515 Broadway (1 Astor Plaza), Room 3445  
New York, New York 10036 -----Telephone: 212/971-5941/2

### **Region III**

U.S. Department of Labor  
Occupational Safety and Health Administration  
15220 Gateway Center, 3535 Market Street  
Philadelphia, Pennsylvania 19104 -----Telephone: 215/596-1201

### **Region IV**

U.S. Department of Labor  
Occupational Safety and Health Administration  
1375 Peachtree Street, N.E., Suite 587  
Atlanta, Georgia 30309 -----Telephone: 404/526-3573/4 or 2281/2

**Region V**

U.S. Department of Labor  
Occupational Safety and Health Administration  
230 S. Dearborn, 32nd Floor  
Chicago, Illinois 60604 -----Telephone: 312/353-4716/7

**Region VI**

U.S. Department of Labor  
Occupational Safety and Health Administration  
555 Griffin Square Building, Room 602  
Dallas, Texas 75202 -----Telephone: 214/749-2477/8/9 or 2567

**Region VII**

U.S. Department of Labor  
Occupational Safety and Health Administration  
Federal Building, Room 3000, 911 Walnut Street  
Kansas City, Missouri 64106 -----Telephone: 816/374-5861

**Region VIII**

U.S. Department of Labor  
Occupational Safety and Health Administration  
Federal Building, Room 15010, 1961 Stout Street  
Denver, Colorado 80202 -----Telephone: 303/837-3883

**Region IX**

U.S. Department of Labor  
Occupational Safety and Health Administration  
9470 Federal Building, 450 Golden Gate Avenue  
Post Office Box 36017  
San Francisco, California 94102 -----Telephone: 415/556-0584

**Region X**

U.S. Department of Labor  
Occupational Safety and Health Administration  
6048 Federal Office Building  
909 First Avenue  
Seattle, Washington 98174 -----Telephone: 206/442-5930

## 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

|                                                |                                                                                       |                                                                                       |                                             |  |  |  |  |
|------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------|--|--|--|--|
| COLUMNS<br>TO THE<br>RIGHT OF<br>THAT<br>CLASS |    |    | CLASS A FIRES<br>USE THESE<br>EXTINGUISHERS |  |  |  |  |
|                                                |                                                                                       |                                                                                       | ORDINARY<br>COMBUSTIBLES                    |  |  |  |  |
|                                                |                                                                                       |                                                                                       | • WOOD                                      |  |  |  |  |
|                                                |                                                                                       |                                                                                       | • PAPER                                     |  |  |  |  |
| COLUMNS<br>TO THE<br>RIGHT OF<br>THAT<br>CLASS |    |   | CLASS B FIRES<br>USE THESE<br>EXTINGUISHERS |  |  |  |  |
|                                                |                                                                                       |                                                                                       | FLAMMABLE<br>LIQUIDS, GREASE                |  |  |  |  |
|                                                |                                                                                       |                                                                                       | • GASOLINE                                  |  |  |  |  |
|                                                |                                                                                       |                                                                                       | • PAINTS                                    |  |  |  |  |
| COLUMNS<br>TO THE<br>RIGHT OF<br>THAT<br>CLASS |  |  | CLASS C FIRES<br>USE THESE<br>EXTINGUISHERS |  |  |  |  |
|                                                |                                                                                       |                                                                                       | ELECTRICAL<br>EQUIPMENT                     |  |  |  |  |
|                                                |                                                                                       |                                                                                       | • MOTORS                                    |  |  |  |  |
|                                                |                                                                                       |                                                                                       | • SWITCHES                                  |  |  |  |  |

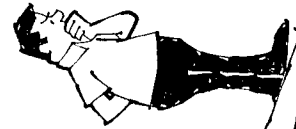
|                                                                             |  |  |
|-----------------------------------------------------------------------------|--|--|
| FOAM<br>Solution of<br>Aluminum<br>Sulphate<br>and Bicarbonate of<br>Soda   |  |  |
| CARBON<br>DIOXIDE<br>Carbon<br>Dioxide<br>Gas Under<br>Pressure             |  |  |
| SODA<br>ACID<br>Bicarbonate<br>of Soda<br>Solution and Sulphuric Acid       |  |  |
| PUMP<br>TANK<br>Plain<br>Water                                              |  |  |
| GAS<br>CART-<br>RIDGE<br>Water Ex-<br>pelled by<br>Carbon<br>Dioxide<br>Gas |  |  |
| MULTI-<br>PURPOSE<br>DRY<br>CHEMICAL                                        |  |  |
| ORDINARY<br>DRY<br>CHEMICAL                                                 |  |  |

# HOW TO LIFT SAFELY

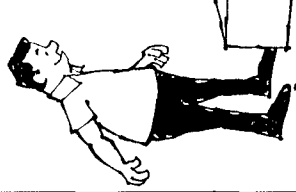
The following safe practices should be observed in order to avoid injury

The factors that contribute to safe lifting are...

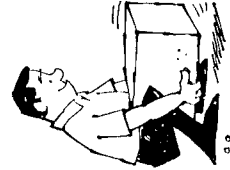
1. Approach the load and size it up (weight, size and shape.) Consider your physical ability to handle the load.



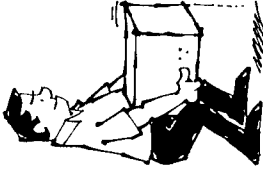
2. Place the feet close to the object to be lifted 8 to 12 inches apart for good balance.



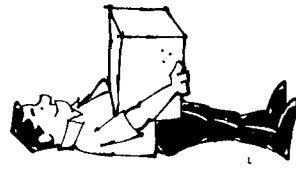
3. Bend the knees to the degree that is comfortable and get a good handhold. Then using both leg and back muscles...



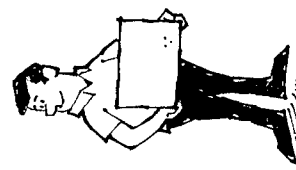
4. Lift the load straight up—smoothly and evenly. Pushing with your legs, keep load close to your body.



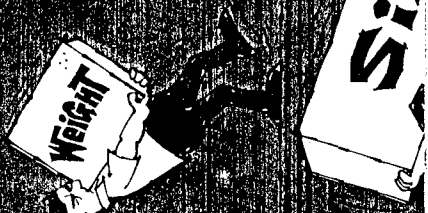
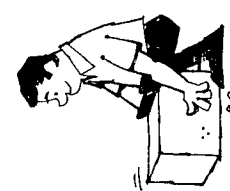
5. Lift the object into carrying position, making no turning or twisting movements until the lift is completed.

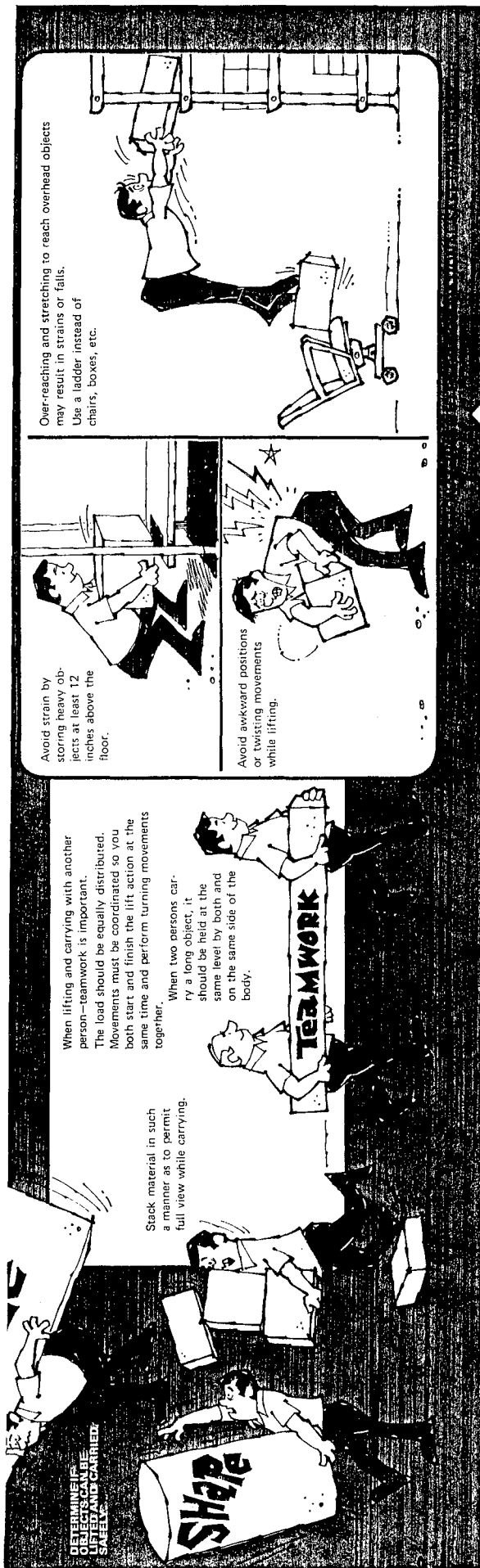


6. Turn your body with changes of foot position after looking over your path of travel making sure it is clear.



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.





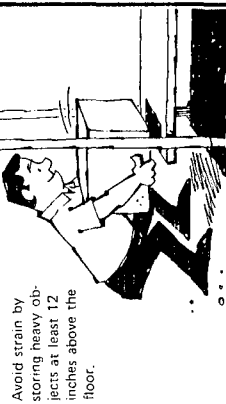
**DETERMINE IF  
OBJECTS CAN BE  
LIFTED AND CARRIED  
SAFELY.**

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.

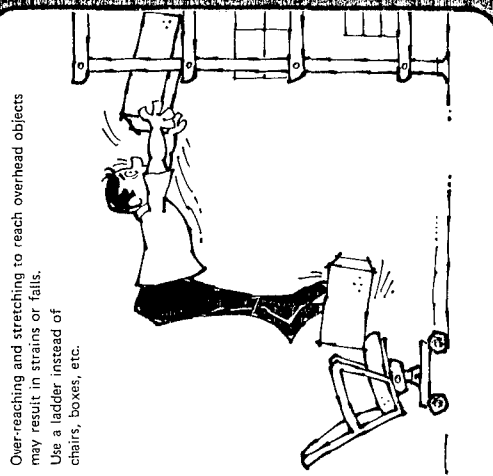
**TEAMWORK**



Avoid strain by  
storing heavy ob-  
jects at least 12  
inches above the  
floor.

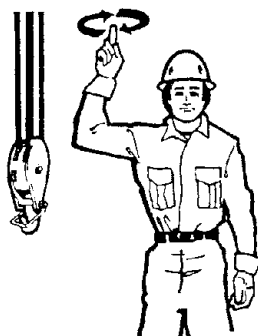


Avoid awkward positions  
or twisting movements  
while lifting.

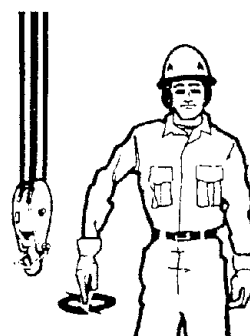


Over-reaching and stretching to reach overhead objects  
may result in strains or falls.  
Use a ladder instead of  
chairs, boxes, etc.

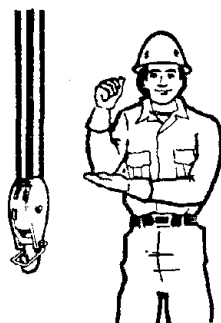
# STANDARD HAND SIGNALS FOR CONTROLLING CRAWLER, LOCOMOTIVE, AND TRUCK CRANE OPERATIONS



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



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



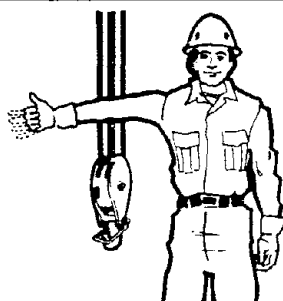
**USE WHIPLINE (Auxiliary Hoist).** Tap elbow with one hand, then use regular signals.



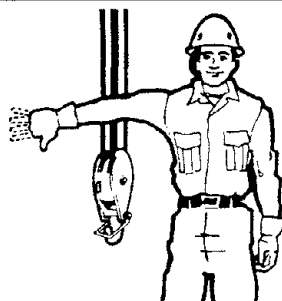
**RAISE BOOM.** Arm extended, fingers closed, thumb pointing upward.



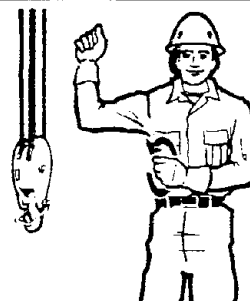
**LOWER BOOM.** Arm extended, fingers closed, thumb pointing downward.



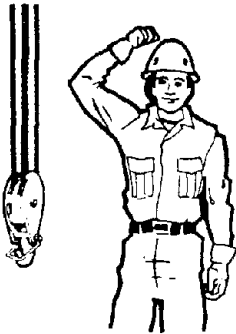
**RAISE THE BOOM AND LOWER THE LOAD.** With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.



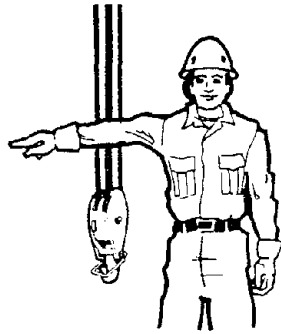
**LOWER THE BOOM AND RAISE THE LOAD.** With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.



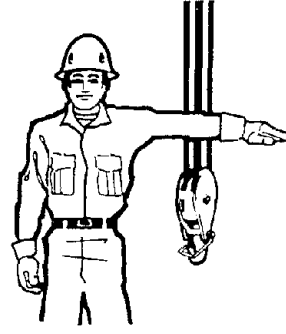
**TRAVEL. (One Track)** Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body. (For crawler cranes only).



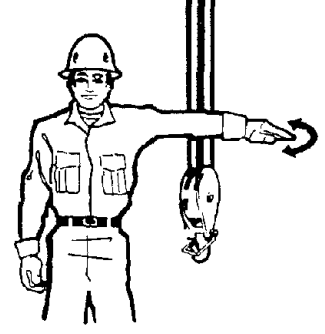
**USE MAIN HOIST.** Tap fist on head, then use regular signals.



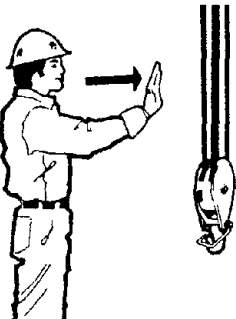
**SWING.** Arm extended point with finger in direction of swing of boom.



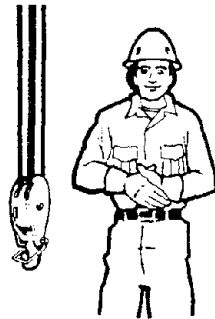
**STOP.** Arm extended, palm down, hold position rigidly.



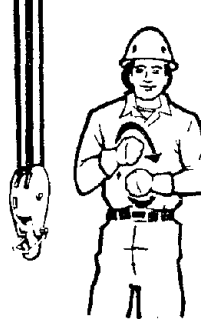
**EMERGENCY STOP.** Arm extended, palm down, move hand rapidly right and left.



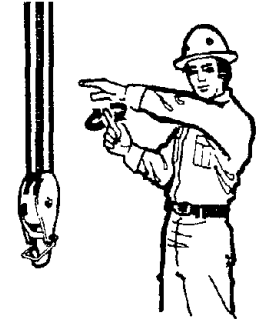
**TRAVEL.** Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.



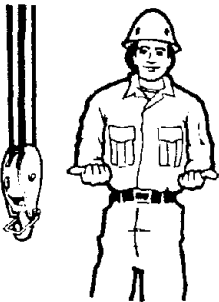
**DOG EVERYTHING.** Clasp hands in front of body.



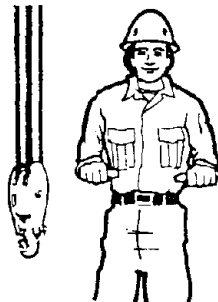
**TRAVEL (Both Tracks).** Use both fists in front of body, making a circular motion about each other, indicating direction of travel, forward or backward (For crawler cranes only).



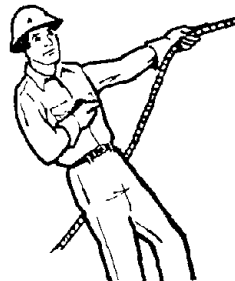
**MOVE SLOWLY.** Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist slowly shown as example).



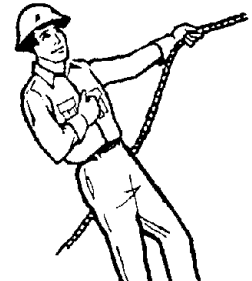
**EXTEND BOOM.** (Telescoping Booms). Both fists in front of body with thumbs pointing outward.



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



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



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

# EMERGENCY INFORMATION

## FIRE

Telephone Fire Department \_\_\_\_\_

Nearest Alarm Box at \_\_\_\_\_

## CRIME

Telephone Police \_\_\_\_\_

## INJURY/ILLNESSES

Avoid infection of minor injuries; always get medical attention or skilled first aid.

Doctor \_\_\_\_\_

Office \_\_\_\_\_ Tel. \_\_\_\_\_

Residence \_\_\_\_\_ Tel. \_\_\_\_\_

Hospital \_\_\_\_\_

Address \_\_\_\_\_ Tel. \_\_\_\_\_

Ambulance \_\_\_\_\_

Address \_\_\_\_\_ Tel. \_\_\_\_\_

(In emergencies, get medical attention and transportation elsewhere if necessary.)

In all cases of Fire, Crime, Accident, or Sickness, promptly notify:

1. Name \_\_\_\_\_ Office Tel. \_\_\_\_\_

Address \_\_\_\_\_ Res. Tel. \_\_\_\_\_

or

2. Name \_\_\_\_\_ Office Tel. \_\_\_\_\_

Address \_\_\_\_\_ Res. Tel. \_\_\_\_\_



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                         |                 |                                                              |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------|-----------------|--------------------------------------------------------------|--|
| <b>REPORT DOCUMENTATION PAGE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  | <b>1. REPORT NO.</b>                                    | <b>2.</b><br>NA | <b>3. Recipient's Accession No.</b><br>PB83-174 722          |  |
| <b>4. Title and Subtitle</b><br>Health and Safety Guide for Fabricated Structural Metal Products Industry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |                                                         |                 | <b>5. Report Date</b><br>October 1977                        |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                         |                 | <b>6.</b><br>NA                                              |  |
| <b>7. Author(s)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                                         |                 | <b>8. Performing Organization Rept. No.</b><br>78-100        |  |
| <b>9. Performing Organization Name and Address</b><br>NIOSH<br>4676 Columbia Parkway<br>Cincinnati, Ohio 45226                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                                         |                 | <b>10. Project/Task/Work Unit No.</b><br>NA                  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                         |                 | <b>11. Contract(C) or Grant(G) No.</b><br>(C)<br>(G)         |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                         |                 | <b>13. Type of Report &amp; Period Covered</b><br>NIOSH 1977 |  |
| <b>12. Sponsoring Organization Name and Address</b><br>NIOSH<br>4676 Columbia Parkway<br>Cincinnati, Ohio 45226                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                         |                 | <b>14.</b><br>NA                                             |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                         |                 |                                                              |  |
| <b>15. Supplementary Notes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                                         |                 |                                                              |  |
| <b>16. Abstract (Limit: 200 words)</b><br><br>In this industry, both physical hazards and health problems exist -- physical hazards when large, heavy sections are moved to various locations, and adverse health effects from (1) noise from welding, burning, chipping, riveting, and sawing; (2) exposure to lead particulate from the paint spraying operation; and (3) exposure to welding gases and metal fumes. Some of the fabricators also install their products; when employees do this work, they may be exposed to construction hazards and construction standards would apply (29 CFR, Part 1926).<br><br>Cuts from the sharp edges of the metal and glass are the predominant hazard. Welding and spray painting operations may be a health hazard if proper procedures are not followed. Noise from the sawing and riveting operations may be a hazard. Often these plants are located in small, crowded buildings where the housekeeping is poor. Although companies in this classification may do their own extruding, extrusion operations are not covered in this Guide. |  |                                                         |                 |                                                              |  |
| <b>17. Document Analysis a. Descriptors</b><br><br>metalworking, safety, occupational-hazards, noise, welding, gases, fumes<br><br><b>b. Identifiers/Open-Ended Terms</b><br><br><b>c. COSATI Field/Group</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |                                                         |                 |                                                              |  |
| <b>18. Availability Statement:</b><br><br>AVAILABLE TO THE PUBLIC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  | <b>19. Security Class (This Report)</b><br>UNCLASSIFIED |                 | <b>21. No. of Pages</b><br>103                               |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  | <b>20. Security Class (This Page)</b><br>UNCLASSIFIED   |                 | <b>22. Price</b>                                             |  |

