
Ca/OSHA
Guide
for the
Manufacturing
Industry

This guide is not meant to be either a substitute for—or a legal interpretation of—the occupational safety and health standards.

Almost every sentence in this guide is followed by a number. That number indicates the **California Code of Regulations Title 8** section or the **California Labor Code** section from which information has been summarized.

The reader is cautioned to refer directly to Title 8 or the Labor Code for detailed and exact information, specifications, or exceptions.

Current through Register 93, No. 22
of the California Code of Regulations, Title 8.

Edited and produced by:
State of California
Department of Industrial Relations
Cal/OSHA
P.O. Box 420603
San Francisco, CA 94142-0603

— Introduction —

This guide covers the safety and health (Cal/OSHA) standards applicable to three major manufacturing industries in California:

- Metal Manufacturing
- Lumber Manufacturing
- Food Processing

These industries are representative of the wide range of manufacturing in California, and are also known for their relatively high rates of occupational illness and injury.

You will find this guide useful, no matter what specific manufacturing industry you work in, because particular health and safety hazards are common to many different trades and occupations.

The first section, *Common Industry Standards*, covers safety and health standards that apply to all three industries. Topics covered in this section are generally not repeated in the following sections. Standards covering water and sanitation, for example, can be found only in the first section. For this reason it is important to refer to the first section as well as to the industry section in which you are interested.

Cal/OSHA standards are adopted to ensure that employers provide safe and healthful working conditions in all places of employment in California. The standards are contained in the California Code of Regulations, Title 8—Industrial Relations. Order forms for the California Code of Regulations Title 8 and subchapters are available from the Cal/OSHA Consultation Service and the Division of Occupational Safety and Health (DOSH) compliance district offices.

Employers must comply with all Cal/OSHA standards that apply to their business. In addition, all employers must meet posting and reporting requirements, and employers with eleven or more employees must meet recordkeeping requirements specified in the booklet *Recordkeeping Guidelines for Occupational Injuries and Illnesses*, available from the California Division of Labor Statistics and Research. Employers are also responsible for informing employees of their rights and obligations under the Cal/OSHA program.

The most effective way to prevent accidents and illnesses on the job is to have an injury and illness prevention program. To assist employers in

developing such a program that includes the required employee training, *Guide to Developing Your Workplace Injury & Illness Prevention Program* (CS-1), and *Sample Programs* (CS-1A) are available from the Cal/OSHA Consultation Service and from DOSH compliance district offices. Free on-site consultation is also available from the Cal/OSHA Consultation Service.

The manufacturing industry in California, as defined by the California Division of Labor Statistics and Research (DLSR), employs more than two million workers. Over 60,000 disabling work-related injuries and illnesses were reported in 1991 for the manufacturing industry. According to DLSR, the most common sources of injuries include: overexertion, 32 percent; being struck by or striking against an object, 25 percent; and falls, 11 percent.

This guide was prepared for use by workers, employers, supervisors, shop stewards, and health and safety personnel. It summarizes and paraphrases selected standards from the **California Code of Regulations, Title 8** that pertain to the manufacturing industry.

Sources of information are:

- **California Code of Regulations, Title 8—Industrial Relations (T8 CCR)**

- Chapter 3.2 California Occupational Safety and Health Regulations

- Subchapters 1 and 2 Pressure Vessels, Boiler Sections 450-797

- Subchapter 4 Construction Safety Orders (CSO) Sections 1500-1938

- Subchapter 5 Electrical Safety Orders (ESO) Sections 2300-2974

- Subchapter 7 General Industry Safety Orders (GISO) Sections 3200-6184

- Subchapter 13 Logging and Sawmill Sections 6248-6402

- **California Labor Code (LC) Division 5**

Additional information may be obtained from the Division of Occupational Safety and Health offices and Cal/OSHA Consultation Service offices listed at the back of this guide.

Additional copies of this guide are available without charge from Cal/OSHA Consultation Service or Division of Occupational Safety and Health offices. This is one of a series of occupational safety and health guides.

— Contents —

	Page
Introduction.....	3
Common Industry Standards	5
Administrative Requirements Under Cal/OSHA.....	5
Injury & Illness Prevention Program Requirements.....	6
Access to Medical & Exposure Records.....	6
Personal Protective Equipment.....	7
Medical & First Aid.....	7
Hazardous Materials & Conditions.....	8
Working Area.....	10
Material Storage & Handling.....	14
Cranes, Hoists, Derricks.....	16
Machinery, Equipment, Tools.....	18
Fumigation.....	22
Metal Manufacturing	23
General Machine Requirements.....	23
Welding/Cutting: Fuel-Gas Pipe Lines.....	27
Hazardous Materials & Operations.....	32
Lumber Manufacturing	36
Sawmills.....	36
Veneer & Plywood Plants.....	40
Lath, Shingle, Shake Mills.....	41
Woodworking Equipment.....	42
Food Processing	43
Work Areas.....	43
Facilities & Storage.....	44
Machinery & Tools.....	45
Index.....	46
Division of Occupational Safety & Health Offices.....	48
Cal/OSHA Consultation Service Offices.....	48

Common Industry Standards

— Administrative Requirements Under Cal/OSHA —

Cal/OSHA Poster

The employer must display the Cal/OSHA Poster *Safety and Health Protection on the Job* in a conspicuous place at the jobsite. This poster is available from offices of the Division of Occupational Safety and Health (DOSH). 340

Cal/OSHA Recordkeeping & Reporting

Every employer of 11 or more people must keep records and make reports as outlined in the booklet *Recordkeeping Guidelines for Occupational Injuries and Illnesses*, available from the Division of Labor Statistics and Research. Every employer must report immediately by phone (within 24 hours) to a Division of Occupational Safety and Health (DOSH) district office any work-related accident or illness causing serious injury or death to an employee. 342(a)

A serious injury or illness is one that requires inpatient hospitalization over 24 hours for other than medical observation, or in which an employee suffers a loss of any member of the body or suffers any serious degree of permanent disfigurement. 330(h)

Reporting Use of Carcinogens

The employer must report to the Chief, Division of Occupational Safety and Health (DOSH), any operations involving a carcinogen and any incident of potential exposure to a carcinogen. 5200, 5207-5215, 5218-5220

Reporting Use of Asbestos

Prior to commencement of an operation that involves the use, handling, disruption, removal, disposal, processing, manufacturing, packaging or repackaging of asbestos, or any material containing greater than 0.1 percent asbestos, employers are required to register with the chief, DOSH. 5208 (r)(1)

Requirements for medical recordkeeping are contained in the following standards:

	Medical Exam	Records of Medical Exam	Work Area Monitoring	Records of Monitoring	Regulated Area
Bloodborne Pathogens	5193 (f)	5193 (h)			5193 (e)
MDA	5200 (m)	5200 (n)	5200 (e)	5200 (n)	5200 (f)
Cadmium	5207 (l)	5207 (n)	5207 (d)	5207 (n)	5207 (e)
Asbestos	5208 (p)	5208 (q)(1)(B)	5208 (d)	5208 (q)(1)(A)	5208 (e)(1)
Carcinogens	5209 (g)(1)	5209 (g)(2)			5209 (c)
Vinyl Chloride	5210 (k)	5210 (m)	5210 (d)	5210 (m)	5210 (e)
Coke Oven Emissions	5211 (s)	5211 (v)(2)	5211 (e)	5211 (v)(1)	5211 (d)
DBCP	5212 (m)	5212 (p)(2)	5212 (f)	5212 (p)(1)	5212 (e)
Acrylonitrile	5213 (n)	5213 (q)(3)	5213 (e)	5213 (q)(2)	5213 (f)
Inorganic Arsenic	5214 (n)	5214 (o)(3)	5214 (e)	5214 (o)(1)	5214 (f)
MBOCA	5215 (k)	5215 (m)(2)	5215 (d)	5215 (m)(2)	5215 (e)
EDB	5219 (m)	5219 (l)	5219 (e)	5219 (l)	

— Injury & Illness Prevention Program Requirements —

Every employer is required to have in writing an effective injury and illness prevention program. The program must include these elements:

- policy naming the person(s) with the authority and responsibility for carrying out the safety and health program
- system for ensuring employee compliance with safe and healthful work practices—including provisions for disciplinary action, and for recognition of safe work habits
- system for communicating with employees on matters relating to occupational safety and health—including provisions for encouraging employees to inform the employer of worksite hazards without fear of reprisal
- procedure for identifying and evaluating workplace hazards, including scheduled periodic inspections
- procedure for investigating an occupational injury or illness
- procedure for correcting in a timely manner unsafe or unhealthful conditions or work practices
- safety and health training for employees and supervisors
- system for documenting with records the scheduled, periodic inspections and the employee safety and health training—records that must be kept for three years. 3203

Background & Recommendations

General Industry Safety Order 3203, outlining the acceptable minimum for an injury and illness prevention program, was adopted because

statistics and research show that many occupational accidents and illnesses are preventable through an effective safety program.

For a workplace program to be most effective, the employer should expand the minimum requirements into a comprehensive injury and illness prevention program. Developing and conscientiously carrying out such a program reduces accidents, illness and property damage, and results in lower costs and higher efficiency for the employer.

Employee Right to Know

Employers must make sure that information on physical and health hazards of materials used in the workplace is transmitted to employees. This is accomplished by the employer's written hazard communication program, which includes an inventory of hazardous substances as well as labeling requirements and providing material safety data sheets (MSDS). 5194

Employee Training & Recordkeeping

Beyond the training and recordkeeping requirements of GISO 3203 and 5194, certain regulations require specific employee training by the employer or his/her representative.

The *Guide to Developing Your Workplace Injury & Illness Prevention Program*, a Cal/OSHA publication, lists in its Appendix D the training requirements in Title 8 of the *California Code of Regulations*. Employers may call a Consultation Service office for this free guide, and for assistance in creating an accident prevention program.

— Access to Medical & Exposure Records —

Employees have the right to see and copy:

- their own medical records (see table of medical recordkeeping requirements under *Cal/OSHA Recordkeeping & Reporting*), and records of exposure to toxic substances
- records of exposure to toxic substances or harmful physical agents for workers with similar past/ present job duties or working conditions
- material safety data sheets (MSDS) or other information that the employer has for chemicals or substances used in the workplace. 3204, 5194

Employers must notify any worker who has been or is being exposed to harmful substances in excess of exposure limits set by Cal/OSHA, and tell the worker what is being done to correct the problem. LC 6408

Workers or employers who need health information on specific toxic substances and the safety precautions that should be taken can contact:

HESIS-TRS
2151 Berkeley Way
Berkeley, CA 94704
Telephone: (510) 540-3014

— Personal Protective Equipment —

Body Protection

Wear clothing appropriate for the work to be done. 3383(b)

Do not wear clothing saturated with flammable liquids, corrosive substances, or oxidizing agents. 3383(c)

Head Protection

Use head protection when exposed to falling or flying objects. 3381(a)

Keep hair up or covered if it is long enough to become entangled in moving parts of machinery. 3381(e)

Wear head protection if exposed to electric shock that may cause shocks or burns. 3381(c), (d)

Eye & Face Protection

Use eye and/or face protection where there is the possibility of injury from flying particles, hazardous substances, or harmful light rays. 3382(a)

Foot Protection

Use appropriate foot protection when there is a possibility of injury. 3385(a)

Hand Protection

Use appropriate hand protection when hands are exposed to cuts, burns, harmful substances or radioactive materials. 3384

Hearing Protection

At over 90 dBA (8-hour time-weighted average):

- Use feasible administrative or engineering controls to reduce exposure to within allowable limits.
- If such controls are not successful, issue

personal protective equipment and ensure that it is used.

At 85 dBA institute a hearing conservation program of monitoring, audiometric testing, and worker training. 5095-5100

Radiant Energy Protection

Welding, soldering, brazing, and cutting operations require different filter lens shades. Refer to GISO 3382(b), Table EP-1 for a summary of the requirements. 3382(b)

Workers exposed to laser beams must wear suitable safety goggles. 3382(e)

Respiratory Protection

If engineering or administrative controls are impractical, or in emergencies involving exposure to harmful airborne contaminants, NIOSH (National Institute of Occupational Safety and Health) approved respirators are required. 5141

Workers must be trained in the need, use, sanitary care, and limitations of respiratory equipment. 5144(c)

Respirators must be inspected and sanitized after each use, and inspected monthly. 5144(d)(2)

Identify breathing gas containers with the words *AIR* or *OXYGEN*. 5144(e)(2)

Safety Belts

For fall prevention:

- use safety belts of the approved type 3388(a)
 - lifelines must have a strength equal to that of 1/2 Manila rope. 3388(b)
- For fall arresting: all safety belts, harnesses, lanyards, lifelines and drop lines shall meet the requirements of ANSI A10.14-1975. 1670(i)

— Medical & First Aid —

Medical personnel must be readily available for consultation on occupational health matters. 3400(a)

If there is no nearby clinic or hospital, at least one employee on each shift must be trained to give first aid.

Note: Trained personnel must possess a Red Cross (First Aid) certificate or the equivalent, and be trained in the exposure control of blood-borne pathogens. 3400(c), 5193

First aid supplies must be readily available, regularly inspected, and replenished. They must also be approved by the consulting physician.

Medications and treatments should not be contained in the first aid supplies, unless the consulting physician has given written approval. 3400(c)

The consulting physician is required to evaluate—and the employer to follow the physician's recommendations—as to whether the designated first aid provider should be supplied with personal protective equipment and/or immunization from bloodborne pathogens.

Where workers are exposed to corrosives or materials harmful to the eyes, facilities for quick drenching or flushing of the eyes must be provided. 3400(d)

— Hazardous Materials & Conditions —

Airborne Contaminants

The employer must prevent employee exposure to harmful airborne contaminants. For a listing of chemical contaminants and the exposure limits, see General Industry Safety Order (GISO) 5155.

Exhaust Emissions

In addition to dilution ventilation or exhaust collection, an approved exhaust purifier device is required if emissions exceed maximum acceptable concentration. 5146(a), (b)

Carcinogens

Whenever the following carcinogenic chemicals are present in the workplace, the employer must comply with safety rules specified in GISO 5209 (see the safety order for conditions and exceptions):

- 2-Acetylaminofluorene
- 4-Aminodiphenyl
- Benzidine (and its salts)
- 3,3'-Dichlorobenzidine (and its salts)
- 4-Dimethylaminoazobenzene
- alpha-Naphthylamine
- beta-Naphthylamine
- 4-Nitrobiphenyl
- N-Nitrosodimethylamine
- beta-Propiolactone
- bis-Chloromethyl ether
- Methyl chloromethyl ether
- Ethyleneimine

Safety rules for the following carcinogens are specified in the General Industry Safety Orders listed to the right of each carcinogen:

• Cotton dust.....	5190
• Methylenedianiline (MDA).....	5200
• Cadmium.....	5207
• Asbestos.....	5208
• Vinyl chloride.....	5210
• Coke oven emissions.....	5211
• 1, 2 Dibromo-3-Chloropropane.....	5212
• Acrylonitrile.....	5213
• Inorganic arsenic.....	5214
• 4,4'-Methylene bis (2-Chloroaniline)....	5215
• Ethylene dibromide.....	5219

Wood Preservative Chemicals

The commonly used wood preservatives contain creosote, pentachlorophenol, or inorganic arsenic.

Where the probability of skin or eye irritation exists, workers must use appropriate protective clothing and equipment, such as coveralls, gloves, shoes, face shields or impervious clothing. Use of appropriate respirators is required when it is impractical to eliminate harmful exposures to these chemicals. 3384, 3385, 3382, 3383, 5144(a)

Exposure Limits (8-hour time-weighted average)

- Creosote (a mixture of aromatic hydrocarbons).....toxicity varies according to chemicals used
- Pentachlorophenol... 0.5 mg/cu. meter 5155
- Inorganic arsenic... 0.01 mg/cu. meter 5214

Exposure to Asbestos

The spraying of materials containing asbestos is prohibited, except for:

- cold asphalt
- coating containing bond fibers. 5208(g)(4)

The following are types of asbestos: Actinolite, Amosite, Amphibole, Chrysotile, Crocidolite, Tremolite.

Worker exposure to asbestos must be no more than 0.2 fiber per cubic centimeter of air, for an 8-hour time-weighted average; 5208(c)(1) and no more than an average of one fiber per cubic centimeter of air during any 30-minute period.

5208(c)(2)

The following engineering controls must be used to keep asbestos exposure below limits: isolation, enclosure, exhaust ventilation, dust collection.

The following work practices are required:

- Asbestos must be handled wet, if possible.
- Spills must be cleaned up promptly.
- Materials must be wetted before removal from containers, unless exposure is controlled by ventilation.

Asbestos waste and debris must be collected in sealed impermeable bags. 5208(g)

When engineering controls are not feasible, respiratory protection for workers is required. 5208(f)(B)

If the exposure may exceed the limit, the asbestos concentration must be determined (at the worker's breathing zone). 5208(d)(1)(A)

Warning signs containing the following information must be displayed at locations where

asbestos fiber concentration may exceed the exposure limit: 5208(m)

DANGER—ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA

All material or scrap containing greater than 0.1 percent asbestos must bear a label:

5208(n)(1)(B)

DANGER
Contains Asbestos Fibers
Avoid Creating Dust
CANCER AND LUNG DISEASE HAZARD

Combustible Dusts

Enclosed areas where combustible dusts are generated must be kept clean to prevent accumulation in amounts that may present a fire or explosion hazard.

Cleaning with compressed air and blowing combustible dust may be done only when other methods cannot be used and possible sources of ignition have been eliminated (and hoses and nozzles are grounded). 5174(f)

Corrosive Liquids

All containers must be plainly marked with a warning legend. 5194(b)

Workers must use appropriate protective equipment when handling corrosives.

3382, 3383, 3384, 3385

Where workers handle corrosives frequently, a deluge shower and emergency eyewash must be provided. 5162(c)

Flammable Liquids

All containers must be marked with a warning legend. 5417(a)

Flammable liquids must not be used:

■ to wash floors, structures, or equipment—except with adequate ventilation. 5417(b)

■ to spray clean, unless used in a spray booth or outdoors. 5417(c)

Flammable liquids must be stored and transported in closed containers. 5417(e)

Flammable Vapors

Ventilation in enclosed places must be sufficient to prevent flammable vapor concentration from exceeding 25 percent of the lower explosive limit. 5416(a)

No source of ignition is permitted in locations where vapor concentrations may reasonably be expected to exceed 25 percent of the lower explosive limit. 5416(c)

Confined Space

Before workers are allowed to enter a confined space, determine whether permit entry requirements are necessary. If not:

■ Lines containing hazardous substances must be disconnected, blinded, or blocked. 5158(a)

■ The space must be emptied, flushed, or purged. 5158(b)

■ The air must be tested for dangerous contamination and/or oxygen deficiency. Ventilation is required if testing reveals any hazard. 5158(c)

Workers in a confined space where dangerous air contamination exists must:

■ use appropriate respiratory protection 5159(a)(2)

■ use safety belt (or harness) protection 5159(a)(3)

■ have one standby worker (equipped with a respirator). 5159(a)(4)

— Working Area —

Aisles, Walkways, Crawlways

Walkways used to exit the work area must be at least 2 feet wide and have 6 feet 8 inches headroom. 3272(b)

Keep permanent aisles, ladders, stairways, walkways reasonably clean and in good repair. Clearly mark any hazardous points. 3272(c)

Aisles used by vehicles must be at least 2 feet wider than the widest vehicle.

Two-way traffic aisles must be 3 feet wider than twice the width of the widest vehicle. 3272(e)

Exception: storage access aisles where pedestrian traffic is excluded during truck operation.

Where normal clearances are hazardous, post a clearance limit warning sign. 3272(f)

Work Areas

Keep permanent floors and platforms free of dangerous projections or obstructions, maintained in good repair, and reasonably free of oil, grease, or water.

Cover slippery floors with mats, grates, or other devices to prevent slipping. 3273(a)

Keep permanent roadways, walkways, and material storage areas free of dangerous depressions, obstructions and debris. 3273(b)

Scaffolds used for repair and maintenance of plant equipment must conform to requirements of Construction Safety Orders. 3275

Clean up spills promptly. 5551(a)

Keep combustible waste material to a minimum and stored in covered metal receptacles. 5551(c)

Keep the ground area around the building free of weeds, trash, and other unnecessary, combustible material. 5551(d)

Guardrails

Guardrails are required:

- on all open sides of roof openings, open sides of landings, balconies, porches, platforms, runways, ramps, or work levels more than 30 inches above the floor or ground

- to be 42 inches high—where overhead clearance prohibits installation of 42-inch guardrails, install a lower guardrail

- for wall and floor openings 3211, 3212(a)(1)

- for foundry pits and similar sunken loca-

tions when not in use 3212(a)(3)

- for floor holes. 3212(a)(4)

If the platform is 6 feet above the work area or passageway, add a toeboard to the railing.

3210(a)

Exception: open hearth and hot metal pouring platforms. 3210(a)(8)

A standard guardrail is to be built 42-45 inches above the supporting surface. It is to consist of a top rail, midrail or equivalent, and posts that are framed in a position to provide maximum support and protection. 3209(a)

A standard guardrail must support a live load of at least 20 pounds per linear foot, and more if heavier loads will be applied.

Specifications for:

wooden guardrails.....3209(c)(1)

metal pipe guardrails.....3209(c)(2)

structural metal guardrails.....3209(c)(3)

Toeboards

Toeboards must be constructed of wood, concrete, metal, or other suitable material at least 3 1/2 inches above the supporting surface.

Note: For piled material, provide higher toeboards. 3209(d)

Fixed Industrial Stairs

Fixed industrial stairs are required:

- for access from one structure level to another where there is regular travel between levels

- for access to operating platforms of equipment requiring routine attention

- for access to elevations for daily gauging, inspection, or maintenance where there is potential for exposure to acids, caustic gases or other harmful substances, or when tools must be carried. 3234(b)(1)

Spiral staircases are prohibited except for limited usage or when a conventional stairway is not practical. 3234(b)(2)

Winding stairways may be used on tanks and similar structures when the diameter is not less than 5 feet. 3234(b)(3)

Design and construct fixed stairways to carry a load 5 times the anticipated live load. The strength of the stairway must never be less than that required to safely carry a concentrated load of 1000 pounds. 3234(c)

The width must be at least 22 inches. If a chute or open conveyor is parallel to and adjoins the stairway, the stairway must be equipped with a railing separating them. 3234(d)

Stairway platforms must be at least the width of the stairway and no less than 30 inches in the direction of travel. 3234(f)

Stairways must have railings on all exposed sides. 3234(g)(1)

Handrails must be provided on at least one side of a closed stairway. 3234(g)(2)

Install standard guardrails on stairway platforms. 3234(g)(4)

Vertical clearance from stair tread to overhead must be at least 6 feet 6 inches. 3234(h)

Access

Provide a safe platform or maintenance runway for every permanent elevated location, and for every permanent pit 30 inches or deeper, where there is equipment, material, or machinery that is usually in operation or frequently repaired, serviced, adjusted or handled.

For access to electrical equipment, see the Electrical Safety Orders. 3270(b), (c)

Exits

Illuminate exits and exit signs when the building is occupied. 3215(e)

Do not occupy a building until all required exits are completed and ready for use. 3215(f)

Provide easily visible exit signs at each doorway. 3216(a), (b)

Do not conceal exit signs, fire alarm sending stations, wet standpipe hose cabinets, or fire extinguishers with any decorative material. 3217(b)

Remove all obstructions to exits. 3227(c)

Equipment Room Requirements

Openings to attics or underfloor spaces are at least 22 inches by 30 inches.

Equipment is located within 20 feet of the opening if the opening is less than 48 inches tall or wide.

Roof and ceiling trap doors are constructed and maintained so that they can be opened and closed from a safe working position.

Exceptions:

■ Where fixed ladders extend through the opening, the opening must be at least 30 inches by 30 inches.

■ Underfloor furnace openings must be at least 18 inches by 24 inches. 3271

Pallets

Construct and maintain pallets so that they can support the loads being handled.

If pallets are walked on, holes must not be larger than 2 inches. 3338

Cargo, Materials, Equipment

Repair broken or damaged cargo, material, and equipment immediately or set it aside a safe distance from the work area. 3339(a)

Provide safe access to high piles of material. 3339(b)

Ventilation

Design, construct and support exhaust ducts to prevent collapse or failure of the supporting system. 5143(a)(2)

Place inspection or clean-out doors every 12 feet for ducts up to 12 inches in diameter; the distance may be greater for larger ducts.

Provide a clean-out door for servicing the fan, and where necessary, a drain. 5143(a)(3)

Do not connect two or more operations to the same exhaust system where the combination of substances removed may ignite or react chemically. 5143(a)(4)

Test the ventilation rate after installation, alterations, or maintenance and at least annually. Keep records of these tests for at least five years.

5143(a)(5)

Operate the system:

■ continually during the process

■ after the process is complete, depending upon circumstances and effectiveness of the ventilation system. 5143(b)

Both the air outlet and the dusts, fumes or gases collected by the ventilating system must discharge to the outside atmosphere, as long as this does not result in harmful exposure in any accessible workplace.

Exception: Collection systems that return air to work areas may be used, if contaminants that accumulate in the work area will not cause harmful exposure for workers.

Air from blast-cleaning, grinding, buffing and polishing must be discharged through dust-collecting equipment and properly disposed of. 5143(c)

Outside (make-up) air entering the work area must not reduce the effectiveness of the local exhaust system.

If filters are used, replace or clean them regularly.

If make-up air is heated by combustion—with the exception of gas—the combustion must be vented to prevent mixing with make-up air.

Where gas heating produces combustion products mixed with make-up air:

- Gas must be nontoxic, and when unburned it must have an odor strong enough to be detected by workers in the area.

- The maximum rate of gas supply to the make-up air heater must not yield more than 2,000 ppm of total combustible gas in the mix, upon flame failure.

- Provide a fan to remove the mixture of heated air and combustible products from the gas burner plenum chambers. 5143(d)

Lighting

Working areas, stairways, aisles, passageways, work benches, and machinery must be adequately lit. (See Table IL-1, General Industry Safety Order 3317, for detailed specifications.)

3317(a)

Water Supply & Sanitation

Provide a sufficient supply of potable water for drinking, washing, and food preparation at all places of employment. 3363(a)

Provide separate toilet facilities for men and women according to the following table: 3364(a)

Number of Workers	Minimum Number of Toilets (with running water)
1-15.....	1
16-35.....	2
36-55.....	3
56-80.....	4
81-110.....	5
111-150.....	6
over 150.....	1 additional for each additional 40 workers or fraction

Exception: For less than 5 workers, separate toilet rooms for men and women are not required.

Toilet rooms must be capable of being locked from the inside.

Provide accessible washing facilities according to the following table: 3366(c)

Number of Workers	Number of Facilities
1-100.....	1 for each 10 workers
over 100.....	1 for each additional 15 workers or fraction

Fire Protection

Portable Fire Extinguishers

The employer must:

- install, make and record monthly inspections for, and test approved fire extinguishers

6151

- maintain them fully charged and operable

- locate them in conspicuous places along normal paths of travel, and at exits. 6151

Fire Extinguishers

Class of Hazard Maximum Travel Distance

A.....75 Feet

B.....50 Feet

C.....75 Feet

D.....75 Feet

Perform a maintenance check on extinguishers at regular intervals, at least yearly.

Record annual maintenance date, and retain record for one year or for the life of the shell.

6151

Standpipe and Hose Systems

Locate the standpipes so they are protected from mechanical and fire damage. 6165(c)

Place hose outlets within easy reach of a person standing on the floor.

Standardize screw threads or provide adapters.

Equip all systems installed after July 1, 1981 with lined hose. 6165(d)

Fixed Extinguishing Systems

Employer responsibilities:

- Notify workers if the system becomes inoperable, and take other precautions to ensure workers' safety. 6175(b)(2)

- Install an alarm on systems where the discharge is not immediately recognizable. 6175(b)(3)

- Warn workers against their entry into discharge areas where the atmosphere is hazardous. 6175(b)(4)

- Inspect fixed systems annually. 6175(b)(6)

- Check the weight and pressure of refillable containers at least twice yearly. 6175(b)(7)

- Maintain records of the last inspection until the container is checked again, or for the life of the container. 6175(b)(9)

- Train workers assigned to inspect, maintain, operate, or repair fixed systems. Review their training annually. 6175(b)(10)

- Do not use chlorobromomethane or carbon tetrachloride where workers may be exposed. 6175(b)(11)

■ Construct systems of non-corrosive materials, or protect them when they are used in corrosive atmospheres. 6175(b)(12)

■ Ensure that systems operate effectively at expected extreme temperatures. 6175(b)(14)

■ Provide each system with at least one manual station for discharge activation. 6175(b)(15)

■ Identify manual operating devices according to the hazard they are designed for. 6175(b)(16)

■ Provide personal protective equipment to be used for rescue of workers trapped in atmospheres made hazardous by agent discharge. 6175(b)(17)

When the workplace is protected by a total flooding system, employers must have an emergency evacuation plan in accordance with GISO 3220, unless workers are unable to enter the area during or after the system's operation. 6175(c)(1),(2)

Equip the flooding system with a pre-discharge alarm. 6175(c)(3)

Gaseous Systems

Carbon dioxide systems must meet the design requirements of NFPA No. 12-1977. 6181(b)(1)

Provide for prompt evacuation from and prevent entry into areas where use of carbon dioxide has made the atmosphere hazardous. 6181(b)(2)

Do not expose workers to toxic levels of the gaseous agent or to the products of its decomposition. 6181(b)(5)

In total flooding systems:

■ Provide an effective pre-discharge alarm.

■ Do not use Halon 1301 in a concentration greater than 7 percent when it takes workers more than a minute to leave the area. 6181(b)(8)(A)

■ When evacuation takes between 30 seconds and 1 minute, do not use Halon 1301 in a concentration greater than 10 percent. 6181(b)(8)(B)

Fire Detection Systems

Install, design, and maintain all devices and equipment in accordance with NFPA 71-1978. 6183(b)(1)

Maintain all systems in operating condition. 6183(c)(1)

Test and adjust fire detectors and fire detector systems as often as necessary. 6183(c)(2)

Equip pneumatic and hydraulic systems installed after July 1, 1981 with supervised systems.

Service, maintenance and testing must be done by a trained person. 6183(c)(4)

Protect fire detection equipment installed outdoors or in a corrosive atmosphere. 6183(d)(1)

Protect fire detection equipment from damage by physical impact. 6183(d)(2)

Employee Alarm Systems

Train workers in the means and methods of reporting emergencies.

Prominently post emergency telephone numbers. 6184(a)

Supervise employee alarm circuitry installed after July 1, 1981 and test annually. 6184(b)

Maintain alarm systems in operating condition.

Test non-supervised systems every two months. 6184(d)

Emergency Action Plan

Make plans in writing and available to workers.

Exception: Employers with 10 or fewer workers may communicate the plan orally. 3220(a),(e)

Include in the plan:

■ emergency escape procedures and route assignments

■ procedures for workers who must perform critical plant operations before they evacuate

■ a method to account for all workers after evacuation is completed

■ rescue and medical duties for responsible workers

■ means of reporting fires, other emergencies. 3220(b)

Install an alarm system. 3220(c)

Designate and train workers to assist in evacuation.

Advise workers of their responsibilities:

■ when the plan is developed

■ when worker responsibilities under the plan are changed

■ when the plan is changed. 3220(e)

Accident Prevention Signs & Tags

Use *DANGER* signs only where an immediate hazard exists. 6003(c)(1)(A)

Use *CAUTION* signs only to warn against potential hazards, or to warn about unsafe work practices. 6003(c)(2)(A)

Accident prevention signs and/or tags shall be placed on the controls of all machines and prime movers during repair work. 3314(b)

— Material Storage & Handling —

Store material so that it does not create a hazard. Limit the height of piles, stacks, and racks to prevent tipping, falling and spreading. 3241(c)

Workers required to work on piles of loose material in bins, bunkers, silos and the like, shall be in a boatswain's chair or a Class III body harness attached to a line suspended from a hoist that is tended by a hoist operator. 3482(c)(1)

Design, Construction, & Capacity of Containers

Containers designed for the storage of combustible or flammable materials must meet the requirements of Chapter 1, Title 49 of the Code of Federal Regulations (DOT Regulations) or NFPA No. 386, Standard for Portable Shipping Tanks. 5532(a)

Limit container size for flammable and combustible materials according to the following chart: 5532(c)

Maximum Allowable Size of Containers & Portable Tanks

Container Type	Liquids				
	Flammable		Combustible		
	Class IA	Class IB	Class IC	Class II	Class III
Glass	1 pt.	1 qt.	1 gal.	1 gal.	5 gal.
Metal (other than DOT drums) or approved plastic	1 gal.	5 gal.	5 gal.	5 gal.	5 gal.
Safety cans	2 gal.	5 gal.	5 gal.	5 gal.	5 gal.
Metal drum (DOT spec)	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.
Approved portable tanks	660 gal.	660 gal.	660 gal.	660 gal.	660 gal.

Storage Cabinets & Rooms

Label storage cabinets: **FLAMMABLE—KEEP FIRE AWAY.** 5533(b)

Inside storage rooms must meet the following requirements: 5534(b)

Maximum Floor Area	Fire Resistance	Total Allowable Quantities (gals./sq. ft. floor area)	Automatic Fire Protection Provided
500 sq. ft.	2-hour	10	yes
500 sq. ft.	2-hour	4	no
150 sq. ft.	1-hour	5	yes
150 sq. ft.	1-hour	2	no

Maintain an aisle at least 3 feet wide in every inside storage room. 5535

Storage of Flammable & Combustible Liquids

Comply with tank storage safety orders (see General Industry Safety Orders 5583-5605 and *Tank Storage* of this guide). 5557(a)

Storage in buildings is permitted only in areas at or above grade that have adequate drainage, and are separated from the processing area by construction with a fire resistance rating of at least two hours.

Day tanks, running tanks, and surge tanks are permitted in the process area.

Openings to other areas must have non-combustible liquid-tight raised sills or ramps at least 4 inches high, or storage areas must be at least 4 inches lower than the surrounding floor. Openings must have approved self-closing fire doors. The room must be liquid-tight where the floor meets the walls. 5557(b)

Storage of flammable or combustible liquids in containers must comply with the safety orders for container and portable tank storage (see GISOs 5531-5543). 5557(c)

Piping, valves and fittings must comply with safety orders for piping, valves, and fittings (see GISOs 5006-5612). 5557(d)

Piping containing flammable or combustible liquids must be identified. 5557(e)

Transfer of large quantities of flammable or combustible liquids must be through pipes by pump or water displacement. Except as required in process equipment, gravity flow must not be used.

Do not use compressed air as a transfer medium. 5557(f)

Positive displacement pumps must have pressure relief that discharges back to the tank or pump suction. 5557(g)

Equipment must prevent unintentional escape of liquids and vapors. 5557(h)

Tank Vehicle & Tank Car Loading & Unloading

Tank vehicle/tank car loading/unloading facilities must be separate from aboveground tanks, other plant buildings, or property lines of adjoining land that could be developed: 25 feet for Class I liquids and 15 feet for Class II and III liquids, as measured from the closest fill stem. Operations must comply with the safety orders for bulk plants (5614-5624). 5558

General Purpose or Industrial Plant Warehouses

Storage of flammable or combustible liquids in general purpose or industrial plant warehouses must be in accordance with the following table:

Class Liquid	Storage Level	Indoor Container Storage		Indoor Portable Tank Storage	
		Protected Storage (gals.)	Unprotected Storage (gals.)	Protected Storage Maximum per Pile (gals.)	Unprotected Storage Maximum per Pile (gals.)
IA	Ground & upper floors	2,750	660	Not permitted	Not permitted
	Basement	Not permitted	Not permitted	Not permitted	Not permitted
IB	Ground & upper floors	5,500	1,375	20,000	2,000
	Basement	Not permitted	Not permitted	Not permitted	Not permitted
IC	Ground & upper floors	16,500	4,125	40,000	5,500
	Basement	Not permitted	Not permitted	Not permitted	Not permitted
II	Ground & upper floors	16,500	4,125	40,000	5,500
	Basement	5,500	Not permitted	20,000	Not permitted
III	Ground & upper floors	55,000	13,750	60,000	22,000
	Basement	8,250	Not permitted	20,000	Not permitted

Fire Control

There must be approved portable fire extinguishers of the appropriate size, type, and number. 5559(a)

When required by state or local regulations, an approved automatic sprinkler system or its equivalent must be installed. This system must comply with NFPA standards. 5559(b)

Sources of Ignition

Class I liquids must not be dispensed into metal containers unless the nozzle or fill pipe is in electrical contact with the container. Bonding is not required in a closed system, or a container made of nonconducting material. 5560(b)

Maintenance & Repair

A responsible supervisor must authorize work before maintenance work in a flammable or combustible liquid processing area can begin. 5561(a)

Hot work and the use of spark-producing power tools and chipping operations must be supervised by a qualified worker. The worker must ensure that the area is safe to work in, and that safe procedures will be followed. 5561(b)

Housekeeping

Maintenance and operating practices must encourage control of leakage, and prevent accidental escape of flammable or combustible liquids.

Spills must be cleaned up promptly. 5562(a)

Adequate aisles must be maintained for unobstructed movement of workers and firefighting equipment. 5562(b)

Combustible waste materials must be kept to a minimum, stored in closed metal waste bins, and disposed of daily. 5562(c)

The ground around operating areas must be free of combustible materials. 5562(d)

Tank Storage

Tanks must be made of steel, unless another material is required due to the nature of the substance being stored. 5583(a), (b)

Exceptions:

- Underground storage tanks may be of other materials. 5583(b)(2)

- If the tanks store Class III B liquids above ground in areas not exposed to spills or leaks of Class I or Class II liquids, they may be non-steel.

- If Class III B liquids are stored where they may come into contact with Class I or Class II liquids, the tanks must comply with GISO 5585.

5583(b)(3)

- The tank may be built inside a building with an approved automatic fire-extinguishing system installed. 5583(b)(4)

Unlined concrete tanks may be used for storing flammable or combustible liquids having a gravity of at least 40° API. 5583(d)

Atmospheric Tanks

Low pressure tanks and pressure vessels may be used as atmospheric tanks. 5585(b)

Atmospheric tanks must not be used for storage of a flammable or combustible liquid at a temperature at or above its boiling point. 5585(c)

Low Pressure Tanks

The normal operating pressure must not exceed the design pressure of the tank. 5586(a)

Atmospheric tanks built according to Underwriter's Laboratories specifications may be used for operating pressures not exceeding 1 p.s.i.g., and up to 2.5 p.s.i.g. under emergency venting conditions. 5586(c)

Pressure vessels may be used as low pressure tanks. 5586(d)

Pressure Vessels

The normal operating pressure must not exceed the design pressure of the vessel. 5587(a)

Storage tanks designed to withstand pressures above 15 p.s.i.g. must meet the requirements of the unfired pressure vessels safety orders. 5587(b)

Outside Aboveground Tank Installation

See GISOs 5589-5590 and Tables FL10-FL15 for specific requirements regarding placement of aboveground tanks in relation to property lines and spacing between tanks. 5589, 5590

— Cranes, Hoists, Derricks —

Travel

Control travel so as to avoid collisions. 4991(a)

While mobile cranes are in transit:

- Carry the boom in line with the direction of motion.

- Secure the superstructure against rotation, except on turns when an operator is in the cab or when the boom is supported on a dolly. 4991(b)(1)

- Prevent the empty hook, headache ball, or block from swinging freely. 4991(b)(2)

Booms

Block or secure booms which are being assembled or disassembled on the ground to prevent dropping of the boom and boom sections. 4992

Swing

Avoid sudden stops when rotating the crane.

Maintain a rotation speed which assures continued control of the swing. 4993

Use tag or restraint lines when rotation of the load is hazardous. 4993(b)

Do not climb on cranes or boom-type excavators unless the unit has stopped or the operator indicates that it is safe to mount. 4993(c)

Do not swing a locomotive crane into a position where cars on an adjacent track may strike it. 4993(d)

Hoisting

Do not operate a crane with wheels or tracks off the working surface, unless it is properly bearing on outriggers. 4994(a), 4954(a)

Provide power-actuated jacks with a means of preventing loss of support under the load.

Wooden blocks used to support outriggers must be:

- strong enough to prevent crushing
- free from defects
- wide and long enough to prevent settling, shifting, or toppling under load. 4994(a),(b)

Test brakes each time a load approaching the rated load is handled. 4994(c)

Do not lower the load or the boom below the point where less than two full wraps of rope remain on their respective drums. 4994(d)

When two or more cranes are used to lift a load, a qualified signal person must be in audible communication with both crane operators at all times. The operation must be directed by a qualified person. 4994(e)

Fire Extinguisher

Keep a fire extinguisher rated at least 10-B:C in or just outside the cage, cab or machine house. Do not use a carbon tetrachloride type. 4997

Refueling

Keep open lights, flames, or spark-producing devices at a safe distance while refueling. 4998

Handling Loads

Size of load: Never handle a load beyond the rated capacity or safe working load, except for test purposes.

When the weight of the load is unknown, the operator shall not make any lift until the load has been weighed. 4999(a)

Attaching the load:

- Attach to the hook by means of slings or other suitable means effectively rigged to ensure safe handling.

- Make sure chain and rope slings are free of kinks and twists.

- Do not load baskets, tubs, or skips beyond their safe carrying capacity.

- Do not wrap hoist rope around the load. 4999(b)

Moving the load—the worker directing the lift shall see that:

- the crane is properly leveled and blocked

- the load is well secured and balanced

- ropes are not handled on the winch head without the knowledge of the operator. 4999(c)

Before starting the hoist:

- Make sure the hoist rope is not kinked.

- Make sure multiple part lines are not twisted around each other.

- Position the hook over the load so as to prevent swinging of the load when lifted.

- Properly seat the rope on the drum and in the sheaves if there is a slack rope condition. 4999(d)

During hoisting:

- avoid sudden acceleration or deceleration of the moving load

- take precautions to prevent contact with obstructions. 4999(e)

Side loading:

- Limit side loading of booms to freely suspended loads.

- Do not use booms for dragging loads sideways unless the boom is specifically designed to withstand side loading. 4999(f)

Testing

All cranes and derricks used in lifting service, exceeding three tons rated capacity, shall be tested and certified annually to be in compliance with requirements specified in Article 99 of the GISO. These tests and examinations shall be conducted

by a qualified person accredited by the U.S. Department of Labor or DOSH. 5021(a)

Operating Rules for Industrial Trucks

Train all drivers in safe operations. Prohibit stunt driving and horseplay.

Do not allow riders without adequate riding facilities.

Do not allow riders on the forks of lift trucks.

Do not work under the elevated portion of a truck unless it is blocked.

Check the vehicle at least once every shift.

Do not operate a truck with a leak in the fuel system.

No speeding.

Do not pass at intersections or blind spots.

Slow down and sound the horn at cross aisles where vision is obstructed.

Drive loaded trucks with the load up grade when ascending or descending grades of more than 10 percent.

Drive motorized hand and hand/ rider trucks with the load-engaging means down grade. 3664(a)

Elevating Workers with Lift Trucks

The truck must be equipped with a safe work platform which:

- is at least 24 inches by 24 inches and can accommodate workers and materials to be elevated

- is securely attached to the forks or masts

- is equipped with standard guardrails with midrails on all open sides (or where the nature of the work prohibits use of guardrails, a safety belt or harness)

- has a slip-resistant surface

- does not have spaces between the floor sections, or holes larger than 1 inch in size. 3657(a)

Gantry Trucks

Equip with an audible warning device. 3801

Equip with an access ladder with side rails to enable the operator to board the landing platform safely. 3803

Guard all gantry trucks with wheel fenders, bumpers or skirt guards. 3805(a)

Enclose the top sprocket and the top half of the lower sprocket.

Guard the chain drive by enclosing it to a height of 7 feet (except the lower half of the lower sprocket). 3805(b)

Enclose the gears. 3805(c)
Train all operators in the safe operation of gantry trucks and prominently post a set of safe operating rules. 3807(a)

Elevating Work Platforms & Aerial Devices

Requirements cover elevating work platforms, self-propelled and truck-mounted aerial devices. 3636(a)

With each unit supply an operating manual including instructions for maintenance and erection. 3638(a)

Each unit shall permanently display a legible plate stating its compliance with the appropriate ANSI standard (ANSI A92.2-1969, ANSI A92.2-1979, ANSI A92.3-1980, ANSI A92.5-1980, ANSI A92.6-1979, or ANSI A92.7-1981), and the following information when applicable:

- make, model, manufacturer's serial number
- rated capacity
- maximum capacity at maximum height
- platform height/maximum travel height
- maximum recommended operating pressure of hydraulic or pneumatic systems
- cautions, restrictions
- operating instructions
- manufacturer's rated line voltage (dielectric capability). 3638(c)

Workers must be trained in the proper operation of the platform. 3638(d)

Requirements for the platform deck:

- guardrails between 38 and 45 inches high with a midrail—where less than 42 inches high, the worker must wear a safety belt 3642(a)(1)
- toeboards at least 3 1/2 inches high 3642(f)(1)
- hinged trap door when applicable 3642(f)(2)
- minimum width not less than 16 inches. 3642(f)(3)

All powered work platforms must have both upper and lower controls. 3642(d)

Operating instructions:

- Aerial devices must not rest against any structure when workers are on the platform in an elevated position. 3648(a)
- Test lift controls according to manufacturer's instructions. 3648(b)
- Allow only authorized workers to operate. 3648(c)
- Prohibit belting-off to adjacent structures. 3648(d)
- Require workers to wear a safety belt with lanyard attached to the boom or basket when truck is moved and boom is elevated. 3648(o)

— Machinery, Equipment, Tools —

Process Machine Power Control

Install a prime mover stopping device within easy reach of the machine operator on process machines, unless the machine has a clutch which stops all operations. 4000(a)

If a worker operates one or more process machines which are not individually driven, each machine must have a stopping device within easy reach. The stopping device may be designed to stop an entire group of machines or a single machine. Hand or pole shifting of belts is not an adequate means of disconnecting power. 4000(b)

Each process machine operated by more than one worker must have machine power controls for each worker who is exposed to point-of-operation hazards. Controls must be interlocked to prevent operation of the machine, unless all con-

trols are operated simultaneously.

Controls for more than one operating station must be designed to operate in complete sets of two hand controls per operating station, and must be visible to the supervisor. 4000(c)

Design, install, and locate machine power controls so that they cannot be operated by accidental contact. 4000(d)

Equip all machines with a control that the operator or another person can use to quickly disconnect the power source in case of emergency. 4001

Pulleys & Belts

If the distance to the nearest fixed pulley, clutch or hanger does not exceed the width of the belt, there must be a guide to prevent the belt from leaving the pulley. 4060(a)

Belts on overhanging flat pulleys on line shafts or countershafts must have a stop to prevent the belt from running off the pulley. 4060(b)

Belt perches designed for safe shifting of the belts must be used if loose pulleys or idlers are not practical. 4060(c)

Composition & Wood Pulleys

Pulleys exposed to corrosion must be made of corrosion-resistant materials. 4062

Remove composition or wood pulleys that are permanently out of service from shafting in use. 4063

Belt Tighteners

Attach or construct belt tighteners so that they will not fall if the belt breaks, or guard the area beneath the tightener. 4071

Hand & Power Tools

The employer is responsible for the safe condition of tools and their proper use, even when the tools are furnished by the employees themselves. 3556(a)

Power-operated tools should be grounded, or be of the double-insulated type. 2395.45

Engines, Portable Boilers & Compressors

Governor

Engines that are not manually throttled must have a governor which will automatically control the speed of the engine under varied loads.

All belt-, rope- or chain-driven governors must have a safety device that will stop the engine if the drive breaks. 3511

Valve Gears

Equip steam engines with valve gears to stop the engine if the governor fails when the load is removed. 3512

Flywheel Speed

Do not operate flywheels at speeds that will develop excessive stresses. 3513

Air Compressors

Air compressor discharge lines with a block valve between the air receiver and the compressor must have a pressure-relieving safety device in the line between the compressor and the block valve. Installation of this device does not provide the required safety relief valve protection for the air receiver. 3518(a)

General Guarding Requirements

Guards must be properly designed, substantial, and secured in place. 3942(a)

Guards must allow access to areas that must be adjusted or lubricated. 3942(b)

The clearance between a guard and moving parts dictates the maximum permissible size of any opening in the guard. 4944, Table G-1

Guard Standards

If the area of a shield guard of wire mesh or expanded metal in a frame exceeds 6 square feet, it shall be reinforced. 3943(a)

An enclosure guard shall be installed so that it completely guards the moving parts. 3943(c)

A nip-point belt and pulley guard shall be constructed so that the nip points are not exposed to accidental contact. 3943(d)

Horizontal overhead belt guard surfaces subject to contact with the belt shall be smooth. The guard width shall be at least 25 percent wider than the belt being protected. The clearance need not exceed 6 inches on each side. 3943(e)

Guards for horizontal overhead rope and chain drives shall not be less than 6 inches wider than the drive on each side. Where employees pass under overhead rope and chain drives, a shallow trough or other effective means of sufficient strength to carry the weight of the broken chain shall be provided. 3943(f)

When a prime mover flywheel extends into a pit or is within 12 inches of the floor and a guardrail is used, a toeboard must be provided. 3995(a)(1)

Guards may be temporarily removed when starting flywheels, but must be replaced immediately. Each jack bar must be equipped with a hand stop that will safely clear the flywheel guard when fully inserted, but will prevent the worker's hand from being pinched between the slot and bar. 3995(b)

Whenever flywheels are above working areas, guards must be strong enough to hold the weight of the flywheel in case a shaft or wheel mounting fails. 3995(c)

Guards are required when the hazard is within 7 feet of the work surface:

- flywheels 3995(a)
- tail rods, extension piston rods, tail cross-heads 3997
- screw conveyors 3999(a)
- all exposed parts of line or countershafting 4050(a)
- shaft ends projecting more than one-half the shaft diameter beyond the end of the bearing 4051(a)

- exposed, unused key-ways 4051(b)
- all moving parts of belt and pulley drives 4070(a)
- friction drives 4076
- gears, sprocket chains and chain drives. 4075(a)

Also guard:

- exposed engine cranks and connecting rods 3996
- hazardous revolving, reciprocating parts not guarded by the frame of the machine or by location 4002
- horizontal overhead belts and chain drives located over passageways and working areas. 4070(d)

Table G-1: Guard Materials

Material	A: Clearance from moving part at all points (inches)	B: Largest mesh or opening allowable (inches)	C: Minimum gauge (U.S. standard) or thickness (inches)
Woven wire	Under 2	3/8	No. 16
	2-4	1/2	No. 16
	4-15	2	No. 12
Expanded metal	Under 4	1/2	No. 18
	4-15	2	No. 13
Perforated metal	Under 4	1/2	No. 20
	4-15	2	No. 14
Sheet metal	Under 4		No. 22
	4-15		No. 22
Plastic	Under 4	1/2	*
	4-15	2	*
Plywood or equivalent	Under 4		5/16
	4-15		5/16
Solid wood	Under 4		1
	4-15		1
Wood or metal strip crossed	Under 4	3/8	Metal No. 16 Wood 3/4
	4-15	2	Metal No. 16 Wood 3/4
Wood or metal strip not crossed	Under 4	1/2 width	Metal No. 16 Wood 3/4
	4-15	1 width	Metal No. 16 Wood 3/4
Standard rail	Minimum 15 Maximum 20		

Other materials that meet the strength requirements of this table and provide equivalent protection may be used.

* Tensile strength of 10,000 lb/in²

Special Hand Tools

Use special hand tools for material handling *only* as supplementary protection for the machine operator. They must not be used in place of other guarding requirements. 3330

Points of Operation & Other Hazardous Parts of Machinery

General Guarding Requirements

Machines with a grinding, shearing, punching, pressing, squeezing, drawing, cutting, rolling, mixing or similar action which presents a hazard, must be guarded at the point of operation.

4184(a)

Foot-operated Devices

Protect all foot-operated devices (treadles, pedals, levers, bars, valves, switches) from unintended operation, if such operation creates a hazard.

4185

Maintenance & Use of Point-of-operation Tools & Guards

Keep all saws, cutting tools, heads, shears and knives that are part of any machine sharp, properly set up, adjusted, and in safe and efficient working condition.

4186

Electrical Safety

General

Only qualified persons can work on electrical equipment. 2320.1(a)

Electrical installations must be maintained in safe condition. 2340.1

Electrical equipment and wiring must be protected from mechanical damage and environmental deterioration. 2340.26, 2340.11, 2340.23

Covers or barriers must be installed on boxes, fittings, and enclosures to prevent accidental contact with live parts. 2340.17(a)

Lockout/Blockout

Accidental movement of machine parts must be prevented by the use of mechanical blocks and de-energizing electrical equipment during cleaning, servicing, or adjustment. 3314

Before working on de-energized electrical equipment, the disconnect shall be locked in the open position to prevent it from being accidentally energized. 2320.4

Slings: Safe Operating Practices

Do not use damaged or defective slings.

Do not shorten chain or wire rope slings with knots or bolts.

Do not kink sling legs.

Do not load in excess of rated capacities.

Balance loads in slings using a basket hitch.

Set slings to avoid slipping.
 Protect slings from the sharp edges of loads.
 Keep suspended loads clear of obstructions.
 Do not place hands or fingers between the sling and the load when the sling is being tightened.
 5042(a)(1)-(10)
 Inspect the sling and fastenings daily before use.
 5043

Portable Wood Ladders

Keep free of sharp edges and splinters.
 3278(c)

Types of stepladders: 3278(d)(1)(A)

Type	Length	Use
I	3-20 feet	Heavy duty
II	3-12 feet	Medium duty
III	3-6 feet	Household

Uniform spacing between the steps must not be more than 12 inches.
 3278(d)(1)(B)

The minimum width between the siderails at the top is 11 1/2 inches.
 3278(d)(1)(C)

Maximum length: 3278(d)(1-10)

Type	Length
Portable step	20 feet
Single	30 feet
Two section	60 feet
Trestle	20 feet
Painter's step	12 feet
Mason's	40 feet
Cleat	30 feet
Trolley & side rolling	20 feet

Minimum overlap on two-section ladders:
 3278(e)(17)

Size	Overlap
to 36 feet	3 feet
36-48 feet	4 feet
48-60 feet	5 feet

Care & Use of Wood Ladders

Maintain ladders in good condition.
 Lubricate metal bearings of locks, wheels, pulleys frequently.

Replace frayed or badly worn rope.
 Keep safety feet and other auxiliary equipment in good condition.

Inspect ladders frequently.
 Withdraw from service and tag defective ladders: **DANGEROUS—DO NOT USE.**

Keep rungs free of grease and oil.
 Face the ladder when ascending or descending.

Do not splice short ladders together.
 Do not use the top step of an ordinary ladder as a step.

Do not use a ladder to climb to a roof, unless the top of the ladder extends at least 3 feet beyond the point of support.
 3278(e)

Portable Metal Ladders

Maximum Length: 3279(c)(2-5)

Type	Length
Trestles/extension trestles	20 feet
Straight & extension	30 feet-single
	48 feet-double
	60 feet-more than 2
Step	20 feet
Platform	20 feet

Maintain ladders in good, useable condition.
 3279(d)(2)

Do not use metal ladders where they may come into contact with electrical circuits. Mark portable metal ladders:
 3279(d)(11)

CAUTION—DO NOT USE AROUND ELECTRICAL EQUIPMENT

Mobile Ladder Stands & Scaffolds (Towers)

Load rating (working load, pounds/square feet):

Light—25	
Medium—50	
Heavy—75	3622(b)(2)

All ladder stands and scaffolds must be able to support four times the designed working load.
 3622(b)(3)

All exposed surfaces must be free of sharp edges, burrs, or other laceration hazards.
 3622(e)

Maximum work level height may not exceed three times the least base dimension below the platform.
 3622(f)(4)

Minimum platform width must not be less than 20 inches for mobile scaffolds and 16 inches for ladder stands.
 3622(f)(2)

The supporting structure must be rigidly braced.
 3622(f)(3)

Ladder stands must have slip-resistant treads.
 3622(f)(4)

All scaffold work levels that are 6 feet or more above the ground must have toeboards at locations where workers work or pass underneath.
 3622(f)(6)

All scaffold work levels that are 30 inches or more above the ground must have standard guard-rails.
 3622(f)(7)

Casters or wheels must be lockable.
 3622(g)(2)

Use of Compressed Air & Gases

Do not use compressed gases to:

- blow dirt, chips, or dust from clothing when the pressure is greater than 10 pounds/square inch. 3301(a)

- empty containers of liquids when the gas pressure is greater than the safe working pressure of the container. 3301(b)

- elevate or transfer a hazardous substance from one container to another unless both containers are designed to withstand four times the pressure of the gas. 3301(e)

Equip abrasive blast cleaning nozzles with an operating valve that must be held open by hand. 3301(d)

Compressed Cylinder Gas

When using compressed gas to test a pressure vessel, install a pressure relief device in the supply line of the vessel being tested. 3304(a)

Do not use compressed gas from a cylinder or cylinder manifold where dangerous pressures

may develop, unless an accepted pressure regulating device is installed. 3304(b)

Compressed Oxygen

Do not use compressed oxygen:

- to purge pipelines, tanks, or any confined areas

- to supply head pressure in a tank

- in pneumatic tools

- in oil preheating burners

- to start internal combustion engines

- for ventilation

- for dusting clothing

- in any other way as a substitute for compressed air. 3305

Salvaging Pressure Vessels

Do not process pressure vessels for salvage until it is certain that they do not contain hazardous substances and are not under pressure.

Before opening closed pressure vessels or other containers, know what they contain and take precautions to avoid risk of injury. 3306

— Fumigation —

General

During fumigation at least two workers must be present at all times, and each must be provided with proper respiratory equipment. 5221(a)

Instruct all workers employed near fumigation operations about the hazards of the fumigant. 5221(b)

During fumigation an approved antidote or first aid treatment may be required when a hazard exists. 5221(c)

Fumigation in Vaults & Chambers

Construct fumigation chambers so as to prevent exposure of workers to hazardous concentrations of fumigants. 5222(a)

A warning notice—such as *POISON GAS*, *DO NOT OPEN*, or *DANGER*—must be posted on the door of the chamber. 5222(b)

After fumigation is completed, purge the chamber of the fumigant and test the air. 5221(c)

If a flammable gas is used in fumigation, remove all sources of ignition before fumigation begins, and do not allow a source of ignition in the chamber until the concentration of flammable gas is under 20 percent of the lower explosive limit. 5221(e)

Fumigation in Buildings or Rooms

(other than fumigation vaults & chambers)

Whenever any building is fumigated with a poisonous gas:

- All sources of leaks in the room must be sealed to confine the gas to the fumigated rooms. 5223(a)(1)

- All openings must be sealed, and warning signs must be posted at all entrances. The signs must state the area being fumigated and the type of gas being used, and must not be removed until the fumigation and ventilation are completed. 5223(a)(2)

- Workers releasing the fumigating gases must wear approved respiratory protection for the type of gas being used. 5223(a)(3)

- Fumigation of single rooms is forbidden, unless the room can be effectively sealed off from the rest of the building. 5223(a)(4)

- When fumigating a part of a building, vacate all adjoining rooms and adjacent buildings into which the gas could penetrate. 5223(a)(5)

- After the fumigation is completed, purge the building of fumigant and test the air. 5223(a)(6)

- Do not allow a source of ignition in areas where a flammable fumigant is being used. 5223(a)(8)

Metal Manufacturing

refer also to section on Common Industry Standards

— General Machine Requirements —

Machines must be used under safe operating conditions, and maintained and inspected according to the manufacturer's recommendations.

3328(a),(b)

Do not use machinery or equipment with defective parts.

3328(c)

Secure machinery and equipment that are designed for a fixed location. Also secure or cover parts that could break loose during operation of the equipment.

3328(d), (e)

Grinders

Securely mount stationary grinding machines on substantial, safe foundations in order to prevent dangerous vibration.

3576(a)

Use portable grinders as bench grinders only when:

- securely clamped in place with band clamps
- equipped with standard wheel and arbor end guards and tool rests
- there is ample clearance between wheels and bench.

3576(b)

Portable Grinders

Right angle head or vertical portable grinders requirements:

- Cover the grinding wheel with a guard and allow a maximum exposure of 180°.
- Locate a guard between the operator and the wheel.
- Locate a guard to deflect broken pieces of the wheel.

3583(d)

Protection Devices—Abrasive Wheels

Protection hoods or safety guards are required.

Exceptions:

- wheels being used for internal work while the work being ground acts as a guard
- special precision tool room grinders under supervision of expert mechanics
- metal centered diamond lapidary wheels—

notched, segmented or continuous rim used with a coolant deflector, at speeds up to 3,500 SFPM

- mounted wheels 2 inches and less in diameter when used in portable operations.

Die Casting Machines

Shield die casting machines so that molten material will not strike workers.

4265

Hot Chamber Machines

Equip hot chamber die casting machines with one of the following controls:

- two-hand controls requiring the use of both hands simultaneously to close the die, or
- a constant pressure-type single control located so that the operator cannot reach into the die at the parting line with a free hand, or
- a sliding gate guard interlocked with the control system so that if the gate is opened before the closing cycle is completed, the cycle will stop or reverse.

4261

Equip every plunger with a control interlocked with the die to prevent operation of the plunger before the die closes.

4264(a)

Cold Chamber Machines

Equip cold chamber die casting machines with any one of the controls listed for hot chamber machines, or two hand controls requiring the use of both hands until the die is within 2 inches of complete closing. This control must have an interlocking limit switch that maintains a closed circuit for the last 2 inches of the closing cycle.

4261

Equip every plunger with a control interlocked with the die that will prevent operation of the plunger, unless the die is completely open or completely closed.

For removal of a stuck plug, a cold chamber machine may be equipped with two-hand controls that operate only the plunger, and require simultaneous use of both hands.

4264(b), (c)

Ladling

Use a single control to activate the plunger in the shot sleeve that allows the operator to use his/her free hand for ladling metal. Guard the control by a shield, or make sure it is recessed so that it cannot be accidentally activated. 4262

Protection for Helpers

Helpers for hot and cold chamber machines must be protected by:

- a fixed barrier guard with controls which are interlocked with the primary control, so that the machine cannot be started while the secondary control is activated, or 4263(a)

- a sliding gate guard interlocked with the primary control system so that the machine cannot be started while the gate is open, and which will stop or reverse the closing cycle if the die is closing when the gate is lifted, or 4263(b)

- two-hand controls connected with the primary controls and requiring simultaneous use of both hands before the machine can be started, or 4263(c)

- a single constant pressure type control connected with the primary controls and located so that the helper cannot reach into the die at the parting line with his/her free hand. 4263(d)

Metal Working Machines

Equipment	Requirements
Abrading, buffing, polishing	Guard exposed arbors. Guard arbor ends without acorn nuts. 4237
Alligator shears	Prevent inadvertent entry of any part of operator's body. Prevent material being cut from flying up. 4236
Bar stock machine	Guard bar stock extending beyond machine with trough or tube. 4233
Circular metal cutting saw	Cover with hood to depth of teeth—automatically adjustable—guard exposed parts of saw blade under table. <i>Exception:</i> saws used for cutting hot metal. 4231
Forging machine	Thermostatic control of heating elements—cover container to store dross skimmings. 4239(b)(1)
Air lift hammer	Two drain cocks, one on main head cylinder and one on clamp cylinder. 4240(c)
Board drop hammer	Board enclosure securely fastened to hammer to prevent damaged or detached boards from falling. 4241

Equipment Requirements

Drop hammer	Safety stops to hold hammer in elevated position—block ram when dies are changed—clearly identify manually-operated valves. 4239(c)
Power-driven air lift hammer	Safety cylinder head: quick-closing emergency valve in admission pipe line—two drain cocks. 4240
Metal embossing machine	Guard point of operation or provide with a feed, preventing operator's hand-contact with die. 4228
Planer	Cover openings in bed of all metal planers with metal or equivalent. 4235
Squaring shears	Guard zone traveled by knives of shears in motion. 4227
Tumbling barrel	Completely enclose and equip with effective lock or brake, or by movable guard-rails—interlock drum with the guard. 4238
Wire drawing machine	Stopping device for blocks—stopping device on operating side of continuous frame or unit—stopping device for reels. 4234
Electric chain saw	Constant pressure switch. 3557(a)
Hand-held powered circular saw	Blade diameter greater than 2 inches: constant pressure switch. 3557(a)
Hydraulic chain saw	Constant pressure switch. 3557(a)
Percussion tool	Constant pressure switch. 3557(a)
Pneumatic chain saw	Constant pressure switch. 3557(a)
Angle grinder	Wheel diameter more than 2 inches: constant pressure switch or lock-on control operated on and off by same finger. 3557(b)
Belt sander	Constant pressure switch or lock-on control operated on and off by same finger. 3557(b)
Disc sander	Discs more than 2 inches: constant pressure switch or lock-on control operated on and off by same finger. 3557(b)
Fastener driver	Constant pressure switch or lock-on control operated on and off by same finger. 3557(b)
Jig saw	Blade shanks more than 1/4 inch: constant pressure switch or lock-on control operated on and off by same finger. 3557(b)
Powered drill	Constant pressure switch or lock-on control operated on and off by same finger. 3557(b)

Equipment	Requirements
Reciprocating saw	Constant pressure switch or lock-on control operated on and off by same finger. 3557(b)
Saber saw	Blade shanks more than 1/4 inch: constant pressure switch or lock-on control operated on and off by same finger. 3557(b)
Scroll saw	Blade shanks more than 1/4 inch: constant pressure switch or lock-on control operated on and off by same finger. 3557(b)
Tapper	Constant pressure switch or lock-on control operated on and off by same finger. 3557(b)
Disc sander	Disc diameter 2 inches or less: positive on-off control. 3557(c)
Grinder	Wheel diameter 2 inches or less: positive on-off control. 3557(c)
Jig saw	Blade shanks 1/4 inch wide or less: positive on-off control. 3557(c)
Laminate trimmer	Positive on-off control. 3557(c)
Nibbler	Positive on-off control. 3557(c)
Planer	Positive on-off control. 3557(c)
Platen sander	Positive on-off control. 3557(c)
Router	Positive on-off control. 3557(c)
Saber saw	Blade shanks 1/4 inch wide or less: positive on-off control. 3557(c)
Scroll saw	Blade shanks 1/4 inch wide or less: positive on-off control. 3557(c)
Airless spray gun	1,000 pounds/square inch or more: automatic or visible manual safety device or a diffuser nut and nozzle tip guard. 3559.1
Pneumatic tool	Safety clips or retainers. 3559
Pneumatic tool	For use with nails and staples: safety device at muzzle to prevent discharge until in contact with lid surface. 3559
Portable grinder	Safety guard with maximum exposure angle of 180° located between operator and wheel—adjust guard to deflect broken wheel parts. 3583(d)
Portable sander	Enclose pulleys and unused run of the sanding belt—rim guards acceptable for pulleys with smooth disc wheels if in-running nip points are guarded. 4312

Portable Power-driven Circular Saws

The teeth on the upper half of the blade shall be permanently guarded.

The lower half of the blade shall be guarded by a retracting guard that automatically covers the saw teeth not in use.

Saw guards must:

- be equipped with a handle or lug
- not be locked open
- be maintained in good condition. 4307

Jacks

Mark the rated load legibly and permanently on the jack.

Design jacks so that their maximum safe extension cannot be exceeded.

Use antifreeze for hydraulic jacks exposed to freezing.

If not on a firm foundation, block the base.

If the cap could slip, place block between the cap and load.

Do not enter the zone beneath a jack-supported load unless it has been effectively blocked or cribbed.

Periodically clean and lubricate screw jacks, following manufacturer's instructions. 3562

Dies & Diesetting

Use hand tools for removing stuck work from die. 4197(a)(2)

Securely mount die to bolster and slide in upper and lower shoes. 4197(b)

Dies that require mechanical handling must have equipment attach points. 4197(c)

If unitized tooling is used, guard the opening between the top of the punch holder and the face of the slide or striking pad. 4197(d)

Stamp or record tonnage and stroke requirements:

- Stamp upper die weight when necessary for air counter-balance pressure adjustment.

- Stamp complete die weight when the handling equipment may become overloaded. 4198(a)

Provide spring-loaded turnover bars for the presses for which they are designed. 4199(a)(1)

Provide die stops for inclined presses. 4199(a)(2)

Use safety blocks when adjusting or repairing dies in the press. 4199(a)(3)

Do not reach into hazardous areas to lubricate. Use appropriate lubricating tools. 4199(a)(4)

Presses

General

Maintain in safe operating condition. 4202(a)
Inspect each press in service at least once a week—particularly the clutch, brake mechanism, anti-repeat feature, and single stroke mechanism.

Keep records of inspection and maintenance.

Make any necessary repairs before operating the press. 4202(b),(c)

Any modification to the press must be accompanied by accurate guidelines for use and care of the modified press. 4202(d)

Electrical Presses

Protect clutch/brake control circuits against accidental grounding, which could cause false operation of the press. 4204(a)

Install features in the clutch/brake control circuit that will minimize the possibility of unintended stroke. 4204(b)

Point-of-operation Guards & Devices

Point-of-operation guards must:

- prevent the placing of hands or fingers into the point of operation
- not create a pinch point between the guard and moving parts
- not be readily removable by the operator
- offer maximum visibility of the point of operation. 4207(a)

Attach a die enclosure guard in a fixed position to die shoe or stripper. 4207(b)

Attach an interlocked press barrier guard to press frame or bolster so that the clutch cannot function unless the movable sections of the guard are in position. 4207(c)

Do not use the hinged or movable sections of an interlocked barrier press guard for manual feeding. 4207(d)

Attach the adjustable barrier guard to the press bed, bolster plate, or die shoe. 4207(e)

Point-of-operation devices protect the operator by:

- preventing or stopping the stroke of the press if hands are placed in the point of operation
- preventing the operator from reaching into or leaving hands in the point of operation as the die closes
- preventing the placing of hands in the point of operation at all times
- requiring two-hand controls located so far

from the point of operation that hands cannot be inserted before the die has closed

- enclosing the point of operation before the press stroke has started. 4208(a)

Hand-operated Levers

Equip hand-lever-operated power presses with a spring latch on the operating lever to prevent accidental tripping. 4210(a)

Interlock the operating levers on hand-tripped presses having more than one operating station. 4210(b)

Two-hand Trip

Protect hand controls against accidental operation. 4211(a)

Incorporate an anti-repeat feature on two-hand trip systems on full revolution clutch machines. 4211(b)

Mechanical & Hydraulic Forging & Hot Trimming Presses

When dies are changed or maintenance is performed:

- lock out power to the press
- make sure the flywheel is at rest
- block the ram with material of adequate strength. 4242

Vats, Pans, Tanks

Every open vat, pan, tank and similar container that contains hazardous substances, and has a top less than 36 inches above the work surface, must be guarded on all sides by one of the following:

- a substantial railing at least 36 inches above the work surface, or
- the top height increased to 36 inches, or
- a complete cover.

Note: Covers or railings may be temporarily removed to provide necessary working openings. 3480(a)

Containers with tops less than 4 inches above the work surface must also have a 4-inch toeboard around the sides. 3480(b)

Where workers are required to work above open vats, pans, tanks, and vessels, provide one of the following safety protections:

- safety belt or lifeline resistant to deterioration from dusts, fumes, vapors arising from the tank, and attached to a traveling trolley on a fixed overhead anchorage

- a grill covering the vessel with no opening larger than 2 inches, and strong enough to withstand the load usually placed on it
- walkway above the vessel that has a standard railing and toeboard
- safety rope nets designed to withstand expected loads, and suspended above the vessel during temporary or emergency work. 3480(c)

- Before workers are allowed to work in a vessel that contains a power-driven agitator, circulator, gyrator, or any other power driven equipment:
- disconnect from the source of power, and
 - lock open the disconnecting controls. 3480(d)

— Welding/Cutting: Fuel-Gas Pipe Lines —

Ventilation & Personal Protective Equipment

Local exhaust systems providing a minimum air velocity of 100 lineal feet per minute in the welding zone are required. 5150(a)

Exceptions:

- Where local exhaust is not feasible, use mechanical dilution ventilation sufficient to prevent concentrations of airborne contaminants from exceeding the limits set in GISO 5155. 5150(a)(1)
- If neither local exhaust nor mechanical dilution ventilation systems are feasible, workers are to use respiratory protective equipment. 5150(a)(2)

■ Where workplace monitoring records clearly demonstrate that exposure levels set in GISO 5155 are not exceeded under the worst conditions, neither mechanical ventilation nor respiratory protective equipment is required. 5150(a)(3)

Local exhaust ventilation is required when hazardous materials are used as base metals, fluxes, coatings, platings, or filler metals. These include, but are not limited to: beryllium, cadmium, chromium, fluorides, lead, mercury, zinc, and inert gas metal-arc welding or oxygen cutting of stainless steel. 5150(b)(1)

Vent the exhaust system so that workers and others are not exposed to hazardous concentrations of toxic substances. 5150(b)(2)

When the nature of the work does not enable effective use of local exhaust ventilation to prevent airborne concentrations in excess of limits in GISO 5155, use supplied-air respirators. 5150(b)(3)

Respiratory protective equipment is to be provided according to GISO 5144. 5150(c)

Exceptions:

- Only supplied-air respirators are to be used in operations involving beryllium-containing base or filler metals. 5150(c)(1)

■ If natural or mechanical ventilation is sufficient to remove welding fumes from the breathing zone of workers, respiratory protective equipment is not required. However, when operations involve beryllium, cadmium, lead or mercury, respiratory equipment is required. 5150(c)(2)

■ Label hazardous materials used in welding and cutting.

Label containers of filler metals and fusible granular materials:

CAUTION—WELDING MAY PRODUCE FUMES AND GASES HAZARDOUS TO HEALTH—AVOID BREATHING THESE FUMES AND GASES—USE ADEQUATE VENTILATION

Label containers of filler metals that contain cadmium and cadmium-plated materials: 5150(f)(2)

WARNING—CONTAINS CADMIUM POISONOUS FUMES MAY FORM ON HEATING DO NOT BREATHE FUMES

—Use Only With Adequate Ventilation Such As Fume Collectors, Exhaust Ventilators, Or Supplied-air Respirators—
If Chest Pain, Cough Or Fever Develops After Use, Call A Physician Immediately

Label containers of fluoride fluxes: 5150(f)(3)

CAUTION—CONTAINS FLUORIDES
—This Flux When Heated Gives Off Fumes That May Irritate Eyes, Nose, Throat—
Avoid Fumes—Use Only In Well-ventilated Spaces
Avoid Contact Of Flux With Eyes Or Skin
Do Not Take Internally

Do not use compressed gases (for welding and cutting) to ventilate, clean or cool the work area, or to blow dust from clothing. 5150(d)

Locate and control vapors from degreasing and other operations involving chlorinated hydrocarbons, so that they will not enter the atmosphere surrounding welding and cutting operations. 5150(e)

Fire Prevention

Establish and give instructions to workers on a fire prevention procedure to use during cutting and welding operations. (see ANSI Z49.1-1973)

Establish areas specifically for cutting and welding, and establish procedures for the approval of cutting and welding in other areas.

Use only approved apparatus such as torches, manifolds, regulators, or pressure reducing valves and acetylene generators.

Remove or isolate flammable materials in the work area.

Do not schedule plant operations that might expose combustibles to ignition during cutting or welding.

Inform welders and cutters of hazardous conditions in the area.

Have available at the site: fire protection, appropriate fire extinguishers, and fire watchers where required.

Before authorizing cutting or welding operations, the supervisor must inspect the area to ensure that it is firesafe and designate precautions to follow.

Cutting or welding is not permitted:

- in areas not authorized by management
- in areas near storage of a large quantity of exposed combustible material 4848
- on a metal partition, wall, ceiling or roof with a combustible covering, or on walls or partitions or combustible-type panel construction
- on pipes or metal contacting combustible walls, partitions, ceilings, roofs, if conduction could cause ignition.

Other Requirements

- Sweep floors clean of combustible material for a radius of 35 feet.
- Wet down combustible floors (while protecting welders and cutters against electric shock), cover with damp sand, or protect with fire-resistant shields.
- Take precautions so that sparks cannot fall through cracks or openings in floors, doors, walls, or windows.
- Before welding or cutting, guard nearby combustible walls, ceilings, partitions, and roof with fire-resistant shields.
- Before welding on a metal wall, partition, ceiling, or roof, remove combustible material from

the other side or, if the combustibles can't be moved, station a fire watch there.

- Remove combustibles to 35 feet from the work site where practical; otherwise protect these materials with flame-proof covers, or metal or asbestos guards or curtains. Secure the edges and overlaps to prevent sparks from going under them.

- Where objects to be welded or cut or fire hazards cannot be moved, guard them to confine heat, sparks, and slag.

- Protect or shut down ducts and conveyor systems that might carry sparks to combustibles. 4848

Fire Watchers Required:

- combustible material within 35 feet of the welding operation
- large amounts of combustible material easily ignited by sparks
- openings and concealed spaces in walls or floors within a 35-foot radius
- combustible material close to welding on metal walls or partitions. 4848

Arc Welding

Where work permits, enclose the welder in an individual booth painted with low reflective finish, such as lamp black or zinc oxide, or with noncombustible screens with a similar finish.

4851(a)

Shield workers from welding area by non-combustible screens, or require them to wear appropriate goggles. 4851(a)

Keep welding machines outside a confined space. 4851(b)

When electrodes and holders are not in use, protect them so that they cannot make electrical contact with workers or conducting objects. 4851(c)

When welding is completed, warn other workers of the location of the hot metal. 4851(c)

Electric Welding

Install and maintain electric welding equipment according to Electrical Safety Orders in T8 CCR Article 90, and Section 4848 of T8 CCR. For additional details see ANSI Z49.1-1973. 4850(a)

Resistance Welding

Equip all suspended welding gun equipment, except the gun assembly, with a support system designed to be fail-safe and capable of supporting the shock load if any component of the system fails.

Where necessary, provide guarding for the movable holder.

Install a minimum of one stop button at each operator's position. 4852

Gas Welding & Cutting

All workers must be thoroughly trained and judged competent before being placed in charge of the operation of oxygen and fuel gas supply systems. 4799(a)

Printed rules and instructions shall be readily available. 4799(b)

Use of Compressed Gases for Welding: Operating Procedures

Do not use an attachment that permits air or oxygen to mix with combustible gas prior to consumption, except at the burner or in a standard torch or blowpipe, unless it has been approved for that purpose. 4845(a)

In a system without a manifold, mount backflow check valves on the torch, hoses, or regulator outlets. 4845(b)

Do not generate, pipe (except in approved cylinder manifolds) or use acetylene at a gauge pressure higher than 15 pounds per square inch. 4845(c)

Do not use liquid acetylene. 4845(d)

Do not allow oil or grease to contact oxygen cylinders, valves, regulators, or other fittings. 4845(e)

Do not handle oxygen from a cylinder or cylinder manifold unless a pressure-reducing device marked for use with oxygen is provided. 4845(f)

Never use fuel-gas from cylinders through torches or other devices equipped with shut-off valves without reducing the pressure through a suitable regulator.

Note: Low pressure air-gas torches may be used on small cylinders provided there is no shutoff valve on the torch. 4845(g)

Place fuel-gas cylinders valve end up when in use.

Store and ship liquified gas valve end up. 4845(h)

Before connecting a regulator to a cylinder valve, stand to one side of the outlet, open the valve slightly and close immediately.

Never crack the valve near welding work or sources of ignition.

Exception: hydrogen cylinders. See supplier's instructions before connecting regulator.

4845(j)

Before removing the regulator from the cylinder valve, close the valve and release the gas from the regulator. 4845(k)

If the valve leaks, slowly empty the cylinder outdoors, away from sources of ignition. 4845(l)

Put warning tags on cylinders with leaking safety devices, and contact the supplier. 4845(m)

Do not tamper with safety devices. 4845(n)

Always open the cylinder valve slowly, and no more than 3/4 to 1 1/2 turns. 4845(o),(p)

Inspect torches at beginning of each work shift for leaks in valves, hose couplings, or tip connectors.

Do not use defective torches.

Clean clogged tip openings with suitable cleaning wires. 4845(q)

Light torches only with approved devices.

Never use matches. 4845(r)

Do not allow acetylene to contact unalloyed copper, except in a blowpipe or torch. 4845(s)

When purging flammable gas lines or other pieces of equipment, do not permit open lights or other sources of ignition near uncapped openings.

Purge the line before cutting or welding on an acetylene or oxygen pipeline or supports.

4845(t)

Maintain liquid level in pipeline protective equipment, using a suitable antifreeze if necessary.

4845(u)

Locate cylinders out of range of sparks and hot slag of welding and cutting. 4845(v)

Fuel-Gas Cylinders—Manifolds

Provide a backflow check valve for fuel-gas and oxygen cylinder lead. 4834(b)

Limit fuel-gas cylinders connected to a portable manifold inside a building to 3000 cubic feet aggregate capacity. 4834(c)

Manifold acetylene and liquified fuel-gas cylinders vertically and guard against damage.

4834(d),(e)

Component parts must be approved as to materials, design and construction either separately or as an assembled unit. 4834(g)

Use manifolds and parts only for gas or gases for which they are approved. 4834(h)

Provide flash arresters between cylinder and coupler block of coupled acetylene cylinders.

4834(i)

Label fuel-gas and oxygen manifold on the manifold in letters at least 1 inch high. 4834(j)

Locate in a safe, well-ventilated, accessible place. Do not place in enclosed space. 4834(k)

Do not place anything on top of a manifold while it is in use. 4834(l)

Fuel-Gas Manifolds: Acetylene, Liquified, Non-liquified other than Acetylene

Manifold only cylinders containing gas at approximately equal pressure. 4835(a)

Limit capacity of fuel-gas cylinders connected to one manifold inside a building to 300 pounds of LPG or 3000 cubic feet of other fuel-gas (except as provided in 4835(c)). 4835(b)

Put manifolds, each of which supplies one blowpipe or machine, 50 feet apart. 4835(b)

If it is necessary to manifold cylinders with gas capacity greater than 300 pounds of LPG or 3000 cubic feet of other fuel-gas, locate cylinders in a special outside building or a separate room, according to 4805(b). 4835(c)

Special buildings or rooms for cylinders must be used only for this purpose. Rooms must be well-ventilated and have no open flame. A sign must be posted reading: *DANGER—NO SMOKING, MATCHES OR OPEN LIGHTS.* 4835(d)

Oxygen Manifolds

Do not put in acetylene generator room, or near fuel-gas cylinders or highly flammable material such as oil or grease. 4836(a)

When connected to cylinders having 6000 cubic feet aggregate capacity, do not locate oxygen manifolds inside a building unless they are put in an area constructed to be fire-resistant and at least 20 feet away from any combustible material. 4836(b)

Construction:

- suitable for use with oxygen at a pressure of 250 p.s.i.g.

- minimum bursting pressure 1000 p.s.i.g.

- safety relief device which will relieve at a maximum pressure of 500 p.s.i.g.

- hose and hose connections complying with GISO 4839 and with a minimum bursting pressure of 1000 p.s.i.g.

- gas-tight leads at 300 p.s.i.g.

- posted sign at manifold: 4836(c)

LOW-PRESSURE MANIFOLD
DO NOT CONNECT HIGH-PRESSURE CYLINDERS
MAXIMUM PRESSURE 250 P.S.I.G.

Portable Outlet Headers

Do not use indoors except for temporary service where conditions do not permit a direct supply from outlets located on the service piping system.

Hose and hose connections must comply with GISO 4839.

Install master shutoff valves for both oxygen and fuel-gas at the entry end.

Provide a readily accessible shutoff valve on each outlet on the service piping.

Attach a detachable outlet seal cap to the body of the valve for a valve assembly at each service outlet.

Provide frames to support the equipment in the correct operating position and protect them from damage during handling and operation.

4836(d)

Liquid Oxygen

Put container(s) holding more than 100 gallons in a separate building. 4837

Pressure Regulators

Use only for gas and pressure specified.

Do not use defective regulators or gauges.

Only properly instructed, skilled mechanics may repair gauges and regulators.

Mark gauges on oxygen regulators:

USE NO OIL.

4838

Hose

Distinguish fuel-gas hose (usually red) from oxygen hose (usually green).

For oxy-fuel, hose must comply with rubber welding hose specifications.

When parallel lengths of oxygen and acetylene hose are taped to prevent tangling, tape only 4 inches out of 12 inches.

Connections must comply with standard hose connection specifications.

Clamp or securely fasten hose connections to withstand at least 300 p.s.i. Use oil-free air or an oil-free inert gas to test.

Use manifold connections that will prevent interchanging of hose between fuel-gas and oxygen manifolds and supply header connections.

Inspect hose at the beginning of each work shift.

Repair or replace hose with leaks, burns, worn spots, or other defects.

Ventilate boxes used to store hose. 4839(a)

Compressor Booster Pumps Fuel-Gas & Acetylene-Oxygen

Pressure relief valves that will relieve pressure exceeding 15 p.s.i.g. to an outside location, or by returning gas to the supply source, are required.

4840(a)

Protective equipment on discharge outlets is required.

4840(b)

Hydraulic Back-pressure Valves

Low pressure fuel-gas systems, where gas is piped at a pressure of 1 p.s.i. or less, employ an approved hydraulic back-pressure valve at every point where fuel-gas and oxygen are withdrawn from the piping system to supply a blowpipe or machine.

Install a shutoff valve at the inlet of each hydraulic valve.

4828(a)

In fuel systems where gas is piped at a pressure in excess of 1 p.s.i., use an approved service regulator, check valve, or hydraulic seal with a shutoff valve at the inlet at every point where gas is withdrawn from the piping system.

For equipment not requiring oxygen, draw fuel upstream of piping protective devices.

4828(b)

Periodically inspect liquid levels of hydraulic back-pressure valves. Station outlet connections must comply with either regulator connection standards or standard hose connection specifications.

4828(c),(d)

Gas Systems Piping for Welding & Cutting

Pipe must be at least Schedule 40 and fittings at least standard weight in sizes up to and including 6-inch nominal.

4821(b)

Copper tubing must be types K or L in accordance with ANSI/ASTM B586-1980.

4821(c)

Piping must be steel, wrought iron, brass or copper, or seamless copper, brass or stainless steel tubing, except as provided in GISO 4822 and 4823.

4821(d)

Piping and fittings must comply with ANSI B31.1.0 1983, insofar as it does not conflict with GISO 4821(b), (c).

4821(a)

Protect piping systems by pressure relief devices set to function at no more than the design pressure of the systems, and discharging upward to a safe location.

4821(e)

Oxygen Piping

Oxygen piping and fittings at pressures exceeding 700 p.s.i.g. shall be stainless steel or copper alloys.

Hose with a minimum bursting pressure of 1000 p.s.i.g. and a maximum length of 5 feet may be used to connect the outlet of a manifold pressure regulator to piping, providing the working pressure does not exceed 250 p.s.i.g.

When oxygen is supplied from a low-pressure oxygen manifold without an intervening pressure regulator, the piping system must have a minimum design pressure of 250 p.s.i.g.

At less than 250 p.s.i.g., use a pressure regulating device at each station outlet.

4822

Acetylene Piping

Use only steel or wrought iron pipe and fittings.

4823

Piping Joints

Weld, thread, or flange joints in steel or wrought iron piping.

Fittings such as ells, tees, couplings, and unions may be rolled, forged or cast steel, malleable iron, or nodular iron. Gray or white cast iron fittings are prohibited.

4824(a)

Joints in brass or copper must be welded, brazed, threaded, or flanged.

Socket-type joints must be brazed with silver brazing alloy or a similar high-melting-point filler metal.

4824(b)

Joints in seamless copper, brass, or stainless steel tubing must be approved gas tubing fittings, or the joints must be brazed. If a socket type, they must be brazed with silver brazing alloy or a similar high-melting-point filler metal.

4824(c)

General Piping Installation

Maintain distribution lines in safe operating condition.

After assembly, blow out the piping with air, carbon dioxide, or nitrogen to remove foreign materials.

For oxygen piping, use only oil-free air, carbon dioxide, or nitrogen.

4825(a)

Never place oxygen piping in a tunnel, trench, manhole, or duct where it may come into contact with oil.

4825(b)

Provide natural or forced ventilation where oxygen piping and fuel-gas pipelines are placed in

the same tunnel, trench or duct. Use only piping that has been welded or brazed, and locate shutoff valves outside such conduits. 4825(c)

All drip pots must have outlets normally closed with screw caps or plugs and be readily accessible. 4824(d)

Provide buildings with gas cocks or valves at points outside the buildings where they will be readily accessible for shutting off the gas supply in case of emergency. 4825(e)

Testing Piping

Test all piping and valves to ensure they are gas-tight at 1 1/2 times the maximum working pressure.

Purge all piping of air before placing it in service.

Use only an oil-free medium for testing oxygen lines. 4826

Painting & Signs

All buried pipe and tubing and all outdoor ferrous pipe and tubing must be painted with a suitable corrosion-resistant material. 4827(a)

Paint oxygen pipelines green and fuel-gas lines a different color. When there are several pipelines supplying different gases, paint each in a distinctive color. 4827(b)

Prominently display the color chart used for gas pipelines. 4827(c)

Provide signs indicating location of shutoff valves. 4827(d)

Pipe Lines

Support pipe lines to prevent dangerous vibration under normal operating conditions. 3329(a)

Design, construct, install, and maintain pipe lines according to good engineering practice. See ANSI B31. 3329(b)

If it is not possible to stop hazardous leaks, use diversion shields or other effective means to protect the work area and workers. 3329(c)

Relieve internal pressure or prevent sudden release of pressure before dismantling or opening closed pressurized or gravity fed systems. 3329(d)

— Hazardous Materials & Operations —

Hazardous Mixtures

Prevent contact between substances which react violently or produce toxic vapors when mixed, by storing them in separate areas. Examples of substances that should be stored separately are:

- mineral acids and strong oxidizing agents
- mineral acids and cyanides
- oxidizing agents and combustible materials
- strong acids and alkalis. 5164(a)

If it is necessary to mix substances that react by producing fumes, spatter, or hazardous gases or vapors, protect workers with isolation from the process by shielding, or where this is not possible, with protective clothing and equipment. 5167(a)

Lead

(except organic lead compounds)

Action level: 30 ug/M³ per 8-hour time-weighted average without regard to use of respirators. 5216(b)

Permissible exposure limit (PEL): 50 ug/M³. 5216(c)

The following are required:

- exposure monitoring and measuring 5216(d)

■ engineering and work practice controls to reduce worker exposure (see Title 8 for schedule of required implementation) 5216(e)

■ respiratory protection when engineering and work practice controls fail to reduce worker exposure to or below 50 ug/M³ 5216(e)

■ respiratory protection program in accordance with GISO 5144. 5216(f)

When workers are exposed to 50 ug/M³ or more without regard to respirators:

■ Provide protective work clothing and equipment. 5216(g)

■ Prohibit food, beverages, tobacco, or the application of cosmetics in the work area.

■ Provide shower facilities, change rooms, lunch rooms with filtered air supply, and lavatories. 5216(i)

Conduct medical surveillance and biological monitoring for all workers who are or who may be exposed at or above the action level for more than 30 days in a year. 5216(j)

Medical Removal Protection

Medical removal protection: see GISO 5216(k) for schedule of implementation.

In work areas where the PEL is exceeded,
post warning signs: 5216(m)

WARNING—LEAD WORK AREA
POISON—NO SMOKING OR EATING

Coke Oven Emissions

Maintain regulated areas for:

- coke oven battery and its machinery
- beehive oven and its machinery. 5211(d)

Permissible exposure limit (PEL): 0.15 mg/
M³ per 8-hour time-weighted average. 5211(c)

Monitor and measure worker exposure in
specified job classifications according to GISO
5211(e)(1)(B) every 3 months, and whenever a
process change may increase exposure.

Results must be given to monitored workers,
and past representative levels must be posted for
all other workers. 5211(e)(3)(A)

The employer must notify workers when
exposure exceeds the allowed limit, and inform
them of corrective action being taken. 5211(e)(3)(B)

Records must be maintained for 40 years, or
for the time the worker is employed plus 20 years,
whichever is longer. 5211(v)(1)(B)

Whenever engineering and work practice
controls are not sufficient to reduce exposure to or
below the PEL of 0.15 mg/M³, these controls are to
be supplemented by worker use of respirators that
comply with the requirements of 5211(p).

5211(f)(2)(C)

Create written procedures for:

- engineering controls during charging 5211(g)
- engineering controls during coking 5211(h)
- work practice controls during charging 5211(i)
- work practice controls during coking 5211(j)
- work practice controls during pushing 5211(k)
- maintenance and repair 5211(l)
- use of filtered air. 5211(m)

Filter air for larry car, pusher machine, door
machine, quench car cabs, and for standby pulpits
on the battery and screening station. 5211(m)

When an emergency occurs, do not begin
the next coking cycle until the cause of the emer-
gency is determined and corrected, unless the
employer establishes that the next coking cycle
has to start in order to determine the cause of the
emergency. 5211(n)

Provide protective clothing and equipment,
and for the cleaning and disposal of such clothing
and equipment. 5211(q)

Provide change rooms with storage facilities
for work clothes, and equipment separate from
storage facilities for street clothes. 5211(r)

Maintain medical surveillance and accurate
records for workers employed in a regulated area
30 days per year. 5211(s)

Schedule annual training for workers who
work in regulated areas. Training must include a
thorough review of requirements of GISO 5211.

5211(t)

Warning signs in regulated areas: 5211(u)

DANGER—CANCER HAZARD
AUTHORIZED PERSONNEL ONLY
NO SMOKING OR EATING

Cadmium

Action level: an airborne concentration of
cadmium of 2.5 ug/M³ per 8-hour time-weighted
average. 5207(b)

Permissible exposure limit (PEL): 5 ug/M³
per 8-hour time-weighted average. 5207(c)

The following are required:

- exposure monitoring and measuring, and
employee notification of monitoring results 5207(d)
- engineering and work practice controls to
reduce employee exposure 5207(f)
- respirator protection program 5207(g)
- establishing a regulated area wherever
exposure is or can be expected to exceed the PEL.

Where employees are exposed above 5 ug/
M³ or any level where skin or eye irritation result,
provide protective work clothing and equipment.

5207(i)

Where employees are exposed above 5ug/
M³, provide clean change rooms, handwashing
facilities, showers and lunchrooms. 5207(j)

Medical Surveillance

Conduct medical surveillance and biological
monitoring for all employees who are or may be
exposed to cadmium at or above the action level on
30 or more days per year, and those who might
previously have been exposed to this level by the
employer for more than 60 months. 5207(l)

Temporarily remove an employee from work
where there is excess exposure to cadmium on
each occasion that medical removal is required.

5207(l)(11)

In regulated areas and all approaches to
them post warning signs: 5207(m)(2)(B)

DANGER—CADMIUM—CANCER HAZARD
CAN CAUSE LUNG AND KIDNEY DISEASE
AUTHORIZED PERSONNEL ONLY
RESPIRATORS REQUIRED IN THIS AREA

Recordkeeping

Establish and maintain an accurate record of:

- exposure monitoring results in terms of 8-hour time-weighted average and date, location, employees exposed, and respiratory protection used for at least 30 years. 5207(n)(1)

- medical surveillance of each employee related to cadmium exposure for at least 30 years. 5207(n)(3)

- certified training—employees, trainer and date—for a period of 1 year after training completion. 5207(n)(4)

Methylenedianiline (MDA)

Action level: 5 ppb airborne MDA per 8-hour time-weighted average. 5200(b)

Permissible exposure limit (PEL): 10 ppb per 8-hour time-weighted average.

Short term exposure limit (STEL): as determined by any 15-minute sample period, 100 ppb. 5200(c)

The following are required:

- information and training on MDA, initially and annually 5200(k)

- written emergency action plan for each workplace where unexpected potentially hazardous release of MDA could occur 5200(d)

- exposure monitoring and measuring, and employee notification of monitoring results 5200(e)

- establishing regulated areas where airborne MDA exceeds or can be expected to exceed the PEL 5200(f)

- a written program to reduce employee exposure with engineering and work practice controls and respiratory protection 5200(g)

- providing protective clothing and equipment 5200(i)

- providing change rooms, showers and MDA-free lunch areas.

In regulated areas and all approaches to them post warning signs: 5200(k)

DANGER—MDA

MAY CAUSE CANCER—LIVER TOXIN

AUTHORIZED PERSONNEL ONLY

Respirators And Protective Clothing

May Be Required To Be Worn In This Area

Provide a medical surveillance program for employees exposed to MDA. 5200(m)

Establish and maintain an accurate record of:

- exposure monitoring results, employees exposed and respiratory protection used for at least 30 years 5200(n)

- the medical surveillance record of each

employee exposed to MDA, including results of medical exams, tests, opinions and recommendations for at least 30 years. 5200(n)

Containers Holding Flammable Liquids

When repairs or cleaning operations are performed on tanks, vats, or confined spaces that contain or last contained a flammable liquid or substance giving rise to flammable vapors:

- Advise workers of the hazards.

- Disconnect lines which may convey hazardous materials to the vessel.

- If work to be done involves flames or other source of ignition, flush and purge the vessel of flammable vapors. Make an initial test for the presence of flammable vapors, and continue frequent tests as long as the work continues.

- No source of ignition is permitted in or in contact with the vessel if the percentage of combustible vapors is greater than 25 percent of the lower explosive limit.

- Keep a fire extinguisher at the site. 5420

Combustible Metals

Grind or pulverize combustible metal wet, or if the metal reacts with water, a petroleum hydrocarbon or other liquid with a flash point higher than 100°F.

Follow the applicable requirements of NFPA No. 651-1980 and NFPA No. 651-1974. 5175(b)

Combustible Dusts

Eliminate all sources of ignition before beginning any operation that creates combustible dust.

Stop all dust-producing operations, allow airborne dust to settle, and remove accumulated dust before introducing an ignition source. 5174(b)

Electrically ground all machines, conveyors, housings, and conductive surfaces in areas where combustible dust is generated. 5174(c)

Electrically ground hoses and nozzles—maintain an electrical continuity from coupling to nozzle. 5174(d)

Remove static electricity from belts. 5174(e)

Use pneumatic or magnetic separators to prevent iron from entering grinding, shredding, or pulverizing equipment where the hazard of dust explosion exists. 5174(g)

Locate, construct, enclose, or vent machines and equipment that pose a hazard of dust explosion, so as to minimize the effect of an explosion. 5174(h)

Equip dust collectors with adequate explosion vents, and locate them outdoors or in detached rooms of fire-resistant construction.

Exception: Liquid spray-type collectors may be located within the buildings. 5174(i)

Abrasive Blasting Operations

Blast cleaning enclosure requirements are:

- exhaust ventilation (see ANSI Z9.4-1968)
- observation windows made of safety glass protected by screening
- door capable of being opened from both inside and outside
- abrasive separator used when abrasive is recirculated
- enclosure not opened until visible airborne dust has been removed by exhaust system. 5151(a)

Workers must wear abrasive blasting or equivalent respirators:

- inside blasting rooms during operations
- during continuous blasting operations when dust concentration exceeds limits set by GISO 5155
- where silica sand is used as the blasting abrasive or when toxic materials are blasted. 5151(b)(1)

The blasting operator must wear protective equipment for eyes and face when the respirator design does not provide such protection. Other workers in the area must also wear such equipment. 5151(b)(2)

Use combustible organic abrasives only in automatic systems. The system must conform to GISO 5174 and the Electrical Safety Orders. 5151(c)

Forging

Provide thermostatic control of heating elements for lead melting, to maintain the temperature at 620°-700° and to prevent overheating. 4239(b)(1)

Store dross skimmings in a covered container. 4239(b)(1)(A)

Keep equipment clean. Do not allow yellow lead oxide to accumulate. 4239(b)(1)(B)

Equip drop hammers with safety stops. 4239(c)(2)

When dies are being changed, or other work is being done on the hammer:

- stop the flywheel
- block the ram. 3314, 4239(c)(3)

Tongs must not have sharp handles, and must be long enough to miss the worker in case of kickback. 4239(c)(4),(5)

Provide oil swabs, scale removers, or similar devices that are long enough to allow the worker to reach the full length of the die without reaching between the dies to remove scale. 4239(c)(6)

Die keys and shims shall be made of material that will not easily crack or splinter. 4239(c)(7)

Identify and provide easy access to valves and switches. 4239(c)(8)

Vapor Degreasing Equipment

Maintain the vapor level below the top edge of the tank by at least 1/2 the width of the tank up to 36 inches.

Design and maintain control systems to prevent decomposition of the solvent by overheating, and to maintain vapor-free zone. 5154(h)(1)

Install suitable clean-out doors near the bottom of tanks or machines of more than 4 square feet surface area.

Design and gasket the doors to prevent leakage of the solvent when they are closed. 5154(h)(2)

When gas is used to heat vapor degreasing tanks:

- Flues must be corrosive-resistant and discharge outdoors.
- Prevent solvent vapors from entering combustion air when chlorinated or fluorinated hydrocarbons are used. 5154(h)(3)

Spray Cleaning & Degreasing

Whenever spraying disperses a hazardous liquid above an open-surface tank, provide control for the airborne spray.

Completely enclose the operation. 5154(i)

Workers who may be exposed to splashing or other contamination by liquids other than water must be given suitable protective equipment and clothing, and instructed as to the hazards and safeguards of the job. 5154(j)(1)

Also provide means of immediate rinse or dilution with clean water. 5154(j)(2)

Spray Coating Operations

Confine to properly constructed and ventilated booths with: 5153(a)

■ mechanical ventilation throughout spraying operations, and for a sufficient time after the operation, to remove hazardous vapors 5153(b)(1)

■ flammable vapors kept to less than 20 percent of their lower explosive limit (GISO 5416). 5153(d)

The spray booth operator must wear a respirator when positioned downstream from the object being sprayed. 5153(g)

Lumber Manufacturing

refer also to section on Common Industry Standards

— Sawmills —

Log Deck

Deck saws must not project into any walkway or aisle. 6345(a)

If the deck saw blocks the entrance to the log haul runway, guard the doorway while the saw is operating. 6345(b)

Install safeguards to prevent logs from rolling off the end of the log deck. 6345(d)

Install a strong positive stop at the mill end to protect the sawyer from rolling logs. 6345(e)

Provide a means of stopping all log movement near the scaler. 6345(f)

Do not let loose overhead chains cause a hazard. 6345(g)

Keep deck surfaces clean. 6345(i)

Provide a clear walkway along the upper side of the log deck and around the head rip—or substitute an overhead walkway or underpass. 6345(j)

Install overhead grablines at log haul or chute crossing. 6345(k)

Workers must not cross or work on the log deck where they can be struck by rolling logs. 6345(h)

Live Rolls & Roll Cases

Workers must not cross over or pass through gaps in moving sorting chains, green chains, cross conveyors, roll conveyors, or bridge rolls—unless there are crossovers or walkways.

Exceptions: decked-over green chains or sorting chains. 6357(a)

Workers shall not ride on a moving sorting chain or similar type of equipment. 6357(e)

Install stops or guides to prevent lumber from running off conveyors. 6357(b)

Fill the space between live rolls with materials to support a load of 250 pounds. The minimum distance on either side of crossovers or runways must be one roll. 6357(c)

Rough shaker rolls are permitted if no workers are exposed to contact. 6357(d)

Join at least 24 inches of the head saw roll cases to the husk. 6357(f)

Dry Kilns

Construct dry kilns on a solid foundation.

Transfer, kiln car, and dolly tracks:

■ Maintain in good condition. 6367(a)

■ Do not allow a grade steeper than 1 1/4 percent.

■ Provide bumpers or stops to prevent cars from running off the ends of the rails. 6367(b)

Provide effective mechanical brakes for gravity-traveled tram or kiln cars. 6367(d)

Track grades in kilns must not exceed 15 inches in 100 feet, unless a winch and line are used for snubbing and pulling cars to and from the kiln. 6367(e)

Provide means for easy attachment and detachment of kiln cars to transfer cables. 6367(f)

Provide adequate means for chocking cars. 6367(g)

Stickers must not protrude. 6367(j)

Provide suitable walkways.

Provide a door that is easily operated from the inside, or a special exit door operated from the inside located in or near the main loading doors. 6367(k)

Allow a clearance of at least 18 inches between loaded cars and the walls of the kiln. 6367(l)

Equip main kiln doors with a means of holding the doors open while the kiln is loaded, and of securing doors when they are disengaged from carriers and hangers. 6367(m)

Block wheels of loaded kiln cars if the cars are on inclined tracks. 6367(c)

Clear tracks before shunting cars to the unstacker. 6367(h)

Do not move cars while workers are in the bight of transfer lines. 6367(i)

Clearly mark unloading points and paths for lumber packages on conveyors, transfers, and other areas where accurate spotting is required.

Provide wheel stops where necessary. 6367(n)

Fuel Houses, Chip Bins, Hoppers

- At least two exits are required. 6368(a)
- Effective means are required for removing the material so that workers do not have to work where there is potential for a cave-in. 6368(b)
- Where employees work over stored materials in fuel houses, platforms and walkways are to be constructed according to the General Industry Safety Orders (see GISO 3481(e)). 6368(c)
- Workers must wear approved safety belts and a line attended by another worker when leaving walkways or other protected areas in fuel houses, bins, and hoppers. 6368(d)

Log Hauls

- Keep log hauls in good repair, and strong enough to support five times the maximum load. 6344(a)
- Bull chains or cables shall be designed and built with an adequate safety factor. 6344(b)
- Guard the return strand of chain log conveyor in the basement to prevent it from falling in case it breaks. 6344(c)
- Identify and arrange controls so that workers can operate them from a position clear of logs, machinery, lines and rigging. 6344(d)
- Install a positive stop or bulkhead to prevent logs from traveling too far ahead in the mill. 6344(e)
- Prohibit work under logs which are being hoisted to the log deck. 6344(f)

Conveyors

- Troughs in which the working strands of a conveyor operate must be large and strong enough to carry a broken chain, and must effectively protect all workers. 6365(a)
- Install a trough guard where return strands are within 7 feet of the working surface. 6365(b)
- Provide rollers or guards underneath return strands of conveyors higher than 7 feet from the work surface, and located over or near passageways or work areas. 6365(c)
- Enclose the entire length of working strands when they cross within 3 feet of the working surface in passageways. 6365(d)
- Provide sidewalls high enough to prevent material being thrown from the conveyor on elevated slab or wood conveyors, or fence off the area under the conveyor. 6365(e)

Barkers

- Provide guards to protect workers from flying objects. 6346(a)

- Provide hoop or other suitable barriers on both sides of the ring barkers. 6346(d)
- Install steel barriers between the operator and revolving head barkers. 6346(e)
- Enclose hydraulic barker with strong baffles at the inlet and outlet.
- Protect the hydraulic barker operator with guards of at least five-ply laminated glass or the equivalent. 6346(f)
- Do not remove logs until the barking head stops revolving, or locate the barking head so that it will not create a hazard to workers. 6346(b)
- Use a safety chain and hook or other positive means of suspension on the elevating ramp or gate when workers work under the gate. 6346(c)

Sawyer

- Provide positive means of locking control levers in neutral when not in use. 6347(a)
- Arrange control levers so that they return to neutral position when released, except for steam or shotgun feed. 6347(b)
- Protect sawyer from flying chips and knots. 6347(d)
- If logs block visibility, use an audible signal device, mirror, or other means of transmitting signals between the sawyer, offbearer, and setter. 6347(e)

Carriages

- Carriages must be substantially constructed, kept in proper adjustment, and floored over to provide secure footing where the workers are required to ride. 6348(a)
- Guard the sheaves on rope-driven carriages at the floor line with substantial housings. In a similar manner, guard sheaves of cable operating rope-feed setworks and setworks pinion, at the rear of carriage head blocks. 6348(b)
- Whenever workers ride the carriage and the distance from the rear edge of the carriage to the wall of the building is no more than 18 inches, board the side wall over smoothly to a height of 6 feet 6 inches above the carriage platform for the length of the carriage travel.
- If overhead knee braces or timbers come within 6 feet 6 inches of the carriage platform, board them over smoothly for the length of the carriage run.
- No roof truss, roof timber, or other projection on any carriage can be less than 6 feet 6 inches above the platform. 6348(e)

Provide a 4-foot clearance or barriers or guardrails to prevent contact by anyone on a walkway located behind a moving carriage. 6348(f)

Guard the exposed carriage run with a guardrail (1 1/4 inch pipe or 2 inch x 4 inch lumber) as high as the carriage platform. The guardrail must clear the carriage blocks when they are in their rear position.

Passageway doors at the end or side of the carriage run must have guardrails opposite the doorways. Post a warning sign at the entrance.

6348(g)(1)

If workers ride the carriage, there must be a spring or pneumatic stop at each end of the carriage travel.

Riderless carriages must have stops at the ends of the carriage runs.

6348(g)(2)

Provide substantial sweeps of suitable material in front of the wheels at each end of the carriage. Sweeps must extend to within 1/4 inch of the rails.

6348(g)(3)

If a steam-operated, Hill-type log-turning device is used, provide carriage knees with goosenecks, unless the carriage is otherwise protected from climbing logs.

6348(h)

Do not saw logs that are shorter than two carriage blocks on carriages.

6348(i)

Use adequate dogging devices to secure logs, cants, or boards during sawing operations.

6348(j)

Shotgun Feed Carriage Drive

Valves must be locked before the sawyer leaves position.

Do not use leaking valves or piping on saw carriage drives.

Prevent the carriage from creeping.

If steam boilers are located above the shotgun feed, prevent condensation from collecting in the shotgun cylinder.

Block heads of shotgun cylinders.

Provide means for workers to stop the head saw in an emergency.

6348(c)

Edgers

House with a guard of No. 8 gauge metal plate or the equivalent.

6358(a)

When equipped with automatic networks, interlock control circuits with the pressure rolls and the edger picker to prevent shifting of the saws when there is stock in the edger.

6358(b)

When saw arbors are mounted below the

feed rolls, equip with an anti-kickback device installed on the in-feed side.

6358(c)

When saw arbors are mounted above the feed rolls, equip with an anti-kickout device installed on the out-feed side.

6358(d)

Do not locate edgers in the main roll case behind the head saws. Offset at least 6 feet from the husk or mill side of the roll case.

6358(e)

Safe Practices

Do not raise the pressure roll while stock is being run, or when a person is in line with the saws.

6358(f)

Do not raise the feed rolls or fingers while standing in front of the edger.

Do not reach between the saws while the edger is in operation.

6358(g)

Do not touch the cants being run through the edger after the cant has been engaged by the feed rolls.

6358(h)

Operate live rolls in back of the edger no slower than the speed of the edger feed rolls.

6358(i)

Keep table in back of the edger clear of cants, edging, and debris.

6358(j)

Do not sharpen or change saws on the arbor until the machine is positively disconnected.

6358(k)

Install and locate a control so that the operator can stop the feed mechanism without releasing tension of the pressure rolls.

6358(l)

Hog Mills

Design feed chutes and conveyors to handle the materials being processed to minimize jamming.

6363(a)

Chutes must be at least 40 inches from the rim to the cutter knives.

6363(b)

Provide baffles, screens, or barriers to prevent material from being thrown from the mill, unless the mill is located so that this is not a hazard.

6363(c)

The top rim of the chute must be at least 36 inches above the working platform, unless the chute opening is protected by other adequate means.

6363(d)

Install a metal detector whenever possible.

6363(g)

Workers feeding or tending hog mills must wear safety belts and lines, unless they are otherwise protected from falling into the mill.

6363(e)

Provide a trip bar or emergency stop in easy reach of workers on all conveyor-fed hog mills.

6363(f)

Band Saws & Band Saw Wheels

Do not operate saws at speeds higher than manufacturer's recommendation. 6349(a)

If the saw's operating speed is changed, clearly mark the new safe operating speed on the saw. 6349(b)

Remove blades that develop a crack larger than 1/10 the width of the saw. Do not use the saw until the crack is repaired or eliminated. 6349(c)

Do not use saws on the head rig that are reduced 30 percent in width. 6349(d)

Keep guides in proper condition and alignment. 6349(e)

Inspect each band saw wheel at least monthly for defects. Repair or discard cracked or defective wheels. 6350(a)

Wheels 7 inches or wider must have a minimum rim thickness of 5/8 inch if they are cast iron, and 1/2 inch if they are cast steel, except for a distance no more than 1 inch from the edge of the wheel. 6350(c)

Do not operate a wheel at a peripheral speed higher than the manufacturer's recommendation. 6350(d)

Circular Saws

Do not operate a circular head saw faster than 10,000 peripheral feet per minute, except when specially tensioned, clearly marked, and recommended by the manufacturer (see *Sawmill Guarding Requirements*). 6352(a)

Install an exhaust hood for a rock saw whenever practicable. 6353(b)

Safety guides must be adjustable without the use of a wrench or other hand tool. 6353(c)

Install brackets or edging support between the saw and the side of the husk or frame. 6353(d)

Provide horizontal clearance from the side of the saw to the nearest post of the husk frame.

The horizontal clearance must be 1 inch greater than the vertical distance between the saw collar and the cutting edge of the saw.

Guard the opening in the off-bearing side between the husk and the saw. 6353(e),(f)

Circular Saw Cracks

Inspect saws for cracks each time the teeth are filed or set. *Do not use any saw with a crack equal to the following table until the crack has been center-punched, drilled, slotted, or welded, and the saw is retensioned.*

Repair or replace any saw found with a

crack equal to the following table: 6356

Length of Crack	Saw Diameter
1/2 inch	12 inches
1 inch	24 inches
1 1/2 inches	36 inches
2 inches	48 inches
2 1/2 inches	60 inches
3 inches	over 60 inches

Slasher Saws

(see also *Sawmill Guarding Requirements*)

Design feed chains to be controlled from the spotter's station. 6360(b)

Stop feed chains while workers are on the feed table, unless the operator is stationed at the feed chain control. 6360(c)

Underhung & Drop Trimmer Saws

(see also *Sawmill Guarding Requirements*)

Do not operate trimmer saws at speeds higher than manufacturer's recommendations. 6361(a)

Set front guards as close to the trimmer table top as practical. 6361(c)

The operator of push, pull, or two-saw trimmers must be able to adjust the trim without coming close to the blades, or the saw must have a self-adjusting hood that covers the blade to the depth of the teeth.

Enclose parts of the saw below the table. 6361(e)

Stop saws completely before propping them up either at quitting time or for the convenience of filers. Lock all controls while the saws are filed. 6361(g)

Stop trimmer feed chains while workers are on the trimmer feed table. 6361(h)

Wood Chippers

The following are required:

- feed throat extending at least 36 inches from the knives, and a distance of at least 88 inches from the floor or working level to the knives 6364(a)

- swinging baffle at the mouth of the chipper or hopper

- screen between the chipper and operator, or some other means of protecting workers from material thrown back by chipper knives 6364(b)

- a trip bar or emergency stop on conveyor-fed chippers within easy reach of workers 6364(c)

- a metal detector whenever possible. 6364(d)

Stop drum or disc before opening access

covers or doors. Post this instruction on or near the covers or doors. 6364(e)

Sawmill Guarding Requirements

Circular head rig: 6353

- hood or canopy over upper saw of double circular saw mill
- guard saw of single circular saw
- guard upper portion of rock saw.

Chain saw (stationary): 6345

- guard top run of chain at pond of log deck.

Gang saw: 6362

- shield cranks, pitman rods, moving parts
- completely enclose drive mechanism
- carriage cradles high enough to prevent logs from kicking out.

Head saw: 6351

- encase or guard bank wheels with No. 7 gauge steel plate, or 2-inch boards secured to frame members no less than 2 inches by 4 inches, except for the lower front quadrant on the off-bearing side of the upper wheel where the blade leaves the wheel
- saw hoists must have brakes and upper travel limit switch.

Jump, underhung, & overhead swing saw: 6359

- guard above and below table or roll case
- stops
- treadle-guards for foot treadle operated saws
- automatic return device (not dependent on fiber rope)
- cotter pins in bolts which support the counterweight.

Sawyer: 6347

- guard carriage control levers
- locks for all control levers.

Slasher saw: 6360

- guard with strong material
- fence off at end opposite operator.

Trimmer saw: 6361

- safety stops or hangers on automatic trimmer saws.

— Veneer & Plywood Plants —

Barking & Peeling Pits

Provide hooks used for handling logs with handholds. Keep hooks in good condition. 6375(a)
Spiked hooks without a bell are prohibited. 6375(b)

Veneer Lathe

The area under the elevating ramp (tipple) from the lathe to stock trays must have railings to prevent workers from entering. 6376(a)

Provide positive control to prevent back-up roll from closing until activated by the operator. 6376(b)

Provide positive means to hold head open while servicing the knife. 6376(d)

Protect the knife edge with a guard while the knife is being transported. 6376(e)

Protect the operator's and the charger operator's stations from flying slabs and chips. 6376(f)

Tray System

Equip the tray system with controls at each end which operate the machine only if both switches are in one position. 6379

Veneer Glue Spreaders

Equip veneer glue spreaders with an automatic stopping device which will stop the spreader rolls when contact is made. 6381(a)

Do not allow spreader clean-up workers to clean the rolls from the in-feed side while the machine is running. 6381(b)

Presses

Equip hot-press hoists with an automatic braking and holding mechanism which will operate when lifting chains or cables fail. 6382(a)

On a hot-press which has an automatic charger, provide an electrically interlocked gate or chain across the opening between the press and the charger to prevent the charger from moving when opened. 6382(b)

Where two workers load the press, provide closing controls within reach at each work station. Interconnect these controls so that both controls must be activated in order to run the press.

Provide a quick-opening device at each work station on the hoist-press platform. 6382(c)

Veneer & Plywood Plant Machine Guarding Requirements

- Chipper:** 6385
- guard top feed roll
 - shield operator's side of chipper.
- Clipper:** 6378
- guard in-feed and out-feed sides
 - guard treadles.
- Core saw:** 6380
- guard unused portions.
- Edge gluer jointer:** 6386
- barrier at end of travel of the head
 - gate to prevent access between jointer and grasshopper which will shut off electricity, air, and hydraulic lines, and bleed cylinders when opened
 - device across front of in-feed nip point to shut off equipment on contact.

- Lathe:** 6376
- guard or positive interlock to prevent forward movement of charger.
- Patch machine:** 6384
- guard punch area and foot treadle.
- Sander:** 6387
- anti-kickback devices
 - barrier on in-feed to allow only one panel to enter at a time.
- Scissors lift:** 6388
- mechanical means to support a raised lift independent of the hydraulic system.
- Slicer:** 6377
- guard slicer knife at front and rear.
- Stripsaw:** 6383
- anti-kickback device and hood guard.

— Lath, Shingle, Shake Mills —

- Bolter & equalizer saw:** 6397
- provide 1 inch wooden guard or equivalent, secured to carriage and covering the saw disc when the carriage is in loaded position
 - device which automatically locks, returns, and holds carriage in neutral position.
- Bolter & lath machine:** 6402
- 2 inch wood or equivalent shield in front
 - metal hood guard at least 1/8 inch thick—can be hinged
 - an anti-kickback device
 - arrange feed rolls and feed mechanisms so that stock does not have to be pushed through.
- Circular shake saw:** 6400
- install splitter behind saw
 - canopy guard over top of saw made of 2 inch x 4 inch timber of a length equal to diameter of saw and high enough to clear moving parts of the carriage
 - protect grooving or edging saws except for operating edge
 - guard portion behind and below the saw table.
- Clip saw:** 6395
- house entirely, except for operating edge
 - approved metal bar guard above operating edge
 - clipper board finger guard.
- Knee bolter saw:** 6398
- 2 inch wooden guards or equivalent secured to carriage which cover saw disc when carriage is in the loading position
 - Locate saw to prevent hazard from flying materials or provide 2 inch planking at rear of saw.
- Lath & shingle mills:** 6401
- protect stock pickers from slabs and blocks that come from slashers and trimmers.
- Shingle jointer:** 6399
- guard cutting face except for slot through which shingles are fed against knives.
- Shingle saw:** 6395
- metal guard covering edge to depth of teeth, except cutting edge
 - die piece attached to rim guard on sawyer's side
 - guard both sides to point left open for stock, provided front and back guards extend 6 inches beyond points of teeth
 - bottom spault catcher 1/4 inch thick, keep sharp.

— Woodworking Equipment —

- Automatic lathes (rotating knife type, shoe last, spoke):** 4319
- completely enclose cutters with hood or cover
 - guards for spoke-like stock.
- Band knife & band saw:** 4310
- blade guarded except operating edge
 - semicylindrical guard on feed rolls.
- Belt sander:** 4312
- enclose both pulleys and unused run of belt
 - guard nip points.
- Boring & mortising machines:** 4316
- completely guard bit and chuck above material being worked—cutting chain driving mechanism enclosed.
- Box shok cutoff saw (California cutoff saw):** 4304
- hood or splitter guard.
- Brush & slash chippers:** 4299
- infeed hopper at least 85 inches from working level over edge of hopper to blades or knives and anti-kick device to protect workers from flying chips if manually fed
 - if mechanically fed, a quick stop and reversing device on infeed with control in reach of operator.
- Circular crosscut saw:** 4302
- hood to cover saw to depth of teeth
 - self-adjusting or manual adjusting hood.
- Circular knife:** 4302
- hood that covers cutting edge, either self-adjusting or manual adjusting.
- Circular rip saw (manual feed):** 4300
- see requirements for circular crosscut saw
 - anti-kickback device
 - revolving double arbor saw guard.
- Circular rip saw (self-feed):** 4301
- see manual feed
 - enclose feed rolls or star wheels.
- Cordwood & similar saws:** 4303
- guard unused portions of blade.
- Disc sander:** 4313
- periphery and back of revolving disc guarded.
- Drum sander:** 4314
- unused portion of drum guarded
 - feed rolls and pressure rolls guarded.
- Elbow sander:** 4315
- revolving head guarded.
- Exhaust systems:** 4324
- exhaust hood as guard.
- Hog mill:** 4298
- feed chutes and conveyors
 - baffles to prevent throwback
 - trip bar
 - workers must wear safety belts and lines.
- Horizontal pull saw (contractor's saw, radial arm saw):** 4309
- encase top half of blade
 - cover arbor ends
 - limit chains, anti-kickback device, automatic saw return
 - post warning: *DO NOT RIP FROM THIS END.*
- Jointer:** 4311
- cylindrical cutting heads, self-adjusting head guard, feed mechanism guard, safety pusher.
- Planer, moulder, sticker, matcher, shaper:** 4318, 4318.1
- knife heads and cutting heads guarded.
- Swing cut-off saw:** 4305
- top half of blade encased
 - arbor end completely covered, automatic saw return, limit chains
 - enclose rear of saw when access is possible.
- Tenoning machine:** 4317
- guard cutting head and saw.
- Underhung swing cut-off saw:** 4306
- guard above and below table
 - fully enclose blade in back position
 - swing frame must not pass vertical at the forward position
 - positive stop.
- Wobble saw:** 4323
- prohibited.
- Combination woodworking machines:** 4320
- each point of operation guarded as a separate machine.

Food Processing

refer also to section on Common Industry Standards

— Work Areas —

Cold Storage Rooms

Install at least one door that can be opened from the inside. 3249(a)

Provide constant illumination or an inside light switch located near the door. 3249(b)

Keep a firefighter's type of axe in the room near the door, unless the door is installed in a manner that prevents it from freezing shut.

3249(c)

Doors may be locked from the outside if there is a release mechanism, or if the room is equipped with an alarm system and a sign posted: *DONOT LOCK THESE DOORS UNTIL YOU ARE POSITIVE NO ONE IS INSIDE.* 3249(d)(1),(2)

If the room is cooled with refrigerant coils filled with carbon dioxide, group 2, or group 3 refrigerants, and the coils are subject to collision damage, provide at least two exits that are remotely located from each other and give unobstructed access to safety.

Exception: storage rooms of less than 200 square feet with less than 12 feet to an exit door.

3250

Refrigerator Vehicles

The refrigerator compartment must have at least one door that is located to provide a safe exit and can be opened from the inside, as well as an axe, pinch bar, or other tool that will enable a person to escape if the door freezes tight. 3251

Loose Material

No employee is to work on granular or loose material, unless the work can be performed safely.

3482(f)

Before workers are required to work over or on loose material, or to assist another worker who is working over or on loose material, train them in the hazards involved and precautions to take to prevent cave-in accidents. 3482(a)

Construct and equip fuel houses, silos, and similar structures with an effective means of removing materials so that workers will not have to

work over loose material—or provide platforms or walkways, unless workers are protected as required by 3482(c) or (d). 3482(b)

When construction as required in 3482(b) is impractical and if design permits, provide an operator-driven, manually-powered hoist.

Do not require a worker to work on loose, granular material within open containers, unless the worker is protected by means of a boatswain's chair or a Class III body harness with a line suspended from a hoist controlled by the operator.

Block inflowing and outflowing material, unless movement is necessary for the work being performed. In such cases, the worker must have complete control over the flow of materials, or be in direct communication with the person who has complete control. 3482(c)

When the requirements in 3482(b) and (c) are not practical, workers must wear an approved safety belt and harness with line attached, and attended by a standby person. 3482(d)

Concrete storage containers must have a conical bottom with mechanical or pneumatic means of starting the flow of the material. 3482(e)

Live Steam & Air Hoses

To prevent them from whipping out of the container, secure live steam and air hoses used to agitate liquids in vats and tanks.

Exception: manually held hoses with pipe lances. 3300(a)

Maintain steam and air hose connections in safe working condition. 3300(b)

Hot Pipes & Hot Surfaces

Where feasible, cover pipes and surfaces that pose a burn hazard with thermal insulating material. 3308

Drainage & Ventilation

Properly ventilate and drain trenches, tunnels, and pits inside buildings. 3309(a)

Tightly cover sewage tanks and sumps. Vent

fumes to the outside atmosphere away from workers. 3309(b)

Provide power ventilated exhaust hoods over pan washing tanks. 4538

Discharge Location

Locate the discharge openings from traps, drains, and blow-offs, and relief or vent discharges of tanks or other closed vessels containing harmful substances, so as not to endanger workers.

3310(a)

Do not release exhaust from internal combustion engines where it will be drawn into air compressors or air conditioning inlets. 3310(b)

Do not discharge condensed steam so as to create a safety hazard by reducing visibility around machines or on walkways. 3310(c)

Where dangerous concentrations of harmful substances cannot be diverted, provide workers with approved respiratory and personal protective equipment. 3310(d)

Flarebacks

The employer must:

- train one or more workers in safe lighting and re-lighting of fixed fire equipment
- make sure that only trained workers light or re-light the equipment

- require that fire boxes or combustion chambers are purged or vented before re-lighting
- provide lighting rods where appropriate
- locate valves and other controls so as to avoid endangering workers from flareback
- post instructions near the equipment.

3311

Entering Combustion Chambers

Do not allow workers to enter the shell or drum of a steam boiler or unfired steam pressure vessel until:

■ valves connected to the steam header or other source are closed and blinded

■ two valves are installed with a bleeder between them, the valves closed and the bleeder open

■ blow down valves and other valves on lines are closed and locked to prevent harmful material from flowing back into the boiler, and the key kept by the worker or supervisor. 3312(a)

Do not allow workers to enter a fire box, flue, or combustion chamber until:

■ the pilot light, fuel and steam lines are blinded, disconnected or closed with two block valves with open bleeder between them

■ there is no possibility of ignition of solid combustibles. 3312(b)

— Facilities & Storage —

Vats, Pans, Tanks

Install guards on all sides of containers or vessels that contain hazardous substances which a worker can fall into, and which have tops less than 36 inches above the work surface. Provide stops if carts or dump trucks are used to load such vessels. 3480(a)

Open containers less than 4 inches above the work surface must have four-inch toeboards which may be removed only during loading operations. 3480(b)

When workers are required to work directly over an open container, take one of the following precautions:

- Require workers to wear an approved safety belt and lifeline.
- Cover the container with a grate or grille.
- Install a walkway with standard railings and toeboards above the container.
- Suspend safety rope nets above the containers. 3480(c)

Bins, Bunkers, Hoppers

Bins, bunkers and hoppers with edges less than 36 inches above the working surface must be:

- guarded on all sides, or
- covered by a grating.

The openings in the grating may not be greater than 2 inches for grain and similar products. 3481(a)

The grating must be strong enough to withstand the load usually placed on it. 3481(b)

If the container is loaded by truck, provide stop bumpers at least 10 inches high on one edge. 3481(c)

Provide curbs at least 8 inches high to prevent vehicles from overrunning the sides of the runway. 3481(d)

If workers are required to work over an open container more than 8 feet deep, install a platform or walkway with standard railings and toeboards. 3481(e)

— Machinery & Tools —

Pressure Bottling Machines

Equip pressure bottling machines with an enclosure at the bottle-filling location that is designed to confine broken glass. When the bottling pressure exceeds 75 p.s.i., such enclosure shall be constructed of at least 12 U.S. standard gauge metal. 4540

Moulders

Hoppers on mechanical feed moulders that are connected to the proofer must prevent the worker's hands from coming into contact with inrunning rolls. 4546(a)

Hand fed moulders must have either a belt-feed device or a hopper extended high enough to prevent the operator's hands from getting into the feed rolls.

The top edge of the hopper must be well rounded. 4546(b)

Provide a stopping device within easy reach of the operator who feeds the moulder, and another stopping device within reach of the worker taking away the dough. 4546(c)

Where a removable crank is used to adjust a nut on the moulding drum for different loaf sizes, provide brackets on the side of the machine to hold the crank when not in use. Connect the brackets to a limit switch so that the machine will not operate unless the crank is placed on the brackets. 4546(d)

Bakery Ovens

Locate ovens away from lockers, lunch rooms, and other areas where people gather, so that an explosion or fire will not endanger groups of people. 4530(a)(1)

Provide main shutoff valves that function separately from any automatic valve.

Locate shutoff valves so that an explosion or fire will not prevent access to them. 4530(a)(2),(3)

Lock main shutoff valves in the closed position when workers enter the oven, or when the oven is not in use. 4530(a)(4)

Automatically controlled gas or oil fired equipment must have a safety pilot mechanism installed by the manufacturer. 4530(b)

In recirculating ovens the circulating fans must be interconnected with the burner so that fuel is shut off when the fan is not running. 4530(c)(1)

Protect the burner flame in recirculating ovens by a flame-sensitive safeguard that will shut off the fuel supply if the burner fails. 4530(c)(2)

Dumpbins & Blenders

Hinged dumpbin covers must be held securely in the open position while the dumpbin is in operation. 4531(a)

Dumpbin and blender hoods must be big enough to prevent circulation of flour dust in the work area. 4531(b)

Dumpbins with an edge more than 2 feet above the floor must be provided with a bag rest step. 4531(c)

Storage Bins

Use gaskets, locks, latches, or other equivalent devices to ensure that the bin cover is dust tight. 4532

Screw Conveyors

Except where drop or hinged bottom sections are provided, covers of screw conveyors must be removable and held on with clamps to keep them dust tight. 4533

Flour Sifter Enclosures

Construct enclosures of all types of flour sifters so that they are dust tight yet readily accessible for interior inspection. 4534

Trough Hoists

Provide safety catches for the chain so that the chain will hold the load in any position. 4535(a)

Use safety hooks. 4535(b)

Air Conditioning Units, Bread Coolers, Fermentation Rooms

The locks on units large enough to enter must be operable on both inside and outside. 4536

Steam Kettle Locking Devices

Steam kettles must be held in position by positive locking devices. 4537

Guarding Requirements & Protective Devices

Cake cutter (band knife): 4541

- blade guarded except operating edge
- use at least 20 U.S. standard gauge.

Candy cutter (roller): 4549

- cutter guard and safety bar.

Caramel slitter (circular knife): 4550

- knife guard and gravity or beltfeed.

Dividers:	4545	Ice breaker (crusher):	4556
■ guard shear and pinch points.		■ protective hopper.	
Dough brake:	4544	Ice cubing (scoring):	4555
■ guard rolls and all moving parts		■ enclosure at least 6 feet high.	
■ install stop-bar.		Meat chopper:	4553
Dough kneader (rotary):	4547	■ enclose knives or choppers.	
■ roll guard		Nougat cutter:	4551
■ power disengage control.		■ cover top half of knife or disc with hood.	
Food grinder (meat, fish, other):	4552	Pressure bottling:	4540
■ worm guards, grill interlock on hopper		■ enclosure around bottle.	
■ use pusher when feeding.		Slicer and wrapper:	4548
Food mixer (horizontal tilt):	4542 (a), (b)	■ loaf push device	
■ inoperative until lid in place		■ inoperative unless cover in place	
■ concurrent use of hands to operate.		■ access limit switch.	
Garbage disposal:	4559		
■ guard moving parts, positive emergency stop controls.			

— Index —

Abrading—24	Board drop hammers—24	Cold chamber machines—23-4	Dry kilns—36
Abrasive blasting—35	Body protection—7	Cold storage rooms—43	Dumpbins—45
Abrasive wheels—23	Bolters—41	Combustible dusts—9, 34-5	EDB (Ethylene Dibromide)—5, 8
Access—11	Bolter saws—41	Combustible liquid containers—14-15	Edge gluer jointers—41
industrial stairs—10-11	Booms—16	Combustible metals—34	Edgers—38
Accident prevention signs, tags—13	Boring machines—42	Combustion chambers—44	Electrical safety—20
Acetylene piping—31	Box shank cutoff saws—42	Compressed air, gas—22	Elevating work platforms—18
welding—29, 30	Bread coolers—45	Compressed cylinder gas—22	Emergency action plan—13
Acrylonitrile—5, 8	Brush/slash chippers—42	Compressed oxygen—22	Engines—19
Administrative requirements:	Buffing—24	Compressors—19	Equalizer saws—41
Cal/OSHA poster—5	Bunkers—44	booster pumps—31	Equipment rooms—11
medical recordkeeping—5	Cadmium—5, 8, 33-4	Confined spaces—9, 34	Exhaust emissions—8
recordkeeping, reporting—5	welding/cutting—27	welding—27	Exhaust systems—42
reporting asbestos use—5	Cake cutters—45	Contractor's saws—42	Exits—11, 37, 43
reporting carcinogen use—5	California cutoff saws—42	Conveyors, sawmill—37	Eye protection—7
Aerial devices—18	Candy cutters—45	hog mills—38	Face protection—7
Airborne contaminants—8	Caramel slitters—45	Cordwood saws—42	Fastener drivers—24
Air conditioning units—45	Carcinogens—5, 8-9	Core saws—41	Fermentation rooms—45
Air hoses, live steam—43	Carriages—37-8	Corrosive liquids—9	Fire alarms—13
Air lift hammers—24	Chain saws:	Cranes—16-17	Fire control—15
Aisles—10	electric—24	Crawlways—10	Fire detection—13
Alligator shears—24	hydraulic—24	Creosote—8	Fire extinguishers—12-13
Arsenic, inorganic—5, 8	pneumatic—44	DBCP (1,2 Dibromo-3-Chloropropane)—5, 8	cranes—16
Asbestos—5, 8, 9	Chip bins—37	Degreasing—35	flammable liquids—34
Back-pressure valves—31	Chippers—11	Derricks—16-17	tank vehicles—15
Bakery ovens—45	Circular crosscut saws—42	Die casting machines—23-4	welding/cutting—28
Band knives—42	Circular head rigs—40	Dies—25	Fire extinguishing systems—12-13
Band saws—39, 42	Circular knives—42	Diesetting—25	Fire protection—12-13
Band saw wheels—39	Circular metal cutting saws—24	Discharge location—44	welding/cutting—28
Barkers—37	Circular rip saws—42	Dividers—46	Fire watchers—28
Barking, peeling pits—40	Circular saws—39	Dough brakes—46	First aid—7
Bar stock machines—24	cracks—39	Dough kneaders—46	Flammables:
Belt and pulley guards—19, 20	hand-held powered—24	Drainage and ventilation—43-4	liquids—9
Belt shifters—19	portable power—25	Drills, powered—24	liquid containers—14-15, 34
Belt tighteners—19	Circular shake saws—41	Drop hammers—24	storage—14-16
Bins—44	Clippers—41	Drop trimmer saws—39	vapors—9, 34
storage—45	Clip saws—41		Flarebacks—44
Blenders—45	Coke oven emissions—5, 8, 33		Flour sifters—45

- Fluorides, welding/cutting—27
- Fly wheels—19
- Foot protection—7
- Forging—35
 - machines—24
- Fuel-gas:
 - cylinders—29
 - hoses—30
 - manifolds—29-30
- Fuel houses—37
- Fumigation—22
- Gang saws—40
- Gantry trucks—17-18
- Garbage disposal—46
- Grinders—23, 25
 - angle—24
 - food—46
 - metal—23
 - portable—23, 25
- Guarding, general—19-20
 - (see specific tool, machine, vehicle listing for guarding requirements)
- Guardrails—10
 - carriages—37-8
 - lift trucks—17
 - platform decks—18
- Hand protection—7
- Hand tools—19
 - special hand tools—20
- Hazardous materials and conditions—8, 32
- Head protection—7
- Head saws—40
- Hearing protection—7
- Hog mills—38, 42
- Hoists—16-17
- Hoppers—37, 44
- Horizontal pull saws—42
- Hot chamber machines—23-4
- Ice breakers—46
- Ice cubing—46
- Industrial trucks—17
 - elevating workers—17
- Injury and illness prevention program—6
- Jacks—25
- Jig saws—24, 25
- Jointers—42
- Jump saws—40
- Knee bolter saws—41
- Ladders—21
- Ladling—24
- Laminate trimmers—25
- Lathes—41
 - automatic—42
- Lath machines—41
- Lath mills—41
- Lead—32-3
- Lifelines—7
- Lighting—12
- Live rolls—36
- Live steam, air hoses—43
- Lockout/blockout—20
- Log decks—36
- Log hauls—37
- Loose material—14, 43
- Low pressure tanks—16
- Machinery requirements, general—23
- Matchers—42
- Material safety data sheets—6
- Material storage, handling—14
- MBOCA (4,4'-Methylene bis (2-Chloroaniline))—5, 8
- Meat choppers—46
- Metal embossing machines—24
- Methylenedianiline(MDA)—5,8,34
- Mixers, food—46
- Mobile ladder stands—21
- Mortising machines—42
- Moulders—42, 45
- Nibblers—25
- Noise—7
- Nougat cutters—46
- Outlet headers—30
- Overhead swing saws—40
- Oxygen:
 - liquid—30
 - manifolds—30
 - pipng—31
- Pallets—11
- Pans—26-7, 44
- Patch machines—41
- Pentachlorophenol—8
- Percussion tools—24
- Personal protective equipment—7
 - abrasive blasting—35
 - cadmium—33
 - coke oven emissions—33
 - discharge location—44
 - lead—32
 - MDA—34
 - spray degreasing—35
 - welding—27
 - wood preservatives—8
- Pipe lines—32
- Piping—31-2
- Planers—24, 25, 42
- Platform decks—18
- Platforms, elevated work—18
- Plywood plants—40
- Pneumatic tools—25
- Point-of-operation guards—20, 26
- Polishing—24
- Power-driven hammers—24
- Power tools—19, 24-5
- Presses—26, 40
 - electrical—26
 - hand-operated levers—26
 - hot trimming—26
 - hydraulic forging—26
 - mechanical—26
 - point-of-operation guards, devices—26
 - two-hand trip—26
- Pressure bottling machines—45, 46
- Pressure regulators—30
- Pressure vessels—16
 - salvaging—22
- Process machine power control—18
- Pulleys:
 - composition, wood—19
 - guards—19-20
 - on line shaft, countershaft—19
- Radial arm saws—42
- Radiant energy protection—7
- Reciprocating saws—25
- Recordkeeping and reporting requirements—5
 - cadmium—33-4
 - carcinogens, asbestos—5
 - coke oven emissions—33
 - MDA—34
 - medical recordkeeping—5
 - ventilation rate—11-12
 - worker access to medical, exposure records—6
- Refrigerator vehicles—43
- Respiratory protection—7
 - abrasive blasting—35
 - asbestos—8-9
 - cadmium—33
 - coke oven emissions—33
 - confined spaces—9
 - discharge location—44
 - fumigation—22
 - spray coating—35
 - welding/cutting—27
 - wood preservatives—8
- Roll cases—36
- Routers—25
- Saber saws—25
- Safety belts:
 - confined spaces—9
 - elevating work platforms—18
 - fall arresting—7
 - fall preventing—7
 - fuel houses, chip bins, hoppers—37
 - hog mills—38, 42
 - lift trucks—17
 - loose material—14, 43
 - platform decks—18
 - vats, pans, tanks—44
- Sanders—41
 - belt—24, 42
 - disc—24, 25, 42
 - drum—42
 - elbow—42
 - platen—25
 - portable—25
- Sanitation—12
- Sawmills—36
- Sawyer—37, 40
- Scaffolds—21
- Scissors lift—41
- Screw conveyors—19, 45
- Scroll saws—25
- Shapers—42
- Shingle jointers—41
- Shingle mills—41
- Shingle saws—41
- Shotgun feed carriage drive—38
- Signs—13, 32
- Slasher saws—39, 40
- Slicers—41
- Slicer/wrappers—46
- Slings—20-1
- Splitters—41, 42
- Spray coating—35
- Spray gun, airless—25
- Squaring shears—24
- Stairs, industrial—10-11
- Steam kettles—45
- Stickers—42
- Storage cabinets—14
- Stripsaws—41
- Swing cutoff saws—42
- Tags—13
- Tanks—26-7, 34, 44
 - atmospheric—16
 - low pressure—16
- Tappers—25
- Tenoning machines—42
- Toeboards—10, 44
- Toilets—12
- Tray systems—40
- Trimmer saws—40
- Trough hoists—45
- Tumbling barrels—24
- Underhung saws—39, 40
 - underhung swing cutoff saws—42
- Vats—26-7, 34, 44
- Veneer glue spreaders—40
- Veneer Lathes—40
- Veneer Plants—40
- Ventilation—11-12
 - asbestos—8
 - confined spaces—9
 - flammable liquids—9
 - flammable vapors—9
 - spray coating—35
 - welding/cutting—27
- Vinyl chloride—5, 8
- Walkways—10
- Water supply—12
- Welding/cutting—27
 - arc welding—28
 - cadmium—27
 - compressed gases—29
 - electric welding—28
 - fire prevention—28
 - fire watchers—28
 - fluoride fluxes—27
 - gas systems piping—31
 - gas welding/cutting—29
 - hose—30
 - liquid acetylene—29, 30
 - resistance welding—28-9
 - ventilation—27
- Wire drawing machines—24
- Wobble saws—42
- Wood chippers—39-40
- Wood preservatives—8
- Woodworking machines, combination—42