



Common Sense Initiative

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Business Impact Analysis

Agency Name: Ohio Bureau of Workers' Compensation

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Regulation/Package Title: Specific Safety Requirements of the Ohio Bureau of Workers' Compensation for Construction

Rule Number(s): Chapter 4123:1-3 of the Administrative Code (24 rules)

Date: July 23, 2019

Rule Type:

- New
 Amended

- 5-Year Review
 Rescinded

The Common Sense Initiative is established in R.C. 107.61 to eliminate excessive and duplicative rules and regulations that stand in the way of job creation. Under the Common Sense Initiative, agencies must balance the critical objectives of all regulations with the costs of compliance by the regulated parties. Agencies should promote transparency, responsiveness, predictability, and flexibility while developing regulations that are fair and easy to follow. Agencies should prioritize compliance over punishment, and to that end, should utilize plain language in the development of regulations.

Regulatory Intent

1. Please briefly describe the draft regulation in plain language.

Please include the key provisions of the regulation as well as any proposed amendments.

The purpose of this chapter 4123:1-3 of the Administrative Code is to provide safety for life, limb, and health of employees. The specific requirements of this code are requirements upon an employer for the protection of such employer's employees in construction operations subject to the Workers' Compensation Act (Sections 4123.01 to 4123.99 of the Revised Code).

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The rules of Chapter 4123:1-3 are due for five-year rule review under Section 119.032 of the Revised Code. The rule review date for the rules is October 1, 2019. BWC performed a five-year rule review of the rules in 2014, at which time BWC amended five of the rules and filed nineteen without changes. Legal Operations reviewed the content of the rules and have identified the changes to the rules indicated below.

Amended rules:

- 4123:1-3-01 Scope and definitions.
- 4123:1-3-03 Personal protective equipment.
- 4123:1-3-04 Floors, stairways, railing, overhead protection and guarding of open-sided floors, platforms and runways.
- 4123:1-3-05 Mechanical power transmission apparatus.
- 4123:1-3-06 Motor vehicles, mechanized equipment and marine operations.
- 4123:1-3-07 Cranes, hoists, and derricks.
- 4123:1-3-10 Scaffolding.
- 4123:1-3-11 Ladders.
- 4123:1-3-13 Trenches and excavations.
- 4123:1-3-16 Tunnels and shafts, caissons, cofferdams, and compressed air.
- 4123:1-3-18 Heating, ventilating and exhaust equipment.
- 4123:1-3-20 Steel erection.
- 4123:1-3-21 Diving operations.
- 4123:1-3-22 Woodworking machines, power saws, and other tools and equipment.
- 4123:1-3-23 Helicopters.
- 4123:1-3-24 Roof car suspended platforms – construction.

No Change rules:

- 4123:1-03-02 Temporary Storage and Disposal.
- 4123:1-03-08 Ropes, chains and slings.
- 4123:1-03-09 Roofing devices.
- 4123:1-03-12 Portable explosive-actuated fastening tools.
- 4123:1-03-14 Electrical conductors, wires, and equipment.
- 4123:1-03-15 Explosives and blasting.
- 4123:1-03-17 Cutting and welding.
- 4123:1-03-19 Demolition.

2. Please list the Ohio statute authorizing the Agency to adopt this regulation.

Article II, Section 35 Ohio Constitution and Sections 4121.12, 4121.121, 4121.13, and 4121.47 of the Revised Code

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- 3. Does the regulation implement a federal requirement? Is the proposed regulation being adopted or amended to enable the state to obtain or maintain approval to administer and enforce a federal law or to participate in a federal program?**

If yes, please briefly explain the source and substance of the federal requirement.

No.

- 4. If the regulation includes provisions not specifically required by the federal government, please explain the rationale for exceeding the federal requirement.**

The Specific Safety Requirements (SSR) are particular to the State of Ohio and governed solely by state law.

- 5. What is the public purpose for this regulation (i.e., why does the Agency feel that there needs to be any regulation in this area at all)?**

The public purpose for these rules is workplace safety. An employer's violation of a specific safety rule can lead to an additional award for the injured worker (VSSR award). BWC bills the VSSR award to the employer as a penalty. The Ohio Constitution, Article II, Section 35, emphasizes safety, stating that the workers' compensation board "shall set aside as a separate fund such proportion of the contributions paid by employers as in its judgment may be necessary, not to exceed one per centum thereof in any year, ... to be expended by such board ... for the investigation and prevention of industrial accidents and diseases." The board also shall "determine whether or not an injury, disease or death resulted because of the failure of the employer to comply with any specific requirement for the protection of the lives, health or safety of employees [sic], enacted by the General Assembly or in the form of an order adopted by such board, ..." A finding of such violation permits the Industrial Commission to increase the injured worker's compensation by "such amount as shall be found to be just, not greater than fifty nor less than fifteen per centum of the maximum award established by law," and "the premium of such employer shall be increased in such amount, covering such period of time as may be fixed, as will recoup the state fund in the amount of such additional award"

- 6. How will the Agency measure the success of this regulation in terms of outputs and/or outcomes?**

These rules continue to enforce safety for employees and employer compliance. As such, these rules encourage workplace safety. The Bureau is measuring such success by the amount of applications submitted for additional awards due to violations of these rules.

Development of the Regulation

- 7. Please list the stakeholders included by the Agency in the development or initial review of the draft regulation.**

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If applicable, please include the date and medium by which the stakeholders were initially contacted.

The review process took place over multiple dates from January 2019 through April 2019 by way of personal phone conversations, electronic document review and email correspondence with the stakeholders listed below.

Chapter 4123:1-3 Construction Review Committee – 2019

Mr. Scott McCormick from the Danis Group of Companies

Mr. Bryan C. Williams from ABC Associated Builders and Contractors Inc.

Mr. Shane Van Bibber from Builders Exchange of Central Ohio (BX)

Mr. Mark Potnick from Ohio Contractors Association (OCA)

Mr. Dennis Underwood from Ohio Laborer’s Training & Apprenticeship Trust Fund

8. What input was provided by the stakeholders, and how did that input affect the draft regulation being proposed by the Agency?

The stakeholders reviewed all chapters of Rule 4123:1-3 Construction Codes. There are a total of one hundred and three (103) recommended changes as outlined in the attached change summary form. Many of these changes are minor or typographical errors. Others are more functional. All stakeholders agreed with recommended changes and noted no additional changes or updates needed

9. What scientific data was used to develop the rule or the measurable outcomes of the rule? How does this data support the regulation being proposed?

The Bureau did a side by side cross reference of the Ohio Administrative Code Specific Safety Requirements and the following publications:

- OSHA General Industry Standards – 29 CFR 1910
- OSHA Construction Standards – 29 CFR 1926
- Related ANSI, NEC and NFPA

10. What alternative regulations (or specific provisions within the regulation) did the Agency consider, and why did it determine that these alternatives were not appropriate? If none, why didn’t the Agency consider regulatory alternatives?

The stakeholders consider both the Ohio Administrative Code (OAC) and the aforementioned references to be comparable in providing safety for life, limb, and health of employees engaged in activities in the Construction Industry.

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11. Did the Agency specifically consider a performance-based regulation? Please explain.

Performance-based regulations define the required outcome, but don't dictate the process the regulated stakeholders must use to achieve compliance.

Because of the technical nature of these rules, this process is not applicable to these rules.

12. What measures did the Agency take to ensure that this regulation does not duplicate an existing Ohio regulation?

OAC Chapter 4123:1-1 is the only rule used in adjudication of additional award claims with respect to the construction industry.

13. Please describe the Agency's plan for implementation of the regulation, including any measures to ensure that the regulation is applied consistently and predictably for the regulated community.

The rules will be implemented through the Joint Committee on Agency Rules Review (JCARR) process. Enforcement of the rules is through the Ohio Industrial Commission, as assisted by reports from the BWC Safety Violation Investigation Unit.

Adverse Impact to Business

14. Provide a summary of the estimated cost of compliance with the rule. Specifically, please do the following:

a. Identify the scope of the impacted business community;

The specific requirements of this code are requirements upon an employer for the protection of such employer's employees and no others and apply to all construction industry subject to the Workers' Compensation Act (Sections 4123.01 to 4123.99 of the Revised Code).

b. Identify the nature of the adverse impact (e.g., license fees, fines, employer time for compliance); and

If an injured worker suffers an injury as a result of an employer's violation of a safety rule, the Industrial Commission can add from 15% to 50% to the injured worker's compensation, which is billed to the employer as a penalty or fine.

c. Quantify the expected adverse impact from the regulation.

The adverse impact can be quantified in terms of dollars, hours to comply, or other factors; and may be estimated for the entire regulated population or for a "representative business." Please include the source for your information/estimated impact.

The expected adverse impact from this regulation varies from case to case, therefore, it is not possible to quantify the exact impact of any factors. If an injured worker's claim results from an employer's violation of one of these rules, the employer must pay an additional penalty to the injured worker.

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15. Why did the Agency determine that the regulatory intent justifies the adverse impact to the regulated business community?

To comply with safety measures for Ohio workers, BWC is mandated under Ohio State Law to develop safety regulations for Ohio employers.

Regulatory Flexibility

16. Does the regulation provide any exemptions or alternative means of compliance for small businesses? Please explain.

There are no exemptions or alternative means of compliance, because these rules govern Specific Safety Requirements (SSR). Specific compliance is mandated by statute and rule.

17. How will the agency apply Ohio Revised Code section 119.14 (waiver of fines and penalties for paperwork violations and first-time offenders) into implementation of the regulation?

Not applicable under OAC 4123-3-20 Additional Awards by reason of Violations of Specific Safety Requirements (VSSR). There are no waiver provisions because these rules protect the safety of employees.

18. What resources are available to assist small businesses with compliance of the regulation?

BWC's Division of Safety & Hygiene (DSH) provides the following resources to obtain compliance, at no direct cost to the employer.

- DSH provides a broad spectrum of services including [technical support](#), [library services](#), [educational services](#) and [publications](#).
- Additional resources include our [Ohio Safety Congress & Expo](#), the largest regional safety and health exhibition in the United States and the [Ohio safety councils](#), which provide a forum for occupational safety and health information in local communities.
- Financial resources are available through the [SafetyGRANTS\\$ program](#), which provides matching safety intervention grants to eligible employers for the purchase of equipment that may substantially reduce or eliminate workplace injuries and illnesses.
- The [OSHA On-Site Consultation Program](#) provides consultation services to small employers in high-hazard industries.
- Employer management services blend traditional risk and safety management approaches to controlling workers' compensation costs. Employer management services are dedicated to working with employers to prevent workplace injury and illness claims and to control claims costs if they do occur.
- The employers' workers' compensation premium includes the cost of our services. As a result, employers invest their safety dollars in prevention.
- The Ohio legislature established DSH as a consultative service to inform, educate and assist employers in loss-prevention activities.

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Amend

4123:1-3-01 Scope and definitions.

(A) Scope.

The purpose of this chapter of the Administrative Code is to provide safety for life, limb and health of employees engaged in construction activity. In cases of practical difficulty or unnecessary hardship, the Ohio bureau of workers' compensation may grant exceptions from the literal requirements of this chapter to permit the use of other devices or methods when it is clearly evident the equivalent protection is thereby secured.

Activities within the scope of this chapter, generally referred to herein as "construction", include the demolition, dismantling, excavation, construction, erection, alteration, repair, painting, decorating, glazing, cleaning, and pointing of buildings and other structures and the installation of machinery or equipment and all operations in connection therewith; the excavation, construction, alteration and repair of subways, sewers, tunnels, trenches, caissons, conduits, pipelines, roads and all operations pertaining thereto; the moving of buildings, signs, and other structures, and to the construction, alteration, repair, or removal of wharfs, piers, abutments, or any other construction, alteration, repair, or removal work carried on, in, about, or over water.

This chapter covers construction activities of employees whose employer engages in such work as its principal business. It also covers employees of other employers when the activities are performed in the course of new construction or substantial reconstruction of all or part of an existing structure, as well as substantial demolition or razing of an existing structure, but does not cover employees of such other employers when the activities are performed in the ordinary course of maintenance work.

This chapter shall not apply to the electric utility industry and contractors and subcontractors when engaged in the installation and maintenance of electric supply lines and/or the transmission and distribution of electric power in such lines between the outlet of the generating station and the outlet side of the meter through which such power is measured to a retail customer.

Installations, construction equipment or constructions built or contracted for prior to the effective date of any specific requirement (shown at the end of each rule) shall be deemed to comply with the provisions of this chapter if such installations or constructions comply either with the provisions of this chapter or with the provisions of any applicable chapter which was in effect prior to said date.

(B) Definitions.

- (1) "Air contaminants" means hazardous concentrations of fibrosis-producing or toxic dusts, toxic fumes, toxic mists, toxic vapors, or toxic gases, or a combination of these, suspended in the atmosphere.
- (2) "Approved" means ~~accepted or certified by a nationally recognized testing agency, such as "Underwriters' Laboratories," "Factory Mutual Engineering Corporation," or a responsible governmental agency~~ sanctioned, endorsed, accredited, certified, or accepted as satisfactory by a duly constituted and nationally recognized authority or agency.
- (3) "Danger zone" means the point of operation where a known critical hazard exists.

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- (4) "Department, division, section or group" means a number of employees that are a separate part or branch of a government, business, school or other organization, classified together because of a common characteristic or function.
- (5) "Equipment" means and includes all machinery, tools, mechanical devices, derricks, hoists, conveyors, scaffolds, platforms, runways, ladders and related safeguards and protective construction used in connection with construction operations.
- (6) "Equivalent" means alternative design, features, or strength which will provide an equal or greater degree of safety.
- (7) "Exposed to contact" means that the location of the material or object during the course of operation is accessible to the employee in performance of his regular or assigned duty.
- (8) "Factor of safety" means the ratio between the ultimate breaking stress and the working stress of the material, structure or device. For example, the term "factor of safety of four" means that the material, structure or device shall be constructed of such strength that the maximum load will be one-fourth the designed ultimate breaking load. Where other factors of safety appear they shall apply in the same manner. The standards of the "American Society for Testing and Materials" (ASTM) shall be used in determining the strength of material except as otherwise provided herein.
- (9) "Fire-resistant" means material or construction which resists failure because of high temperatures and which prevents or retards the passage of high temperatures, hot gases, or flames.
- (10) "Ground connection" means the equipment used in establishing a path between an electric circuit or equipment and earth. A ground connection consists of a ground conductor, a ground electrode and the earth which surrounds the electrode.
- (11) "Grounded" means connected to earth or to some extended conducting body which serves instead of the earth whether the connection is intentional or accidental.
- (12) "Grounded effectively" means permanently connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to prevent the building up of voltages which may result in undue hazard to connected equipment or to employees.
- (13) "Guard" means the covering, fencing, railing or enclosure which shields an object from accidental contact.
- (14) "Guarded" means that the object is covered, fenced, railed or otherwise shielded from accidental contact.
- (15) "Hazardous concentrations" (as applied to air contaminants) means concentrations which are known to the employer to be in excess of those which would not normally result in injury to an employee's health if the employee had not been previously exposed to such air contaminants.
- (16) "Lanyard" means a flexible line rope, wire rope, or strap which generally has a connector at each end for connecting the body belt or body harness to a life line or anchorage.
- (17) "Operator" means any person authorized to operate the specific equipment.
- (18) "Pinch (or shear) point" means any point at which it is possible to be caught between the moving parts of a machine, or between the moving and stationary parts of a machine, or between the materials and the

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moving part or parts of a machine.

- (19) "Point of operation" means the point or points at which material is placed in or removed from the machine.
- (20) "Protective equipment" means any appliance used or required to be used to prevent injury to employees.
- (21) "Provide" means to make available.
- (22) "Rope, wire (haulage)" means a wire rope which is to be used only on inclined planes, for dragging objects along the ground and only where the rope is not subjected to repeated bending.
- (23) "Rope, wire (hoisting)" means wire rope to be used on cranes, derricks, dredges, draglines and power shovels in lifting operations.
- (24) "Securely fastened" means that the object or thing referred to shall be substantially fixed in place.
- (25) "Shall" shall be construed as mandatory.
- (26) "Standard guardrail" means a substantial barrier, constructed in accordance with paragraph (E) of rule 4123:1-3-04 of the Administrative Code.
 - (a) "Top rail" means the top lateral member of a standard guardrail.
 - (b) "Intermediate rail" means the lateral member or members of a standard guardrail, installed at intervals of no more than twenty-one inches.
- (27) "Structure" means that which is built or constructed, an edifice or building of any kind, or any piece of work artificially built up or composed of parts joined together in some definite manner.
- (28) "Substantial" means construction of such strength, of such materials, and of such workmanship that the object will withstand the wear, usage or shock for which it is designed.
- (29) "Toeboard" means a vertical barrier at floor level erected along the exposed edges of a floor opening, platform, runway, or ramp to prevent falls of material.
- (30) "Walkway" means a cleared passageway for ingress and egress for employees, between two given points.
- (31) "Wall opening" means an opening ~~in a wall from which there is a clear drop of six feet or more, and shall include openings giving access to yardarms, or block and tackle, doorways and other openings thirty inches or more in height and eighteen inches or more in width, the sill or lower edge of which is within eighteen inches of the floor or platform level. Open sides of buildings between columns, girders, or piers shall not be considered as wall openings~~ no less than eighteen inches in its horizontal dimension in any wall, where the outside bottom edge of the wall opening is six feet (1.8 m) or more above lower levels and the inside bottom edge of the wall opening is less than thirty-nine inches (1.0 m) above the walking/working surface, shall be protected from falling by the use of a guardrail system, a safety net system, or a personal fall arrest system.

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No Change

4123:1-3-02 Temporary storage and disposal.

(A) Reserved.

(B) Reserved.

(C) Temporary storage.

- (1) All materials stored in tiers shall be stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling or collapse.
- (2) Material stored inside buildings under construction shall not be placed within six feet of any hoistway or inside floor openings, nor within ten feet of an exterior wall which does not extend above the top of the material stored.
- (3) Bagged materials shall be stacked by stepping back the layers and cross-keying the bags at least every ten bags high.
- (4) Lumber piles shall not exceed twenty feet in height provided that lumber to be handled manually shall not be stacked more than sixteen feet high.
- (5) Structural steel, poles, pipe, bar stock, and other cylindrical materials, unless racked, shall be stacked and blocked so as to prevent spreading or tilting.

(D) Disposal.

- (1) During the course of construction, alteration, or repairs, form and scrap lumber with protruding nails, and all other debris shall be kept cleared from work areas, passageways, and stairs, in and around buildings or other structures.
- (2) Containers shall be provided for the collection of waste, trash, oily and used rags, and other refuse. Containers used for oily, flammable, or hazardous wastes, such as caustics, acids, harmful dusts, etc., shall be equipped with covers.

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4123:1-3-03 Personal protective equipment.

(A) Scope.

The requirements of this rule relate to the personal protective equipment listed immediately below, as required for employees on operations described in this rule in which there is a known hazard, recognized as injurious to the health or safety of the employee.

- (1) Eye and face protection.
- (2) Foot (toe) protection.
- (3) Respiratory protection - includes respirators, masks, canister type masks, supplied-air helmets, etc., for protection of the respiratory system from inhalation of particulate matter, noxious gases and vapors, and oxygen deficiency. Although this rule does not cover engineered protective measures (for example, ventilation), exposure control shall be accomplished as far as is feasible by accepted engineering methods before considering or instituting use of respirators (see rule 4123:1-3-18 of the Administrative Code).
- (4) Head and hair protection - includes all operations where employees are required to be present in areas where a hazard to their head exists from falling or flying objects, or from physical contact from rigid objects, or from exposures where there is a risk of injury from electrical shock or hair entanglement.
- (5) Protective clothing.
- (6) Hearing protection.
- (7) Safety belts, body harness lifelines and lanyards.
- (8) Seat belts.
- (9) Safety nets.
- (10) Working over or near water.

(B) Definitions.

- (1) "Head protection devices" means any device that meets the American National Standards Institute (ANSI) Z89.1- 1997, "American National Standard for Personnel Protection-Protective Headwear for Industrial Workers- Requirements," or any revisions to that standard.
 - ~~(a) (a) "Bump cap or hat" means a thin-shelled plastic headgear worn to provide protection to the head from bumps or lacerations but does not meet the requirements for protective helmets.~~
 - ~~(b) (b) "Crown straps" means that part of the suspension which passes over the head.~~
 - ~~(c) (c) "Hair enclosure" means a hat or cap (other than a protective helmet or bump cap) or a hair net specifically designed to protect the wearer from hair entanglement in moving parts of machines, equipment, or where there is exposure to sparks, hot metal, or ignition.~~

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~~(d) (d) "Protective helmet" means a rigid headgear also known as a safety or hard hat, or as a safety or hard cap that is worn to provide protection for the head, or portions thereof, against impact, flying particles, or electrical shock, or any combination thereof; and which is held in place by a suitable suspension.~~

~~(e) (e) "Suspension" means the internal cradle of a protective helmet or bump cap which holds it in place on the head and is made up of the head band and crown straps.~~

(2) "Lanyard" means a flexible line of rope, wire rope, or strap which generally has a connector at each end for connecting the body belt or body harness deceleration device to a life line or anchorage.

(3) "~~Vertical~~ Lifeline" means a ~~rope, suitable for supporting one person, to which a lanyard or safety belt (or harness) harness~~ harness is attached component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall arrest system to the anchorage.

(4) "O.D." means optical density and refers to the light refractive characteristics of a lens.

(5) "Radiant energy" means energy that travels outward in all directions from its sources.

(6) "Respiratory devices" means:

(a) "Air-purifying device respirator" means a ~~device which removes contaminants from the atmosphere and can be used only in atmospheres containing sufficient oxygen to sustain life (at least nineteen and one-half per cent by volume at sea level) and within specified concentration limitations of the specific device respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.~~

~~(i) (i) "Mechanical filter respirator" means a device which provides respiratory protection against particulate matter, such as non-volatile dusts, mists, or metal fumes.~~

~~(ii) (ii) "Chemical cartridge respirator" means a device which provides respiratory protection against certain gases and vapors in concentrations not in excess of one-tenth per cent by volume.~~

~~(iii) (iii) "Gas mask" means a device which provides respiratory protection against certain specific gases and vapors in concentrations up to two per cent by volume or as specified on the canister label and against particulate matter.~~

(b) Assigned protection factor (APF) means the workplace level of respiratory protection that a respirator or class of respirators is expected to provide to employees when the employer implements a continuing, effective respiratory protection program as specified by this section.

(c) Atmosphere-supplying respirator means a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

(d) Canister or cartridge means a container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container.

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(e) Demand respirator means an atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation

(f) Escape-only respirator means a respirator intended to be used only for emergency exit.

(g) Filter or air purifying element means a component used in respirators to remove solid or liquid aerosols from the inspired air

(h) Filtering facepiece (dust mask) means a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium

(i) Positive pressure respirator means a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator

(j) Powered air-purifying respirator (PAPR) means an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering

(k) Supplied-air respirator (SAR) or airline respirator means an atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user

~~(b)(b) "Supplied-air device" means a device which delivers breathing air through a supply hose connected to the wearer's facepiece.~~

~~(e)(l) "Self-contained breathing apparatus (SCBA)" means a device which provides complete breathing protection for various periods of time based on the amount of breathing air or oxygen supplied and the breathing demand of the wearer. The basic types of self-contained breathing apparatus are: an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user~~

~~(i)(i) Closed-circuit devices (rebreathers):~~

~~(a)(a) Compressed oxygen type.~~

~~(b)(b) Chemical oxygen type.~~

~~(c)(c) Liquid oxygen type.~~

~~(ii)(ii) Open-circuit devices:~~

~~(a)(a) Demand type.~~

~~(b)(b) Pressure demand type.~~

~~(7) "Safety Body belt or harness" means a device, worn around the body, which, by reason of its attachment to a lanyard and lifeline or a structure, will prevent an employee from falling strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device.~~

(8) "Body harness" means straps which may be secured about the employee in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and shoulders with means for attaching it to other components of a personal fall arrest system

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(C) Specific requirements of general application.

- (1) Personal protective equipment furnished by the employer shall be issued to the employee in sanitary and proper condition so that it will effectively protect against the hazard involved.
- (2) Where employees provide their own protective equipment, such equipment shall give equal or greater protection than that furnished by the employer.

(D) Eye and face protection.

(1) Responsibility.

The employer shall provide eye protection for all employees engaged in the operations listed in paragraph (D)(2) of this rule and exposed to an eye hazard. Eye protection shall also be provided for any other employees required to work in the immediate area and who are exposed to the hazards of the operations listed. It shall be the responsibility of the employee to use the eye protection provided by the employer (see sections 4101.12 and 4101.13 of the Revised Code). (See also appendix to paragraph (D) of this rule for "Eye and Face Protector Selection Guide".)

(2) Operations requiring eye protection.

(a) Eye protection shall be provided to employees performing the following operations:

- (i) When using hand tools or mechanical equipment to cut, chip, drill, clean, buff, grind, polish, shape, or surface masonry, plaster, stone, plastics, or other hardened substances. This also covers demolition work where the materials listed are part of the operation;
- (ii) Where acids, sand or shot blast are used in building cleaning operations;
- (iii) Welding or cutting operations involving the use of gas flames or electric arc. For all electric welding operations the employer shall provide suitable helmets, hoods, or hand shields. (See appendix to this rule);
- (iv) Where portland cement or similar dust-producing material is taken from an elevated bin, hopper, or similar structure by a chute;
- (v) All spray paint operations where the employee's eyes are exposed to paint mist in the atmosphere;
- (vi) All sand or shot blast operations where the employee's eyes are exposed to the blasting;
- (vii) In the handling of molten metal, hot tars, hot pitch, hot asphalt, hot plastic, or similar hot substances;
- (viii) Dressing grinding wheels;
- (ix) Cleaning operations where wire wheels are used;
- (x) In handling injurious acids, alkalis, or other chemicals;
- (xi) When working in close proximity to a laser beam in excess of five milliwatts;
- (xii) Cutting, drilling, turning, planing, jointing, and sanding of wood with power tools;

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(xiii) Operations of portable explosive-actuated fastening tools and portable pneumatically powered fasteners;

(xiv) Operations requiring the use of compressed air for cleaning purposes.

(b) This rule does not apply where a shield or exhaust equipment provides adequate eye protection for employees otherwise exposed to the hazards covered in paragraphs (D)(2)(a)(i) to (D)(2)(a)(xiv) of this rule.

(3) Face shields.

Face shields may be used only in conjunction with safety glasses and/or goggles where additional protection for the face is necessary.

(4) Material requirements for eye and face protection shall meet ANSI Z87.1 - 1968 or any revisions to that standard.

(5) Laser protection.

The employer shall provide laser safety goggles which will protect the employee from direct or reflected laser light equal to or greater than 0.005 watts (five milliwatts) per square centimeter. The laser safety goggles shall provide protection for the specific wavelength of the laser and be of optical density (O.D.) adequate for the energy involved. Table 3-3 lists the maximum power or energy density for which adequate protection is afforded by glasses of optical densities from five through eight. Output levels falling between lines in this table shall require the higher density.

(a) Labeling of eye protection.

All protective goggles shall bear a label identifying the following data:

(i) The laser wavelength for which use is intended;

(ii) The optical density of those wavelengths;

(iii) The visible light transmission.

(b) Labeling of laser equipment.

The employer shall furnish equipment provided with labels containing the following minimum information for continuous-wave (cw) lasers:

(i) Wavelength or wavelength range;

(ii) Emergent beam size;

(iii) Beam divergence;

(iv) Maximum average power output;

(v) Maximum emergency beam irradiance;

(vi) Manufacturer's name and address;

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(vii) Product identification number.

(c) Posting.

The employer shall post [standard laser warning placard](#) notices in prominent locations in which lasers are being operated. (For examples see appendix to this rule.)

(d) Beam shutters or caps shall be utilized, or the laser turned off, when laser transmission is not actually required. When the laser is left unattended for a substantial period of time, such as during lunch hour, overnight or at change of shifts, the laser shall be turned off.

(e) Atmospheric conditions.

When it is raining or snowing, or when there is dust or fog in the air, the operation of laser systems shall be prohibited where practicable; in any event, employees shall be kept out of range of the area of source and target during such weather conditions.

~~The employer shall require the employee to keep away from the source, range and target of the laser when there is exposure to rain or snow or when there is dust or fog in the air.~~

(E) Foot (toe) protection.

Foot protection shall be worn by the employee where an employee is exposed to machinery or equipment that represents a foot hazard or where an employee is handling material which presents a foot hazard. Safety-toe footwear for employees shall meet the requirements and specifications in American National Standard for Men's Safety-Toe Footwear, Z41.1-1967 or any revisions of that standard.

(F) Respiratory equipment.

(1) The employer shall furnish approved respiratory equipment where there are air contaminants as defined in paragraph (B)(1) of rule 4123:1-3-01 of the Administrative Code. It shall be the responsibility of the employee to use the respirator or respiratory equipment provided by the employer, guard it against damage and report any malfunction to the employer (see sections 4101.12 and 4101.13 of the Revised Code). Note: See appendix to this rule for basic guides for the selection of respirators.

(2) This requirement does not apply where an effective exhaust system or other means of equal or greater protection has been provided.

(G) Head and hair protection.

(1) Responsibility.

(a) Employer.

(i) Whenever employees are required to be present in areas where the potential hazard mentioned in paragraph (A)(4) of this rule are present, employers shall provide them with ~~suitable protective headgear~~ head protection devices or hair enclosures.

Where required, head protection shall meet the requirements of ANSI Z89.1 - 1969 or any revisions to that standard.

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- (ii) When required, employers shall provide accessories designed for use with protective headgear and which are suitable for their intended purpose.
- (iii) Protective helmets and bump caps, or parts thereof, and hair enclosures shall be sanitized before reissue and damaged parts of protective headgear shall be replaced.

(b) Employees.

Employees shall not alter any head or hair protective equipment that lessens its effectiveness, and shall use such equipment in accordance with instructions and training received.

(2) Hair enclosures.

- (a) A hat, cap, or net shall be worn where there is danger of hair entanglement in moving parts of machinery or equipment, or where there is exposure to means of ignition. It shall be designed to enclose all loose hair and be adjustable to accommodate all head sizes. Material used for a hair enclosure shall be durable, fast-dyed, nonirritating to the skin and capable of withstanding frequent cleaning. It shall not be reissued from one employee to another unless it has been thoroughly sanitized.
- (b) Hair enclosures used in areas where there is exposure to sparks, hot or molten metals, or ignition from heat, flames, or chemical reaction shall be made of materials that are nonburning or flame retardant and do not melt.

(H) Protective clothing.

(1) When handling chemicals injurious to the skin.

The employer shall provide rubber or plastic gloves, sleeves and aprons for all operations involving the handling of injurious concentrations of acids, alkalis, epoxy or similar substances.

(2) Welding, cutting, brazing, and molten metal exposures.

- (a) All employees exposed to the hazards created by welding, cutting, brazing, or molten metal operations shall be protected by personal protective equipment.
- (b) Specified protective clothing.
 - (i) The employer shall provide durable flame-resistant gloves for all welders and oxygen cutters. Insulated linings shall be provided when the employee is exposed to high radiant energy.
 - (ii) The employer shall provide cape sleeves or shoulder covers with bibs made of leather or other flame-resistant materials for employees required to perform overhead welding or cutting operations.
 - (iii) Clothing treated with nondurable flame-retardant materials shall be treated after each wetting or cleaning.

(3) When working by hand on electrical circuits ~~in excess of two hundred fifty volts~~, protector gloves shall be worn over insulating gloves, except as follows:

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~~Unless deenergized and grounded, the employer shall provide electricians' rubber gloves with protectors, or other means of insulating employees from ground or current of opposite polarity when working on circuits in excess of two hundred fifty volts.~~

(a) Unless deenergized and grounded, the employer shall provide electricians' rubber gloves with protectors, or other means of insulating employees from ground or current of opposite polarity when working on circuits in excess of two hundred fifty volts.

(b) Protector gloves need not be used with Class 0 gloves, under limited use conditions, when small equipment and parts manipulation necessitate unusually high finger dexterity.

(c) If the voltage does not exceed two hundred fifty volts, ac, or three hundred seventy-five volts, dc, protector gloves need not be used with Class 00 gloves, under limited-use conditions, when small equipment and parts manipulation necessitate unusually high finger dexterity.

(d) Any other class of glove may be used without protector gloves, under limited-use conditions, when small equipment and parts manipulation necessitate unusually high finger dexterity but only if the employer can demonstrate that the possibility of physical damage to the gloves is small and if the class of glove is one class higher than that required for the voltage involved.

(e) Insulating gloves that have been used without protector gloves may not be reused until they have been tested under the provisions of "ASTM F496-14a Standard Specification for In-Service Care of Insulating Gloves and Sleeves."

(4) When handling hot asphaltic materials.

The employer shall provide suitable foot protection to prevent burns when employees are required to handle hot asphaltic materials.

(I) Hearing protection.

Employees exposed to continuous noise levels of ninety or more decibels, A-scale (dBA) slow response shall be provided with approved ear protection. ~~(Variations in noise level involving maxima at intervals of one second or less, are to be considered continuous.)~~ If ear plugs that require fitting are provided, they shall be fitted to the individual employee by a competent person.

(J) Safety-Body belts, harness lifelines and lanyards.

(1) Lifelines, safety-body belts or harnesses and lanyards shall be provided by the employer, and it shall be the responsibility of the employee to wear such equipment when exposed to hazards of falling where the operation being performed is more than six feet above ground or above a floor or platform, except as otherwise specified in this chapter, and when required to work on stored material in silos, hoppers, tanks, and similar storage areas. Lifelines and safety-body belts or harnesses shall be securely fastened to the structure and shall sustain a static load of no less than three thousand pounds.

(2) Lifelines, safety-body belts or harnesses and lanyards shall be used only for employee safeguarding. Any lifeline, safety-body belt, safety harness, or lanyard actually subjected to in-service loading, as distinguished from static load testing, shall be removed from service and shall not be used again for

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employee safeguarding until inspected and determined by an authorized person to be undamaged and suitable for reuse.

- (3) Lifelines used on rock-scaling operations, or in areas where the lifeline may be subjected to cutting or abrasion, shall be a minimum seven-eighths-inch wire core manila rope or equivalent. For all other lifeline applications, a minimum of three-fourths-inch manila rope or equivalent shall be provided.
- (4) **Safety-Body** belt or harness lanyard shall be a minimum of one-half-inch nylon, or equivalent, with a maximum length to provide for a fall of no more than six feet. The lanyard shall have a breaking strength of no less than three thousand pounds.
- (5) All **safety-body** belt or harness and lanyard hardware shall be drop forged or pressed steel, cadmium plated. Surface shall be smooth and free from sharp edges.
- (6) All **safety-body** belt or harness and lanyard hardware shall be capable of withstanding a tensile loading of three thousand pounds without cracking, breaking, or becoming permanently deformed.
- (7) Safety nets may be used in lieu of lifelines and safety belts or harnesses.

(K) Seat belts.

~~Seat belts shall be provided for crawler type tractors, bulldozers, rubber tired earth moving equipment, off-highway trucks and graders except on equipment that is designed for standup operations only or that has no rollover protective structure.~~

(1) Seat belts shall be provided for crawler-type tractors, bulldozers, rubber-tired earth-moving equipment, off-highway trucks and graders except on equipment that is designed for standup operations only or that has no rollover protective structure.

(2) Seat belts and anchorages meeting the requirements of 49 CFR Part 571 (Department of Transportation, Federal Motor Vehicle Safety Standards) shall be installed in all motor vehicles.

(L) Safety nets.

- (1) Safety nets shall be provided when workplaces are more than twenty-five feet above the ground, water, or other surface where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines or safety belts or harnesses is impractical.
- (2) Where safety net protection is required by this rule operations shall not be undertaken until the net is in place and has been tested.
- (3) Safety nets shall extend ~~outward from the outermost projection of the work surface in accordance with the following table to this rule and shall be installed as close under the work surface as practical but in no case more than thirty feet below such work surface with the exception of bridge construction where only one level of nets is required. Nets shall be hung with sufficient clearance to prevent employees' contact with the surfaces or structures below. Such clearance shall be determined by impact load testing~~ eight feet beyond the edge of the work surface where employees are exposed and shall be installed as close under the work surface as practical but in no case more than twenty-five feet below such work surface.

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Safety Nnets shall be hung with sufficient clearance to prevent user's contact with the surfaces or structures below. Such clearances shall be determined by impact load testing.

Table

Vertical distance from working level to horizontal plane of net	Minimum required horizontal distance of outer edge of net from the edge of the working surface.
Up to five feet	Eight feet
More than five feet up to ten feet	Ten feet
More than ten feet	Thirteen feet

- (4) The mesh size of safety nets shall not exceed six inches. All new safety nets shall meet accepted performance standards of seventeen thousand five hundred foot-pounds minimum impact resistance as determined and certified by the manufacturer, and shall bear a label of proof test. Edge ropes shall provide a minimum breaking strength of five thousand pounds.
 - (5) Forged steel safety hooks or shackles shall be used to fasten the safety net to its supports. Attachment of safety nets to the working platform is prohibited.
 - (6) Connections between safety net panels shall maintain the full strength of the safety net.
- (M) Working over or near water.
- (1) Where employees are working over or near water, and where the depth or current of the water creates a danger of drowning, the employer shall provide U.S. coast guard-approved life jackets or buoyant work vests for each employee.
 - (2) Ring buoys with no less than ninety feet of line attached shall be provided and readily available for emergency rescue operations. Distance between ring buoys shall not exceed two hundred feet.
 - (3) At least one lifesaving skiff shall be immediately available at locations where employees are working over or adjacent to water.
 - (4) In cribs and cofferdams where employees are exposed to danger of falling inside of the enclosure containing water, a life raft shall be provided.
- (N) Employee's responsibility.
- It shall be the responsibility of the employee to properly use the equipment provided by the employer as required in this rule (See also sections 4101.12 and 4101.13 of the Revised Code).

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Amend

4123:1-3-04 Floors, stairways, railing, overhead protection and guarding of open-sided floors, platforms and runways.

(A) Scope.

This rule shall apply to temporary conditions where there is danger of employees or material falling through floor, roof or wall openings or from stairways or runways.

(B) Definitions.

~~(1)-(1)~~ ~~"Floor hole" means an opening measuring less than twelve inches but more than two inches in its least dimension in any walking or working surface six feet or more above the lower level.~~

~~(2)-(2)~~ ~~"Floor opening" means an opening measuring twelve inches or more in its least dimension in any walking or working surface six feet or more above the lower level.~~

~~(3)-(1)~~ "Handrail" means a ~~single bar or pipe supported on brackets from a wall or partition, as on a stairway or ramp~~ rail used to provide employees with a handhold for support.

~~(2)~~ "Hole" means a gap or void two inches (5.1 cm) or more in its least dimension, in a floor, roof, or other walking/working surface

~~(4)-(3)~~ "Nose (nosing)" means that portion of a tread projecting beyond the face of the riser immediately below.

~~(5)-(4)~~ "Platform" means a working space for employees elevated above the surrounding floor or ground.

~~(6)-(5)~~ "Rise (riser)" means ~~the vertical distance from the top of a tread to the top of the next higher tread~~ the vertical distance from the top of a tread to the top of the next higher tread or platform/landing or the distance from the top of a platform/landing to the top of the next higher tread or platform/landing.

~~(7)-(6)~~ "Runway" means a passageway for employees, elevated above surrounding floor or ground level.

~~(8)-(7)~~ "Stair platform" means an extended step or landing breaking a continuous run of stairs.

~~(9)-(8)~~ ~~"Stair railing" means a vertical barrier erected along exposed sides of a stairway.~~ "Stairrail system" means a vertical barrier erected along the unprotected sides and edges of a stairway to prevent employees from falling to lower levels. The top surface of a stairrail system may also be a "handrail."

~~(10)-(9)~~ "Stairs (stairway)" means a series of steps and landings having four or more risers leading from one level or floor to another, or leading to platforms.

~~(11)-(10)~~ "Standard guard railing" means a substantial barrier, constructed in accordance with paragraph (E) of this rule.

(a) "Intermediate rail" means the intermediate lateral member or members of a standard guard railing, installed at intervals of no more than twenty-one inches.

(b) "Top rail" means the top lateral member of a standard guard railing.

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~~(12)~~(11) "Toeboard" means a ~~vertical barrier at floor level, erected along exposed edges of a floor opening, platform, runway, or ramp to prevent falls of material~~ low protective barrier that will prevent the fall of materials and equipment to lower levels and provide protection from falls for personnel.

~~(13)~~(12) "Tread width" means the horizontal distance from the front to back of tread, ~~including~~ (excluding nosing, ~~when used~~ if any).

~~(14)~~(13) "Wall opening" means an opening ~~no less than thirty inches in its vertical dimension and~~ no less than eighteen inches in its horizontal dimension in any wall where the outside bottom edge of the wall opening is six feet (1.8 m) or more above lower levels and the inside bottom edge of the wall opening is less than thirty-nine inches (1.0 m) above the walking/working surface.

(C) Temporary floors.

(1) Strength and construction.

(a) Strength.

Temporary floors shall be provided in all structures for employees working on various floor levels and shall be substantially constructed to support employees and equipment safely.

(b) Construction.

The planks shall be placed as close together as possible, and shall not extend more than one foot beyond supports unless securely fastened to prevent slipping or tipping.

(2) Guarding of partial area.

(a) When employees are not required to work over the entire area of a floor, only such partial area on which employees are required to work shall be provided with the temporary working floors as required in paragraph (C)(1) of this rule.

(b) Standard guard railing and toeboards shall be provided around the unused portion of exposed sides of all openings in floors, roofs, platforms or shafts.

(3) Joists.

(a) Joists shall be securely fastened to prevent tipping before placing temporary floors.

(b) Over joists upon which concrete floors are to be placed, expanded metal lath or wire mesh (no greater than one-half inch mesh) may be used where the joist spacing does not exceed twenty-four inches, provided that all laps and joints are securely fastened and that plank runways are provided for safe passage or working thereon by employees.

(4) Temporary floors below finished floor.

In buildings or structures where the upper floors are constructed before the lower floors, temporary floors of the strength required in paragraph (C)(1) of this rule shall be maintained no more than two floors below the floor being constructed.

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(5) In structural steel frame buildings.

(a) Structural steel frame buildings shall have temporary floors as provided in paragraph (C)(1) of this rule placed within two typical floors of the erectors and the riveters. Such floors shall cover the entire floor area beneath riveters or erectors except that no floors are required over hoistway or stairway openings.

(b) Exception.

The provisions of paragraph (C)(5)(a) of this rule shall not apply to what is generally known as mill buildings where no floors are contemplated, and where the operation of overhead cranes, etc., will not permit compliance.

(6) In reinforced concrete frame constructed buildings.

Reinforced concrete frame constructed buildings shall have floor or concrete forms constructed before the forms of the story above are started.

(7) Sectionally constructed buildings.

In sectionally constructed buildings each section constitutes a separate building operation in the application of the temporary floor requirements of this rule.

(D) Holes and Openings.

(1) ~~Floor openings~~ Openings.

Floor openings shall be guarded by a standard guard railing and toeboard or a cover with a safety factor of no less than two and so constructed that the cover cannot be accidentally displaced. A safety belt or harness with a lanyard may be provided in lieu of a standard guard railing and toeboard or cover.

(a) Ladderway floor openings or platforms.

Ladder ~~floor opening~~ or ~~platforms~~ openings shall be guarded by a standard guard railing and toeboard on all exposed sides except at the entrance to the opening, with the passage through the standard guard railing either provided with a swinging gate or so offset that an employee cannot walk directly into the opening.

(b) Floor holes.

Floor holes into which employees can accidentally walk, shall be provided with either a standard guard railing and toeboard on all exposed sides, or a floor hole cover which provides a factor of safety of no less than two and so constructed that the cover cannot be accidentally displaced. While the cover is not in place, the floor hole shall be guarded by a standard guard railing.

(c) Hatchways.

A removable standard guard railing and toeboard shall be provided on no more than two sides of the hatchway opening and fixed standard guard railing and toeboard shall be provided on all other exposed sides. The removable portion of the standard guard railings shall be kept in place when the opening is not in use and where practicable should be hinged or otherwise mounted so as to be

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conveniently replaceable.

(2) Wall openings.

(a) Guarding.

~~Where there is a danger of an employee falling six feet or more to a lower level through a wall opening, the opening shall be guarded by a standard guard railing and toeboard or a barricade. When the height and placement of the opening in relation to the working surface is such that either a standard guardrail or intermediate rail will effectively reduce the danger of falling, one or both shall be provided. One-fourth inch wire rope, securely fastened in place, may be used in lieu of the top rail and intermediate rail. A safety belt or harness or a safety net system may be provided in lieu of the standard guard railing and toeboard or barricade.~~ Each employee working on, at, above, or near wall openings (including those with chutes attached) shall be protected from falling by the use of a guardrail system, a safety net system, or a personal fall arrest system.

(b) Spreaders.

If spreaders are used in window or door frames, such spreaders shall be substantially secured in place.

(c) Where doors or gates open directly onto a stairway, a platform shall be provided and the swing of the door shall not reduce the effective width of the platform to less than twenty inches.

(3) Roof openings.

Wherever there is a danger of an employee falling six feet or more to a lower level through a roof opening, including skylights, a standard guard railing and toeboard shall be provided on all exposed sides, or a cover which provides a factor of safety of no less than two shall be provided. A safety belt or harness or a safety net system may be provided in lieu of the standard guard railing and toeboard or cover.

(E) Standard guard railing.

(1) Standard guard railing shall be constructed as a substantial barrier, securely fastened in place and free from protruding objects such as nails, screws, and bolts, to protect openings or prevent accidental contact with some object. ~~Which barrier shall consist of a top rail no less than thirty-nine inches or more than forty-five inches above the working level, and unless the space between the top rail and the working level is covered with substantial material, an intermediate rail.~~ Top edge height of top rails, or equivalent guardrail system members, shall be forty-two inches (1.1 m) plus or minus three inches (8 cm) above the walking/working level. When conditions warrant, the height of the top edge may exceed the forty-five inch height, provided the guardrail system meets all other criteria of this paragraph. Note: When employees are using stilts, the top edge height of the top rail, or equivalent member, shall be increased an amount equal to the height of the stilts. Minimum material requirements shall be:

(a) Metal

(i) For pipe railings, the top rail, intermediate rail and uprights shall be no less than one and one half

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inches nominal diameter ([schedule forty pipe](#)) with uprights spaced no more than eight feet on centers.

- (ii) For structural steel railings, the top rail, intermediate rail and uprights shall be of two-inch by two-inch by three-eighths-inch angles ~~or other metal shape of equivalent bending strength~~, with uprights spaced no more than eight feet on centers.
- (iii) For wire rope railings, the top and intermediate rail shall be at least one-quarter inch diameter of thickness. [If wire rope is used for top rails, it shall be flagged at not more than 6-foot intervals with high-visibility material.](#)

(b) Wood.

For wood railings, the uprights shall be of no less than two-inch by four-inch (nominal) stock space not to exceed eight feet; the top rail shall be of no less than two-inch by four-inch (nominal) stock; the intermediate rail shall be of no less than one-inch by six-inch stock (nominal).

- (2) A standard toeboard shall be constructed of substantial material. It shall be three and one-half inches minimum in vertical height from its top edge to the level of the floor, platform, runway or ramp. It shall be securely fastened in place, with a clearance of no more than one-fourth-inch above the floor, platform, runway or ramp. [They shall be solid or have openings not over one inch \(2.5 cm\) in greatest dimension. Toeboards shall be capable of withstanding, without failure, a force of at least fifty pounds applied in any downward or outward direction at any point along the toeboard.](#)

(F) Stairways.

(1) Uniform dimensions.

- (a) The rise height and tread width shall be uniform throughout any flight of stairs, including any foundation structure used as one or more treads of the stairs. [Variations in riser height or tread depth shall not be over 1/4-inch \(0.6 cm\) in any stairway system](#)
- (b) Temporary stairs shall have a landing no less than thirty inches in the direction of travel [travel and extend at least twenty-two inches \(56 cm\) in width](#) at every twelve feet of vertical rise.
- (c) ~~Temporary spiral (winding) stairways are prohibited~~ [Winding and spiral stairways shall be equipped with a handrail offset sufficiently to prevent walking on those portions of the stairways where the tread width is less than six inches \(15 cm\).](#)

(2) Angle of stairways.

- (a) ~~Buildings or other structures in which permanent stairways are not installed for construction use, shall be provided with no less than one temporary stairway of substantial construction between floors, fitted with no less than two-inch by eight-inch treads, securely fastened in place. The flights of stairs shall be installed at angles to the horizontal of between thirty and fifty degrees to the floors or other horizontal parts to which they connect or land.~~ [Stairways that will not be a permanent part of the](#)

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structure on which construction work is being performed shall have landings of not less than thirty inches (76 cm) in the direction of travel and extend at least twenty-two inches (56 cm) in width at every twelve feet (3.7 m) or less of vertical rise. Stairs shall be installed between thirty deg. and fifty deg. from horizontal.

(b) Where it is not possible to provide temporary stairways due to the absence of floors in the structure, a ladder shall be provided.

(3) Stairways with pan-type treads.

~~Permanent steel or other metal stairways with hollow pan-type treads that are to be filled with concrete or other materials, when used during construction, shall be filled to the level of the nosing with solid material. This requirement shall apply as each flight of stairs is completed.~~ Except during stairway construction, foot traffic is prohibited on stairways with pan stairs where the treads and/or landings are to be filled in with concrete or other material at a later date, unless the stairs are temporarily fitted with wood or other solid material at least to the top edge of each pan. Such temporary treads and landings shall be replaced when worn below the level of the top edge of the pan.

(4) Treads, landings, gratings.

~~Stairways used for construction purposes shall be fitted with substantial treads, securely fastened and shall have tightly floored landings or gratings.~~ Treads for temporary service shall be made of wood or other solid material, and shall be installed the full width and depth of the stair.

(5) Illumination.

Stairways, ramps, runways and platforms shall be lighted to no less than the minimum illumination intensity of five foot-candles.

(6) Stair railings and handrails.

(a) Every flight of stairs having four or more risers or rising thirty inches, whichever is less, shall be equipped with stair railings or handrails as specified in paragraphs (F)(6)(a)(i) to (F)(6)(a)(i)(v) of this rule, the width of the stair to be measured clear of all obstructions except handrails: Handrails and the top rails of stairrail systems shall be capable of withstanding, without failure, a force of at least two hundreds pounds (890 n) applied within two inches (5 cm) of the top edge, in any downward or outward direction, at any point along the top edge.

(i) ~~On stairways less than forty-four inches wide having both sides enclosed, at least one handrail, preferably on the right side descending;~~ The height of handrails shall be not more than thirty-seven inches (94 cm) nor less than thirty inches (76 cm) from the upper surface of the handrail to the surface of the tread, in line with the face of the riser at the forward edge of the tread

(ii) ~~On stairways less than forty-four inches wide having one side open, at least one stair railing on the open side;~~ When the top edge of a stairrail system also serves as a handrail, the height of the

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top edge shall be not more than thirty-seven inches (94 cm) nor less than thirty-six inches (91.5 cm) from the upper surface of the stairrail system to the surface of the tread, in line with the face of the riser at the forward edge of the tread

- (iii) ~~On stairways less than forty-four inches wide having both sides open, one stair railing on each side;~~ Stairrail systems and handrails shall be so surfaced as to prevent injury to employees from punctures or lacerations, and to prevent snagging of clothing.
- (iv) ~~On stairways more than forty-four inches wide but less than eighty-eight inches wide, one handrail on each enclosed side and one stair railing on each open side;~~ Handrails shall provide an adequate handhold for employees grasping them to avoid falling.
- (v) ~~On stairways eighty-eight or more inches wide, one handrail on each enclosed side, one stair railing on each open side and one intermediate stair railing located approximately midway of the width;~~ The ends of stairrail systems and handrails shall be constructed so as not to constitute a projection hazard.
- (vi) ~~On the open sides of stairways and stair landings, except where such stairways and landings are protected by studding and other permanent construction, a stair railing shall be provided.~~ Unprotected sides and edges of stairway landings shall be provided with guardrail systems.

(b) Construction.

(i) Stair railing.

A stair railing shall be of construction similar to a standard guard railing, except that the vertical height shall be no less than thirty-six inches from the upper surface of the top rail to the surface of the tread in line with the face of the riser at the forward edge of the tread.

(ii) Handrail.

- (a) A handrail shall be of construction similar to a standard guard railing except that it is mounted to a wall or partition, and does not include an intermediate rail. It shall have a smooth surface along the top and both sides of the handrail. Ends of the handrail shall be constructed so as not to constitute a projection hazard.
- (b) The height of handrails shall be no more than thirty-seven inches and no less than thirty inches from the upper surface of the handrail to the surface of the tread, in line with the face of the riser or to the surface of the ramp.
- (c) Handrails and railings shall be provided with a clearance of approximately three inches between the handrail or railing and any other object.

(G) Overhead protection.

Overhead protection shall be provided where employees are working below other employees on floor levels with open floor above.

(H) Guarding of open-sided floors, platforms and runways.

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(1) Open-sided floors or platforms.

- (a) Standard guard railing and toeboards shall be provided on every open-sided floor or platform six feet or more above adjacent floor or ground level, except where there is entrance to a ramp, stairway or fixed ladder.
- (b) One-quarter-inch wire rope and toeboard, substantially secured in place, may be used in lieu of standard guard railing.

(2) Runways.

- (a) Standard guard railings and toeboards shall be provided on all open sides of runways six feet or more above floor or ground level.
- (b) Runways used exclusively for special purposes may have the railing on one side omitted where operating conditions necessitate such omission, providing the falling hazard is minimized by using a runway no less than eighteen inches wide.

(3) Working above dangerous equipment.

- (a) Each employee working less than six feet above dangerous equipment, such as machinery in operation, open vats, hoppers, or tanks, railroad tracks with moving equipment below the work, live electrical conductors unless deenergized and effectively grounded, or similar sources of danger, shall be protected from falling into or onto the dangerous equipment by a standard guard railing and toeboard, or the equipment shall be guarded.
- (b) Each employee working six feet or more above dangerous equipment, such as machinery in operation, open vats, hoppers, or tanks, railroad tracks with moving equipment below the work, live electrical conductors unless deenergized and effectively grounded, or similar sources of danger, shall be protected from falling into or onto the dangerous equipment by a standard guard railing and toeboard, or safety belt or harness, or a safety net system.

(4) Bridge decks.

The height of the standard guard railing on bridge decks may be adjusted to provide clearance for the operation of paving machinery.

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Amend

4123:1-3-05 Mechanical power transmission apparatus.

(A) Scope.

- (1) This rule provides for the protection of employees from motion hazards associated with equipment used in the mechanical transmission of power on construction sites. Installations to be guarded include sources of mechanical power, the associated and intermediate equipment and the driven machines up to, but excluding, the point of operation. This pertains to revolving, oscillating, reciprocating, or other moving parts such as, but not limited to, belts, brakes, cams, chains, clutches, collars, compressors, counterweights, couplings, cranks, eccentrics, engines, gears, lead screws, motors, power cylinders, pumps, pulleys, shafting, sheaves, spindles, sprockets, turbines and winches.
- (2) This rule shall not be construed as being applicable to power transmission facilities located within the frame of the equipment and where exposure is necessary to its operation or adjustment.

(B) Reserved.

(C) Belts, rope and chain drives.

(1) Vee belts.

Vee belts and pulleys, where exposed to contact, shall be guarded.

(2) Rope and chain drives.

Rope and chain drives and their pulleys, where exposed to contact, shall be guarded.

(D) Power driven conveyors - chain, bucket, belt and screw.

(1) Horizontal overhead, vertical and inclined conveyors.

(a) Overhead protection.

Where overhead conveyors carry material with a clearance of seven feet or more above the floor or ground level, and cross designated walkways or roads, or pass over areas where employees are normally at work, a substantial barrier shall be installed to catch falling material.

(b) Screw conveyors.

In addition to the requirements of paragraph (D)(1)(a) of this rule, the auger of screw conveyors shall be guarded. Guards shall be solid or of wire mesh, in accordance with appendix I to this rule. Where an electric power source is used guards designed for removal shall be interlocked so that removal will disconnect the power source.

(2) Conveyors exposed to contact.

A stopping device shall be immediately available to disengage conveyors from their source of power, where conveyors are exposed to contact. Means for stopping the motor or engine shall be provided at the operator's station. Conveyor systems shall be equipped with an audible warning signal to be sounded

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immediately before starting up the conveyor. If the operator's station is at a remote point, similar provisions for stopping the motor or engine shall be provided at the motor or engine location. Emergency stop switches shall be arranged so that the conveyor cannot be started again until the actuating stop switch has been reset to running or "on" position.

(3) Safe means of passage.

Where employees are required to cross over conveyors, a fixed platform equipped with standard guard railing and toeboards shall be provided.

(4) Pinch (shear) points.

Pinch points created by travel of conveyor belts over or around end, drive and snubber, or take-up pulleys shall be guarded or a means shall be provided at the pinch point to disengage the belt from the source of power.

(5) Lockout for repairs and maintenance.

Conveyors shall be locked out or otherwise rendered inoperable, and tagged out with a "Do Not Operate" tag during repairs and when operations is hazardous to employees performing maintenance work.

(E) Shafts.

(1) Revolving shafting.

(a) All revolving shafting and couplings thereof, located seven feet or less above the floor, platform or ground level and exposed to contact shall be guarded.

(b) Ends of shafting, where exposed to contact, shall present a smooth edge and end, and shall not project more than one-half of the diameter of the shaft unless guarded by non-rotating caps or safety sleeves.

(2) Universal joints.

Universal joints where exposed to contact shall be guarded.

(3) Unused keyways.

Unused keyways where exposed to contact shall be filled or covered.

(4) Set screws, keys and other projections.

Set screws, keys and other projections; protruding beyond the surface of revolving parts, where exposed to contact, shall be guarded.

(5) Revolving face plates and chucks.

Revolving face plates and chucks shall be cylindrical with no projecting parts on the rim unless such projecting parts are guarded. This does not apply to those face plates and chucks revolving less than five revolutions per minute.

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(F) Gears, sprockets and friction drives.

(1) Set or train of gears.

- (a) A set or train of gears is two or more power driven gears that move and intermesh. This does not apply to adjusting gears which do not normally revolve and are not power operated, or to adjusting gears which require access ~~to such gears~~ for manual manipulations, such as hand-operated gears used only to adjust machine parts and do not continue to move after hand power is removed.

(b) Guarding.

All or any part of a set or train of gears, exposed to contact, shall be completely guarded or have a band guard around the face of the gear with the side flanges extending inward beyond the root of the teeth. Where there are openings of more than two and one-half inches between arm or through web, the entire gear shall be guarded. Guarding shall be in accordance with appendix I to this rule, and shall be securely fastened in place.

- (2) Frictional disc, link belt, and sprocket drives. The driving point of all friction drives when exposed to contact shall be guarded, all arm or spoke friction drives and all web friction drives with holes in the web shall be entirely enclosed. All projecting belts on friction drives where exposed to contact shall be guarded.

~~Frictional disc, link belt, and sprocket drives shall be guarded.~~

(G) Machinery control.

(1) Disengaging from source of power.

A stopping device shall be provided at each machine, within easy reach of the operator, for disengaging it from its source of power.

(2) When machines are shut down.

The employer shall furnish and the employees shall use a device to lock the controls in the off position when machines are shut down for repair, adjusting, oiling, or cleaning. On mobile equipment where lockout devices cannot be used the employer shall furnish and the employee shall use warning tags when machines are shut down for repair, adjusting, oiling, or cleaning.

(3) Mechanical belt shifters.

Tight and loose pulley arrangements shall be equipped with mechanical belt shifters. Tight and loose pulleys on all installations shall be equipped with a permanent belt shifter provided with mechanical means to prevent the belt from creeping from loose to tight pulley. It is recommended that old installations be changed to conform to this rule.

(4) Treadles or extensions.

Treadles or extensions for starting machinery shall be located or guarded as to minimize accidental starting tripping of the machinery.

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(H) Anchoring and mounting of equipment.

(1) Anchoring.

All stationary machinery shall be securely fastened.

(2) Portable machinery.

Portable machinery mounted upon mobile units shall be securely fastened thereto, and such mobile unit shall be so locked or blocked as to prevent movement or shift while such machine is in operation.

(I) Counterweights.

Counterweights, other than those which are an integral part of machines, shall be guarded by an enclosure guard or secured with a safety chain or wire rope, in addition to the suspending device for the counterweight.

(J) Feed rolls.

Power driven feed rolls, when exposed to contact, shall be guarded at the pinch points.

4123:1-3-05

Appendix I

TABLE OF STANDARD MATERIALS AND DIMENSIONS*

Material	Clearance from moving part at all points	Largest mesh of opening allowable	Minimum gauge (U.S. Standard or thickness	Minimum height of guard from floor or platform level
	Inches	Inches		Feet
Woven Wire	Under 2	3/8	No. 16	7
	2 - 4	1/2	No. 16	7
	Under 4	1/2	No. 16	7
	4 - 15	2	No. 12	7
Expanded metal	Under 4	1/2	No. 18	7
	4 - 15	2	No. 13	7
Perforated metal	Under 4	1/2	No. 20	7
	4 - 15	2	No. 14	7
Sheet metal	Under 4		No. 22	7
	4 - 15		No. 22	7
Wood or metal strip crossed	Under 4	3/8	Wood 3/4 Metal No. 16	7
	4 - 15	2	Wood 3/4 Metal No. 16	7
Wood or metal strip not crossed	Under 4	1/2 width	Wood 3/4 Metal No. 16	7
	4 - 15	1 width	Wood 3/4 Metal No. 16	7
Standard guard railing**	Minimum 15			
	Maximum 20			

* Guards constructed of these materials shall be securely fastened in place.

** Permissible only where indicated.

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Amend

4123:1-3-06 Motor vehicles, mechanized equipment and marine operations.

(A) Reserved.

(B) Definitions.

- (1) "Earthmoving equipment" means, but is not limited to, scrapers, loaders, crawlers or wheel tractors, bulldozers, off-highway trucks, graders, agricultural and industrial tractors, shovels and backhoes.
- (2) "Jacked piles" means a method of driving horizontal piles for under supports of existing buildings by the use of hydraulic jacks.
- (3) "Motor vehicles" (as covered by this rule) means all those vehicles that operate within an off-highway jobsite, not open to unrestricted public traffic.

(C) Equipment.

- (1) A safety tire rack, cage, or equivalent protection shall be provided and used when inflating, mounting, or dismounting tires installed on split rims, or rims equipped with locking rings or similar devices.
- (2) When being repaired, or when not in use, machinery, equipment, or parts thereof, which are suspended or held aloft by use of slings, hoists or jacks shall be substantially blocked or cribbed. Bulldozer and scraper blades, end-loader buckets, dump bodies and similar equipment, shall be either fully lowered or blocked when being repaired or when not in use.
- (3) Equipment parked on inclines shall have the wheels chocked and brakes set, or the blade, bucket, etc., shall be fully lowered.
- (4) All cab glass shall be safety glass or equivalent, [that introduces no visible distortion affecting the safe operation of any machine covered by this section.](#)
- (5) All equipment which can contact power lines shall also comply with the requirements of paragraph (E) of rule 4123:1-3-07 of the Administrative Code.
- (6) At locations where gasoline is being transferred to the fuel tank of any construction machinery the engine shall be shut down during the transfer of fuel.

(D) Motor vehicles.

- (1) All trucks shall be equipped with an audible warning device, in an operable condition, at the operator's station.
- (2) On mobile equipment having an obstructed view to the rear, the employer shall:
 - (a) Provide a reverse signal alarm audible above the surrounding noise, or
 - (b) Provide an observer to signal the assured clear distance.
- (3) All haulage vehicles loaded by means of cranes, power shovels, loaders, or similar equipment shall have a substantial cab shield or canopy to protect the operator from shifting or falling materials.

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(4) Trucks used to transport employees.

- (a) Trucks assigned to, or generally used for the transportation of employees shall be equipped with seats and back rests which are securely fastened, for the number of employees to be transported.
- (b) Tools and material transported in the same compartment with employees shall be secured to prevent movement.

(5) Seat belts.

The employer shall provide and the employee(s) shall use seat belts on all motor vehicles which have rollover protective structures or cabs. This does not apply to equipment designed only for stand-up operations.

- (6) Trucks with dump bodies shall be ~~blocked or cribbed to prevent accidental lowering of the body while maintenance or inspection work is being performed~~ equipped with positive means of support, permanently attached, and capable of being locked in position to prevent accidental lowering of the body while maintenance or inspection work is being done.

(E) Material handling equipment.

- (1) The employer shall provide seat belts on all equipment covered by this rule except:

- (a) Equipment which is designed only for stand-up operations, and
- (b) Equipment which does not have rollover protective structure or substantial canopy protection.

(2) Forklift tractors and forklift trucks.

A substantial overhead guard shall be provided for operators of forklift tractors and forklift trucks.

(3) Mobile concrete mixers.

(a) Guarding.

- (i) Mobile concrete mixers with skips having a capacity of one cubic yard or more, shall be provided with single rail guards on both sides of the skip pan. The single rail guard shall be constructed of substantial material and shall be no less than thirty-six inches or more than forty-two inches in height above the ground or working level and shall extend the full length of the pan.
- (ii) Where the single rail guard is of a type having a chain or rod connection, such guard shall not be removed, but shall be kept in place while the mobile concrete mixer or skip is in operation. Employees shall be instructed to not tie up or otherwise fasten the single rail guard to the mixer in such manner as to expose employees to contact with the skip when in operation.

(b) Chutes and spouts for transferring concrete.

Chutes and spouts for transferring concrete shall be constructed and installed so as to sustain no less than four times the maximum working load.

(F) Site clearing.

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Rider operated equipment used in site clearing operations shall be equipped with rollover protective structures. In addition, such equipment shall be equipped with an overhead and rear canopy guard meeting the following requirements:

- (1) The overhead covering on the canopy structure shall be of no less than one-eighth-inch steel plate or one-fourth-inch woven wire mesh or equivalent, with openings no greater than one inch at its greatest dimension.
- (2) The opening in the rear of the canopy structure shall be covered with no less than one-fourth-inch woven wire mesh or equivalent, with openings no greater than one inch at its greatest dimension.

(G) Pile driving equipment.

(1) General requirements.

- (a) Overhead protection, which will not obscure the vision of the operator shall be provided. Protection shall be the equivalent of two-inch planking or other solid material of equivalent strength.
- (b) Stop blocks shall be provided for the leads to prevent the hammer from being raised against the head block.
- (c) A blocking device shall be provided for placement in the leads under the hammer at all times while employees are working under the hammer.
- (d) A device shall be provided across the top of the head block to prevent the cable from jumping out of the sheaves.
- (e) Fixed ladders shall be provided on leads. The loft worker shall be equipped with a safety belt and lanyard and there shall be rings provided, with a factor of safety of no less than four for attachment to the ladder or leads. If the leads are provided with a loft platform(s), such platform(s) shall be protected by standard guardrails.
- (f) Steam or air hose leading to a hammer or jet pipe shall be securely fastened to the hammer with a length of no less than one-quarter-inch diameter chain or cable to prevent whipping in the event the joint at the hammer breaks.
- (g) Safety chains, or equivalent means, shall be provided for each hose connection to prevent the line from thrashing around in case the coupling becomes disconnected.
- (h) Steam or air line controls shall consist of two shutoff valves, one of which shall be a quick-acting lever type within easy reach of the hammer operator.
- (i) The stability of pile driver rigs shall be maintained by the use of guys, outriggers, thrustouts or counterbalances.

(2) Pile driving operations.

- (a) When piles are being driven in an excavated pit of five feet or more in depth, the walls of the pit shall be sloped to the angle of repose or shored and braced.
- (b) When it is necessary to cut off the tops of driven piles, cutting operations shall be suspended except where the cutting operations are being separated from the leads by twice the length of the exposed

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pile prior to its being securely fastened in the leads and driving has commenced.

(c) When driving jacked piles, all access pits shall be provided with ladders and bulkheaded curbs to prevent material from falling into the pit.

(3) Pile driving from barges and floats.

Barges and floats supporting pile driving operations shall meet the requirements of paragraph (H) of this rule.

(H) Marine operations and equipment.

(1) Access to barges - employees.

When employees are required to step to or from the wharf, float, barge, or river towboat, a ramp or walkway shall be provided substantial in construction and fastening.

(2) Access to barges - vehicles.

Ramps, with side boards, shall be provided for access of vehicles to or between barges. Such ramps shall be substantial in construction and fastening. (See rule 4121:1-3-21 of the Administrative Code for requirements for diving operations.)

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Amend

4123:1-3-07 Cranes, hoists, and derricks.

(A) Reserved.

(B) Definitions.

- (1) "Derrick" means an apparatus consisting of a mast or equivalent members held at the top by guys or braces, with or without a boom, for use with a hoisting mechanism and operating ropes.
- (2) "Derrick, A-frame" means a derrick in which the boom is hinged from a crossmember between the bottom ends of two upright members spread apart at the lower ends and united at the top, the upper ends of the boom being secured to the upper junction of the side members and the side members braced or guyed from the junction point.
- (3) "Derrick, basket" means a derrick without a boom, similar to a gin pole, with its base supported by ropes attached to corner posts or other parts of the structure. The base is at a lower elevation than its supports. The location of the base of a basket derrick can be changed by varying the length of the rope supports. The top of the pole is secured with multireeved guys to position the top of the pole to the desired location. By varying the length of the upper guy lines, the load is raised and lowered by ropes through the sheave or block secured to the top of the pole.
- (4) "Derrick, breast" means a derrick without a boom, the mast consisting of two side members spread farther apart at the base than at the top, tied together at the top and bottom by rigid members, the top held from tipping by guys and the load raised and lowered by ropes through a sheave or block secured to the top crosspieces.
- (5) "Derrick, Chicago boom" means an ordinary derrick boom so installed as to utilize a building column or tower hoist as the mast, and to depend upon the structural steel beam connections or bracing to take the place of the stiff legs. The lower end of the boom is attached to the building columns by means of a combination hinge pin and swivel pin to a heavy steel plate clamp attached to the column. The derrick is completed with load fall line and boom fall line.
- (6) "Derrick, gin pole" means a derrick consisting only of a mast with guys so arranged as to permit leaning the mast in any direction, the load being raised or lowered by ropes leading through sheaves or blocks at the top of the mast. Where the size and/or spacing of guy lines do not result in the gin pole being stable in both boomed and vertical positions, the employer must ensure that the derrick is not used in an unstable position.
- (7) "Derrick, guy" means a fixed derrick consisting of a mast capable of being rotated, supported in a vertical position by ~~three or more guys~~ and a boom whose bottom end is hinged or pivoted to move in a vertical plane, with lines between the head of the mast and the head of the boom for raising and lowering the boom lines from the head of the boom for raising and lowering the load. a minimum number of six guys, with equal spacing, except:
 - (a) Where a qualified person or derrick manufacturer approves variations from these requirements and revises the rated capacity to compensate for such variations; or

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(b) Where more guys and a boom whose bottom end is hinged or pivoted to move in a vertical plane, with lines between the head of the mast and the head of the boom for raising and lowering the boom lines from the head of the boom for raising and lowering the load.

- (8) "Derrick, stiff leg" means a derrick similar to a guy derrick except that the mast is supported or held in place by two or more stiff members capable of resisting either tensile or compressive forces. Sills are generally provided to connect the lower ends of the two stiff legs to the foot of the mast.
- (9) "Derrick, tripod" means a derrick consisting of three upright legs or members securely fastened together at the top, supporting a hoisting mechanism and operating ropes. The legs can be spread to various angles.
- (10) "Hoist, mast" means a hoist having no less than two upright parallel members forming the mast, on which the cage is suspended outside of the parallel members. The entire unit is portable, but not self-propelled.
- (11) "Hoist, material" means a hoist for raising and lowering material only, with the hoisting of persons being prohibited except for inspection and maintenance.
- (12) "Hoist, personnel" means a mechanism for use in connection with construction, alteration, maintenance, or demolition of buildings, structures, or other work. It is used for hoisting and lowering employees or material or both, is equipped with a car that moves on guide members during its vertical movement, and includes a hoistway.
- (13) "Hoist tower" means a tower constructed of sections forming a shaftway in which a cage or platform travels. Towers inside of structures shall be enclosed on all four sides throughout the full height.
- (14) "Prime mover" means equipment used as the primary source of power, such as engines and motors.

(C) Cranes.

(1) Load rating chart.

A substantial and durable manufacturer's load rating chart with clearly legible letters and figures shall be maintained in each crane and securely fixed to the crane cab in a location easily visible to the operator while seated at the operator's control station. The data and information to be provided on such charts shall include, but not necessarily be limited to, the following data:

- (a) A full and complete range of manufacturer's approved crane load ratings at all stated operating radii and boom angles, and for all permissible boom lengths, jib lengths, and angles, also alternate ratings for use and non-use of optional equipment on the crane such as outriggers and extra counterweights which affect ratings.
- (b) An operating manual shall be provided, showing recommended parts of hoist reeving, size and type of rope for various crane loads and the operating manual shall be maintained with the equipment.

(2) Boom hoist.

When using the manufacturer's recommended boom hoist reeving with rated loads suspended, the boom hoist shall be capable of raising the boom, holding it stationary without attention from the operator, and lowering it only when coupled to its prime mover.

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- (a) The boom hoist drum shall have sufficient rope capacity to operate the boom at all positions from horizontal to the highest angle recommended when using the manufacturer's reeving and rope size.
 - (i) No less than two full wraps of rope shall remain on the drum with the boom point lowered to the level of the crane supporting surface.
 - (ii) The drum end of the rope shall be anchored by a clamp securely attached to the drum or a wedge socket arrangement approved by the crane manufacturer.
- (b) The drum diameter shall be sufficient to provide a first layer rope pitch diameter of no less than eighteen times the nominal diameter of the rope used.

(3) Main hoist mechanism.

Load hoist drums shall have sufficient rope capacity with recommended rope size and reeving to perform crane service within the range of boom lengths, operating radii and vertical lifts stipulated by the manufacturer.

- (a) No less than two full wraps of rope shall remain on the drum when the hook is in its extreme low position.
- (b) The drum end of the rope shall be anchored by a clamp securely attached to the drum or a wedge socket arrangement approved by the crane or rope manufacturer.

(4) Ropes.

- (a) The hoisting rope shall be of a construction recommended for crane service. Non-rotating rope shall not be used for boom hoist reeving or multiple reeving.
- (b) Socketing shall be done in the manner specified by the manufacturer of the assembly.
- (c) If a load is supported by more than one part of the rope, the tension in the parts shall be equalized.
- (d) Wherever exposed to temperatures at which fiber cores would be damaged, rope having an independent wire rope or wire strand core, or other temperature damage-resistant core shall be used.
- (e) Replacement rope shall be the same size, grade and construction as the original rope furnished by the crane manufacturer, unless otherwise recommended by a rope manufacturer due to actual working condition requirements.
- (f) Factor of safety.

The employer shall, when re-reeving boomed equipment, provide ropes which will meet the manufacturer's specifications and the factor of safety shall be no less than three and one-half.

(g) Splicing.

~~The splicing of all wire ropes shall conform to the manufacturer's specifications and in no case, whether of ordinary or preformed wire rope, shall the overall length of splice be less than thirty-two times the rope diameter in feet and the length of the tucked ends shall be no less than twenty-four times the rope diameter in inches.~~ If the deficiency is localized, the problem is corrected by severing

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the wire rope in two; the undamaged portion may continue to be used. [If a rope is shortened the employer must ensure that the drum will still have two wraps of wire rope when the load and/or boom is in its lowest position.](#) Joining lengths of wire rope by splicing is prohibited.

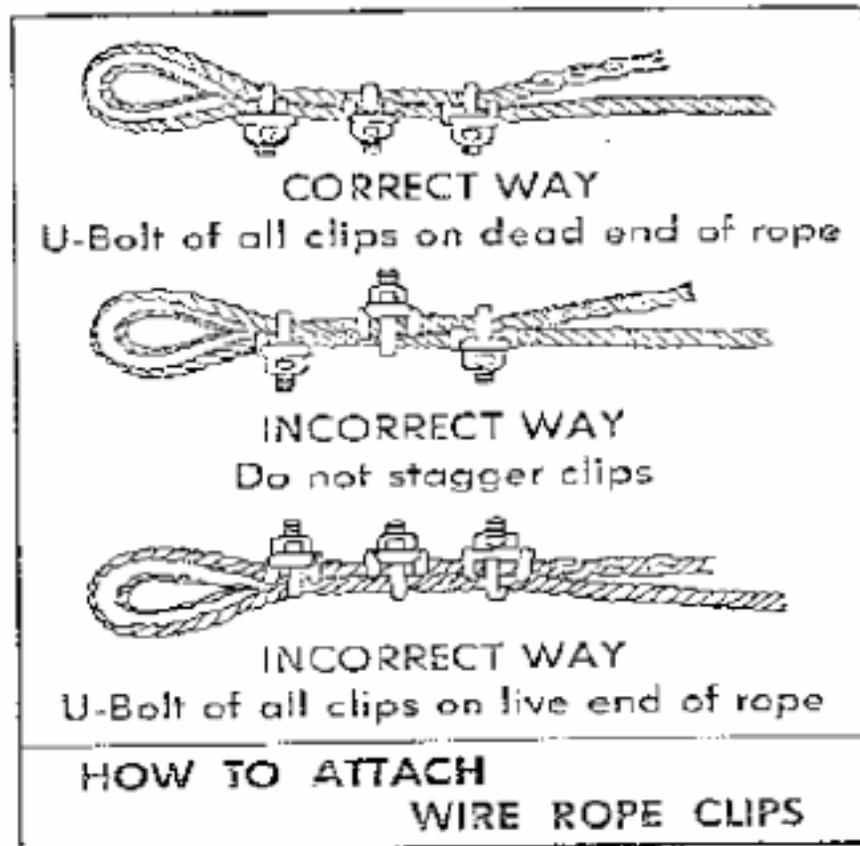
(h) Fastening.

Wire rope shall not be secured by knots. Thimbles shall be used where wire rope is looped. Wire rope clips shall conform to the manufacturer's specifications. The loop ends of wire rope clips shall be on the dead end of the wire rope and the grooved plate of the wire rope clip shall take the load of the pulling part for which it is designed. In looping or in short bends, wire rope clips and turnback of rope shall conform to the following table and spacing of clips shall be uniform between the loop and the dead end.

Number and Spacing of U-Bolt Wire Rope Clips

Improved Plow Steel, rope diameter (inches)	Number of clips		Other material
	Drop forge	Other material	
1/2	3	4	3
5/8	3	4	3 3/4
3/4	4	5	4 1/2
7/8	4	5	5 1/2
1	5	6	6
1 1/8	6	6	6 3/4
1 1/4	6	7	7 1/2
1 3/8	7	7	8 1/4
1 1/2	7	8	9

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Figure: How to attach wire rope clips

(5) Reeving accessories.

Eye splices shall be made in accordance with the requirements of paragraph (C)(4)(g) of this rule and thimbles shall be used in all eye splices.

(6) Sheaves.

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- (a) Sheave grooves shall be smooth and free from surface defects.
- (b) Sheaves carrying wire ropes shall be provided with close-fitting guards or other suitable devices to guide the rope back into the groove when the load is applied again.

(7) Cabs.

(a) Construction.

- (i) Power driven cranes shall be provided with a cab to protect the operator in case the cable should break or material fall from the dipper or bucket.
- (ii) All windows shall be of safety glass or equivalent.
- (iii) A clear passageway shall be provided from the operator's station to an exit door on the operator's side.

(b) Platform to cab.

- (i) Principal walking surfaces shall be of an anti-skid type.
- (ii) Originally-equipped steps, handholds, ladders and guardrails, railings, grab rails shall be maintained in good condition.

(8) Roof.

Where necessary for rigging or service requirements, a ladder or steps shall be provided to give access to the cab roof.

(9) Booms.

- (a) Boom stops shall be provided on all mobile cranes.
- (b) A boom angle indicator shall be provided.
- (c) All repairs on booms, boom sections and jibs shall meet the manufacturer's specifications.

(10) Exhaust pipes.

All exhaust pipes shall be guarded or insulated in areas where employees are exposed to contact in the performance of normal duties. (See rule 4121:1-3-18 of the Administrative Code for ventilating exhaust gases.)

(11) Miscellaneous equipment.

- (a) Portable fuel containers shall be equipped with a self-closing filler cap. Where gasoline is the fuel, a flame arrestor shall be provided.
- (b) An effective warning and operating signal device shall be provided.
- (c) Means shall be provided for the operator to visually determine the levelness of the crane.
- (d) Barricades shall be provided to prevent an employee from being struck or crushed by the rotating superstructure of the crane.

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(D) Hoists.

(1) General requirements.

(a) Rated load capacity - posting.

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

(b) Hoisting ropes shall be installed in accordance with the wire rope manufacturer's recommendations.

(c) The installation of live booms on hoists is prohibited.

(d) The use of endless belt type manlifts on construction sites is prohibited.

(e) Hoist platforms.

Blocking and cleats shall be provided on hoist platforms when wheelbarrows or other rolling equipment is transported.

(f) Landing platforms.

- (i) Landing platforms shall be of sufficient strength to support the maximum working loads imposed upon them, and no less than seventy-five pounds per square foot, without exceeding the allowable working stresses specified in the appendix to this rule.
- (ii) Standard guard railing, toeboards and side screens shall be provided on both sides of landing platforms.
- (iii) Clearance between adjacent edges of the hoist platform and the landing platform shall not exceed two inches.

(2) Material hoists.

(a) Operating rules shall be established and posted at the operator's station of the hoist. Such rules shall include signal system and allowable line speed for various loads. Rules and notices shall be posted on the car frame or crosshead in a conspicuous location, including the statement, "No Riders Allowed".

(b) No employee shall be required to ride on material hoists except for the purposes of inspection and maintenance.

(c) All entrances of the hoistway shall be guarded by substantial gates or bars which shall guard the full width of the landing entrance. All hoistway entrance bars and gates shall be painted with diagonal contrasting colors, such as black and yellow stripes.

- (i) Bars shall be no less than two-inch by four-inch wooden bars or the equivalent, located two feet from the hoistway line. Bars shall be located no less than twenty-six inches or more than forty-two inches above the floor.

- (ii) Gates or bars protecting the entrances to hoistways shall be equipped with a latching device.

(d) Overhead protective covering of two-inch planking, three-fourths-inch plywood, or other solid

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material of equivalent strength, shall be provided on the top of every material hoist cage or platform.

- (e) The operator's station of a hoisting machine shall be provided with overhead protection equivalent to tight planking no less than two inches thick. The support for the overhead protection shall be of equivalent strength.
- (f) Hoist towers may be used with or without an enclosure on all sides. However, whichever alternative is chosen, the following applicable conditions shall be met:
 - (i) When a hoist tower is enclosed, it shall be enclosed on all sides for its entire height with a screen enclosure of one-half-inch mesh, "No. 18 U.S. Gauge" wire or equivalent, except for landing access.
 - (ii) When a hoist tower is not enclosed, the hoist platform or car shall be totally enclosed (caged) on all sides for the full height between the floor and the overhead protective covering with one-half-inch mesh of "No. 14 U. S. Gauge" wire or equivalent. The hoist platform enclosure shall include the required gates for loading and unloading. A six-foot high enclosure shall be provided on the unused sides of the hoist tower at ground level.
- (g) Car arresting devices shall be installed to function in case of rope failure.
- (h) Material hoists shall be securely fastened to the structure at no less than twenty-five-foot intervals.

(3) Personnel hoists.

- (a) Hoist towers outside the structure shall be enclosed for the full height on the side or sides used for entrance and exit to the structure. At the lowest landing, the enclosure on the sides not used for exit or entrance to the structure shall be enclosed to a height of no less than ten feet. Other sides of the tower adjacent to floors or scaffold platforms shall be enclosed to a height of ten feet above the level of such floors or scaffolds.
- (b) Towers inside of structures shall be enclosed on all four sides throughout the full height.
- (c) Towers shall be anchored to the structure at intervals not exceeding twenty-five feet. In addition to tie-ins, a series of guys shall be installed. Where tie-ins are not practical the tower shall be anchored by means of guys made of wire rope no less than one-half inch in diameter, securely fastened to anchorage to ensure stability.
- (d) A minimum of two and one-half square feet shall be provided for each person riding on hoist car.
- (e) Whenever a hoist tower extends twenty-five feet or more above the roof line or last possible tie-ins to the structure, it shall be guyed.
- (f) Hoistway doors or gates shall be no less than six feet six inches high and shall be provided with mechanical locks which cannot be operated from the landing side, and shall be accessible only to employees on the car.
- (g) Cars shall be permanently enclosed on all sides and the top, except sides used for entrance and exit which have car gates or doors.
- (h) A door or gate shall be provided at each entrance to the car which shall guard the full width and height of the entrance opening.

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- (i) Overhead protective covering of two-inch planking, three-fourths-inch plywood or other solid material of equivalent strength shall be provided on the top of every personnel hoist.
- (j) Doors or gates shall be provided with electric contacts which do not allow movement of the hoist when door or gate is open.
- (k) Cages of all hoists upon which employees are permitted to ride shall be equipped with a down speed governor to operate the car safety.
- (l) Safeties shall be capable of stopping and holding the car and rated load when traveling at governor tripping speed.
- (m) Cars shall be provided with a capacity and data plate secured in a conspicuous place on the car or crosshead.
- (n) Internal combustion engines for direct drive are prohibited.
- (o) Normal and final terminal stopping devices shall be provided.
- (p) An emergency stop switch shall be provided in the car and marked "STOP".
- (q) Ropes.
 - (i) The minimum number of hoisting ropes used shall be three for traction hoists and two for drum-type hoists.
 - (ii) The minimum diameter of hoisting and counterweight wire ropes shall be one-half inch.
 - (iii) Factor of safety.

Minimum factors of safety for suspension wire ropes	
Rope speed in feet per minute:	Minimum factor of safety:
50	7.60
75	7.75
100	7.95
125	8.10
150	8.25
175	8.40
200	8.60
225	8.75
250	8.90
300	9.20
350	9.50
400	9.75
450	10.00
500	10.25

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550	10.45
600	10.70

- (r) Following assembly and erection of hoists, and before they are put in service, an inspection and test of all functions and safety devices shall be made at full rated capacity under the supervision of the manufacturer or the manufacturer's authorized representative. A similar inspection and test is required following major alteration of an existing installation. All hoists shall be inspected and tested no less often than at three-month intervals. Records shall be maintained and kept on file for the duration of the job.
- (s) Personnel hoists used in bridge tower construction shall be approved by a registered professional engineer and erected under the supervision of a qualified engineer competent in this field.
- (i) When a hoist tower is not enclosed, the hoist platform or car shall be totally enclosed (caged) on all sides for the full height between the floor and the overhead protective covering with three-fourths-inch mesh of "No. 14 U.S. Gauge" wire or equivalent. The hoist platform enclosure shall include the required gates for loading and unloading.
- (ii) These hoists shall be inspected and maintained on a weekly basis. Whenever the hoisting equipment is exposed to winds exceeding thirty-five miles per hour it shall be inspected and put in operable condition before re-use.
- (iii) Wire rope shall be taken out of service when any of the following conditions exist:
- (a) In running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay;
 - (b) Wear of one-third the original diameter of outside individual wires. Kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure;
 - (c) Evidence of any heat damage from any cause;
 - (d) Reductions from nominal diameter of more than three-sixty-fourths-inch for diameters to and including three-fourths-inch, one-sixteenths-inch to one and one-eighth inches inclusive, three-thirty-seconds-inch for diameters one and one-fourth inches to one and one-half inches inclusive;
 - (e) In standing ropes, more than two broken wires in one lay in sections beyond end connections or more than one broken wire at an end connection.
- (4) Overhead hoists.
- (a) The safe working load of the overhead hoist, as determined by the manufacturer, shall be indicated on the hoist, and this safe working load shall not be exceeded.
 - (b) The supporting structure to which the hoist is attached shall have a safe working load equal to that of the hoist.
 - (c) The support shall be arranged so as to provide for free movement of the hoist and shall not restrict the hoist from lining itself up with the load.
 - (d) The hoist shall be installed only in locations that will permit the operator to stand clear of the load at

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all times.

(e) All overhead hoists in use shall meet the applicable requirements for construction, design, installation, testing, maintenance, and operation as prescribed by the manufacturer.

(E) Proximity to overhead electric conductors.

When it is necessary to move or operate cranes, derricks, or any other type of hoisting apparatus or construction equipment within twenty feet of an electrical conductor carrying one hundred ten volts or more, the employer shall:

- (1) Arrange with the owner of the conductor, or the owner's authorized representative, to deenergize the conductor, or
- (2) Arrange with the owner of the conductor, or the owner's authorized representative, to move the conductor, or
- (3) Arrange with the owner of the conductor, or the owner's authorized representative, to guard the conductor from accidental contact and the employer shall designate an employee to act as signalman to direct the operator in the movement of derricks, cranes, or any other type of hoisting apparatus or construction equipment, or
- (4) Install an insulated type guard about the boom or arm of the equipment and a dielectric insulator link between the load and the block and the employer shall designate an employee to act as a signalman to direct the operator in the movement of derricks, cranes, or any other type of hoisting apparatus or construction equipment.

(F) No employee shall be permitted to pass or be under loads handled by power shovels, derricks, or hoists. Employees who are not engaged in vehicle loading shall be required to stand back from any such vehicle during the loading.

(G) Derricks.

The following types of derricks are covered by the requirements in this section wherever such requirements apply to the specific type of derrick: gin poles, tripod derricks, A-frame derricks, Chicago boom derricks, stiff leg derricks, breast derricks and guyed masts. (See appendix to this rule for diagrams of derricks.)

(1) Design.

(a) Derricks and all appurtenances thereof, including anchorage, shall be designed to carry the maximum working loads to be imposed upon them and shall provide a factor of safety of no less than four, including wind loads calculated on the basis of the following table:

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Wind loads to be used in design of derricks

Height Zone (Feet)	Wind Load (lbs./sq. ft. of Vertical Surface)
Less than 20	10
20 to less than 30	15
30 to less than 50	20
50 to less than 100	25
100 to less than 500	30
500 to less than 1200	35
Over 1200	40

NOTES:

1. For cylindrical sections in excess of two inch diameter, multiply by factor of 0.80.
2. For cylindrical sections two inches or less in diameter, multiply by factor of 1.00.
3. For flat sections, multiply by factor of 1.30.
4. When height under consideration is fifty feet or more, interpolate wind load for such height from table.
5. Design shall be checked for wind loading in all directions. No allowance shall be made for sheltering from adjacent structures.

(b) All equipment shall be designed and erected in a substantial manner and securely fastened in place.

(2) Foundations and anchoring.

(a) Foundations.

Derricks shall be set upon substantial foundations.

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(b) Anchoring and securing.

(i) Independent of building or structure.

- (a) Derricks independent of a building or structure shall be substantially anchored at the top of each corner post and at intermediate intervals of no more than forty feet with no less than three-eighths-inch steel wire rope or material of equal or greater strength. Anchorage for the guys of derricks shall be designed to resist the loads imposed.
- (b) Under no circumstances shall less than six guys be used on a derrick supported solely by guys.
- (c) The anchoring of derricks shall be such as to ensure that with the boom in any position, the righting moment will exceed the overturning moment, imposed under service conditions with rated load or under storm conditions.

(ii) Secured to building or structure.

Derricks shall be securely fastened to the building or structure, at intervals of no more than forty feet.

(3) Hoist hooks.

Hoist hooks used with bucket, cage or skip shall be equipped with a safety latch designed to prevent the load from being accidentally detached.

(4) Braking systems.

Derricks shall be provided with a brake which will operate in case of power failure. The braking system shall be capable of holding the maximum rated load at any point of the lift.

(5) Protection from falling material or objects.

A substantial overhead guard shall be provided which will protect the operator of the derrick from falling material and objects.

(6) Running lines.

Running lines and pinch points where a wire rope runs onto sheaves, blocks or pulleys of derricks, located six feet or less from the ground or working level shall be guarded, except when loads are moved horizontally.

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4123:1-3-09 Roofing devices.

(A) Reserved.

(B) Reserved.

(C) Buckets for handling hot tar, hot pitch or hot asphalt.

Buckets furnished by the employer and used by the employee to handle hot tar, hot pitch, hot asphalt or similar materials shall be made of "No. 24 Gauge" or heavier sheet metal and shall have a metal bail of one-fourth-inch diameter or larger. The bail shall be fastened to offset ears which have been riveted or welded to the bucket.

(D) Felt-laying machines and mechanical moppers.

Operators of felt-laying machines and mechanical moppers shall not be required to operate such machines within a distance of six feet of any unprotected roof opening or within six feet of any unprotected roof edge which is parallel to the direction of mechanical equipment operation, and not less than ten feet from the roof edge which is perpendicular to the direction of mechanical equipment operation.

(E) Roofing brackets.

(1) Construction.

Roofing brackets shall be constructed to fit the pitch of the roof.

(2) Fastening.

Roofing brackets shall be securely fastened in place. When brackets cannot be securely fastened by any other means, rope supports shall be used. When rope supports are used, such supports shall consist of manila rope of no less than three-quarter-inch diameter, or equivalent.

(F) Catch platforms for pitched and flat roofs.

(1) Catch platforms for pitched roofs.

On pitched roofs with a rise of four inches in twelve or greater, sixteen feet or more above ground, and not having a parapet of at least thirty inches in height, catch platforms shall be installed. The platform shall extend two feet beyond the projection of the eaves and shall be provided with a standard guardrail substantially fixed in place. Safety belts or harnesses attached to a lifeline which is securely fastened to the structure may be used in lieu of a catch platform.

(2) For flat roofs.

On flat roofs, not having a parapet of at least thirty inches in height, a standard guardrail substantially fixed in place may be used. Safety belts or harnesses attached to a lifeline which is securely fastened to the structure may be used in lieu of a standard guardrail.

(G) Kettles and tankers.

(1) Heating of kettles and tankers.

(a) All kettles and tankers in use or being heated up for use shall have a qualified person, designated by

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the employer, in attendance.

(b) Automatic tanker heaters when used to maintain a minimum temperature are exempt.

(2) Leveling devices.

Kettles shall be equipped with leveling devices and such leveling devices shall be securely fastened in place.

(3) Lids or covers.

Kettles shall be equipped with lids or covers hinged in place.

(4) Pumper or agitator.

A pumper or agitator shall not be set into hot material.

(5) Propane cylinders.

Valves, fittings and accessories connected directly to propane cylinders, including primary shut-off valves, shall have a rated working pressure of no less than two hundred and fifty p.s.i.g. and shall be of material and design suitable for LP-gas service.

(6) Storage containers for fuel.

Storage containers for fuel used to heat tankers shall be located no less than twenty-five feet from burners on tankers with capacity of less than two thousand gallons, no less than fifty feet on tankers with capacity of two thousand gallons or more.

(H) Chicken ladders or crawling boards.

(1) Construction.

Chicken ladders or crawling boards shall be no less than ten inches wide and one inch thick having cleats no less than one inch by one and one half inches and extending no less than two inches beyond each side of the board. Cleats shall be evenly spaced and shall not exceed twenty-four inches on center. Nails shall be driven through and clinched on the underside.

(2) Securing of crawling boards.

Crawling boards shall be secured to the roof by means of ridge hook(s) or no less than three-quarters-inch manila line, or its equivalent, passed over the ridge and securely fastened to maintain a safe working condition. A firmly fastened grabline of no less than three-quarters-inch manila line, or its equivalent, shall be strung beside each crawling board for a handhold.

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Amend

4123:1-3-10 Scaffolding.

(A) Reserved.

(B) Definitions.

- (1) "Bearer" means a horizontal member of a scaffold upon which the platform rests and which may be supported by ledgers.
- (2) "Boatswain's chair" means a seat supported by slings attached to a suspended rope, designed to accommodate one employee in a sitting position.
- (3) "Brace" means a tie that holds one scaffold member in a fixed position with respect to another member.
- (4) "Bricklayer's square scaffold" means a scaffold the platform of which is supported on built-up squares secured to each other by full and continuous diagonal bracing.
- (5) "Carpenter's bracket scaffold" means a scaffold the platform of which is supported on triangular braced brackets fastened to the side of the structure.
- (6) "Chimney, stack, or tank bracket scaffold" means a scaffold composed of a platform supported by wood or steel brackets, hooked over a steel wire rope which surrounds the circumference of the chimney, stack, or tank.
- (7) "Coupler" means a device for locking together the component parts of a tubular metal scaffold.
- (8) "Double pole or independent pole scaffold" means a scaffold supported from the base by a double row of uprights, independent of support from the walls and constructed of uprights, ledgers, horizontal platform bearers, and diagonal bracing.
- (9) "Elevating assembly" means a mechanical, hydraulic, or other type of mechanism used to elevate and lower a work platform.
- (10) "Float or ship scaffold" means a scaffold hung from overhead supports by means of ropes and consisting of a platform having diagonal bracing underneath, resting upon and fastened to two parallel plank bearers at right angles to the span.
- (11) "Foot scaffold" means a scaffold used to give additional height, the platform of which does not exceed eighteen inches above the supporting surface.
- (12) "Heavy duty scaffold" means a scaffold designed and constructed to carry a working load in excess of fifty pounds but no more than seventy-five pounds per square foot.
- (13) "Horizontal wire rope supported scaffold" means a scaffold the platform of which is supported at two or more points by horizontal wire ropes.
- (14) "Horse scaffold" means a scaffold or light or medium duty, composed of [saw](#) horses supporting a work platform.
- (15) "Interior hung scaffold" means a scaffold suspended from the ceiling or roof structure.

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- (16) "Ladder jack scaffold" means a light duty scaffold supported by brackets attached to ladders.
- (17) "Lean to, or shore, scaffold", use prohibited (see paragraph (C)(16) of this rule), means scaffold the platform of which is supported on members consisting of a putlog or bearer, knee braced to two diverging inclined legs that are in a plane substantially transverse to the putlog and that support the outer end of the putlog or bearer, while the inner end of the bearer or putlog rests on or against the structure or on a bearing block attached to the structure.
- (18) "Ledgers" or "stringers" means a horizontal scaffold member which extends from post to post at right angles to the putlogs or bearers, supports the putlogs or bearers, and forms a tie between the posts and becomes a part of the scaffold bracing.
- (19) "Light duty scaffold" means a scaffold designed and constructed to carry a working load of no more than twenty-five pounds per square foot.
- (20) "Manually propelled mobile scaffold" means a portable rolling scaffold equipped with casters.
- (21) "Mason's adjustable multiple-point suspension scaffold" means a scaffold having a continuous platform supported by bearers suspended by wire rope from overhead supports, so arranged and operated as to permit the raising or lowering of the platform to desired working positions.
- (22) "Maximum rated load" means the total of all loads including the working load, the weight of the scaffold, and such other loads as may be reasonably anticipated.
- (23) "Medium duty scaffold" means a scaffold designed and constructed to carry a working load in excess of twenty-five pounds but no more than fifty pounds per square foot.
- (24) "Needle beam scaffold" means a cantilevered light duty scaffold consisting of two parallel horizontal beam called needle beams supporting a platform.
- (25) "Outrigger scaffold" means a scaffold supported by outriggers or thrustouts projecting beyond the wall or face of the building or structure, the inboard ends of which are secured inside the wall or face of such building or structure.
- (26) "Pick, or kick, plank" means a platform, similar in construction to a narrow ladder with light decking strung upon and attached to the rungs, which rests upon horizontal and parallel stringers, or other bearers, and is movable along the course of the stringer.
- (27) "Platform" means the temporary flat working surface used to support employees, material, and equipment.
- (28) "Putlog" means a scaffold member upon which the platform rests (also see "bearer").
- (29) "Runner" means the lengthwise horizontal bracing or bearing members, or both.
- (30) "Scaffold" means any temporary elevated platform and its supporting structure used for supporting employees, materials, or equipment.
- (31) "Single-point adjustable suspension scaffold" means a manually or power operated unit designed for light duty use, supported by a single wire rope from an overhead support so arranged and operated as to permit the raising or lowering of platform to desired working positions.

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- (32) "Single-pole scaffold" means platforms resting on putlogs or cross beams, the outside ends of which are supported on ledgers secured to a single row of posts or uprights, and the inner ends of which are supported on or in a wall.
 - (33) "Stack bracket scaffold" - see "chimney bracket scaffold".
 - (34) "Suspended scaffold" means a scaffold supported from above, the platform of which is supported at more than two points from overhead outriggers which are fastened to the framework of the structure.
 - (35) "Tank bracket scaffold" - see "chimney bracket scaffold".
 - (36) "Tube and coupler scaffold" means an assembly consisting of tubing which serves as posts, bearers, braces, ties, and runner, a base supporting the posts, and special couplers which serve to connect the uprights and to join the various members.
 - (37) "Tubular welded frame scaffold" means a sectional panel or frame metal scaffold built up of prefabricated welded sections which consists of posts and horizontal bearers with intermediate members.
 - (38) "Two-point suspension scaffold" or "swinging scaffold" means a scaffold the platform of which is supported by stirrups or hangers at two points to permit raising or lowering, suspended from overhead supports.
 - (39) "Window jack scaffold" means a scaffold the platform of which is supported by a jack or thrustout which projects through a window opening.
 - (40) "Working load" means the load on the scaffold imposed by employees, material, and equipment.
- (C) General requirements for all scaffolds.

See appendix to this rule for examples of various scaffolds mentioned throughout this rule.

- (1) The footing or anchorage for scaffolds shall be sound, rigid, and capable of supporting the load without settling or displacement. Unstable or loose objects shall not be used to support scaffolds.
- (2) Scaffolds and their components shall be capable of supporting without failure no less than four times the maximum rated load.
- (3) Any scaffold including accessories, such as braces, brackets, trusses, screw legs, ladders, etc., damaged or weakened from any cause shall be immediately repaired or replaced.
- (4) Guardrails and toeboards.

Standard guardrails and toeboards shall be installed on all open sides and ends of platforms more than ten feet above the ground or floor, except on needle beam scaffolds and floats.

- (5) ~~Where employees are required to work or pass under the scaffold each employee on a scaffold shall be provided with a additional protection from falling hand tools, debris, and other small objects through the installation of toeboards, screens, or guardrail systems, or through the erection of debris nets, catch platforms, or canopy structures that contain or deflect the falling objects.~~ Where employees are required to work or pass under the scaffold, each employee shall be provided with additional protection from falling hand tools, debris, and other small objects through the installation of toeboards, screens, or

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guardrail systems, or through the erection of debris nets, catch platforms, or canopy structures that contain or deflect the falling objects. When the objects are too large, heavy or massive to be contained or deflected by any of the above-listed measures, the employer shall place such potential falling objects away from the edge of the surface from which they could fall and shall secure those materials as necessary to prevent their falling.

- (6) Nails provided for the construction of scaffolds shall be no less than eight-penny common.
- (7) All planking shall be "Scaffold Grade," or equivalent, as recognized by approved grading rules for the species of wood used.
- (8) All planking of platforms shall be overlapped a minimum of twelve inches or secured from movement.
- (9) An access ladder or equivalent safe access shall be provided for all scaffolds.
- (10) Scaffold planks shall extend over end supports no less than six inches and no more than twelve inches.
- (11) The poles, legs, or uprights of scaffolds shall be plumb and securely and rigidly braced to prevent swaying and displacement.
- (12) Overhead protection shall be provided for employees on a scaffold exposed to hazards from overhead.
- (13) Reasonable care shall be taken to maintain all scaffold surfaces free of debris and slippery substances.
- (14) No welding, burning, riveting, or open flame work shall be performed on any scaffolding suspended by means of fiber or synthetic rope. Only fiber or synthetic ropes, properly treated or protected, shall be used for or near any work involving the use of corrosive substances or chemicals.
- (15) Wire, synthetic, or fiber rope used for scaffold suspension shall be capable of supporting no less than six times the maximum rated load.
- (16) The use of shore or lean-to scaffolds is prohibited.
- (17) When there is danger of material being hoisted striking against the scaffold, a tag line shall be provided.
- (18) The free ends of fall lines from scaffolds shall be guarded.

(D) Wood pole scaffolds.

See appendix to this rule for examples of wood pole scaffolds.

- (1) Scaffold poles shall bear on a foundation of sufficient size and strength to spread the load from the pole over a sufficient area to prevent settlement. All poles shall be set plumb.
- (2) Where poles are spliced, the ends shall be squared and the upper section shall rest squarely on the lower section. Wood splice plates shall be provided on no less than two adjacent sides and shall be no less than four feet in length, overlapping the abutted ends equally, and have the same width and no less than the cross-sectional area of the pole. Splice plates or other materials of equivalent strength may be used.
- (3) Independent pole scaffolds shall be set as near to the wall of the building as practicable.
- (4) All pole scaffolds shall be securely guyed or tied to the building or structure. Where the height or length

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exceeds twenty-five feet, the scaffold shall be secured at intervals no greater than twenty-five feet vertically and horizontally.

- (5) Putlogs or bearers shall be set with the greater dimension vertical, long enough to project over the ledgers of the inner and outer rows of poles no less than three inches for proper support.
- (6) Every wooden putlog on single pole scaffolds shall be reinforced with a three-sixteenths - by two-inch steel strip, or equivalent, secured to its lower edge throughout its entire length.
- (7) Ledgers shall be long enough to extend over two pole spaces. Ledgers shall not be spliced between the poles. Ledgers shall be reinforced by bearing blocks securely fastened to the side of the pole to form a support for the ledger.
- (8) Diagonal bracing shall be provided to prevent the poles from moving in a direction parallel with the wall of the building, and from buckling.
- (9) Cross bracing shall be provided between the inner and outer sets of poles in independent pole scaffolds. The free ends of pole scaffolds shall be cross braced.
- (10) Full diagonal face bracing shall be erected across the entire face of pole scaffolds in both directions. The braces shall be spliced only at the poles. The inner row of poles on medium and heavy duty scaffolds shall be braced in similar manner.
- (11) Platform planks shall be laid with their edges butted together so the platform shall be tight with no spaces through which tools or fragments of material can fall.
- (12) Where planking is lapped, each plank shall lap its end support no less than twelve inches. Where the ends of planks abut each other to form a flush floor, the butt joint shall be at the centerline of a pole. The abutted ends shall rest on separate bearers. Intermediate beams shall be provided where necessary to prevent dislodgment of planks due to deflection, and the ends shall be secured to prevent their dislodgment.
- (13) When a scaffold materially changes its direction, the platform planks shall be laid to prevent tipping. The planks that meet the corner putlog at an angle shall be laid first, extending over the diagonally placed putlog far enough to have a good safe bearing, but not far enough to involve any danger from tipping. The planking running in the opposite direction at an angle shall be laid so as to extend over and rest on the first layer of planking.
- (14) When moving platforms to the next level, the old platform shall be left undisturbed until the new putlogs or bearers have been set in place, ready to receive the platform planks.
- (15) All wood pole scaffolds sixty feet or less in height shall be constructed and erected in accordance with "Tables 10-1 to 10-6." If they are over sixty feet in height, they shall be designed by a professional engineer competent in this field, and shall be constructed and erected in accordance with such design.

Table 10-1. Minimum nominal size and maximum spacing of members of single-pole scaffolds - light duty.

	Maximum height of scaffold
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	20 ft.	60 ft.
Uniformly distributed load	Not to exceed 25 p.s.f.	
Poles or uprights	2 × 4 in.	4 × 4 in.
Pole spacing (longitudinal)	6 ft. 0 in.	10 ft. 0 in.
Maximum width of scaffold	5 ft. 0 in.	5 ft. 0 in.
Bearers or putlogs to 3 ft. 0 in. width	2 × 4 in.	2 × 4 in.
Bearers or putlogs to 5 ft. 0 in. width	2 × 6 in. or 3 × 4 in.	2 × 6 in. or 3 × 4 in. (rough).
Ledgers	1 × 4 in.	1 1/4 × 9 in.
Planking	1 1/4 × 9 in. (rough)	2 × 10 in.
Vertical spacing of horizontal members	7 ft. 0 in.	9 ft. 0 in.
Bracing, horizontal and diagonal	1 × 4 in.	1 × 4 in.
Tie-ins	1 × 4 in.	1 × 4 in.
Toeboards	4 in. high (minimum)	4 in. high (minimum).
Guardrails	2 × 4 in.	2 × 4 in.

All members except planking shall be used on edge.

Table 10-2. Minimum nominal size and maximum spacing of members of single-pole scaffolds - medium duty.

Uniformly distributed load.	Not to exceed 50 p.s.f.
Maximum height of scaffolds.	60 ft.
Poles or uprights	4 × 4 in.
Pole spacing (longitudinal).	8 ft. 0 in.
Maximum width of scaffold.	5 ft. 0 in.
Bearers or putlogs	2 × 10 in. or 3 × 4 in.
Spacing of bearers or putlogs.	8 ft. 0 in.
Ledgers	2 × 10 in.
Vertical spacing of horizontal members.	7 ft. 0 in.
Bracing, horizontal	1 × 6 in. or 1 1/4 × 4 in.
Bracing, diagonal	1 × 4 in.
Tie-ins	1 × 4 in.
Planking	2 × 10 in.
Toeboards	4 in. high (minimum).
Guardrails	2 × 4 in.

All members except planking shall be used on edge.

Table 10-3. Minimum nominal size and maximum spacing of members of single-pole scaffolds - heavy duty.

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Uniformly distributed load.	Not to exceed 75 p.s.f.
Maximum height of scaffold.	60 ft.
Poles or uprights	4 × 6 in.
Pole spacing (longitudinal).	6 ft. 0 in.
Maximum width of scaffold.	5 ft. 0 in.
Bearers or putlogs	2 × 10 in. or 3 × 5 in.
Spacing of bearers or putlogs.	6 ft. 0 in.
Ledgers	2 × 10 in.
Vertical spacing of horizontal members.	6 ft. 6 in.
Bracing, horizontal and diagonal.	2 × 4 in.
Tie-ins	1 × 4 in.
Planking	2 × 10 in.
Toeboards	4 in. high (minimum).
Guardrails	2 × 4 in.

All members except planking shall be used on edge.

Table 10-4. Minimum nominal size and maximum spacing of members of independent pole scaffold - light duty.

	Maximum height of scaffold	
	20 ft.	60 ft.
Uniformly distributed load	Not to exceed 25 p.s.f.	
Poles or uprights	2 × 4 in.	4 × 4 in.
Pole spacing (longitudinal)	6 ft. 0 in.	10 ft. 0 in.
Pole spacing (transverse)	6 ft. 0 in.	10 ft. 0 in.
Ledgers	1 1/4 × 4 in.	1 1/4 × 9 in.
Bearers to 3 ft. 0 in. span	2 × 4 in.	2 × 4 in.
Bearers to 10 ft. 0 in. span	2 × 6 in. or 3 × 4 in.	2 × 10 (rough) or 3 × 8 in.
Planking	1 1/4 × 9 in.	2 × 10 in.
Vertical spacing of horizontal members	7 ft. 0 in.	7 ft. 0 in.
Bracing, horizontal and diagonal	1 × 4 in.	1 × 4 in.
Tie-ins	1 × 4 in.	1 × 4 in.
Toeboards	4 in. high	4 in. high (minimum)
Guardrails	2 × 4 in.	2 × 4 in.

All members except planking shall be used on edge.

Table 10-5. Minimum nominal size and maximum spacing of members of independent pole scaffolds - medium duty.

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Uniformly distributed load.	Not to exceed 50 p.s.f.
Maximum height of scaffold.	60 ft.
Poles or uprights	4 × 4 in.
Pole spacing (longitudinal).	8 ft. 0 in.
Pole spacing (transverse).	8 ft. 0 in.
Ledgers	2 × 10 in.
Vertical spacing of horizontal members.	6 ft. 0 in.
Spacing of bearers	8 ft. 0 in.
Bearers	2 × 10 in.
Bracing, horizontal	1 × 6 in. or 1 1/4 × 4 in.
Bracing, diagonal	1 × 4 in.
Tie-ins	1 × 4 in.
Planking	2 × 10 in.
Toeboards	4 in. high (minimum).
Guardrails	2 × 4 in.

All members except planking shall be used on edge.

Table 10-6. Minimum nominal size and maximum spacing of members of independent pole scaffold - heavy duty.

Uniformly distributed load.	Not to exceed 75 p.s.f.
Maximum height of scaffold.	60 ft.
Poles or uprights	4 × 4 in.
Pole spacing (longitudinal).	6 ft. 0 in.
Pole spacing (transverse).	8 ft. 0 in.
Ledgers	2 × 10 in.
Vertical spacing of horizontal members.	6 ft. 0 in.
Bearers	2 × 10 in. (rough).
Bracing, horizontal and diagonal.	2 × 4 in.
Tie-ins	1 × 4 in.
Planking	2 × 10 in.
Toeboards	4 in. high (minimum).
Guardrails	2 × 4 in.

All members except planking shall be used on edge.

(E) Tube and coupler scaffolds.

- (1) The material used for couplers shall be of a structural type, such as drop-forged steel, malleable iron, or structural grade aluminum.
- (2) A light duty tube and coupler scaffold shall have all posts, bearers, runners, and bracing of nominal two-inch outside-diameter (O.D.) steel tubing. The posts shall be spaced no more than six feet apart in width and ten feet apart in length. Other structural metals when used must be designed to carry an

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equivalent load. No dissimilar metals shall be used together.

- (3) A medium duty tube and coupler scaffold shall consist of no less than nominal two-inch O.D. steel tubing in all posts, runners, and bracing. Where the posts are spaced no farther apart than five feet by eight feet, the bearers shall also be no less than nominal two-inch O.D. steel tubing. Where the posts are spaced at greater distances apart than five feet by eight feet, the bearers shall be of not less than nominal two and one-half inch O.D. steel tubing but, in no event, may the posts of a medium duty tube and coupler scaffold be spaced farther apart than six feet by eight feet. Other structural metals, when used, must be capable of carrying a load equivalent to the load supportable by the prescribed tube and coupler scaffold. No dissimilar metals shall be used together.
- (4) A heavy duty tube and coupler scaffold shall have all posts, runners, and bracing of nominal two-inch O.D. steel tubing, with the posts spaced no more than six feet by six feet six inches. Other structural metals, when used, must be designed to carry an equivalent load. No dissimilar metals shall be used together.
- (5) Tube and coupler scaffolds shall be limited in heights and working levels to those permitted in Tables 10-7 to 10-9. Drawings and specifications of all tube and coupler scaffolds above the limitations in Tables 10-7 to 10-9 shall be designed by a qualified engineer competent in this field.
- (6) Posts shall be accurately spaced, erected on suitable bases, and maintained plumb.
- (7) Runners shall be erected along the length of the scaffold, located on both the inside and the outside posts at even heights. Runners shall be interlocked to the inside and the outside posts at even heights. Runners shall be interlocked to form continuous lengths and coupled to each post. The bottom runners shall be located as close to the base as possible. Runners shall be placed no more than six feet six inches on centers.
- (8) Bearers shall be installed transversely between posts and shall be securely coupled to the posts bearing on the runner coupler. When coupled directly to the runners, the coupler must be kept as close to the posts as possible.
- (9) Bearers shall extend past the post and runners.
- (10) Cross bracing shall be installed across the width of the scaffold no less than every third set of posts horizontally and every fourth runner vertically. Such bracing shall extend diagonally from the inner and outer runners upward to the next outer and inner runners.
- (11) Longitudinal diagonal bracing on the inner and outer rows of poles shall be installed at approximately a forty-five degree angle from near the base of the first outer post upward to the extreme top of the scaffold. Where the longitudinal length of the scaffold permits, such bracing shall be duplicated beginning at every fifth post. In a similar manner, longitudinal diagonal bracing shall also be installed from the last post extending back and upward toward the first post. Where conditions preclude the attachment of this bracing to the posts, it may be attached to the runners.
- (12) The entire scaffold shall be tied to and securely braced against the building at intervals not to exceed thirty feet horizontally and twenty-six feet vertically.

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Table 10-7. Tube and coupler scaffolds - light duty

Uniformly distributed load	Not to exceed 25 p.s.f.
Post spacing (longitudinal)	10 ft. 0 in.
Post spacing (transverse)	

Working levels	Additional planked levels	Maximum height
1	8	125 ft.
2	4	125 ft.
3	0	91 ft. 0 in.

Table 10-8. Tube and coupler scaffolds - medium duty

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

Working levels	Additional planked levels	Maximum height
1	6	125 ft.
2	0	78 ft. 0 in.

Table 10-9. Tube and coupler scaffolds - heavy duty

Uniformly distributed load	Not to exceed 75 p.s.f.
Post spacing (longitudinal)	6 ft. 6 in.
Post spacing (transverse)	6 ft. 0 in.

Working levels	Additional planked levels	Maximum height
1	6	125 ft.

(F) Tubular welded frame scaffolds.

- (1) Scaffolds shall be properly braced by diagonal braces for securing vertical members together laterally, and the cross braces shall be of such length as will automatically square and align vertical members so that the erected scaffold is always plumb, square, and rigid. All brace connections shall be made secure.
- (2) Scaffold legs shall be set on adjustable bases or plain bases placed on mud sills or other adequate foundations.
- (3) The frames shall be placed one on top of the other with coupling or stacking pins to provide proper vertical alignment of the legs.
- (4) Where uplift may occur, panels shall be locked together vertically by pins or other equivalent suitable means.
- (5) Supported scaffolds with a height to base width (including outrigger supports if used) ratio of more than four to one shall be secured to the building or structure at intervals not to exceed thirty feet horizontally and twenty-six feet vertically.
- (6) Maximum permissible spans or planking shall be in conformity with paragraph (C)(7) of this rule.

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(G) Manually propelled mobile scaffolds.

- (1) When free-standing mobile scaffold towers are used, the height of the work platform shall not exceed four times the minimum base dimension.
- (2) Casters shall be properly designed for strength and dimensions to support four times the maximum rated load. All casters shall be provided with a locking device to hold the scaffold in position.
- (3) Scaffolds shall be properly braced by cross bracing and horizontal bracing conforming with paragraph (F)(1) of this rule.
- (4) Platforms shall be tightly planked for the full width of the scaffold except for necessary entrance opening. Platforms shall be secured in place.
- (5) A ladder or stairway shall be provided for proper access and exit and shall be affixed or built into the scaffold and so located that when in use it will not have a tendency to tip the scaffold. A landing platform must be provided at intervals not to exceed thirty-five feet.
- (6) Provision shall be made to stabilize the tower during movement from one location to another.
- (7) The employer shall not require employees to ride on manually propelled scaffolds unless the following conditions exist:
 - (a) The floor or surface is within three degrees of level and free from pits, holes, or obstructions;
 - (b) When ready for rolling the height of the work platform shall not exceed two times the narrowest dimension of the base; when outriggers are used they shall be included in the base dimension and shall be installed on both sides of the staging;
 - (c) The wheels are equipped with rubber or similar resilient tires;
 - (d) All tools and materials are secured or removed from the platform before the mobile scaffold is moved.

(H) Elevated work platforms and self-propelled elevated work platforms.

- (1) The minimum rated work load of a platform shall be no less than two hundred fifty pounds. The work platform and all structural components shall have a factor of safety of no less than four.
- (2) Any work platform when raised to its maximum working height shall be capable of sustaining without reaching instability, a horizontal force of fifty pounds applied to any point on the platform while the platform is carrying the working load.
- (3) The base shall not be used or placed on an inclined surface unless leveled by a device that is part of the unit.
- (4) Work platform elevating assemblies.
 - (a) Factors of safety of elevating assembly.
 - (i) Where the platform is supporting its working load by a system of wire ropes or lift chains, or both, the factor of safety of the wire or chain shall be no less than six.
 - (ii) All critical components of a hydraulic or pneumatic system used in a work platform shall have a

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bursting strength that exceeds the pressure attained when the system is subjected to the equivalent of four times the maximum rated load. Critical components are those in which a failure would result in a free fall. All noncritical hydraulic components shall have a bursting factor of safety of no less than two.

(b) Systems protection.

- (i) Where the elevation of the platform is accomplished by an electromechanical assembly, or a hydraulic or pneumatic cylinder assembly, the system shall be so equipped as to prevent free fall in the event of a power failure.
- (ii) Where the elevation of the platform is accomplished by a hydraulic or pneumatic cylinder assembly, the system shall be so equipped as to prevent free fall in the event of a hydraulic or pneumatic line failure.
- (iii) Where the elevation of the platform is accomplished by a single hoist cable, the system shall be protected by a broken-cable safety device.
- (iv) Where the elevation of the platform is accomplished by manual-mechanical or manual-hydraulic assembly, the assembly shall be equipped to prevent free fall in case of failure.

(c) Controls.

- (i) Any powered work platform shall have both upper and lower control devices. Controls shall be plainly marked as to their function and guarded to prevent accidental operation. The upper control device shall be in or beside the platform, within easy reach of the operator. The lower control device shall have the capability to lower the platform where the operator's safety is in jeopardy.
- (ii) Each elevated work platform shall be equipped with a clear visible instruction plate stating:
 - (a) Rated capacity;
 - (b) Maximum platform height;
 - (c) Special warning or restrictions necessary for safe operation.
- (iii) Protection to personnel.
 - (a) Pinch points and shear points shall be guarded with a barrier to prevent accidental or inadvertent entrapment of personnel while the work platform is being operated.
 - (b) All rotating shafts, gearing, and other moving parts shall be guarded.

(1) Outrigger scaffolds.

See appendix to this rule for examples of outrigger scaffolds.

- (1) Outrigger beams shall extend no more than six feet beyond the face of the building. The inboard end of the outrigger beams, measured from the fulcrum point to anchorage point, shall be no less than one and one-half times the outboard end in length. The beams shall rest on edge, the sides shall be plumb, and the edges shall be horizontal. The fulcrum point of the beam shall rest on a secure bearing no less than

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six inches in each horizontal dimension. The beam shall be secured in place against movement and shall be securely braced at the fulcrum point against movement and shall be securely braced at the fulcrum point against tipping.

- (2) The inboard ends of outrigger beams shall be securely anchored either by means of struts bearing against sills in contact with the overhead beams or ceiling, or by means of tension members secured to the floor joists underfoot, or by both if necessary. The inboard ends of outrigger beams shall be secured against tipping and the entire supporting structure shall be securely braced in both directions to prevent any horizontal movement.
- (3) Unless outrigger scaffolds are designed by a professional engineer competent in this field, they shall be constructed and erected in accordance with "Table 10-10." Outrigger scaffolds, designed by a professional engineer, shall provide equivalent or greater safeguards than those required herein.
- (4) Planking shall be laid tight and shall extend to within three inches of the building wall. Planking shall be secured to the beams.

Table 10-10. Minimum nominal size and maximum spacing of members of outrigger scaffolds.

	Light duty	Medium duty
Maximum scaffold load.	25 p.s.f.	50 p.s.f.
Outrigger size	2 × 10 in.	3 × 10 in.
Maximum outrigger spacing.	10 ft. 0 in.	6 ft. 0 in.
Planking	2 × 10 in.	2 × 10 in.
Guardrail	2 × 4 in.	2 × 4 in.
Guardrail uprights	2 × 4 in.	2 × 4 in.
Toeboards	4 in. (minimum).	4 in. (minimum).

(J) Masons' adjustable multiple-point suspension scaffolds.

See appendix to this rule for examples of masons' adjustable multiple-point suspension scaffolds.

- (1) The scaffold shall be capable of sustaining a working load of fifty pounds per square foot and shall not be loaded in excess of that figure.
- (2) The scaffold shall be provided with hoisting machines that meet the requirements of ~~"Underwriters' Laboratories or Factory Mutual Engineering Corporation."~~ [an approved testing laboratory.](#)
- (3) The platform shall be supported by wire ropes, capable of supporting no less than six times the intended load, suspend from overhead outrigger beams.
- (4) The scaffold outrigger beams shall consist of structural metal securely fastened or anchored to the frame or floor system of the building or structure.
- (5) Where an outrigger beam does not project more than six feet six inches beyond the bearing point, it shall be equivalent in the strength to no less than a standard seven-inch, fifteen and three-tenths-pound steel I-beam no less than fifteen feet long.

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- (6) Where the overhang exceeds six feet six inches, outrigger beams shall be composed of stronger beams or multiple beams, providing proportionally greater strength than that required in paragraph (J)(5) of this rule.
 - (7) All outrigger beams shall be set and maintained with their webs in a vertical position.
 - (8) A stop bolt shall be placed at each end of every outrigger beam.
 - (9) The outrigger beam shall rest on suitable wood bearing blocks.
 - (10) The free end of the suspension wire ropes shall be equipped with proper size thimbles and secured by splicing or other equivalent means. The running ends shall be securely attached to the hoisting drum and no less than four turns of wire rope shall at all times remain on the drum. The use of fiber rope is prohibited.
 - (11) Where a single outrigger beam is used, the steel shackles or clevises with which the wire ropes are attached to the outrigger beams shall be placed directly over the hoisting drum.
 - (12) The scaffold platform shall be equivalent in strength to no less than two-inch planking.
 - (13) When employees are at work on the scaffold and a hazard exists from overhead, overhead protection shall be provided on the scaffold, no more than nine feet above the platform, consisting of two-inch planking, or material of equivalent strength, laid tight, and extending no less than the width of the scaffold.
- (K) Two-point suspension scaffolds (swinging scaffolds).
- See appendix to this rule for examples of swinging scaffolds.
- (1) Two-point suspension scaffold platforms shall be no more than thirty-six inches wide overall. The platform shall be securely fastened to the hangers by U-bolts or by other equivalent means.
 - (2) The hangers of two-point suspension scaffolds shall be made of mild steel, or other equivalent materials, having a cross-sectional area capable of sustaining four times the maximum rated load, and shall be constructed to accommodate a guardrail, intermediate rail, and toeboard.
 - (3) When hoisting machines are used on two-point suspension scaffolds, such machines shall be of a design tested and approved by ~~"Underwriters' Laboratories or Factory Mutual Engineering Corporation."~~[an approved testing laboratory.](#)
 - (4) Employees shall not be required to use a bridge between, or to move directly from, one swinging scaffold and another unless the platforms are at the same height, are abutting, and walk through stirrups specifically designed for this purpose are used.
 - (5) The roof irons or hooks shall be of mild steel, or other equivalent material, of proper size and design, securely installed and anchored. Tiebacks of three-quarter-inch manila rope, or the equivalent, shall serve as an additional means of anchorage, installed at right angles to the face of the building, whenever possible, and secured to a structurally sound portion of the building.
 - (6) Two-point suspension scaffolds shall be suspended by wire, synthetic, or fiber ropes capable of supporting no less than six times the maximum rated load. All other components shall be capable of supporting no

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less than four times the maximum rated load.

- (7) The sheaves of all blocks shall fit the size and type of rope used.
- (8) No more than two employees shall be required to be on a two-point suspension scaffold designed for a working load of five hundred pounds at any time. No more than three employees shall be required to be on a two-point suspension scaffold designed for a working load of seven hundred pounds, at any time. Each employee shall be protected by an approved safety belt or harness attached to a lifeline. The lifeline shall be securely attached to substantial members of the structure (not scaffold) or to securely rigged lines, which will safely suspend the employee in case of a fall.
- (9) Two-point suspension scaffolds shall be securely lashed to the building or structure to prevent from swaying. Window cleaners' anchors shall not be used for this purpose.
- (10) The platform of every two-point suspension scaffold shall be one of the following types:

- (a) Ladder-type platforms.

Ladder-type platforms shall be capable of sustaining four times the maximum rated load and shall be constructed in accordance with "Table 10-11."

- (b) Plank-type platforms.

Plank-type platforms shall be composed of no less than "Scaffold Grade" two-inch by ten-inch unspliced planks, properly cleated together on the underside, starting six inches from each end; intervals in between shall not exceed four feet. The plank-type platform shall not extend beyond the hangers more than twelve inches. A bar or other effective means shall be securely fastened to the platform at each end to prevent its slipping off the hanger. The span between hangers for plank-type platforms shall not exceed eight feet.

- (c) Beam-type platforms.

Beam-type platforms shall have side stringers of lumber no less than two inches by six inches set on edge. The span between hangers shall not exceed twelve feet when beam platforms are used. The flooring shall be supported on two-inch by six-inch cross beams, laid flat and set into the upper edge of the stringers with a snug fit, at intervals of no more than four feet, securely nailed in place. The flooring shall be of one-inch by six-inch material, or equivalent, properly nailed. Floor boards shall be spaced no more than one-half-inch apart.

- (d) Light metal-type platforms.

Approved light metal-type platforms shall meet the requirements of paragraph (C)(2) of this rule.

Table 10-11. Schedule for ladder-type platforms.

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	Length of Platform (feet)				
	12	14 and 16	18 and 20	22 and 24	28 and 30
Side Stringers, minimum cross section (finished sizes):					
At ends (inches)	1-3/4 x 2-3/4	1-3/4 x 2-3/4	1-3/4 x 3	1-3/4 x 3	1-3/4 and 3-1/2
At middle (inches)	1-3/4 x 3-3/4	1-3/4 x 3-3/4	1-3/4 x 4	1-3/4 and 4-1/4	1-3/4 x 5
Reinforcing strip (minimum)	A 1/8 x 7/8-inch steel reinforcing strip or its equivalent shall be attached to the side or underside, full length.				
Rungs	Rungs shall be 1-1/8 inches minimum diameter with at least 7/8-inch diameter tenons, and the maximum spacing shall be 12 inches center to center.				
Tie Rods:					
Number (minimum)	3	4	4	5	6
Diameter (minimum)	3/4 inch	1/4 inch	1/4 inch	1/4 inch	1/4 inch
Flooring, minimum Finished size (inches)	1/2 x 2-3/4	1/2 x 2-3/4	1/2 x 2-3/4	1/2 x 2-3/4	1/2 x 2-3/4

(L) Single-point adjustable suspension scaffolds.

- (1) The scaffolding, including power units or manually operated winches, shall be of an approved type and meet the requirements of paragraph (C)(2) of this rule.
- (2) All power-operated gears and brakes shall be enclosed.
- (3) In addition to the normal operating brake, all power-driven units shall have an emergency brake which engages automatically when the normal speed of descent is exceeded.
- (4) The units may be combined to form a two-point suspension scaffold. Such scaffold shall then comply with paragraph (K) of this rule.
- (5) The supporting cable shall be vertical for its entire length.
- (6) Suspension methods shall conform to applicable provisions of paragraphs (J) and (K) of this rule.
- (7) The employee shall be protected by a safety ~~belt or~~ harness and lifeline in accordance with paragraph (J) of rule 4123:1-3-03 of the Administrative Code. The attachment point of the lifeline to the structure shall be appropriately changed as the work progresses.

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(M) Boatswains' chairs.

- (1) When constructed of wood the chair seat shall be no less than twelve inches by twenty-four inches by one-inch thickness, reinforced by cleats on the underside to prevent splitting. A chair of the same size may be constructed of material of equal strength.
- (2) Seat slings shall be of no less than five-eighths-inch diameter, "First Grade" manila rope, or its equivalent, which shall be reeved through the four seat holes so as to cross each other on the underside of the seat.
- (3) Seat slings shall be of no less than three-eighths-inch wire rope when an employee is conducting a heat-producing process, such as gas or ~~arc~~ welding.
- (4) The employee shall be protected by a safety belt or harness and lifeline in accordance with paragraph (J) of rule 4123:1-3-03 of the Administrative Code. The attachment point of the lifeline to the structure shall be appropriately changed as the work progresses.
- (5) The tackle shall consist of correct size ball bearing or bushed blocks and properly spliced five-eighths-inch diameter, "First Grade" manila rope, or equivalent.
- (6) The roofirons, hooks, or the object to which the tackle is anchored, shall be securely installed. Tiebacks shall be installed at right angles to the face of the building and securely fastened when using wall hooks.

(N) Carpenters' bracket scaffolds.

- (1) The brackets shall consist of a triangular wood frame no less than two inches by three inches in cross section, or of metal of equivalent strength. Each member shall be properly fitted and securely joined.
- (2) Each bracket shall be secured to the structure by a means which shall provide a factor of safety of no less than four.
- (3) The brackets shall be spaced no more than eight feet apart.
- (4) The platform shall consist of no less than two two-inch by ten-inch "Scaffold Grade" planks extending no more than twelve inches or less than six inches beyond each and support.

(O) Bricklayers' square scaffolds.

- (1) Bricklayers' square scaffolds shall conform to "Table 10-12" and the square shall not exceed five feet in width and five feet in height.
- (2) The squares shall be reinforced on both sides of each corner with one-inch by six-inch gusset pieces. They shall also have diagonal braces one inch by eight inches on both sides running from center to center of each member, or other means to secure equivalent strength and rigidity.
- (3) The squares shall be set no more than five feet apart for medium duty scaffolds, and no more than eight feet apart for light duty scaffolds. Bracing, one inch by eight inches, extending from the bottom of each square to the top of the next square, shall be provided on both front and rear sides of the scaffold.
- (4) Platform planks shall be no less than two-inch by ten-inch "Scaffold Grade." The ends of the planks shall overlap the bearers of the squares and each plank shall be supported by no less than three squares.
- (5) Bricklayers' square scaffold shall not exceed three tiers in height and shall be so constructed and arranged

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that one square shall rest directly above the other. The upper tiers shall stand on a continuous row of planks laid across the next lower tier and be nailed down or otherwise secured to prevent displacement.

- (6) Scaffolds shall be level and plumb and set upon a firm foundation.

Table 10-12. Minimum dimensions for bricklayers' square scaffold members.

Members	Dimensions
Bearers or horizontal members	2 × 6 in.
Legs	2 × 6 in.
Braces at corners	1 × 6 in.
Braces diagonally from center frame	1 × 8 in.

(P) Foot scaffolds.

- (1) Foot scaffolds shall not exceed eighteen inches in height, measured from the level upon which the supports are placed.
- (2) Foot scaffolds imposed on other scaffolds when supported on brick or tile, shall be limited to eighteen inches in height and have a bearing surface of no less than ninety-six square inches. Supports shall be no more than seven feet cent to center.

(Q) Horse scaffolds.

- (1) Horse scaffolds shall not be constructed or arranged more than two tiers in height.
- (2) The members of the horses shall be no less than those specified in "Table 10-13."
- (3) Horses shall be spaced no more than five feet for medium duty and no more than eight feet for light duty.
- (4) When arranged in tiers, each horse shall be placed directly over the horse in the tier below.
- (5) On all scaffolds arranged in tiers, the legs shall be nailed down or otherwise secured to the planks to prevent displacement or thrust and each tier shall be substantially cross braced.
- (6) Defective or damaged horses or parts shall not be used.

Table 10-13. Minimum dimensions for horse scaffold members.

Members	Dimensions
Horizontal members or bearers	3 × 4 in.
Legs	1-1/4 × 4-1/2 in.
Longitudinal brace between legs	1 × 6 in.
Gusset brace at top of legs	1 × 8 in.
Half diagonal braces	1-1/4 × 4-1/2 in.

(R) Chimney, stack, or tank bracket scaffolds.

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(1) Minimum width.

The minimum width of platform shall be no less than eighteen inches.

(2) Spacer blocks.

Spacer blocks, large enough to hold the suspending cable away from the structure, shall be provided.

(3) Ascending and descending.

For ascending to and descending from a chimney, stack or tank bracket scaffold, a scaling ladder or boatswain's chair shall be provided.

(4) Platforms on masonry chimneys or stacks.

Platforms supported on the rim of masonry chimneys or stacks are prohibited.

(5) Inside scaffolds.

In construction of chimneys or stacks where an inside scaffold is being used, the working platform shall be no less than eighteen inches below the top of the wall.

(6) Guardrails.

Chimney, stack, or tank bracket scaffolds shall be provided with standard guardrails, but no guardrail is required when safety belts or harness with lifelines are provided.

(S) Needle beam scaffolds.

(1) Wood needle beams shall be no less than four inches by six inches in size, with the greater dimensions placed in a vertical direction. Metal beams or the equivalent, conforming to paragraph (C)(2) of this rule may be used and shall not be altered or moved horizontally while they are in use.

(2) Ropes or hangers shall be provided for supports. The span between supports on the needle beam shall not exceed ten feet for four-inch by six-inch timbers. Rope supports shall be equivalent in strength to one-inch diameter "First Grade" manila rope.

(3) The scaffold shall be rigged so as to prevent the needle beam from rolling or becoming otherwise displaced.

(4) The platform span between the need beams shall not exceed eight feet when using two-inch "Scaffold Grade" planks. For spans greater than eight feet, platforms shall be constructed based on design requirements for the special span. The overhang of each end of the platform planks shall be no less than six inches and no more than twelve inches. Planks shall be secured against displacement.

(5) All unattached tools, bolts, and nuts used on needle beam scaffolds shall be kept in suitable containers, properly secured.

(6) One end of a needle beam scaffold may be supported by a permanent structural member conforming to paragraph (C)(2) of this rule.

(7) Each employee working on a needle beam scaffold shall be protected by a safety ~~belt or~~ harness and

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lifeline in accordance with paragraph (J) of rule 4123:1-3-03 of the Administrative Code.

(T) Interior hung scaffolds.

- (1) An interior hung scaffold shall be hung or suspended from a structure capable of providing a factor of safety of no less than four.
- (2) The suspending wire or fiber rope shall be capable of supporting no less than six times the maximum rated load.
- (3) The scaffold shall be designed to sustain a working load with a factor of safety of no less than four.
- (4) For wood scaffolds, the following minimum "Scaffold Grade" material shall be used:
 - (a) Supporting bearers, two inches by ten inches on edge;
 - (b) Planking, two inches by ten inches, with maximum span of seven feet for heavy duty and ten feet for light duty or medium duty.
- (5) Steel tube and coupler members may be used for such type scaffolds.

(U) Ladder jack scaffolds.

- (1) All ladder jack scaffolds shall be limited to light duty and shall not exceed a height of twenty feet above the floor or ground.
- (2) All ladders used in connection with ladder jack scaffolds shall be heavy duty ladders. Cleated ladder shall not be used for this purpose.
- (3) The ladder jack shall be so designed and constructed that it will bear on the side rails in addition to the ladder rungs, or if bearing on rungs only, the bearing area shall be no less than ten inches on each rung.
- (4) Ladder used in conjunction with ladder jacks shall be so placed, fastened, held, or equipped with devices so as to prevent slipping.
- (5) The platform shall be "Scaffold Grade," two-inch by ten-inch plank, or material of equal strength. Planks shall overlap the bearing surface no less than twelve inches. The span between supports shall not exceed eight feet. Platform width shall be no less than eighteen inches and provide a factor of safety of no less than four.

(V) Window jack scaffolds.

- (1) Window jack scaffolds shall be used only for the purpose of working at the window opening through which the jack is placed.
- (2) Window jacks shall not be used to support planks spaced between one window jack and another or for other elements of scaffolding.
- (3) Window jack scaffolds shall be provided with standard guardrails unless safety belts or harnesses with lifelines are attached and provided for the employee.
- (4) No more than one employee shall be required to occupy a window jack scaffold.

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(W) Float or ship scaffolds.

See appendix to this rule for examples of float or ship scaffolds.

- (1) No more than three employees shall be required to occupy a float or ship scaffold.
- (2) The platform shall be no less than three feet wide and six feet long, made of three-quarter-inch plywood, equal to "American Plywood Association Grade B-B, Group I, Exterior," or other equivalent material.
- (3) Under the platform, there shall be two supporting bearers made from two-inch by four-inch, or one-inch by ten-inch, rough, select lumber or better. Bearers shall be free of knots or other flaws and project six inches beyond the platform on both sides. The ends of the platform shall extend six inches beyond the outer edges of the bearers. Each bearer shall be securely fastened to the platform.
- (4) An edging of wood no less than three-fourths by one and one-half inches shall be placed around all sides of the platform to prevent tools from rolling off.
- (5) Supporting ropes shall be one-inch diameter manila rope, or equivalent, providing a factor of safety of no less than six. Rope connections shall be such that the platform cannot shift or slip. Two ropes shall be used with each float, arranged so as to provide four ends which are to be securely fastened to an overhead support. Each of the two supporting ropes shall be securely fastened around one end of the bearer and pass under the platform to the other end of the bearer where it shall be securely fastened again, leaving sufficient rope at each end for the supporting ties.

(X) Form scaffolds.

See appendix to this rule for examples of various types of form scaffolds covered under this rule.

- (1) General requirements for all form scaffolds.
 - (a) All form scaffolds and their components shall be capable of supporting without failure no less than four times the maximum rated load.
 - (b) Maximum permissible spans shall not exceed eight feet on centers for two-inch by ten-inch "Scaffold Grade" planking. Scaffold planks shall be securely fastened to the ledgers or of such length that they overlap the ledgers no less than six inches. Unsupported projecting ends of scaffolding planks of all form scaffolds shall be limited to a maximum overhang of twelve inches.

(2) Figure-four form scaffolds.

Figure-four form scaffolds are intended for light duty and shall not be used to support loads exceeding twenty-five pounds per square foot unless specifically designed for heavier loading. Frames shall be spaced no more than eight feet on centers. (For minimum design criteria, see "Table 10-14").

Table 10-14. Minimum design criteria for figure-four form scaffolds.

Members	Dimensions
Uprights	2 × 4 in. or 2 × 6 in.
Outrigger ledgers (two)	1 × 6 in.

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Braces	1 × 6 in.
Guardrails	2 × 4 in.
Guardrail height	Approximately 42 in.
Intermediate guardrails	1 × 6 in.
Toeboards	4 in. (minimum)
Maximum length of ledgers	3 ft. 6 in. (unsupported)
Planking	2 × 10 in.
Upright spacing	8 ft. 0 in. (on centers)

(3) Metal bracket form scaffolds.

- (a) Metal brackets or scaffold jacks which are an integral part of the form shall be securely bolted or welded to the form. Folding type brackets shall be either bolted or secured with a locking type pin when extended for use.
- (b) "Clip-on" or "hook-over" brackets may be used, provided the form walers are bolted to the form or secured by snap ties or shea-bolt extending through the form and securely anchored.
- (c) Metal brackets shall be spaced no more than eight feet on centers.
- (d) Scaffold planks shall be either bolted to the metal brackets or of such length that they overlap the brackets at each end by no less than six inches. Unsupported projecting ends of scaffolding planks shall be limited to a maximum overhang of twelve inches.
- (e) Metal bracket form scaffolds shall be equipped with standard guardrails and toeboards, meeting the minimum dimensions shown in "Table 10-15."

Table 10-15. Minimum design criteria for metal bracket form scaffolds.

Members	Dimensions
Uprights	2 × 4 in.
Guardrails	2 × 4 in.
Guardrail height	Approximately 42 in.
Intermediate guardrails	1 × 6 in.
Toeboards	4 in. (minimum)
Planking	2 × 9 in.

(4) Wooden bracket form scaffolds.

Wooden bracket form scaffolds shall be an integral part of the form panel. The minimum design criteria set forth herein and in "Table 10-16" cover scaffolding intended for light duty and shall not be used to support loads exceeding twenty-five pounds per square foot, unless specifically designed for heavier loading.

Table 10-16. Minimum design criteria for wooden bracket form scaffolds.

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Members	Dimensions
Uprights	2 × 4 in. or 2 × 6 in.
Support ledgers	2 × 6 in.
Maximum scaffold width	3 ft. 6 in.
Braces	1 × 6 in.
Guardrails	2 × 4 in.
Guardrail height	Approximately 42 in.
Intermediate guardrails	1 × 6 in.
Toeboards	4 in. (minimum)
Upright spacing	8 ft. 0 in. (on centers)

(Y) Pump jack scaffolds.

(1) Pump jack scaffolds shall:

- (a) Not carry a working load exceeding five hundred pounds; and
- (b) Be capable of supporting no less than four times the maximum rated load.
- (c) The manufactured components shall not be loaded in excess of the manufacturer's recommended limits.

(2) Each pump jack bracket shall have two gripping mechanisms to prevent any failure or slippage.

(3) The platform bracket shall be fully decked and the planking secured. Planking, or equivalent, shall conform with paragraph (C)(7) of this rule.

(4) Poles and bracing.

- (a) When wood scaffold planks are used as platforms, poles for pump jacks shall be spaced no more than ten feet center to center. When fabricated platforms are used that fully comply with all other provisions of this section, pole spacing may exceed ten feet center to center.
- (b) Poles shall not exceed thirty feet in height.
- (c) Poles shall be secured to the work surface by rigid triangular bracing, or equivalent, at the bottom, top and other points as necessary, to provide a maximum vertical spacing of no more than ten feet between braces. Each brace shall be capable of supporting a minimum of two hundred twenty-five pounds tension and compression.
- (d) For the pump jack bracket to pass bracing already installed, an extra brace shall be used approximately four feet above the one to be passed until the original brace is reinstalled.
- (e) All poles shall bear on mud sills or other firm foundations.
- (f) Pole lumber shall be two-by-fours, of Douglas fir, or equivalent, straight-grained, clear, free of cross-grain, shakes, large knots, and other defects which might impair strength.
- (g) When poles are constructed of two continuous lengths, they shall be two-by-fours, spiked together with the seam parallel to the bracket, and with ten-penny common nails, no more than twelve inches center to center, staggered uniformly from opposite outside edges.

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(h) If two-by-fours are spliced to make up the pole, the splices shall be so constructed as to develop the full strength of the member.

(5) A ladder shall be provided for access to the platform during use.

(6) No more than two employees shall be required at any time to be on a pump jack scaffold between any two supports.

(7) Pump jack scaffolds shall be provided with standard guardrails, but no guardrail is required when safety ~~belts or~~ harnesses with lifelines are provided for employees.

(8) When a work bench is used at an approximate height of forty-two inches, the top guardrail may be omitted in the space occupied by the work bench, if the work bench is fully decked, the decking is secure, and is capable of withstanding two hundred pounds pressure in any direction.

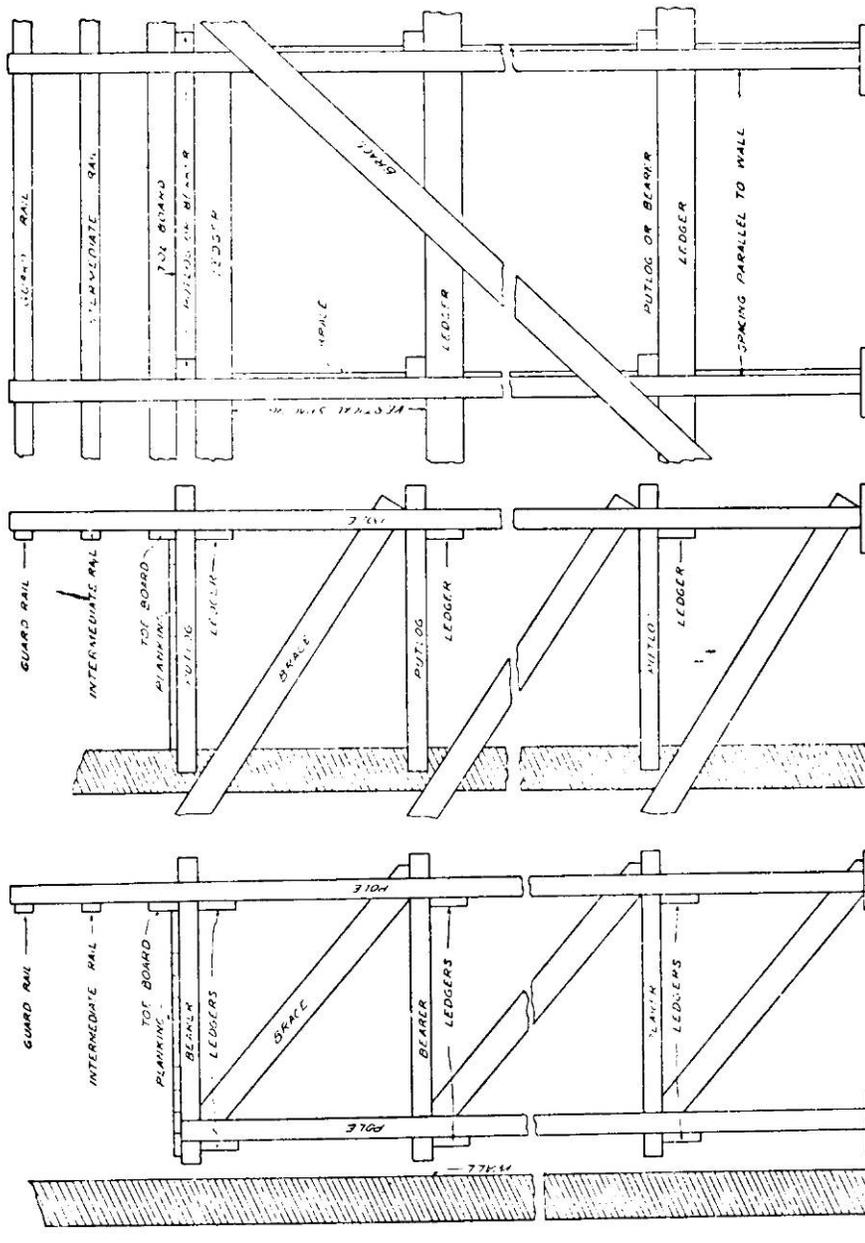
(9) Employees shall not be required to use a work bench as a scaffold platform.

(Z) Stilts.

Stilts shall be equipped with "feet" of skid resistant material. Means shall be provided to securely fasten the stilts to employee's feet and legs. The floor in the work area shall be maintained free of debris and other possible hazards.

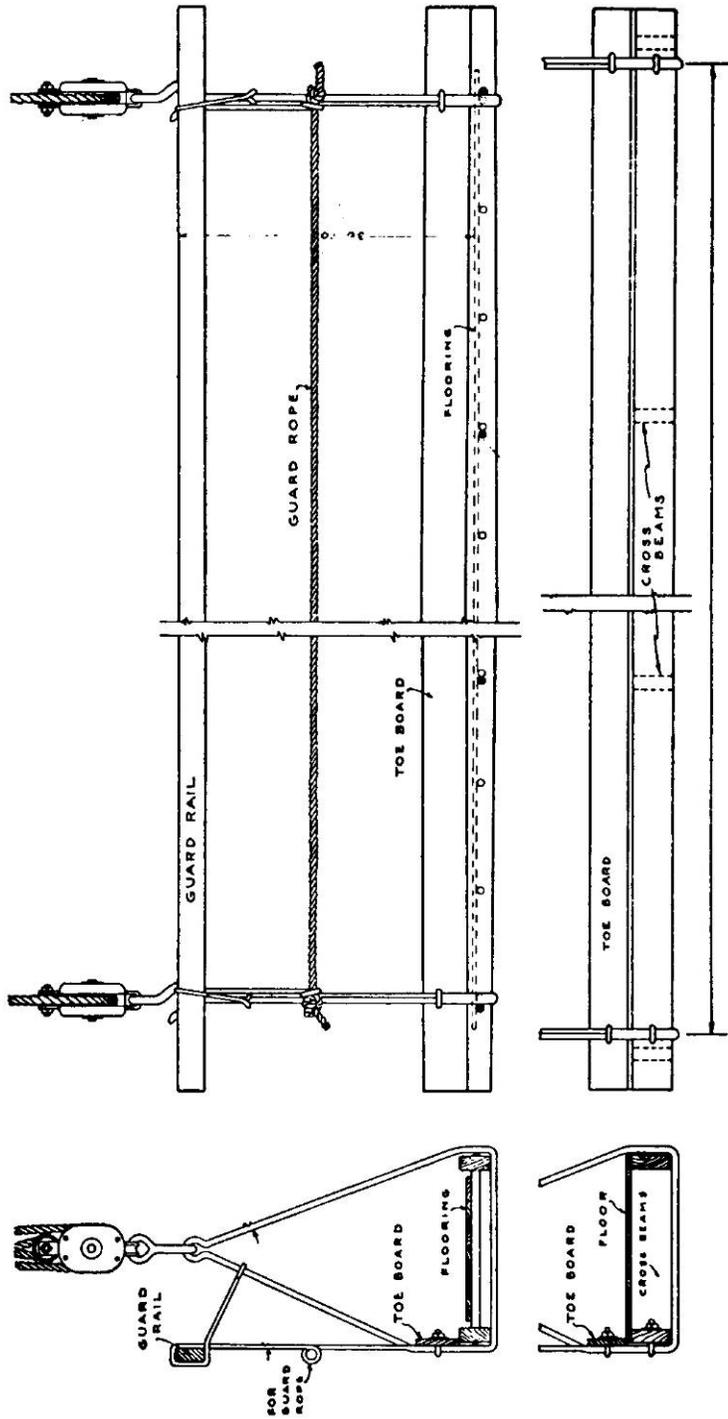
APPENDIX TO RULE 4121:1-3-10

Pole Scaffold—Single and Double Type.



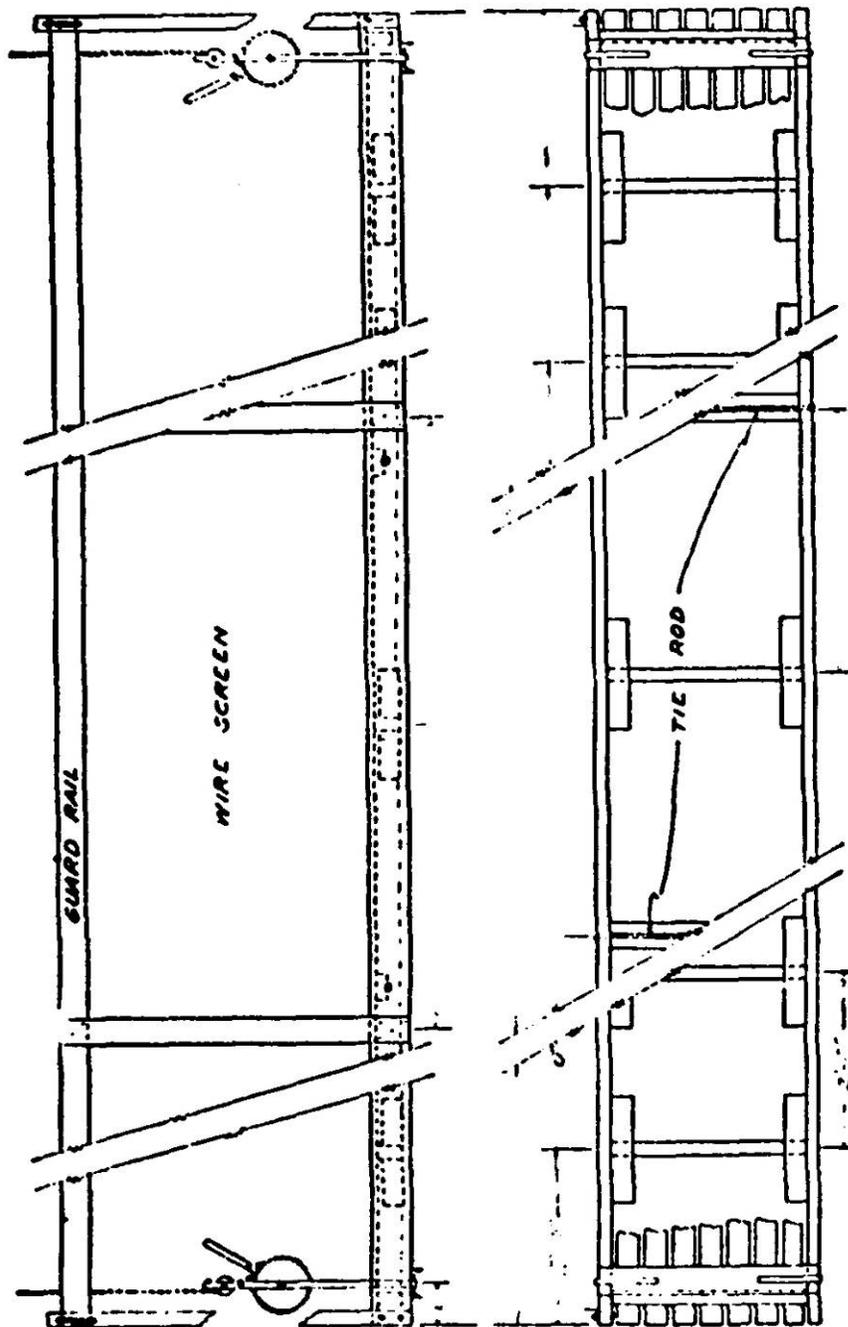
APPENDIX TO RULE 4121:1-3-10 - continued

Swinging Scaffold—Ladder Platform and Longitudinal Beam Type.

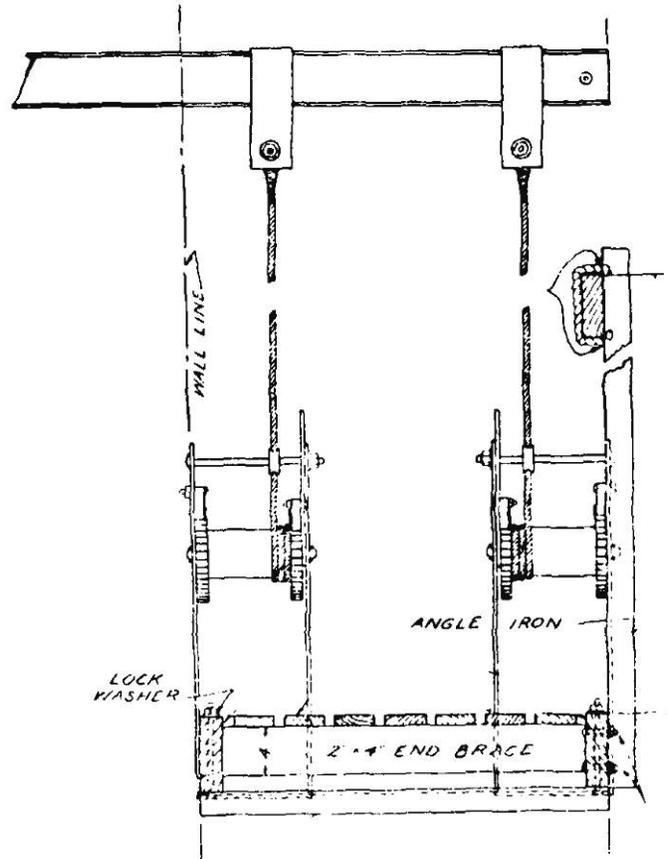


APPENDIX TO RULE 4121:1-3-10 - continued

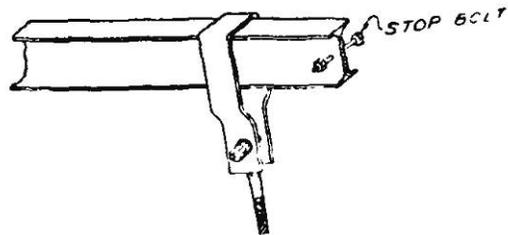
Suspended Scaffold.



APPENDIX TO RULE 4121:1-3-10 - continued

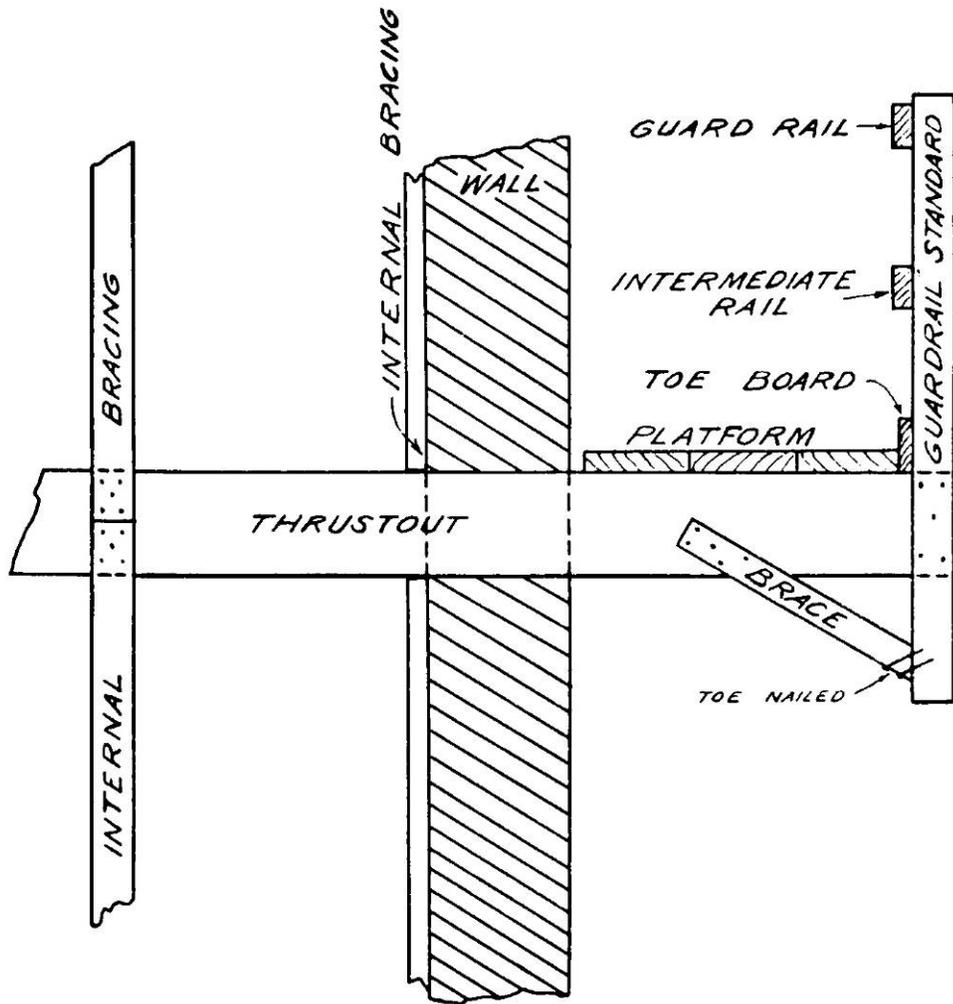


End View of Suspended Scaffold.



Suspended Scaffold—Thrustout.

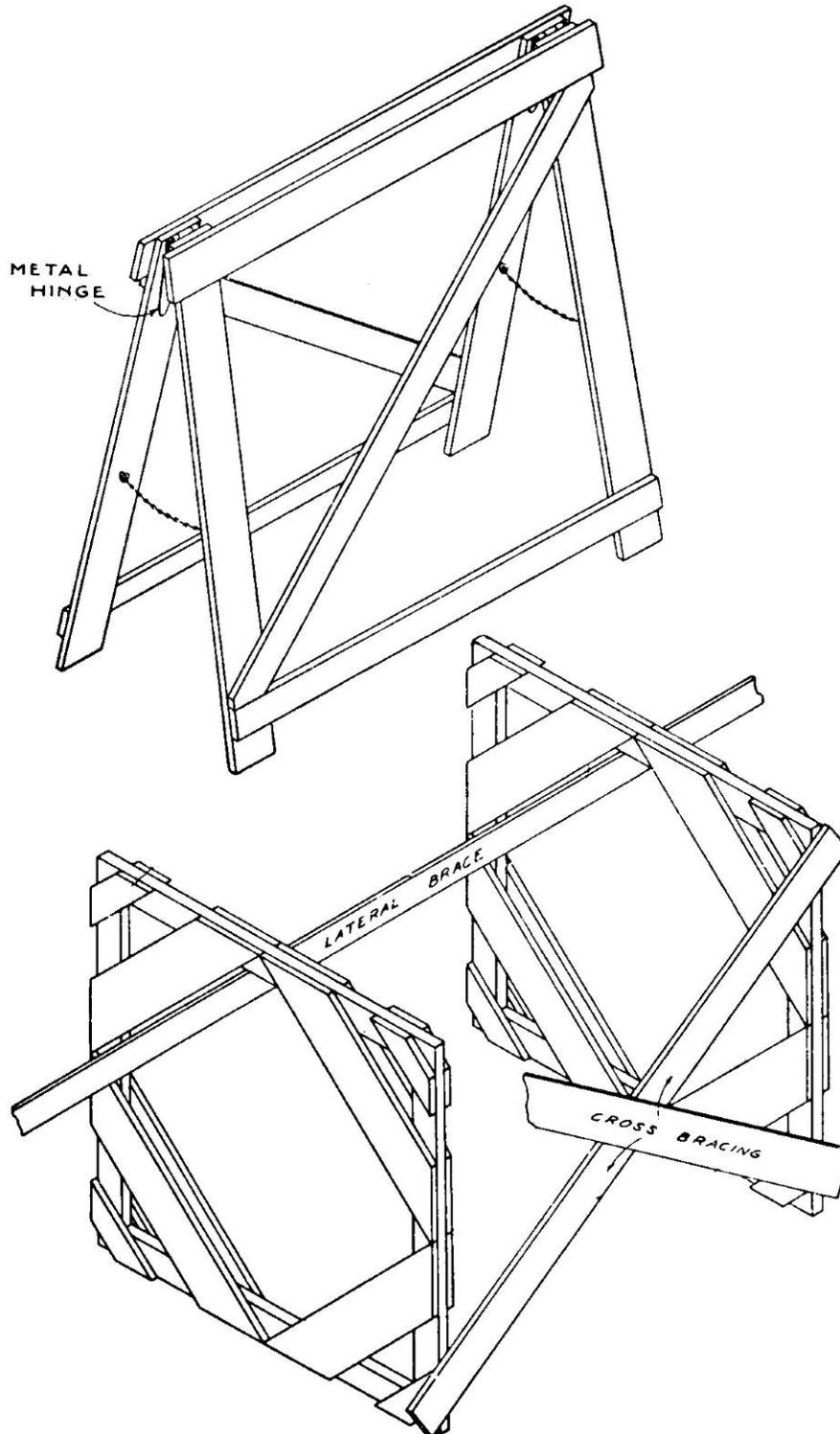
APPENDIX TO RULE 4121:1-3-10 - continued



Outrigger Scaffold.

APPENDIX TO RULE 4121:1-3-10 - continued

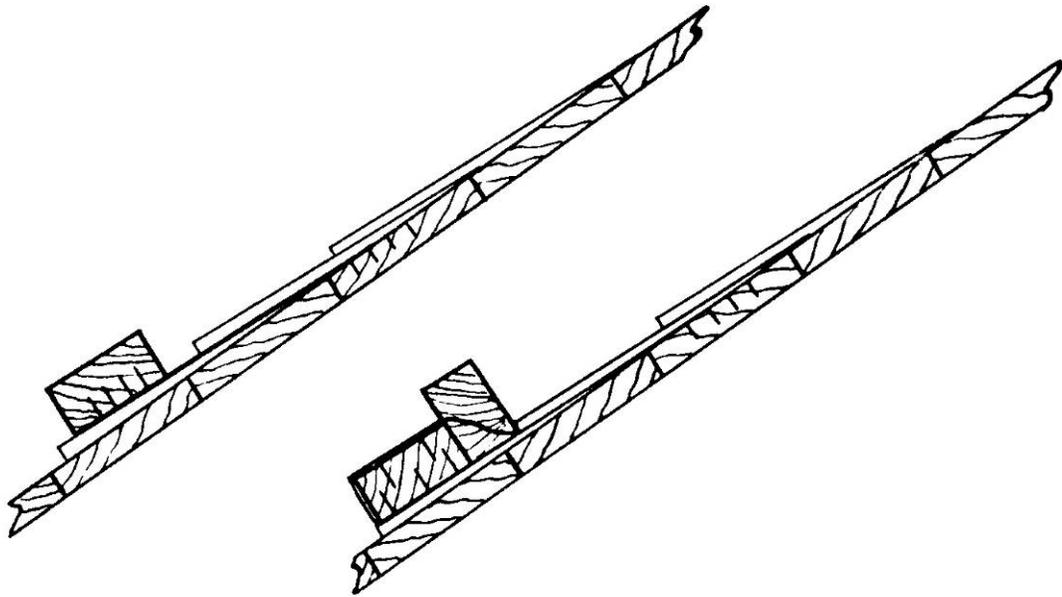
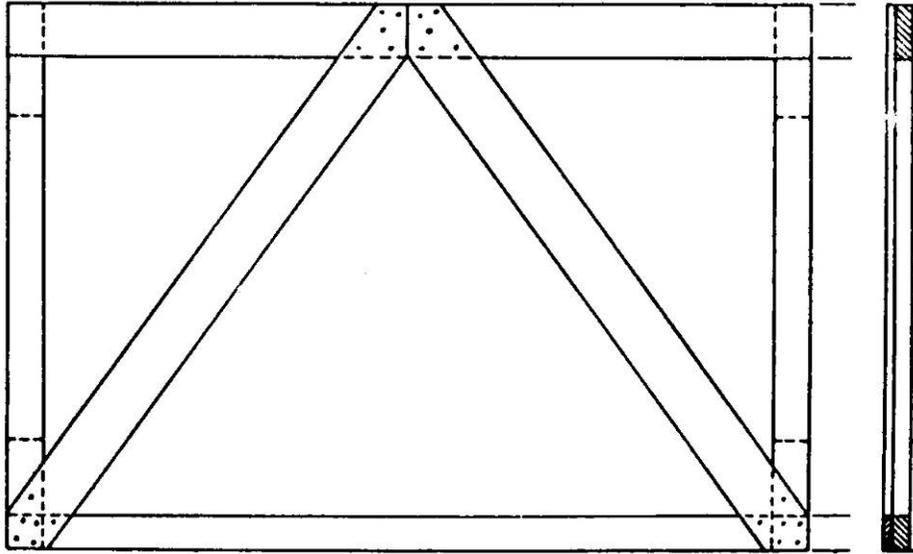
Scaffold Horse.



Masons' Square Scaffold Frame.

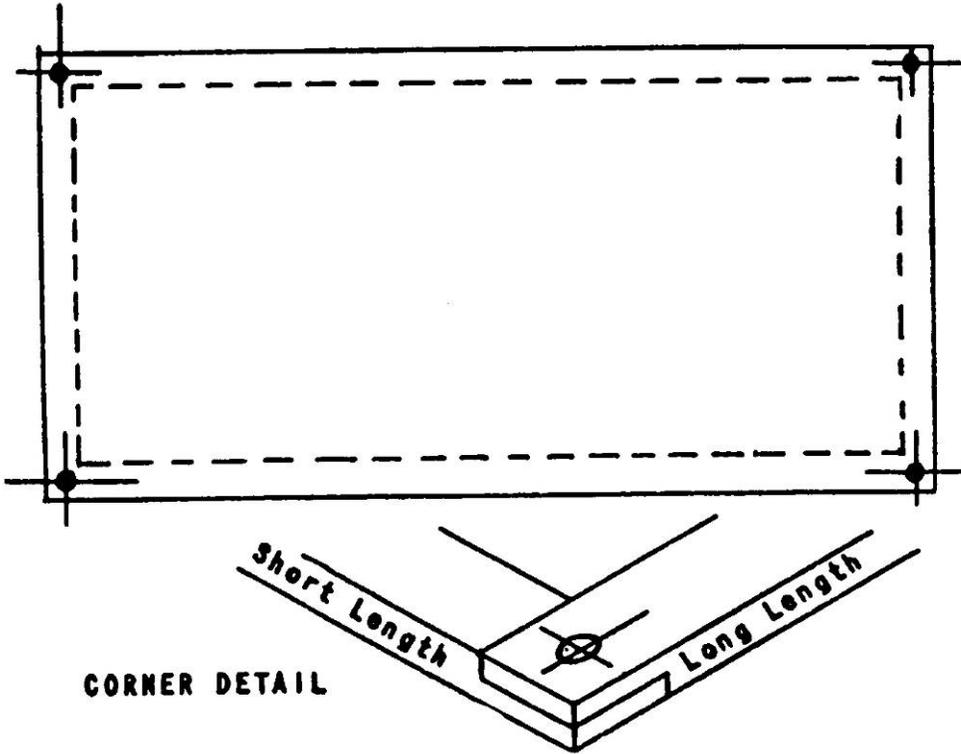
APPENDIX TO RULE 4121:1-3-10 - continued

Scaffold Jack.

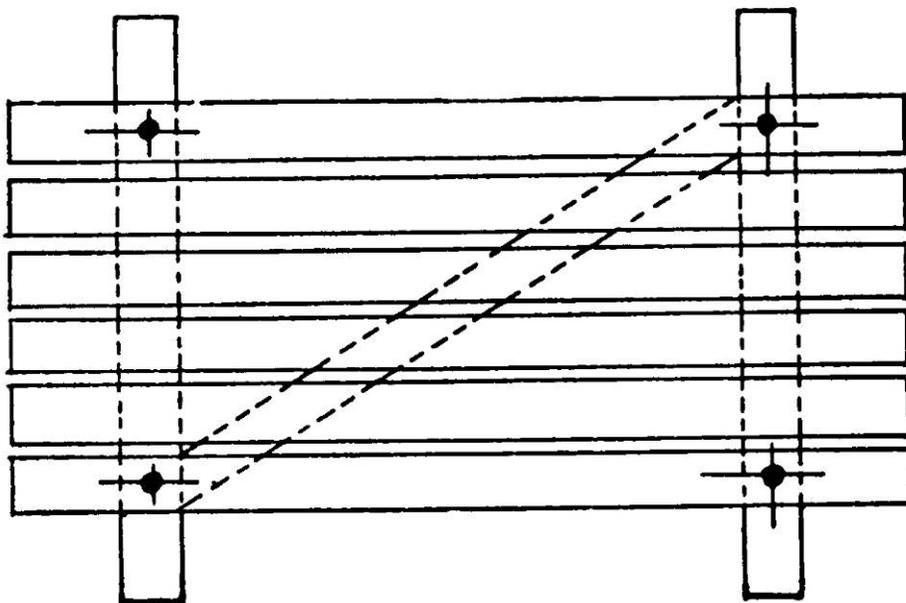


Footlocks.

APPENDIX TO RULE 4121:1-3-10 - continued



Float or Ship Scaffold.



APPENDIX TO RULE 4121:1-3-10 - continued

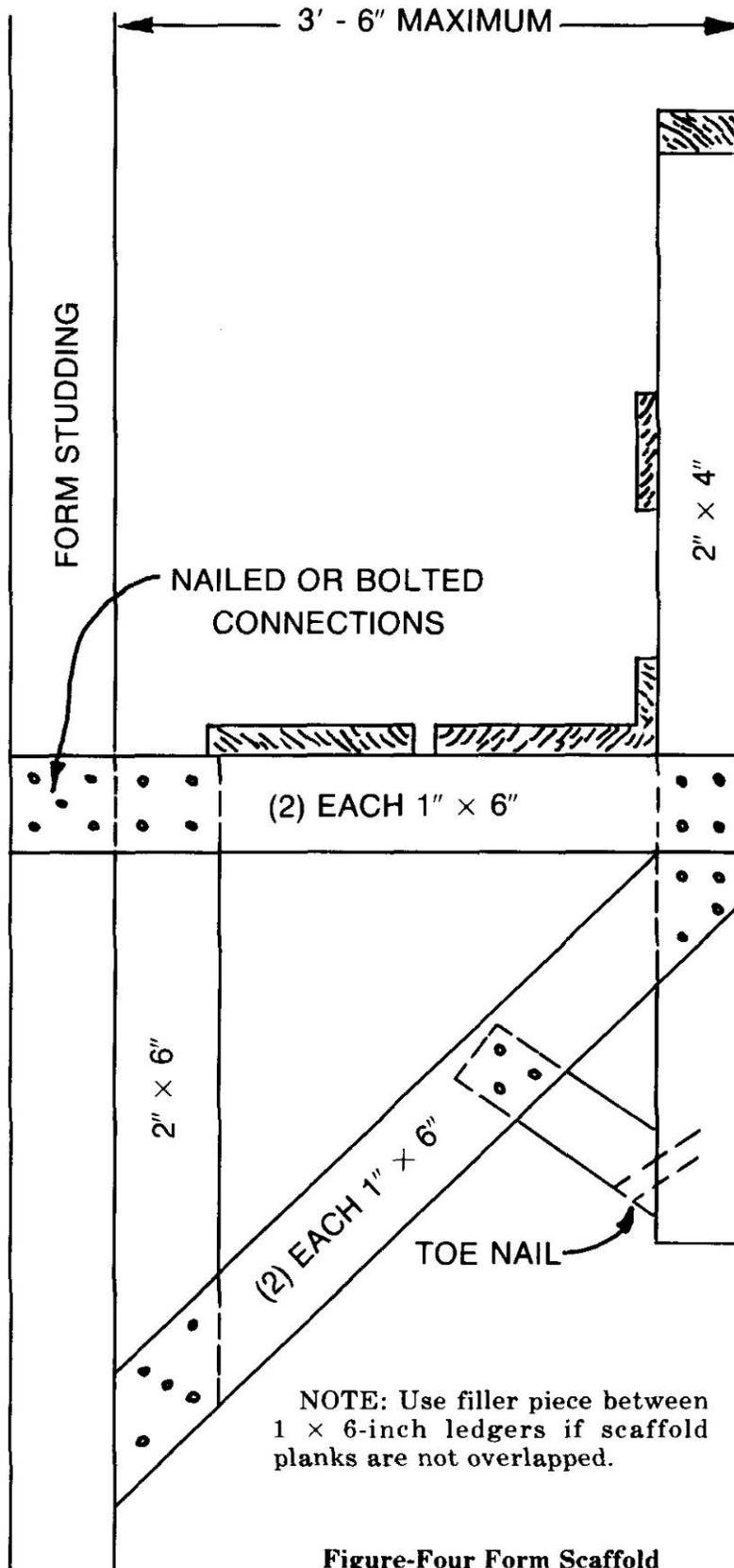
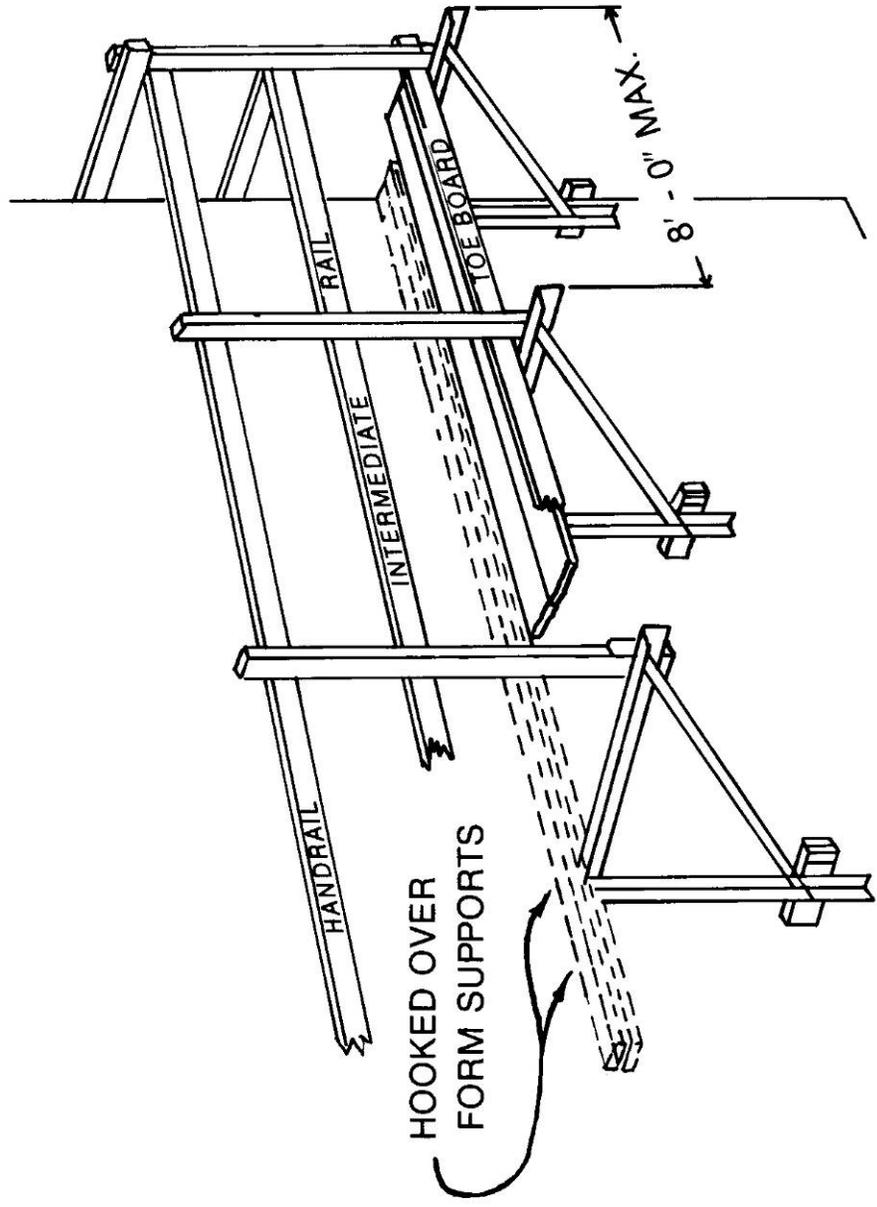


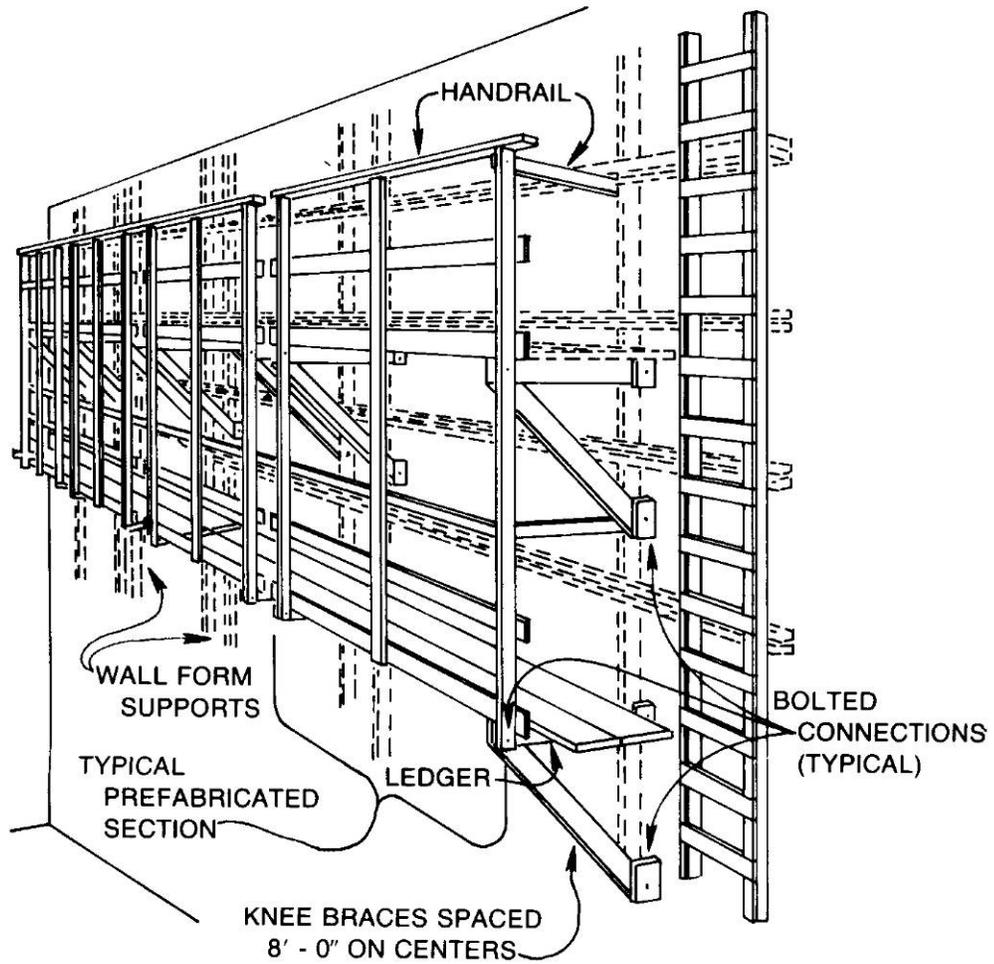
Figure-Four Form Scaffold

APPENDIX TO RULE 4121:1-3-10 - continued



Metal Bracket Form Scaffold

APPENDIX TO RULE 4121:1-3-10 - continued



NOTE: Scaffold can be prefabricated for attachment to wall forms at various positions, or it can be made as a permanent part of a movable form panel.

Wooden Bracket Form Scaffold

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Amend

4123:1-3-11 Ladders.

(A) Reserved.

(B) Definitions.

- (1) "Cleat ladder" means a ladder consisting of one section having two side rails and steps formed of cleats attached to the side rails with fillers between the cleats.
- (2) "Extension ladder" means a portable ladder, adjustable in length. It consists of two or more sections traveling in guides or brackets so arranged as to permit length adjustment. Its size is designated by the sum of the lengths of the sections measured along the side rails.
- (3) "Extension trestle ladder" means a portable ladder consisting of an "A" or trestle ladder with an additional vertical single ladder, having parallel sides, which adjustable perpendicularly and is provided with a device to lock it into place. Its size is designated by the length of the trestle ladder base.
- (4) "Fixed ladder", as used in this rule, means a ladder is securely fastened in a fixed position, whether to remain as part of the structure or for use during a part or all of the construction period.
- (5) "Ladder" means a piece of equipment usually consisting of two side rails joined at regular intervals by cross-pieces called steps, treads, rungs, or cleats, on which employee may step in ascending or descending.
- (6) "Sectional ladder" means a portable ladder, nonadjustable in length, consisting of two or more sections so constructed that the sections may be combined to function as a single ladder. Its size is designated by the over-all length of the assembled sections.
- (7) "Single ladder" means a portable, nonadjustable ladder consisting of but one section.
- (8) "Step ladder" means a self-supporting portable ladder, nonadjustable in length, having flat steps or treads and a hinged back. Its size is designated by the over-all length of the ladder measured along the front edge of the side.
- (9) "Trestle, or 'A', ladder" means a self-supporting portable ladder, nonadjustable in length, consisting of two sections hinged at the top of form equal angles with the base. The size is designated by the length of the side rail measured along the front edge.

(C) General requirements for all ladders.

(1) Construction.

All ladders shall be constructed of wood, metal, or other equivalent material and shall be capable of supporting all loads without failure with a factor of safety of no less than four, except that each extra-heavy-duty type 1A metal or plastic/composite ladder shall sustain at least 3.3 times the maximum intended load.

(a) Side rails.

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- (i) Side rails shall be parallel or shall vary uniformly in separation along the length (tapered) of the ladder or shall flare at the base. The design of the side rails shall be such that the ladder will conform to the specific safety requirements of this rule.
- (ii) Wood side rails shall be of sound material free from shakes, cross grain, checks or decay. Knots shall not exceed one-half-inch diameter and shall not be nearer than one-half inch to the edge of the rail or within three inches of the rung, step, or tread.

(b) Rungs, steps, cleats, or treads.

All rungs, steps, cleats, or treads shall have a uniform spacing which shall be no less than ten and no more than fourteen inches on center.

(2) Defective ladders.

Defective ladders shall be repaired to meet original specifications or shall be withdrawn from service. Cleats shall not be used to repair rung ladders.

(D) Portable ladders.

(1) General requirements for all portable ladders.

(a) Metal rungs, steps, or treads.

All metal rungs, steps or treads shall be corrugated, knurled, dimpled, or coated with skid-resistant material.

(b) Safety shoes, spikes, or spurs.

All portable ladders shall be equipped with safety shoes, metal spikes, or spurs. Safety shoes shall be surfaced with cork, carborundum, rubber, or other material with equivalent coefficient of friction. This does not apply to step ladders, lash ladders, or hook ladders.

(c) Hook ladders.

Ladders designed for use by hooking shall be equipped with two or more substantial metal hooks at the top of the ladder. (For chicken or roof ladders, see paragraph (H) of rule 4123:1-3-09 of the Administrative Code.)

(d) Ladders shall not be placed in passageways, doorways, driveways, or any locations where they may be displaced by activities being conducted on any other work, unless protected by barricades or guards.

(e) Portable metal ladders shall not be used for electrical work or where they may contact electrical conductors.

(2) Extension ladders.

Extension ladders shall be equipped with two automatic locks of malleable iron, cast aluminum or equivalent material attached to the side rails of the upper extension and of such construction as to make the extension ladder equal in strength to a ladder constructed of continuous side rails.

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(3) Step ladders.

A substantial spreader shall be provided on step ladders to hold the ladder in the open position

(4) Sectional ladders.

(a) Sectional ladders shall not exceed thirty-seven feet in extended length.

(b) The distance between rungs shall be twelve inches on centers.

(c) Adjacent sections shall be joined by means of groove in the ends of each rail of each section so that the two sections of the ladder enjoined are set together firmly, the grooves of the rails of one section gripping the rung inside or adjacent extensions of the rung outside of the adjoining section. The fit between rail grooves and rungs shall provide a good fit without binding or unnecessary play.

(d) The grooved ends of the sections shall be reinforced with a steel plate no less than eighteen-gauge steel (manufacturing standard) properly secured thereto, and a rivet adjacent to the groove, extending through the depth of the rail, or the equivalent reinforcement.

(5) Trestle and extension trestle ladders.

(a) The width between the side rails at the base of the trestle ladder and base sections of the extension trestle ladder shall be no less than twenty-one inches for all ladders and sections up to and including six feet. Longer lengths shall be increased no less than one inch for each additional foot of length. The width between the side rails of the extension sections of the trestle ladder shall be no less than twelve inches.

(b) The tops of the side rails of the trestle ladder and of the base section of the extension trestle ladder shall be beveled, or of equivalent construction and shall be provided further with a metal hinge to prevent spreading.

(c) A metal spreader or locking device to hold the front and back sections in an open position, and to hold the extension section securely in the elevated position shall be a component of all extension trestle ladders and all trestle ladders over twelve feet in length.

(d) Where a single rung support holds an entire rung of the upper extension and the support is attached to both side rails of the lower section, two automatic locks shall not be required.

(e) Rungs shall be parallel and level. On the trestle ladder, or on the base sections of the extension trestle ladder, rungs shall be spaced no less than eight inches or more than eighteen inches apart; on the extension section of the extension trestle ladder, rungs shall be spaced no less than six inches or more than twelve inches apart.

(f) Trestle ladders or extension sections or base sections of extension trestle ladders shall be no more than twenty feet in length.

(g) The minimum distance between side rails of the trestle or extension sections or base sections at the narrowest point shall be no less than twelve inches. The width spread shall be no less than one inch per foot of length of side rail.

(E) Fixed ladders that can not be readily moved or carried because it is an integral part of a building or structure.

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(1) Maintained in place.

Fixed ladders shall be provided and maintained in place until temporary or permanent stairways are ready for use.

(2) Fixed ladders exceeding fifty feet in length.

Ladder landings (rest platforms) shall be installed on fixed ladders each fifty feet or major fraction thereof in length. This shall not apply to water towers, masts, smokestacks, or material hoists.

(3) Fixed ladder landings.

All fixed ladder landings shall be equipped with standard guard railing, intermediate rail and toeboards. The platform of such landings shall be no less than twenty four inches in width.

(4) Extension of side rail above landing.

At least one side rail of fixed ladders to landings shall extend a distance of no less than thirty-six inches above the landing. The rungs may be omitted above the landing. Where an employee must step a greater distance than twelve inches from the ladder to the roof, structure, etc., a landing shall be provided.

(5) Vertical distance between landing and top rung.

The vertical distance between the platform of the landing and the top rungs of the fixed ladder shall not exceed the rung spacing of the fixed ladder.

(F) Ladders constructed on the job.

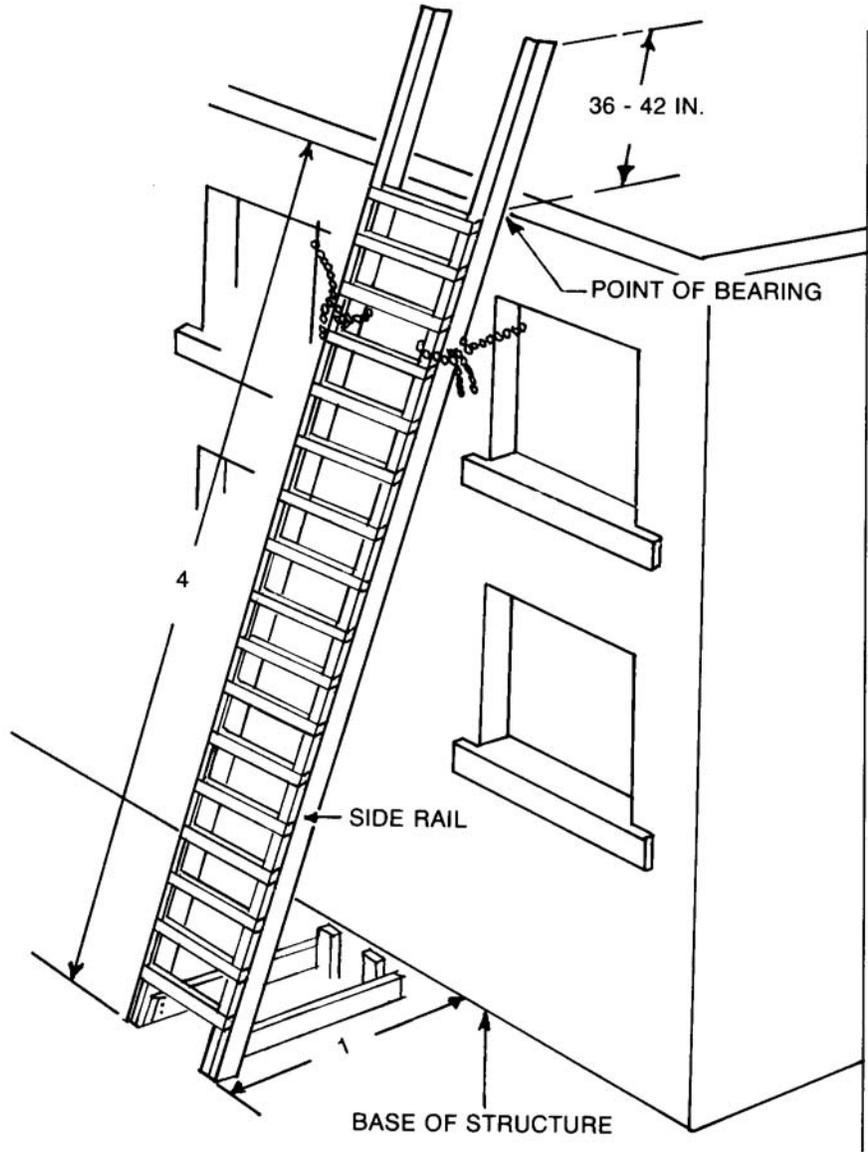
Ladders constructed on the job shall comply with the provisions of paragraphs (C)(1) of this rule and the following table. (See appendix to this rule for examples of ladders constructed on the job.)

Single section cleat construction ladders

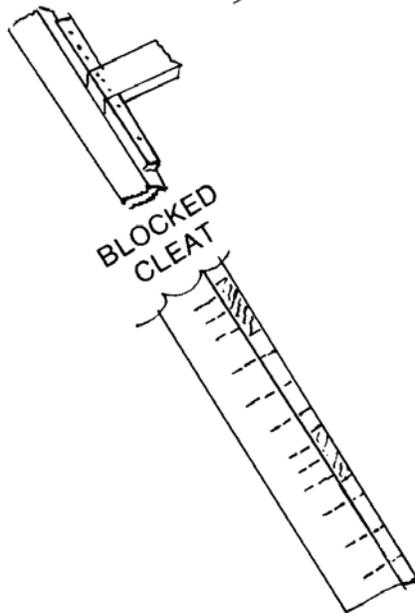
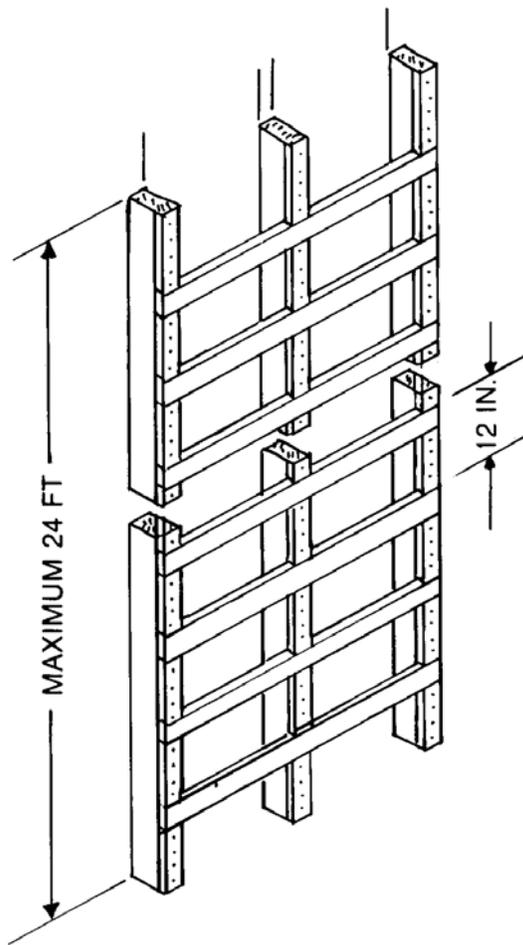
	Min. Inside Width	Max. Inside Width	Nominal Cross Section of Rails	Nominal Cross Section of Cleats
Up to 16' (feet)	20"	24"	2" × 4"	1" × 3"
More than 16' (feet); up to 24' (feet)	20"	24"	2" × 6"	1" × 4"

EXAMPLES OF LADDERS CONSTRUCTED ON THE JOB

Example 11-1. Single cleat ladder.



Example 11-2.
Double cleat ladder.



Example 11-3.
Blocked cleat.

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No Change

4123:1-3-12 Portable explosive-actuated fastening tools.

(A) Reserved.

(B) Definitions.

- (1) "Portable explosive-actuated fastening tool (powder-actuated)" means a tool which depends upon an explosive charge to propel or discharge a stud, pin, or fastener for the purpose of impinging it upon, affixing it to, or penetrating another object or material.
 - (a) "High velocity tool" means a tool or machine which, when used with a load, propels or discharges a stud, pin, or fastener, at velocities in excess of three hundred feet per second when measured six and five-tenths feet from the muzzle end of the barrel, for the purpose of impinging it upon, affixing it to, or penetrating another object or material.
 - (b) "Low velocity tool" means a tool or machine which by means of a powder-load, actuates a piston, which, in turn, propels or discharges a stud, pin, or fastener, at velocities not in excess of three hundred feet per second when measured six and five-tenths feet from the muzzle end of the barrel, for the purpose of impinging it upon, affixing it to, or penetrating another object or material.
- (2) "Protective shield or guard" means a device or guard attached to the muzzle end of the tool which is designed to confine flying particles.
- (3) "Stud, pin, or fastener" means a fastening device specifically designed and manufactured for use in portable explosive-actuated fastening tools.
- (4) "Tool" means a portable explosive-actuated fastening tool, unless otherwise indicated, and shall include all accessories pertaining thereto.

(C) High velocity tools.

Tools of this type shall have the following characteristics:

- (1) The muzzle end of the tool shall have a protective shield or guard no less than three and one-half inches in diameter, mounted perpendicular to and concentric with the barrel, and designed to confine any flying fragments or particles that might otherwise create a hazard at the time of firing.
- (2) Where a standard shield or guard cannot be used, or where it does not cover all apparent avenues through which flying particles might escape, a special shield, guard, fixture, or jig designed and built by the manufacturer of the tool being used, which provides this degree of protection, shall be used as a substitute.
- (3) The tool shall be so designed that it cannot be fired unless it is equipped with a standard protective guard or shield, or a special shield, guard, fixture, or jig.
- (4) Firing the tool.
 - (a) The firing mechanism shall be so designed that the tool cannot fire during loading or preparation to fire, or if the tool should be dropped while loaded.

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(b) Firing of the tool shall be dependent upon no less than two separate and distinct operations of the operator, with the final firing movement being separate from the operation of bringing the tool into the firing position.

(5) The tool shall be so designed as not to be operable other than against a work surface, and unless the operator is holding the tool against the work surface with a force no less than five pounds greater than the total weight of the tool.

(6) The tool shall be so designed that it will not operate when equipped with the standard guard indexed to the center position if any bearing surface of the guard is tilted more than eight degrees from contact with the work surface.

(7) The tool shall be so designed that positive means of varying the power are available or can be made available to the operator as part of the tool, or as an auxiliary, in order to make it possible for the operator to select a power level adequate to perform the desired work without excessive force.

(8) The tool shall be so designed that all breeching parts will be reasonably visible to allow a check for any foreign matter that may be present.

(D) Low velocity tools -- piston type tools.

Tools of the low velocity piston type shall have the following characteristics:

(1) The muzzle end of the tool shall be designed so that suitable protective shields, guards, jigs, or fixtures, designed and built by the manufacturer of the tool being used, can be mounted perpendicular to the barrel. A standard spall shield, when supplied, shall be utilized with each tool.

(2) Firing the tool.

(a) The tool shall be designed so that it cannot fire during loading or during preparation to fire, or if the tool should be dropped while loaded.

(b) Firing of the tool shall be dependent upon no less than two separate and distinct operations of the operator, with the final firing movement being separate from the operation of bringing the tool into the firing position.

(3) The tool shall be so designed as not to be operable other than against a work surface, and unless the operator is holding the tool against the work surface with a force no less than five pounds greater than the total weight of the tool.

(4) The tool shall be so designed that positive means of varying the power are available or can be made available to the operator as part of the tool, or as an auxiliary, in order to make it possible for the operator to select a power level adequate to perform the desired work without excessive force.

(5) The tool shall be so designed that all breeching parts will be reasonably visible to allow a check for any foreign matter that may be present.

(E) Minimum instructions for qualifying operators.

Instructions to operators in order to teach them the use of portable explosive-actuated fastening tools shall include, but shall not be limited to the following items:

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Only employees who have been trained in the operation of that particular tool in use shall be allowed to operate a powder-actuated tool.

The tool shall be tested each day before loading to see that safety devices are in proper working condition. The method of testing shall be in accordance with manufacturer's recommendation procedure.

- (1) Before using a tool, the operator shall inspect it to determine that it is clean, that all moving parts operate freely, and that the barrel is free from obstructions.
- (2) When a tool develops a defect during use, the operator shall immediately cease to use it until it is properly repaired.
- (3) Tools shall not be loaded until just prior to the intended firing time. Neither loaded nor empty tools are to be pointed at any person, and hands shall be kept clear of the open barrel end.
- (4) No tools shall be loaded unless being prepared for immediate use, nor shall an unattended tool be left loaded.
- (5) In case of a misfire, the operator shall hold the tool in the operating position for no less than fifteen seconds, and then try to operate the tool a second time. The operator shall wait another fifteen seconds, holding the tool in the operating position and only then shall proceed to remove the explosive load which shall be done in strict accordance with the manufacturer's instructions. Misfired cartridges shall be placed carefully in a metal container filled with water, and returned to the supervisor for disposal.
- (6) A tool shall never be left unattended in a place where it would be available to unauthorized persons.
- (7) Fasteners shall not be driven into very hard or brittle materials, including but not limited to cast iron, glazed tile, surface-hardened steel, glass block, living rock, face brick, or hollow tile.
- (8) Driving into materials easily penetrated shall be avoided unless such materials are backed by a substance that will prevent the pin or fastener from passing completely through and creating a flying missile hazard on the other side.
- (9) Driving distance from edge.
 - (a) Fasteners shall not be driven directly into materials such as brick or concrete closer than three inches from the unsupported edge or corner, or into steel surfaces closer than one-half inch from the unsupported edge or corner, unless a special guard, fixture, or jig is used.
 - (b) Exception: low velocity tools may drive no closer than two inches from an edge in concrete or one-fourth inch in steel.
 - (c) When fastening other materials, such as a two- by four-inch wood section to a concrete surface, it is permissible to drive a fastener of no greater than seven-thirty-seconds-inch shank diameter no closer than two inches from the unsupported edge or corner of the work surface.
- (10) Fasteners shall not be driven through existing holes unless a positive guide is used to secure accurate alignment.
- (11) No fastener shall be driven into a spalled area caused by an unsatisfactory fastening.
- (12) Tools shall not be used in an explosive or flammable atmosphere.

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- (13) All tools shall be used with the correct shield, guard or attachment recommended by the manufacturer.
- (14) Any tool found not in proper working order shall be immediately removed from service. The tool shall be inspected each day before loading and shall be repaired in accordance with the manufacturer's specifications.

(F) Strength of charge - identification.

All explosive charges (cartridges and shells) to be used in portable explosive-actuated tools shall be marked by color, in accordance with "Table 12-1," "Identification of cased loads", to designate the strength of the charge.

Table 12.1 Identification of cased loads.

Power Level	Color Identification		Nominal Velocity (= 45 f.p.s.)
	Case Color	Load Color	
1	Brass	Gray	300
2	Brass	Brown	390
3	Brass	Green	480
4	Brass	Yellow	570
5	Brass	Red	660
6	Brass	Purple	750
7	Nickel	Gray	840
8	Nickel	Brown	930
9	Nickel	Green	1020
10	Nickel	Yellow	1110
11	Nickel	Red	1200
12	Nickel	Purple	1290

Note: The nominal velocity applies to 3/8-inch diameter 350-grain ballistic slug fired in a test device and has no reference to actual fastener velocity developed in any specific size or type of tool.

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Amend

4123:1-3-13 Trenches and excavations.

(A) Reserved.

(B) Definitions.

- (1) "Accepted engineering requirements (or practices)" means those requirements or practices which are compatible with standards required by a registered architect, a registered professional engineer, or other duly licensed or recognized authority.
- (2) "Angle of repose" means the greatest angle above the horizontal plane at which material will lie without sliding.
- (3) "Braces (trench)" means the horizontal members of the shoring system with ends bearing against the uprights or stringers.
- (4) "Excavation" means any manmade cavity or depression in the earth's surface, including its sides, walls or faces, formed by earth removal and producing unsupported earth conditions by reasons of the excavation. If installed forms or similar structures reduce the depth-to-width relationship, an excavation may become a trench.
- (5) "Hard compact soil" means all earth materials not classified as unstable.
- (6) "Kickouts" means accidental release or failure of a shore or brace.
- (7) "Shaft" means an excavation made from the surface of the ground the longer axis of which forms an angle with the vertical of no more than forty-five degrees.
- (8) "Sheet pile" means a pile, or sheeting, that may form one of a continuous interlocking line, or a row of timber, concrete, or steel piles, driven in close contact to provide a tight wall to resist the lateral pressure of water, adjacent earth, or other materials.
- (9) "Sides", "walls", or "faces" means the vertical or inclined earth surfaces formed as a result of trenching or excavation work.
- (10) "Stringers (wales)" means the horizontal members of a shoring system with sides bearing against the uprights or earth.
- (11) "Trench", when used as a noun, means a narrow excavation made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench at the bottom is no greater than fifteen feet.
- (12) "Trench boxes (safety cages, trench shields)" means a shoring system ~~composed of steel plates and bracing, welded or bolted together, which support~~ capable of supporting the walls of a trench from the ground level to the trench bottom and which can be moved along as work progresses.
- (13) "Trench jack" means screw or hydraulic type jacks used as cross bracing in a trench shoring system.
- (14) "Unstable soil" means earth material, that because of its nature or the influence of related conditions,

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cannot be depended upon to remain in place without extra support, such as would be furnished by a system of shoring.

(15) "Uprights" means the vertical members of a shoring system.

(C) General requirements.

(1) Utility companies and municipally owned utilities shall be contacted and advised of proposed work prior to the start of actual excavation. Prior to opening an excavation, effort shall be made to determine whether underground installations, i.e. sewer, telephone, water, fuel, electric lines, etc., will be encountered and, if so, where such underground installations are located.

(2) Additional precautions by way of shoring and bracing shall be taken to prevent slides or cave-ins where trenches or excavations are made in locations adjacent to backfilled trenches or excavations, or where trenches or excavations are subjected to vibrations from railroad or highway traffic, the operation of machinery, or any other source.

(3) Undercutting of the exposed faces of trenches or excavations is prohibited unless the exposed faces of such undercutting are supported by one or more of the methods prescribed for the support of exposed faces of trenches.

(4) Material placement.

(a) Excavated material or other material shall be placed a minimum of twenty-four inches from the top edge of the trench or excavation.

(b) As an alternative to the clearance prescribed in paragraph (C)(4)(a) of this rule, the employer may use effective barriers or other effective retaining devices in lieu thereof in order to prevent excavated or other materials from falling into the trench or excavation.

(5) Wells, pits, shafts, etc.

(a) All wells, pits, shafts, etc., shall be barricaded or covered.

(b) Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc., shall be backfilled.

(D) Trenches.

(1) The exposed faces of all trenches more than five feet high shall be shored, laid back to a stable slope, or some other equivalent means of protection shall be provided where employees may be exposed to moving ground or cave-ins. (See appendix "Table 13-1").

(2) Sides of trenches in unstable or soft material, five feet or more in depth, shall be shored, sheeted, braced, sloped, or otherwise supported by means of sufficient strength to protect the employees working within them. (See appendix Table 13-1 and "Table 13-2").

(3) Sides of trenches in hard compact soil, including embankments, shall be shored or otherwise supported when the trench is more than five feet in depth and eight feet or more in length. In lieu of shoring, the sides of the trench above the five-foot level may be sloped to preclude collapse, but shall not be steeper than a one-foot rise to each one-half-foot horizontal.

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(4) Materials used for sheeting and sheet piling, bracing, shoring, and underpinning, shall be in good serviceable condition, and timbers used shall be sound and free from large or loose knots, and shall be designed and installed so as to be effective to the bottom of the trench.

(5) Minimum requirements - trench shoring.

(a) Minimum requirements for trench bracing and shoring shall be in accordance with "Table 13-2."

(b) Braces and diagonal shores in a wood shoring system shall not be subjected to compressive stress in excess of value given by the following formula:

$$S = 1300 - 20L/D$$

$$\text{Maximum ratio } L/D = 50$$

Where: L = Length, unsupported, in inches

D = Least side of the timber in inches

S = Allowable stress in pounds per square inch of cross-section.

(6) When employees are required to be in trenches four feet deep or more, an adequate means of exit, such as a ladder or steps, shall be provided and located so as to require no more than twenty-five feet of lateral travel.

(7) When bracing or shoring of trenches is required, such bracing and shoring shall be carried along with the excavation.

(8) Cross braces or trench jacks shall be placed in true horizontal position, be spaced vertically, and be secured to prevent sliding, falling or kickouts.

(9) Portable trench boxes, safety cages or sliding trench shields may be used for the protection of employees in lieu of shoring system or sloping. Where such trench boxes or shields are used they shall be designed, constructed, and maintained in a manner which will provide protection equal to or greater than the sheeting or shoring required for the trench and shall extend no less than six inches above the vertical part of the trench face.

(10) Backfilling and removal of trench supports shall progress together from the bottom of the trench. Jacks or braces shall be released slowly and, in unstable soil, ropes shall be used to pull out the jacks or braces from above after employees have cleared the trench.

(E) Excavations.

(1) The walls and faces of all excavations in which employees are exposed to danger from moving ground shall be guarded by a shoring system, sloping of the ground, or some other equivalent means. (See appendix "Table 13-1 and Table 13-2").

(2) Supporting systems, i.e. piling, cribbing, shoring, etc., shall be designed by a qualified person and shall meet accepted engineering requirements.

(3) Excavations sloped to the angle of repose shall be flattened when an excavation has water conditions, silty materials, loose boulders, and areas where erosion, deep frost action, and slide planes appear.

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- (4) Sides, slopes, and faces of all excavations shall meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing, or other equally effective means.
- (5) Materials used for sheeting, sheet piling, cribbing, bracing, shoring, and underpinning shall be in good serviceable condition, and timbers shall be sound, free from large or loose knots, and of proper dimensions. (See "Table 13-2" for proper dimensions.)
- (6) Excavations below the level of the base of the footing of any foundation or retaining wall is prohibited, except in hard rock, unless the wall is underpinned and appropriate precautions taken to insure the stability of adjacent walls.
- (7) If it is necessary to place or operate power shovels, derricks, trucks, materials, or other heavy objects on a level above and near an excavation, the side of the excavation shall be sheet-piled, shored, braced or sloped as necessary to resist the extra pressure due to such superimposed loads.
- (8) When mobile equipment is utilized or allowed adjacent to excavations, substantial stop logs or barricades shall be installed. If possible, the grade should be away from the excavation.
- (9) Walkways shall be provided where employees or equipment are required to cross over excavations, standard guardrails shall be provided where the walkways are six feet or more above lower levels.

Appendix to Rule 4123:1-3-13

TABLE 13-1.

APPROXIMATE ANGLE OF REPOSE FOR SLOPING OF SIDES OF EXCAVATIONS

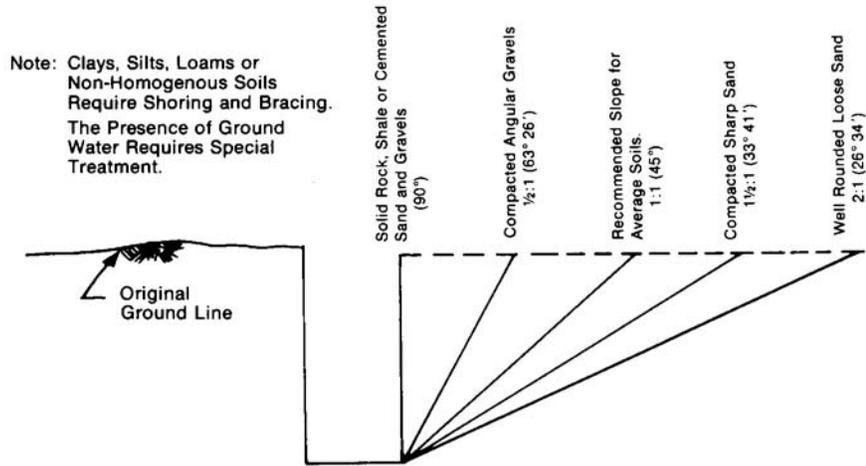


TABLE 13-2.

TRENCH SHORING—MINIMUM REQUIREMENTS

Depth of trench	Kind or condition of earth	Size and spacing of members																		
		Uprights		Stringers		Cross braces ¹						Maximum spacing								
		Inches	Feet	Inches	Feet	Width of trench		Up to 3 feet		6 to 9 feet		9 to 12 feet		12 to 15 feet		Vertical Horizontal				
Minimum dimension		Maximum spacing		Minimum dimension		Maximum spacing		Inches		Inches		Inches		Inches		Feet		Feet		
5 to 10	Hard, compact	3 x 4 or 2 x 6	6	2 x 6	4 x 4	4 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	4	4	6	6
	Likely to crack	3 x 4 or 2 x 6	3	4 x 6	4 x 4	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4	4	6	6
	Soft, sandy, or filled	3 x 4 or 2 x 6	Close sheeting	4 x 6	4	4 x 4	4 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	4	4	6	6
10 to 15	Hydrostatic pressure	3 x 4 or 2 x 6	sheeting	6 x 8	4	4 x 4	4 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	4	4	6	6	
	Hard	3 x 4 or 2 x 6	4	4 x 6	4 x 4	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4	4	6	6
	Likely to crack	3 x 4 or 2 x 6	2	4 x 6	4 x 4	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4 x 6	4	4	6	6
15 to 20	Soft, sandy, or filled	3 x 4 or 2 x 6	sheeting	4 x 6	4	4 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	4	4	6	6	
	Hydrostatic pressure	3 x 6	sheeting	8 x 10	4	4 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	6 x 6	4	4	6	6	
	All kinds or conditions	3 x 6	sheeting	4 x 12	4	4 x 12	6 x 8	8 x 8	8 x 8	8 x 8	8 x 8	8 x 8	8 x 8	8 x 8	8 x 8	4	4	6	6	
Over 20	All kinds or conditions	3 x 6	sheeting	6 x 8	4	4 x 12	8 x 8	8 x 8	8 x 8	8 x 8	8 x 8	8 x 8	8 x 8	8 x 8	8 x 8	4	4	6	6	

¹ Trench jacks may be used in lieu of, or in combination with, cross braces. Shoring is not required in solid rock, hard shale, or hard slag. Where desirable, steel sheet piling and bracing of equal strength may be substituted for wood.

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No Change

4123:1-3-14 Electrical conductors, wires and equipment.

(A) Reserved.

(B) Definitions.

- (1) "Circuit" means a conductor or system of conductors through which an electric current is intended to flow.
- (2) "Conductor" means a metallic material, usually in the form of a wire or cable, suitable for carrying an electric current. Does not include bus bars.
- (3) "Current-carrying" means a conducting part intended to be connected in an electric circuit to a source of voltage. Noncurrent-carrying parts are those not intended to be connected.
- (4) "De-energized" means being free from any electrical connection to a source of a potential different from that of the earth.
- (5) "Energized" means anything connected to an electrical source having a greater potential than that of the earth.
- (6) "Ground connection" means the equipment used in establishing a path between an electric circuit or equipment and earth. A ground connection consists of a ground conductor, a ground electrode and the earth which surrounds the electrode.
- (7) "Grounded" means connected to earth or to some extended conducting body which serves instead of the earth whether the connection is intentional or accidental.
- (8) "Grounded effectively" means permanently connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to prevent the building up of voltages which may result in undue hazard to connected equipment or to employees.
- (9) "Grounding conductor" means a conductor which is used to connect the equipment or the wiring system with a grounding electrode or electrodes.
- (10) "Insulated" means separated from other conducting surfaces by a dielectric substance or air space permanently offering a high resistance to the passage of current and to disruptive discharge through the substance or space. (Note: When any object is said to be insulated it is understood to be insulated in a suitable manner for the conditions to which it is subjected. Otherwise it is, within the purpose of this rule, uninsulated).
- (11) "Insulating" (where applied to the covering of a conductor or to clothing, guards, rods, and other safety devices) means that a device, when interposed between an employee and current-carrying parts, protects the employee making use of it against electric shock, from the current-carrying parts with which the device is intended to be used; the opposite of conducting.
- (12) "Phase" means one energized conductor of an electrical system.
- (13) "Switch" means a device for opening and closing or for changing the connection of a circuit. In this rule, a switch will always be understood to be manually operated, unless otherwise stated.

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- (14) "Voltage (of a circuit)" means the greatest root-mean-square (effective) difference of potential between any two conductors of the circuit concerned. On various systems such as three-phase four-wire, single-phase three-wire and three-wire direct current, there may be various circuits of various voltages.
- (15) "Voltage to ground" means, in grounded circuits, the voltage between the given conductor and that point or conductor of the circuit which is grounded; in grounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit.
- (16) "Voltage" (or "volts") means the highest effect electrical potential between any two conductors of the circuit concerned except where, in certain paragraphs of this rule, reference is made to the term "voltage (or volts) to ground".

(C) Installation and maintenance of temporary wiring.

- (1) All temporary wiring shall be installed with approved overload protection and maintained in accordance with the following:
 - (a) Main feed and secondary conductors shall be no less than eight feet above the floor or ground level unless in rigid or other conduit such as nonmetallic sheathed cable or metallic sheathed cable which provides equivalent protection and support. Extension cords shall not be considered as secondary conductors. No branch circuits or feeder conductors shall be laid on the floor except properly maintained extension cords feeding portable powered tools.
 - (b) All receptacles shall be grounded effectively.
 - (c) All lamps for general illumination shall be protected from accidental contact or breakage. Protection shall be provided by elevation of no less than seven feet from working surface or by a suitable fixture or lampholder with a guard.
 - (d) All temporary circuits shall be grounded effectively.

(2) Bare conductors and earth returns.

No bare conductors nor earth returns shall be used for the wiring of any temporary circuit.

(3) Disconnecting means.

Approved disconnecting switches or plug connectors shall be installed to permit the disconnection of all ungrounded conductors of each temporary circuit.

(4) Construction sites.

All one-hundred-twenty-volt single-phase fifteen and twenty ampere receptacle outlets which are not a part of the permanent wiring of the building or structure, shall have ground fault circuit interrupters or the implementation of an assured equipment grounding program on construction sites.

(5) All energized equipment exposed to contact shall be guarded.

(6) Portable lights in damp locations shall not exceed twelve volts, except that one hundred twenty volt lights may be used if protected by a ground-fault circuit interrupter.

(D) Extension cords.

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- (1) Extension cords used with portable electric tools and appliances shall be of three-wire type.
- (2) Three-wire type extension cords to lights or electrically powered tools or devices shall be equipped with a three-wire grounding type receptacle and attachment plug of nonconductive material. Splicing shall be done by vulcanized or plastic molded splice method. Insulation shall be equal to the capable being spliced and wire connections shall be soldered.
- (3) Where different voltages, frequencies, or type of current (alternating or direct) are to be supplied by portable cords, receptacles shall be of such design that attachment plugs used on such circuits are not interchangeable.

(E) Lockout and tagging of de-energized equipment or circuits.

The employer shall instruct employees to lock out all de-energized equipment or circuits and attach tags at all points where such de-energized equipment or circuits can be energized.

(F) Circuits in excess of two hundred fifty volts.

- (1) The employer shall instruct employees to de-energize and effectively ground circuits in excess of two hundred fifty volts before working on such circuits unless personal protective equipment is provided in accordance with paragraph (H)(3) of rule 4121:1-3-03 of the Administrative Code.
- (2) All circuits shall be worked as energized unless grounded effectively.

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No Change

4123:1-3-15 Explosives and blasting.

(A) Reserved.

(B) Definitions.

- (1) "Approved storage facility" means a facility for the storage of explosive materials covered by a license or permit issued under authority of the appropriate federal agency.
- (2) "Blast area" means the area in which explosives loading and blasting operations are being conducted.
- (3) "Blaster" means the person having a comprehensive knowledge of the installation and use of appliances associated with the type of blasting operations being performed, designated by the employer to perform and direct the functions of placing and fixing explosives, firing, approaching misfires, thawing explosives and all other duties in connection with the blasting operation.
- (4) "Blasting agent" means any material or mixture consisting of a fuel and oxidizer used for blasting, but not classified an explosive and, in which none of the ingredients is classified as an explosive provided the furnished (mixed) product cannot be detonated with a no. 8 test blasting cap.
- (5) "Blasting cap" means a metallic tube closed at one end, containing a charge of one or more detonating compounds, and designed for and capable of detonation from the sparks or flame from a safety fuse inserted and crimped into the open end.
- (6) "Bus wire" means an insulated expendable wire used between connecting wires and leading wires.
- (7) "Connecting wire" means an insulated expendable wire used between electric blasting caps and the bus wires or leading wires.
- (8) "Detonating cord" means a flexible cord containing a center core of high explosives which when detonated, will have sufficient strength to detonate other cap-sensitive explosives with which it is in contact.
- (9) "Detonator" means igniters, blasting caps, electric blasting caps, or similar devices used to explode explosives.
- (10) "Explosive" means any chemical compound or mixture that is intended for the purpose of producing an explosion; that contains any oxidizing and combustible units, or other ingredients in such proportions, quantities, or packing that an ignition by fire, by friction, by concussion, by percussion, or by a detonator, of any part of the compound mixture may cause such a sudden generation of highly heated gases that the resultant gaseous pressures are capable of producing destructive effects on contiguous objects, or of destroying life or limb.
- (11) "Fuse lighters" means special devices for the purpose of igniting safety fuse.
- (12) "Leading wire" means an insulated wire used between the electric power source and the electric blasting cap circuit.
- (13) "Magazine" means any building or other structure used for the storage of explosives.

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- (14) "Primed cartridge" means a cartridge of explosives to which a detonator has been attached as a means of firing, and intended to be placed in the bore hole or other explosive chamber for the purpose of exploding the remainder of the charge.
- (15) "Safety fuse" means the slow-burning commercially used blasting fuse, usually consisting of a core of powder overspun with yarns and tapes, and which may be treated with a waterproofing compound, and intended to convey fire to the blasting caps or explosive mass while minimizing the danger to the employee lighting it.

(C) Specific requirements for all blasting operations.

- (1) The employer shall designate one employee qualified as a blaster, to be in charge of blasting at each location where blasting operations are being performed.
- (2) The use of black powder is prohibited.
- (3) No explosives or blasting agents shall be abandoned.
- (4) Smoking, firearms, matches, open flame lamps, and other fire, flame, heat or spark-producing devices are prohibited in or near explosive magazines or while explosives are being handled, transported or used.
- (5) When blasting is done employees shall be removed from the area or the blast shall be covered, before firing, with a mat or mats so constructed as to control the throw of fragments.
- (6) The blaster shall be responsible for using every reasonable precaution such as visual and audible warning signals, flags, and barricades, to ensure employee safety.
- (7) Blasting operations in the proximity of overhead power lines, communication lines, utility services, or other services and structures shall not be carried on until the operators or owners have been notified and measures have been taken to ensure the safety of the employer's employees.
- (8) Due precautions shall be taken to prevent accidental discharge of electric blasting caps by current induced by radar, radio transmitters, lightning, adjacent power lines, dust storms, or other sources of extraneous electricity. These precautions shall include:
 - (a) The suspension of all blasting operations and removal of employees from the blasting area during the approach and progress of an electrical storm.
 - (b) The posting of signs warning against the use of mobile radio transmitters on all roads within one thousand feet of the blasting operations.
- (9) Empty boxes, paper and fiber packing materials which have previously contained high explosives shall not be used again for any purpose, but shall be destroyed by burning at a location approved by the blaster, and no employee shall be permitted closer than one hundred feet after the burning has started.
- (10) Containers of explosive materials shall not be opened within fifty feet of any magazine. In opening cases, nonsparking tools shall be used, except that metal slitters may be used for opening fiberboard boxes.
- (11) Explosive materials that are obviously deteriorated or damaged shall not be used and shall be destroyed by or under the direction of the blaster.

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(12) Flagmen posted on highways to stop traffic during blasting operations shall be stationed far enough away from the blasting for their own safety.

(D) Transportation of explosives.

(1) Surface transportation of explosives.

Any vehicle used to transport explosives on the job site shall have a nonsparking floor and side members and shall contain a suitable fire extinguisher. Explosives and blasting caps shall not be transported in the same vehicle.

(2) Underground transportation of explosives.

(a) No employee shall ride in any shaft conveyance transporting explosives and blasting agents.

(b) Detonators and other explosives shall not be transported at the same time in any shaft conveyance.

(c) Explosives or blasting agents, not in original containers, shall be placed in a suitable container when transported manually.

(d) Detonators, primers, and other explosives shall be carried in separate containers when transported manually.

(e) When detonators or explosives are brought into an air lock, no employee except the blaster, lock tender and the employees necessary for carrying, shall be permitted to enter the air lock. No other material, supplies, or equipment shall be locked through with the explosives.

(f) Detonators and explosives shall be taken separately into pressure working chambers.

(g) The blaster shall be responsible for the receipt, unloading, storage, and on-site transportation of explosives and detonators.

(E) Storage of explosives and blasting agents.

(1) Blasting caps, electric blasting caps, or other detonating devices shall not be stored in the same magazine with other explosives or blasting agents.

(2) Primed cartridges shall not be stored.

(3) All explosives stored on the job site shall be stored in approved storage facilities. All brush and combustible materials shall be kept clear of the magazine to a distance of twenty-five feet.

(4) Detonators and explosives shall not be stored or kept in tunnels, shafts, or caissons. Detonators and explosives for each round shall be taken directly from the magazines to the blasting zone and immediately loaded. Detonators and explosives left over after loading a round shall be removed from the working chamber before the connecting wires are connected.

(F) Loading of explosives or blasting agents.

(1) All drill holes shall be sufficiently large to admit freely the insertion of the packages of explosive materials.

(2) Tamping shall be done only with nonsparking tools without exposed metal parts, except that nonsparking

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metal connectors may be used for jointed poles. Violent tamping is prohibited. Primed cartridges shall not be tamped.

- (3) No holes shall be loaded except those to be fired in the next round of blasting. After loading, all remaining explosives shall be immediately returned to the magazine or removed from the area to a distance of no less than one hundred feet.
 - (4) Drilling shall not be started until all remaining butts of old holes are examined for unexploded charges, and if any are found, they shall be disposed of before work proceeds.
 - (5) No person shall be allowed to deepen drill holes which have contained explosives or blasting agents.
 - (6) No loaded holes shall be left unattended or unprotected.
 - (7) The explosives used in wet holes or holes that may become wet shall be water-resistant.
- (G) Initiation of explosive charges.
- (1) General.
 - (a) When safety fuse is used, the blasting cap shall be securely attached to it with a standard ring type cap crimper. All primers shall be assembled no less than fifty feet from any magazine.
 - (b) Primers for use in blasting shall be made up only as required for each round of blasting.
 - (c) No blasting cap shall be inserted in the explosive materials without first making a hole in the cartridge for the cap with a nonsparking punch.
 - (d) If there are any misfires while using cap and fuse, all employees shall be required to remain away from the charge for at least an hour. If electric blasting caps are used and a misfire occurs, this waiting period may be reduced to thirty minutes.
 - (2) Electric blasting caps.
 - (a) Bus wires, connecting wires and lead wires shall be insulated single solid wires of sufficient current-carrying capacity.
 - (b) Blasters, when testing circuits to charged holes, shall use only blasting galvanometers or other instruments that are specifically designed for the purpose.
 - (c) Only the employee making the final check on the wire connections shall fire the shot. All connections shall be made from bore hole back to the source of firing current, and the leading wires shall remain shorted and not be connected to the blasting machine or other source of current until the charge is to be fired.
 - (d) In any single blast using electric blasting caps, all caps shall be of the same style or function, and of the same manufacture.
 - (e) Electric blasting shall be carried out by using blasting circuits or power circuits in accordance with the electric blasting cap manufacturer's recommendations, or an approved contractor or his designated representative.

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(f) When firing a circuit of electric blasting caps, every reasonable precaution shall be exercised to ensure that an adequate quantity of delivered current is available, in accordance with the manufacturer's recommendations.

(3) Use of safety fuse.

(a) No one shall be permitted to carry detonators or primers of any kind on the person.

(b) The minimum length of safety fuse to be used in blasting shall be as required by applicable state law, but shall be no less than thirty inches.

(c) At least two employees shall be present when multiple cap and fuse blasting is done by hand lighting methods.

(d) No more than twelve fuses may be lighted by any individual when hand lighting devices are used, provided that when two or more safety fuses in a group are lighted as one by means of igniter cord, or other similar fuse-lighting devices, they may be considered as one fuse.

(e) The so-called "drop fuse" method of dropping or pushing a primer or any explosive with a lighted fuse attached is prohibited.

(4) Use of detonating cord.

(a) Care shall be taken to select a detonating cord consistent with the type and physical condition of the bore hole and stemming and type of explosives used.

(b) Detonating cord shall be handled and used with the same precaution as with other explosives.

(c) The line of detonating cord extending out of a bore hole or from a charge shall be cut from supply spool before loading the remainder of the bore hole or placing additional charges.

(d) Detonating cord shall be handled and used with care to avoid damaging or severing the cord during and after loading and hooking-up.

(e) Detonating cord connections shall be made in accordance with approved methods. Knot-type or other cord-to-cord connections shall be made only with detonating cord in which the explosive core is dry.

(f) All detonating cord trunklines and branchlines shall be free of loops, sharp kinks, or angles that direct the cord back toward the oncoming line of detonation.

(g) All detonating cord connections shall be inspected before firing the blast.

(h) When detonating cord millisecond-delay connectors or short-interval-delay electric blasting caps are used with detonating cord, the practice shall conform strictly to the manufacturer's recommendations.

(i) When connecting a blasting cap or an electric blasting cap to detonating cord, the cap shall be taped or otherwise attached securely along the side or the end of the detonating cord, with the end of the cap containing the explosive charge pointed in the direction in which the detonation is to proceed.

(j) Detonators for firing the trunkline shall not be brought to the loading area nor attached to the detonating cord until everything else is in readiness for the blast.

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(H) Underwater blasting.

- (1) Loading tubes and casings of dissimilar metals shall not be used in electric blasting because of possible electric transient currents from galvanic action of the metals and water.
- (2) In marine blasting only water-resistant blasting caps and detonating cords shall be used. When a loading tube is necessary one of a nonsparking type shall be used.
- (3) No blast shall be fired while any vessel under way is closer than one thousand five hundred feet to the blasting area. Those on board vessels or craft moored or anchored within one thousand five hundred feet shall be notified before a blast is fired.
- (4) If swimming or diving operations are in progress in the vicinity of the blasting area, signals and arrangements shall be agreed upon to assure that no blast shall be fired while any employee is in the water.
- (5) Blasting flags shall be displayed.
- (6) When more than one charge is placed under water, a float device shall be attached to an element of each charge in such manner that it will be released by the firing. Misfires shall be handled in accordance with the requirements of paragraph (G)(1)(d) of this rule.

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Amend

4123:1-3-16 Tunnels and shafts, caissons, cofferdams, and compressed air.

(A) Reserved.

(B) Definitions.

- (1) "Air lock" means a chamber designed for the passage of employees and materials from one air pressure to a greater or lesser air pressure.
- (2) "Bulkhead" means an airtight structure separating the working chamber from free air or from another chamber under a greater or lesser pressure than the working pressure.
- (3) "Caisson" means a wood, steel, concrete or reinforced concrete, air-and water-tight chamber in which it is possible for men to work under air pressure greater than atmospheric pressure to excavate the material below water level.
- (4) "Decanting" means a method used for decompressing under emergency circumstances. In this procedure, the employees are brought to atmospheric pressure with a very high gas tension in the tissues and then immediately recompressed in a second and separate chamber or lock.
- (5) "Emergency lock" means a lock designed to hold and permit the quick passage of an entire shift of employees.
- (6) "Hazardous concentrations" as applied to air contaminants, means concentrations which are known to be in excess of recognized occupational exposure limits such as, but not exclusively, the OSHA Permissible Exposure Limits (OSHA-PEL), National Institute for Occupational Safety and Health Recommended Exposure Limits (NIOSH-REL) or American Conference of Governmental Industrial Hygienists' Threshold Limit Values (ACGIH TLV).
- ~~(6)~~(7) "High air" means air pressure used to supply power to pneumatic tools and devices.
- ~~(7)~~(8) "Low air" means air supplied to pressurize working chambers and locks.
- ~~(8)~~(9) "Manlock" means an airlock for personnel.
- ~~(9)~~(10) "Materials lock" means an airlock for materials and equipment.
- ~~(10)~~(11) "Medical lock" means a special chamber in which employees are treated for decompression illness.
- ~~(11)~~(12) "Normal condition" means one during which exposure to compressed air is limited to a single continuous working period followed by a single decompression in any given twenty-four-hour period. A second exposure should not occur for at least 12 hours after normal atmospheric pressure has passed.
- ~~(12)~~(13) "Safety screen" means an air-and water-tight diaphragm placed across the upper part of a compressed air tunnel between the face and bulkhead in order to prevent flooding the crown of the tunnel.
- ~~(13)~~(14) "Shafting" means an air-and water-tight enclosure built in the roof of the caisson and extended upward until above the normal ground or water level.

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~~(14)~~(15) "Working chamber" means the space or compartment under air pressure in which the work is being done.

~~(15)~~(16) "Working face" (work face) means the transverse face of the tunnel heading at the point of greatest advancement of the tunnel excavation.

(C) General.

- (1) Access to unattended underground openings shall be restricted by gates or doors. Unused chutes, manways, or other openings shall be tightly covered, bulkheads, or fenced off, and posted.
- (2) Where hazardous settlement of the earth has occurred the area shall be fenced and posted.
- (3) Each operation shall have a check-in and check-out system that will provide identification of every employee underground.
- (4) All pipe, fittings and wires extending in shafts, tunnels and caissons shall be securely fastened in place.

(D) Tunnels and shafts.

(1) Emergency provisions.

- (a) Evacuation plans and procedures shall be developed and made known to the employees.
- (b) Emergency hoisting facilities shall be readily available at shafts more than fifty feet in depth, unless the regular hoisting facilities are independent of electrical power failures.
- (c) Approved self-contained breathing apparatus shall be available near the advancing face adequate in number to equip each employee at the face. Such items shall be on the haulage equipment and in other areas where employees might be trapped by smoke or gas.
- (d) A method of affording instant communications shall be provided between the work face and the tunnel portal, and such method shall be independent of the tunnel power supply.
- (e) Safety belts shall be worn on skips and platforms used in shafts unless guardrails or cages are provided.

(2) Ground support.

- (a) The exposed faces of tunnel excavations (except the portion being worked on at the particular time) and shafts made in material other than rock shall be supported and held in place by a securely fastened bracing system.
- (b) Damaged or dislodge tunnel supports, whether steel sets or timber, shall be repaired or replaced. New supports shall be installed whenever possible before removing the damaged supports.
- (c) All sets, including horseshoe-shaped or arched rib steel sets, shall be designed and installed so that the bottoms shall be securely anchored to prevent pressures from pushing them inward into the excavation. Lateral bracing shall be provided between sets to further stabilize the support.

(3) Ventilation.

- (a) ~~When ventilation fails for longer than a safe temporary period employees~~ Employees shall be

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evacuated from the tunnel or shaft if ventilation fails. Before employees are permitted to enter or reenter the tunnel or shaft, ventilation shall be restarted and the area shall be examined, ~~after ventilation has been started~~, for gas and other atmospheric hazards by an employee designated by the employer the person checking air quality shall be knowledgeable in direct reading instruments and how to interpret readings from the instruments.

- (b) Under no circumstances shall a tunnel or shaft be entered to make any of the following prescribed tests.
- (i) No employer shall permit entrance into any tunnel or shaft unless an entry procedure, incorporating one of the following, is used:
- (a) Air sampling shall be performed by qualified, trained personnel prior to and periodically during occupancy to determine either that:
- (i) The atmosphere within the tunnel or shaft contains an adequate quantity of oxygen (19.5 per cent) and harmful atmospheric contaminants have been diluted to safe concentrations; or
- (ii) Adequate mechanically induced dilution ventilation is used prior to entry and continued in use during occupancy to ensure that no less than 19.5 per cent oxygen is maintained in the tunnel or shaft.
- (b) A supplied-air respirator or self-contained breathing apparatus is provided and used.
- (ii) When the tunnel or shaft has been exposed to, contained, or is likely to have combustible gases within its confines (such as sewage treatment plants), it shall not be entered if ~~any reading is obtained on a~~ hazardous concentration of combustible gas ~~indicator (See "Appendix III to this rule) is detected~~.
- (iii) If tests under paragraph (D)(3)(b)(i)(a) or (D)(3)(b)(ii) of this rule indicate that the atmosphere in the tunnel or shaft to be entered contains:
- (a) Any concentration of flammable vapor or gas; and/or,
- (b) A hazardous concentration of toxic contaminants ~~above the threshold limit value~~; and/or
- (c) Less than 19.5 per cent oxygen; then appropriate control measures shall be instituted. Control measures may consist of forced or natural ventilation, use of personal protective equipment, a combination of these, or other effective control techniques.
- (c) Internal combustion engines other than approved mobile diesel powered equipment shall not be used underground.
- (4) Illumination.
- Lighting of no less than ten lumens shall be provided at the tunnel and shaft headings and no less than five lumens elsewhere in the tunnel or shaft where employees are required to work.
- (5) Fire prevention and control.

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- (a) Signs warning against smoking and open flames shall be posted so that they can be readily seen in areas or places where fire or explosion hazards exist.
- (b) The carrying of matches, lighters, or other flame-producing smoking materials is prohibited in all underground operations.
- (c) Gasoline and liquefied petroleum gases shall not be taken, stored or used underground.
- (d) Oil and grease stored underground shall be kept in tightly sealed containers in fire-resistant enclosures at least three hundred feet from underground explosive magazines and at least one hundred feet from shaft stations and steep incline passageways.
- (e) Air that has passed through underground oil storage areas shall not be used to ventilate working areas.
- (f) Approved fire-resistant hydraulic fluids shall be used in hydraulically actuated underground machinery and equipment.
- (g) Fires shall not be built underground.
- (h) Noncombustible barriers shall be installed below welding or burning operations that are performed in or over a shaft.
- (i) Fire extinguishers or equivalent protection shall be provided at the head and tail pulleys of underground belt conveyors and at three-hundred-foot intervals along the belt line.
- (j) Sufficient employees trained in the use, care and limitations of ~~oxygen~~-self-contained breathing apparatus (SCBA) and the use of fire fighting equipment shall be on duty on each shift in tunnel operations.

(6) Personal protective equipment.

Protective clothing or equipment shall be worn as specified in rule 4123:1-3-03 of the Administrative Code.

(7) Hearing protection.

Employees exposed to ~~continuous~~ a time-weighted average (TWA) of noise levels of ninety or more decibels (>90dBA TWA) slow response shall be provided with approved ~~ear~~-hearing protection.-
~~(Variations in noise level involving maxima at intervals of one second or less, are to be considered continuous.)~~

(8) Drilling.

- (a) Employees shall not be required to be on a drill mast while the drill bit is in operation.
- (b) When a drill is being moved from one drilling area to another, drill steel, tools, and other equipment shall be secured, and the mast placed in a safe position.
- (c) Receptacles or racks shall be provided for drill steel stored on jumbos.
- (d) The employer shall be required to provide and employee shall use a warning system to warn all

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employees below jumbo decks before the drilling cycle is started.

- (e) Drills on columns shall be anchored firmly before drilling is started and shall be retightened when necessary thereafter.
- (f) The employer shall provide mechanical means for lifting drills, roof bolts, mine straps, and other unwieldy heavy material to the top decks of jumbos over ten feet in height.
- (g) Jumbo decks wide enough to accommodate two employees and more than ten feet in height shall be provided with stair or ladder access.
- (h) On jumbo decks over ten feet in height, standard guardrails, which may be removable shall be provided on all sides and back platforms.
- (i) Scaling bars shall be in good condition at all times, and blunted and severely worn bars shall not be used.
- (j) When jumbos are being moved, only the driver and those assisting the driver shall be permitted on the jumbo.
- (k) Before commencing the drill cycle, the face and lifters shall be examined for misfires (residual explosives) and, if found, they shall be removed before drilling commences at the face. Lifters shall not be drilled through blasted rock (muck) or water.
- (l) Air lines that are buried in the invert shall be identified by signs posted nearby, warning all personnel.

(9) Blasting.

- (a) All blasting and explosives-handling operations shall be conducted in compliance with rule 4123:1-3-15 of the Administrative Code.
- (b) When using explosives in tunnels, shafts and caissons, all metal pipes, rails, air locks, and steel tunnel lining shall be electricity bonded together and grounded at or near the portal or shaft, and such pipes and rails shall be cross-bonded together at no less than one-thousand-foot intervals throughout the length of the tunnel. In addition, each low air supply shall be grounded at its delivery end.

(10) Haulage.

- (a) Powered mobile equipment shall be provided with adequate brakes.
- (b) Powered mobile haulage equipment shall be provided with audible warning devices. Lights shall be provided at both ends.
- (c) Cab windows shall be of safety glass, or equivalent material in good condition.
- (d) Adequate backstops or brakes shall be installed on inclined conveyor drive units. A conveyor of such type which would cause injury when run in reverse shall not be reversed until employees in the area are alerted by a signal or by a designated person that the conveyor is about to start.
- (e) No employees shall be permitted to ride a power-driven chain, belt, or bucket conveyor, unless the conveyor is specifically designed for the transportation of employees.

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- (f) The employer shall not permit employees to be transported in dippers, shovel buckets, forks, clamshells, or in the beds of the dump trucks, or on other haulage equipment not specifically designed or adapted for the transportation of employees.
- (g) Electrically powered mobile equipment shall not be left unattended unless the master switch is in the off position, all operations controls are in the neutral position, and the brakes are set, or other equivalent precautions are taken against rolling.
- (h) When dumping cars by hand, the car dumps shall be provided with tie-down chains or bumper blocks to prevent cars from overturning.
- (i) Rocker-bottom or bottom-dump cars shall be equipped with positive locking devices.
- (j) Equipment which is to be hauled shall be so loaded and protected as to prevent sliding or spillage.
- (k) Parked railcars shall be blocked securely.
- (l) Berms, bumper blocks, safety hooks, or similar means shall be provided to prevent over-travel and overturning at dumping locations.
- (m) Where necessary, bumper blocks, or the equivalent, shall be provided at all track dead ends.
- (n) Supplies, materials, and tools, other than small handtools, shall not be transported with employees in mantrip cars.

(11) Electrical equipment.

Oil-filled transformers shall not be used underground unless they are located in a fire-resistant enclosure and surrounded by a dike to contain contents of the transformers in event of a rupture.

(12) Hoisting.

- (a) Hoisting machines, either powered or hand operated, shall be worm-gear or powered both ways. The design must be such that when the power is stopped, the load cannot move.
- (b) Controls for powered hoists shall be of the deadman type with a nonlocking switch or control.
- (c) A device to shut off the power shall be installed ahead of the operating control.
- (d) Hand-operated release mechanisms, which can permit the load to descend faster than the speed rating, may be performed if shaft conditions permit.
- (e) Hoist machines with cast metal parts shall not be used.
- (f) Every hoist shall be tested with twice the maximum load before being put into operation, and annually thereafter as well as when repairs or alteration are made. Records of inspection must be kept on file.
- (g) All anchorages of hoists shall be inspected at the beginning of each shift.
- (h) An enclosed covered metal cage shall be used to raise and lower employees in the shaft. The cage shall be designed with a safety factor of four and shall be load-tested prior to use. The exterior of the cage shall be free of projections or sharp corners. Only closed shackles shall be used in the cage

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rigging.

- (i) If the cage is equipped with a door, a locking device shall be installed to prevent the door from opening accidentally while the cage is being lowered or raised while hoisting or lowering employees.

(E) Caissons.

(1) Sinking of caissons.

(a) Bracing of caissons.

Caissons shall be substantially braced before loading with concrete or other weight.

(b) Concreting caissons.

When two or more caissons are sunk together, employees shall be removed from adjacent caissons during concreting operations.

(c) Air lock platforms.

All outside air locks shall be provided with a platform no less than forty-two inches wide, and such platform shall be provided with a standard guard railing and toeboard.

(d) Fifteen or more employees - two locks.

All caissons in compressed air environments in which there are fifteen or more employees, or are ten feet or more in diameter, shall have two locks, one of which shall be used as a manlock. It shall be the duty of one or more trained employees to be in charge of and operate said manlock and any associated man shafts.

(e) Door opening of locks.

The bottom of the lowest door opening of locks shall be no less than three feet above water level.

- (2) Where the working chamber is less than eleven feet in length, and the caisson is at any time suspended or hung while work is in progress so that the bottom of the excavation is more than nine feet below the deck of the working chamber, a shield shall be erected therein for the protection of the employees.
- (3) Shafting shall be subjected to a hydrostatic or air-pressure test, at which pressure such shafting shall be tight. Shafting shall be stamped on the outside shell about twelve inches from each flange to show the pressure to which it has been subjected.
- (4) Whenever shafting is used, it shall be provided, where space permits, with a safe, proper, and suitable staircase for its entire length, including landing platforms, no more than twenty feet apart. Where this is impracticable, suitable ladders shall be installed with landing platforms located about twenty feet apart to break the climb.
- (5) All caissons having diameter or side greater than ten feet shall be provided with a manlock and shafting for the exclusive use of employees.
- (6) In addition to the gauge in the locks, gauges shall also be maintained on the outer and inner side of each

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bulkhead. These gauges shall be accessible at all times and kept in accurate working order.

(7) Where employees are exposed to compressed air working environments in caissons the requirements contained in paragraph (G) of this rule shall be complied with.

(F) Cofferdams.

- (1) If overtopping of the cofferdam by high waters is possible, means shall be provided for controlled flooding of the work area.
- (2) Warning signals for evacuations of employees in case of emergency shall be developed and instructions posted.
- (3) Cofferdam walkways, bridges, or ramps with no less than two means of rapid exit shall be provided and equipped with standard guardrails.
- (4) Cofferdams located close to navigable shipping channels shall be appropriately marked to protect them from vessels in transit.

(G) Compressed air.

(1) General provision.

When work is in progress which requires employees to work in compressed air, there shall be present a representative of the employer, who is thoroughly trained and experienced in compressed air techniques.

(2) Medical attendance, examination and regulations.

- (a) A licensed physician shall be designated for each job who is knowledgeable of compressed air work, who shall at all times be available for immediate service and who shall be responsible for all matters on the job pertaining to the health of employees, treatment on the job of illness and injuries, and medical and first aid equipment. The physician shall make all required physical examinations and shall make and sign all required reports of such examinations.
- (b) No employee shall be assigned to work in a compressed air environment until examined by the physician and reported to be physically qualified to engage in such work.
- (c) After being employed continuously in compressed air work for a period designated by the physician, but not to exceed one year, the employee shall be reexamined by the physician to determine if such employee is still physically qualified to engage in compressed air work.
- (d) An ambulance or transportation suitable for a litter case shall be provided at each project and at each portal of a project when the portals are more than five road miles apart.
- (e) A medical lock shall be established and maintained in immediate working order whenever air pressure in the working chamber is increased above the normal atmosphere.
- (f) Identification badges shall be furnished to all employees, indicating that the wearer is a compressed air worker. A permanent record shall be kept of all identification badges issued. The badge shall give the employee's name, address of the medical lock, the telephone number of the licensed physician for the compressed air project and contain instructions that in case of emergency of unknown or doubtful cause of illness, the wearer shall be rushed to the medical lock. The employer shall advise

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the employee to wear the badge at all times, off the job as well as on the job.

(3) Telephone and signal communication.

Effective and reliable means of communication, such as bells, whistles, or telephones, shall be maintained at all times between all the following locations:

- (a) The working chamber face;
- (b) The working chamber side of the manlock near the door;
- (c) The interior of the manlock;
- (d) The lock attendant's station;
- (e) The compressor plant;
- (f) The medical lock;
- (g) The emergency lock (if one is required); and
- (h) The special decompression chamber (if one is required).

(4) Signs and records.

(a) The time of decompression shall be posted in each manlock as follows:

"Time of Decompression for this Lock"

.....pounds to.....pounds in.....minutes.

.....pounds to.....pounds in.....minutes.

(Signed by)	
	(Superintendent)

This form shall be posted in the manlock at all times.

(b) Any code of signals used shall be conspicuously posted near workplace entrances and such other locations as may be necessary to bring them to the attention of all employees concerned.

(c) For each eight-hour shift, a record of employees employed under air pressure shall be kept by another employee who shall remain outside the lock near the entrance. This record shall show the period each employee spends in the air chamber and the time taken for decompression. A copy shall be submitted to the appointed physician after each shift.

(5) Compression.

(a) During the compression of employees, the pressure shall not be increased to more than three pounds per square inch gauge (p.s.i.g.) within the first minute. The pressure shall be held at three p.s.i.g. and again at seven p.s.i.g. sufficiently long to determine if any employees are experiencing discomfort.

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- (b) After holding at seven p.s.i.g. the pressure shall be raised uniformly and at a rate not to exceed ten pounds per square inch (p.s.i.) per minute.
- (c) If any employee complains of discomfort, the pressure shall be held to determined if the symptoms are relieved. If, after five minutes the discomfort does not disappear, the lock attendant shall gradually reduce the pressure until the employee signals that the discomfort has ceased. If he does not indicate that the discomfort has disappeared, the lock attendant shall reduce the pressure to atmospheric and the employee shall be released from the lock.
- (d) No employee shall be subjected to pressure exceeding fifty pounds per square inch except in emergency.

(6) Decompression.

- (a) Decompression to normal condition shall be in accordance with the decompression tables in the appendix to this rule.
- (b) Except in emergencies no employee working in compressed air shall be permitted to pass from the place in which the work is being done to normal air pressure except after decompression in accordance with the decompression tables in the appendix to this rule.

(7) Compressor plant and air supply.

- (a) At all times there shall be a thoroughly experienced, competent, and reliable person, designated by the employer, on duty at the air control valves as a gauge tender who shall regulate the pressure in the working areas. During tunneling operations, one gauge tender may regulate the pressure in no more than two headings; provided, that the gauge and controls are all in one location. In caisson work, there shall be a gauge tender for each caisson.
- (b) The low air compressor plant shall be of sufficient capacity to not only permit the work to be done safely, but shall also provide a margin to meet emergencies and repairs.
- (c) Low air compressor units shall have no less than two independent and separate sources of power supply and each shall be capable of operating the entire low air plant and its accessory systems.
- (d) All high-and low-pressure air supply lines shall be equipped with check valves.
- (e) Low-pressure air shall be regulated automatically. In addition, manually operated valves shall be provided for emergency conditions.
- (f) The air intakes for all air compressors shall be located at a place where fumes, exhaust gases, and other air contaminants will be at a minimum.
- (g) Gauges indicating the pressure in the working chamber shall be installed in the compressor building, the lock attendant's station, and at the employer's field office.

(8) Ventilation and air quality.

- (a) Exhaust valves and exhaust pipes shall be provided and operated so that the working chamber shall be well ventilated, and there shall be no pockets of dead air.
- (b) The air in the workplace shall be analyzed by the employer no less than once each shift, and records

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of such tests shall be kept on file at the place where the work is in progress. The test results shall be within ~~threshold unit values specified in "Appendix II," for hazardous gases, and within ten per cent of the lower explosive limit (see "Appendix III"), of flammable gases~~ established, recognized occupational exposure limits. If these limits are not met, immediate action to correct the situation shall be taken by the employer.

(c) The temperature of all working chambers which are subjected to air pressure shall be maintained at a temperature not to exceed eighty-five degrees Fahrenheit.

(9) Electricity.

(a) All lighting in compressed air chambers shall be by electricity exclusively, and two independent electric lighting systems with independent sources of supply shall be used. The emergency source shall be arranged to become automatically operative in the event of failure of the regularly used source.

(b) The minimum intensity of light of any walkway, ladder, stairway, or working level shall be no less than ten ~~foot-candles~~ lumens, and in all workplaces the lighting shall at all times be such as to enable employees to see clearly.

(c) All electrical equipment, and wiring for light and power circuits, shall be suitable for use in damp, hazardous, high temperature, and compressed air environments.

(d) External parts of lighting fixtures and all other electrical equipment, when within eight feet of the floor, shall be constructed of noncombustible, nonabsorptive, insulating materials, except that metal may be used if it is effectively grounded.

(e) Portable lamps shall be equipped with noncombustible, nonabsorptive, insulating sockets, approved handles, basket guards, and approved cords.

(f) The use of worn or defective portable and pendant conductors is prohibited.

(10) Fire prevention and protection.

(a) Firefighting equipment shall be available at all times and shall be maintained in working condition.

(b) While welding or flame-cutting is being done in compressed air, an employee with a fire hose or approved extinguisher shall stand by until such operation is completed.

(c) Shafts and caissons containing flammable material of any kind, either above or below ground, shall be provided with a waterline and a fire hose connected thereto, so arranged that all points of the shaft or caisson are within reach of the hose stream.

(d) Fire hose shall be no less than one and one-half inches in nominal diameter; the water pressure shall at all times be adequate for efficient operation of the type of nozzle used; and the water supply shall be such as to ensure an uninterrupted flow. Fire hose, when not in use, shall be located or guarded to prevent damage thereto.

(e) The power house, compressor house, and all buildings housing ventilating equipment, shall be provided with at least one hose connection in the waterline, with a fire hose connected thereto. A

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fire hose shall be maintained within reach of structures wood over or near shafts.

- (f) Tunnels shall be provided with a two-inch minimum diameter waterline extending into the working chamber and to within one hundred feet of the working face. Such line shall have hose outlets with one hundred feet of fire hose attached and maintained as follows: one at the working face; one immediately inside of the bulkhead of the working chamber; and one immediately outside such bulkhead. In addition, hose outlets shall be provided at two-hundred-foot intervals throughout the length of the tunnel, and one hundred feet of fire hose shall be attached to the outlet nearest to any location where flammable materials is being kept or stored or where any flame is being used.
 - (g) In addition to fire hose protection required by this section, on every floor of every building not under compressed air, but used in connection with the compressed air work, there shall be provided at least one approved fire extinguisher of the proper type for the hazard involved. At least two approved fire extinguishers shall be provided in the working chamber as follows: one at the working face and one immediately outside the bulkhead (pressure side). Extinguishers in the working chamber shall use water as the primary extinguishing agent and shall not use any extinguishing agent which could be harmful to the employees in the working chamber. The fire extinguishers shall be protected from damage.
 - (h) Highly combustible materials shall not be used or stored in the working chamber. Wood, paper, and similar combustible material shall not be used in the working chamber in quantities which could cause a fire hazard. The compressor building shall be constructed of noncombustible material.
 - (i) Manlocks shall be equipped with a manual type fire extinguisher system that can be activated inside the manlock and also by the outside lock attendant. In addition, a fire hose and portable fire extinguisher shall be provided inside and outside the manlock. The portable fire extinguisher shall be the dry chemical type.
 - (j) Equipment, fixtures, and furniture in manlocks and special decompression chambers shall be constructed of noncombustible material. Bedding, etc., shall be chemically treated so as to be fire resistant.
 - (k) Head frames shall be constructed of structural steel or open frame-work fire-proofed timber. Head houses and other temporary surface buildings or structures within one hundred feet of the shaft, caisson, or tunnel opening shall be built of fire-resistant materials.
 - (l) No oil, gasoline, or other combustible material shall be stored within one hundred feet on any shaft, caisson, or tunnel opening, except that oils may be stored in suitable tanks in isolated fireproof buildings, provided such buildings are no less than fifty feet from any shaft, caisson, or tunnel opening, or any building directly connected thereto.
 - (m) Leaking flammable liquids shall be prevented from flowing into the areas specifically mentioned in the preceding paragraph.
 - (n) All explosives used in connection with compressed air work shall be selected, stored, transported, and used as specified in rule 4123:1-3-15 of the Administrative Code.
- (11) Bulkheads and safety screens.
- (a) Intermediate bulkheads with locks, or intermediate safety screens or both, are required where there is the danger of rapid flooding.

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- (b) In tunnels sixteen feet or more in diameter, hanging walkways shall be provided from the face to the manlock as high in the tunnel as practicable, with no less than six feet of head room. Walkways shall be constructed of noncombustible material. Standard railings shall be securely installed throughout the length of all walkways on open sides in accordance with rule 4123:1-3-04 of the Administrative Code. Where walkways are ramped under safety screens, the walkway surface shall be skidproofed by cleats or by equivalent means.
- (c) Bulkheads used to contain compressed air shall be tested, where practicable, to prove their ability to resist the highest air pressure which may be used.

Appendix to Rule 4123:1-3-16

DECOMPRESSION TABLES

Explanation:

The decompression tables are computed for working chamber pressures from zero to fourteen pounds, and from fourteen to fifty pounds per square inch gauge inclusive by two-pound increments and for exposure times for each pressure extending from one-half to over eight hours inclusive. Decompressions will be conducted by two or more stages with a maximum of four stages, the latter for a working chamber pressure of forty pounds per square inch gauge or over.

Stage 1 consists of a reduction in ambient pressure ranging from ten to a maximum of sixteen pounds per square inch, but in no instance will the pressure be reduced below four pounds at the end of stage one. This reduction in pressure in stage one will always take place at a rate not greater than five pounds per minute.

Further reduction in pressure will take place during stage two and subsequent stages as required at a slower rate, but in no event at a rate greater than one pound per minute.

Decompression Table No. 1 indicates in the body of the table the total decompression time in minutes for various combinations of working chamber pressure and exposure time.

Decompression Table No. 2 indicates for the same various combinations of working chamber pressure and exposure time the following:

- a. The number of stages required;
- b. The reduction in pressure and the terminal pressure for each required stage;
- c. The time in minutes through which the reduction in pressure is accomplished for each required stage; and
- d. The pressure reduction rate in minutes per pound for each required stage.

IMPORTANT NOTE: The Pressure Reduction in Each Stage is Accomplished at a Uniform Rate. Do Not Interpolate Between Values Shown on the Tables. Use the Next Higher Value of Working Chamber Pressure or Exposure Time Should the Actual Working Chamber Pressure or the Actual Exposure Time, Respectively, Fall Between Those for Which Calculated Values Are Shown in the Body of the Tables.

Appendix to Rule 4123:1-3-16

EXAMPLES

Example No. 1:

4 hours working period at 20 pounds gauge.

Decompression Table No. 1:

20 pounds for 4 hours, total decompression
time 43 minutes.

Decompression Table No. 2:

Stage 1: Reduce pressure from 20 pounds to
4 pounds at the uniform rate of 5 pounds
per minute.

Elapsed time stage 1: $\frac{16}{5}$ 3 minutes.

Stage 2 (final stage): Reduce pressure at a
uniform rate from 4 pounds to 0-pound
gauge over a period of 40 minutes.

Rate - 0.10 pound per minute or 10 minutes
per pound.

Stage 2 (final) elapsed time 40 minutes.

Total time 43 minutes.

Example No. 2:

5-hour working period at 24 pounds gauge.

Decompression Table No. 1:

24 pounds for 5 hours, total decompression
time 117 minutes.

Decompression Table No. 2:

Stage 1: Reduce pressure from 24 pounds to 8
pounds at the uniform rate of 5 pounds per
minute.

Elapsed time stage 1: $\frac{16}{5}$ 3 minutes.

Stage 2: Reduce pressure at a uniform rate
from 8 pounds to 4 pounds over a period of
4 minutes.

Rate - 1 pound per minute.

Elapsed time stage 2: 4 minutes.

Transfer men to special decompression chamber maintaining the 4-pound pressure during the transfer operation.

Stage 3 (final stage): In the special decompression chamber, reduce the pressure at a uniform rate from 4 pounds to 0-pound gauge over a period of 110 minutes.

Rate - 0.037 pound per minute or 27.5 minutes per pound.

Stage 3 (final) elapsed time 110 minutes.

Total time 117 minutes.

DECOMPRESSION TABLE NO. 1—TOTAL DECOMPRESSION TIME

Work Pressure p.s.i.g.	Working Period Hours										
	1/2	1	1-1/2	2	3	4	5	6	7	8	Over 8
0-12 ..	3	3	3	3	3	3	3	3	3	3	3
14...	6	6	6	6	6	6	6	6	16	16	33
16...	7	7	7	7	7	7	17	33	48	48	62
18...	7	7	7	8	11	17	48	63	63	73	87
20...	7	7	8	15	15	43	63	73	83	103	113
22...	9	9	16	24	38	68	93	103	113	128	133
24...	11	12	23	27	52	92	117	122	127	137	151
26...	13	14	29	34	69	104	126	141	142	142	163
28...	15	23	31	41	98	127	143	153	153	165	183
30...	17	28	38	62	105	143	165	168	178	188	204
32...	19	35	43	85	126	163	178	193	203	213	226
34...	21	39	58	98	151	178	195	218	223	233	248
36...	24	44	63	113	170	198	223	233	243	253	273
38...	28	49	73	128	178	203	223	238	253	263	278
40...	31	49	84	143	183	213	233	248	258	278	288
42...	37	56	102	144	189	215	245	260	263	268	293
44...	43	64	118	154	199	234	254	264	269	269	293
46...	44	74	139	171	214	244	269	274	289	299	318
48...	51	89	144	189	229	269	299	309	319	319	...
50...	58	94	164	209	249	279	309	329	...	...	...

DECOMPRESSION TABLE NO. 2

(Do not interpolate, use next higher value for conditions not computed.)

Decompression Data							
Working Chamber Pressure p. s. i. g.	Working Period Hours	Stage No.	Pressure Reduction p. s. i. g.		Time In Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes
			From	To			
14.....	1/2.....	1	14	4	2	0.20	6
		2	4	0	4	1.00	6
	1.....	1	14	4	2	0.20	6
		2	4	0	4	1.00	6
	1-1/2.....	1	14	4	2	0.20	6
		2	4	0	4	1.00	6
	2.....	1	14	4	2	0.20	6
		2	4	0	4	1.00	6
	3.....	1	14	4	2	0.20	6
		2	4	0	4	1.00	6
	4.....	1	14	4	2	0.20	6
		2	14	0	4	1.00	6
	5.....	1	14	4	2	0.20	6
		2	4	0	4	1.00	6
	6.....	1	14	4	2	0.20	6
		2	4	0	4	1.00	6
	7.....	1	14	4	2	0.20	6
		2	4	0	14	3.50	16
	8.....	1	14	4	2	0.20	6
		2	4	0	14	3.50	16
Over 8 ...	1	14	4	2	0.20	6	
	2	4	0	30	7.50	32	
16.....	1/2.....	1	16	4	3	0.20	7
		2	4	0	4	1.00	7
	1.....	1	16	4	3	0.20	7
		2	4	0	4	1.00	7
	1-1/2.....	1	16	4	3	0.20	7
		2	4	0	4	1.00	7
	2.....	1	16	4	3	0.20	7
		2	4	0	4	1.00	7
3.....	1	16	4	3	0.20	7	
	2	4	0	4	1.00	7	

DECOMPRESSION TABLE NO. 2 — Continued

Decompression Data								
Working Chamber Pressure p. s. i. g.	Working Period Hours	Stage No.	Pressure Reduction p. s. i. g.		Time In Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes	
			From	To				
16.....	4.....	1	14	4	3	0.20		
		2	4	0	4	1.00	7	
	5.....	1	14	4	3	0.20	7	
		2	4	0	4	3.50	17	
	6.....	1	14	4	3	0.20		
		2	4	0	30	7.50	33	
	7.....	1	14	4	3	0.20		
		2	4	0	45	11.25	48	
	8.....	1	14	4	3	0.20		
		2	4	0	45	11.25	48	
	Over 8 ...	1	14	4	3	0.20		
		2	4	0	60	15.00	63	
	18.....	1/2.....	1	18	4	3	0.20	
			2	4	0	4	1.00	7
1.....		1	18	4	3	0.20		
		2	4	0	4	1.00	7	
1-1/2		1	18	4	3	0.20		
		2	4	0	4	1.00	7	
2.....		1	18	4	3	0.20		
		2	4	0	5	1.25	8	
3.....		1	18	4	3	0.20		
		2	4	0	8	2.00	11	
4.....		1	18	4	3	0.20		
		2	4	0	14	3.50	17	
5.....		1	18	4	3	0.20		
		2	4	0	45	11.25	48	
6.....		1	18	4	3	0.20		
		2	4	0	60	15.00	63	
7.....		1	18	4	3	0.20		
		2	4	0	60	15.00	63	
8.....		1	18	4	3	0.20		
		2	4	0	70	17.50	73	
Over 8 ...	1	18	4	3	0.20			
	2	4	0	84	21.00	87		
20	1/2.....	1	20	4	3	0.20		
		2	4	0	4	1.00	7	
	1.....	1	20	4	3	0.20		
		2	4	0	4	1.00	7	
	1-1/2	1	20	4	3	0.20		
		2	4	0	5	1.25	8	
	2.....	1	20	4	3	0.20		
		2	4	0	12	3.00	15	

DECOMPRESSION TABLE NO. 2 — Continued

		Decompression Data					
Working Chamber Pressure p. s. i. g.	Working Period Hours	Stage No.	Pressure Reduction p. s. i. g.		Time In Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes
			From	To			
20	3	1	20	4	3	0.20	
		2	4	0	12	3.00	15
	4	1	20	4	3	0.20	
		2	4	0	40	10.00	43
	5	1	20	4	3	0.20	
		2	4	0	60	15.00	63
	6	1	20	4	3	0.20	
		2	4	0	70	17.50	73
	7	1	20	4	3	0.20	
		2	4	0	80	20.00	83
	8	1	20	4	3	0.20	
		2	4	0	100	25.00	103
	Over 8 ...	1	20	4	3	0.20	
		2	4	0	110	27.50	113
22	1/2	1	22	6	3	0.20	
		2	6	0	6	1.00	9
	1	1	22	6	3	0.20	
		2	6	0	6	1.00	9
	1-1/2	1	22	6	3	0.20	
		2	6	0	13	2.20	16
	2	1	22	6	3	0.20	
		2	6	0	21	3.50	24
	3	1	22	6	3	0.20	
		2	6	0	35	5.85	38
	4	1	22	6	3	0.20	
		2	6	0	65	10.83	68
	5	1	22	6	3	0.20	
		2	6	0	90	15.00	93
	6	1	22	6	3	0.20	
		2	6	0	100	16.67	103
	7	1	22	6	3	0.20	
		2	6	0	110	18.35	113
	8	1	22	6	3	0.20	
		2	6	0	125	20.80	128
	Over 8 ...	1	22	6	3	0.20	
		2	6	0	130	21.70	
24	1/2	1	24	8	3	0.20	
		2	8	4	4	1.00	
		3	4	0	4	1.00	11
	1	1	24	8	3	0.20	
		2	8	4	4	1.00	
		3	4	0	5	1.25	12
	1-1/2	1	24	8	3	0.20	
		2	8	4	4	1.00	
		3	4	0	16	4.00	23

DECOMPRESSION TABLE NO. 2 — Continued

Decompression Data								
Working Chamber Pressure p. s. i. g.	Working Period Hours	Stage No.	Pressure Reduction p. s. i. g.		Time In Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes	
			From	To				
24	2	1	24	8	3	0.20		
		2	8	4	4	1.00		
		3	4	0	20	5.00	27	
	3	1	1	24	8	3	0.20	
			2	8	4	4	1.00	
			3	4	0	45	11.25	52
	4	1	1	24	8	3	0.20	
			2	8	4	4	1.00	
			3	4	0	85	21.25	92
	5	1	1	24	8	3	0.20	
			2	8	4	4	1.00	
			3	4	0	110	27.50	117
	6	1	1	24	8	3	0.20	
			2	8	4	4	1.00	
			3	4	0	115	28.80	122
	7	1	1	24	8	3	0.20	
			2	8	4	4	1.00	
			3	4	0	120	30.00	127
	8	1	1	24	8	3	0.20	
			2	8	4	4	1.00	
			3	4	0	130	32.50	137
Over 8 ...	1	1	24	8	3	0.20		
		2	8	4	8	2.00		
		3	4	0	140	35.00	151	
26	1/2	1	26	10	3	0.20		
		2	10	4	6	1.00		
		3	4	0	4	1.00	13	
	1	1	1	26	10	3	0.20	
			2	10	4	6	1.00	
			3	4	0	5	1.25	14
	1-1/2	1	1	26	10	3	0.20	
			2	10	4	6	1.00	
			3	4	0	20	5.00	29
	2	1	1	26	10	3	0.20	
			2	10	4	6	1.00	
			3	4	0	25	6.25	34
	3	1	1	26	10	3	0.20	
			2	10	4	6	1.00	
			3	4	0	60	15.00	69
	4	1	1	26	10	3	0.20	
			2	10	4	6	1.00	
			3	4	0	95	23.75	104
	5	1	1	26	10	3	0.20	
			2	10	4	8	1.33	
			3	4	0	115	28.80	126

DECOMPRESSION TABLE NO. 2 — Continued

Decompression Data							
Working Chamber Pressure p. s. i. g.	Working Period Hours	Stage No.	Pressure Reduction p. s. i. g.		Time In Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompression Minutes
			From	To			
26.....	6.....	1	26	10	3	0.20	
		2	10	4	8	1.33	
		3	4	0	130	32.50	141
	7.....	1	26	10	3	2.20	
		2	10	4	9	1.50	
		3	4	0	130	32.50	142
	8.....	1	26	10	3	0.20	
		2	10	4	9	1.50	
		3	4	0	130	32.50	142
Over 8 ...	1	26	10	3	0.20		
	2	10	4	30	5.00		
	3	4	0	130	32.50	163	
28.....	1/2.....	1	28	12	3	0.20	
		2	12	4	8	1.00	
		3	4	0	4	1.00	15
	1.....	1	28	12	3	0.20	
		2	12	4	8	1.00	
		3	4	0	12	3.00	23
	1-1/2.....	1	28	12	3	0.20	
		2	12	4	8	1.00	
		3	4	0	20	5.00	31
	2.....	1	28	12	3	0.20	
		2	12	4	8	1.00	
		3	4	0	30	7.50	41
	3.....	1	28	12	3	0.20	
		2	12	4	10	1.25	
		3	4	0	85	21.20	98
	4.....	1	28	12	3	0.20	
		2	12	4	14	1.75	
		3	4	0	110	27.50	127
	5.....	1	28	12	3	0.20	
		2	12	4	20	2.50	
		3	4	0	120	30.00	143
	6.....	1	28	12	3	0.20	
		2	12	4	20	2.50	
		3	4	0	130	32.50	153
7.....	1	28	12	3	0.20		
	2	12	4	20	2.50		
	3	4	0	120	32.50	153	
8.....	1	28	12	3	0.20		
	2	12	4	32	4.00		
	3	4	0	130	32.50	165	
Over 8 ...	1	28	12	3	0.20		
	2	12	4	50	6.25		
	3	4	0	130	32.50	183	

DECOMPRESSION TABLE NO. 2 — Continued

Decompression Data								
Working Chamber Pressure p. s. i. g.	Working Period Hours	Stage No.	Pressure Reduction p. s. i. g.		Time In Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes	
			From	To				
30	1/2	1	30	14	3	0.20		
		2	14	4	10	1.00		
		3	4	0	4	1.00		17
	1	1	1	30	14	3	0.20	
			2	14	4	10	1.00	
			3	4	0	15	3.75		28
	1-1/2	1-1/2	1	30	14	3	0.20	
			2	14	4	10	1.00	
			3	4	0	25	6.25		38
	2	2	1	30	14	3	0.20	
			2	14	4	14	1.40	
			3	4	0	45	11.25		62
	3	3	1	30	14	3	0.20	
			2	14	4	17	1.70	
			3	4	0	85	21.20		105
	4	4	1	30	14	3	0.20	
			2	14	4	30	3.00	
			3	4	0	110	27.50		143
	5	5	1	30	14	3	0.20	
			2	14	4	35	3.50	
			3	4	0	130	32.50		165
	6	6	1	30	14	3	0.20	
			2	14	4	35	3.50	
			3	4	0	130	32.50		168
7	7	1	30	14	3	0.20		
		2	14	4	45	4.50		
		3	4	0	130	32.50		178
8	8	1	30	14	3	0.20		
		2	14	4	55	5.50		
		3	4	0	130	32.50		188
Over 8 ...	Over 8 ...	1	30	14	3	0.20		
		2	14	4	71	7.10		
		3	4	0	130	32.50		204
32	1/2	1	32	16	3	0.20		
		2	16	4	12	1.00		
		3	4	0	4	1.00		19
	1	1	1	32	16	3	0.20	
			2	16	4	12	1.00	
			3	4	0	20	5.00		35
	1-1/2	1-1/2	1	32	16	3	0.20	
			2	16	4	15	1.25	
			3	4	0	25	6.25		43
	2	2	1	32	16	3	0.20	
			2	16	4	22	1.83	
			3	4	0	60	15.00		85

DECOMPRESSION TABLE NO. 2 — Continued

Decompression Data							
Working Chamber Pressure p. s. i. g.	Working Period Hours	Stage No.	Pressure Reduction p. s. i. g.		Time In Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes
			From	To			
32	3	1	32	16	3	0.20	
		2	16	4	28	2.33	
		3	4	0	95	23.75	126
	4	1	32	16	3	0.20	
		2	16	4	40	3.33	
		3	4	0	120	30.00	163
	5	1	32	16	3	0.20	
		2	16	4	45	3.75	
		3	4	0	130	32.50	178
	6	1	32	16	3	0.20	
		2	16	4	60	5.00	
		3	4	0	130	32.50	193
	7	1	32	16	3	0.20	
		2	16	4	70	5.83	
		3	4	0	130	32.50	203
	8	1	32	16	3	0.20	
		2	16	4	80	6.67	
		3	4	0	130	32.50	213
	Over 8 ...	1	32	16	3	0.20	
		2	16	4	98	7.75	
		3	4	0	130	32.50	226
34	1/2	1	34	18	3	0.20	
		2	18	4	14	1.00	
		3	4	0	4	1.00	21
	1	1	34	18	3	0.20	
		2	18	4	14	1.00	
		3	4	0	22	5.50	39
	1-1/2	1	34	18	3	0.20	
		2	18	4	25	1.80	
		3	4	0	30	7.50	58
	2	1	34	18	3	0.20	
		2	18	4	35	2.50	
		3	4	0	60	15.00	98
	3	1	34	18	3	0.20	
		2	18	4	43	3.10	
		3	4	0	105	26.25	151
	4	1	34	18	3	0.20	
		2	18	4	55	3.93	
		3	4	0	120	30.00	178
	5	1	34	18	3	0.20	
		2	18	4	62	4.43	
		3	4	0	130	32.50	195

DECOMPRESSION TABLE NO. 2 — Continued

Working Chamber Pressure p. s. i. g.	Working Period Hours	Decompression Data					Total Time Decompress Minutes	
		Stage No.	Pressure Reduction p. s. i. g.		Time In Stage Minutes	Pressure Reduction Rate Min/Pound		
			From	To				
34	6	1	34	18	3	0.20	218	
		2	18	4	85	6.07		
		3	4	0	130	32.50		
	7	1	34	18	3	0.20	223	
		2	18	4	90	6.43		
		3	4	0	130	32.50		
	8	1	34	18	3	0.20	233	
		2	18	4	100	7.15		
		3	4	0	130	32.50		
	Over 8 ...	1	34	18	3	0.20	248	
		2	18	4	115	8.23		
		3	4	0	130	32.50		
	36	1/2	1	36	20	3	0.20	24
			2	20	4	16	1.00	
			3	4	0	5	1.25	
1		1	36	20	3	0.20	44	
		2	20	4	16	1.00		
		3	4	0	25	6.25		
1-1/2		1	36	20	3	0.20	63	
		2	20	4	30	1.88		
		3	4	0	30	7.50		
2		1	36	20	3	0.20	113	
		2	20	4	40	2.50		
		3	4	0	70	17.50		
3		1	36	20	3	0.20	170	
		2	20	4	52	3.25		
		3	4	0	115	28.75		
4		1	36	20	3	0.20	198	
		2	20	4	65	4.06		
		3	4	0	130	32.50		
5		1	36	20	3	0.20	223	
		2	20	4	90	5.63		
		3	4	0	130	32.50		
6		1	36	20	3	0.20	233	
		2	20	4	100	6.25		
		3	4	0	130	32.50		
7		1	36	20	3	0.20	243	
		2	20	4	110	6.88		
		3	4	0	130	32.50		
8	1	36	20	3	0.20	253		
	2	20	4	120	7.50			
	3	4	0	130	32.50			
Over 8 ...	1	36	20	3	0.20	273		
	2	20	4	140	8.75			
	3	4	0	130	32.50			

DECOMPRESSION TABLE NO. 2 — Continued

Decompression Data								
Working Chamber Pressure p. s. i. g.	Working Period Hours	Stage No.	Pressure Reduction p. s. i. g.		Time In Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes	
			From	To				
38	1/2	1	38	22	3	0.20		
		2	22	6	16	1.00		
		3	6	0	9	1.50	28	
	1	1	1	38	22	3	0.20	
			2	22	6	16	1.00	
			3	6	0	30	5.00	49
	1-1/2	1-1/2	1	38	22	3	0.20	
			2	22	6	20	1.25	
			3	6	0	50	8.34	73
	2	2	1	38	22	3	0.20	
			2	22	6	30	1.88	
			3	6	0	95	15.83	128
	3	3	1	38	22	3	0.20	
			2	22	6	35	2.19	
			3	6	0	140	23.35	178
	4	4	1	38	22	3	0.20	
			2	22	6	50	3.12	
			3	6	0	150	25.00	203
	5	5	1	38	22	3	0.20	
			2	22	6	55	3.44	
			3	6	0	165	27.50	223
	6	6	1	38	22	3	0.20	
			2	22	6	70	4.38	
			3	6	0	165	27.50	238
	7	7	1	38	22	3	0.20	
			2	22	6	85	5.32	
			3	6	0	165	27.50	253
	8	8	1	38	22	3	0.20	
2			22	6	95	5.93		
3			6	0	165	27.50	263	
Over 8 ...	Over 8 ...	1	38	22	3	0.20		
		2	22	6	110	6.88		
		3	6	0	165	27.50	278	
40	1/2	1	40	24	3	0.20		
		2	24	8	16	1.00		
		3	8	4	4	1.00		
		4	4	0	8	2.00	31	
	1	1	1	40	24	3	0.20	
			2	24	8	16	1.00	
			3	8	4	5	1.25	
			4	4	0	25	6.25	49
	1-1/2	1-1/2	1	40	24	3	0.20	
			2	24	8	16	1.00	
			3	8	4	20	5.00	
			4	4	0	45	11.25	84

DECOMPRESSION TABLE NO. 2 — Continued

Decompression Data								
Working Chamber Pressure p. s. i. g.	Working Period Hours	Stage No.	Pressure Reduction p. s. i. g.		Time In Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes	
			From	To				
40	2	1	40	24	3	0.20		
		2	24	8	25	1.56		
		3	8	4	20	5.00		
		4	4	0	95	23.75	143	
	3	3	1	40	24	3	0.20	
			2	24	8	30	1.88	
			3	8	4	30	7.50	
			4	4	0	120	30.00	183
	4	4	1	40	24	3	0.20	
			2	24	8	45	2.81	
			3	8	4	35	8.75	
			4	4	0	130	32.50	213
	5	5	1	40	24	3	0.20	
			2	24	8	47	2.94	
			3	8	4	53	13.25	
			4	4	0	130	32.50	233
	6	6	1	40	24	3	0.20	
			2	24	8	55	3.44	
			3	8	4	60	15.00	
			4	4	0	130	32.50	248
	7	7	1	40	24	3	0.20	
			2	24	8	65	4.06	
			3	8	4	60	15.00	
			4	4	0	130	32.50	258
	8	8	1	40	24	3	0.20	
			2	24	8	75	4.70	
			3	8	4	60	15.00	
			4	4	0	130	32.50	268
Over 8 ...	Over 8 ...	1	40	24	3	0.20		
		2	24	8	95	5.93		
		3	8	4	60	15.00		
		4	4	0	130	32.50	288	
42	1/2	1	42	26	3	0.20		
		2	26	10	16	1.00		
		3	10	4	6	1.00		
		4	4	0	12	3.00	37	
	1	1	1	42	26	3	0.20	
			2	26	10	16	1.00	
			3	10	4	12	2.00	
			4	4	0	25	6.25	56
	1-1/2	1-1/2	1	42	26	3	0.20	
			2	26	10	16	1.00	
			3	10	4	23	3.83	
			4	4	0	60	15.00	102

DECOMPRESSION TABLE NO. 2 — Continued

Decompression Data								
Working Chamber Pressure p. s. i. g.	Working Period Hours	Stage No.	Pressure Reduction p. s. i. g.		Time In Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes	
			From	To				
42	2	1	42	26	3	0.20		
		2	26	10	16	1.00		
		3	10	4	30	5.00		
		4	4	0	95	23.75	144	
	3	1	1	42	26	3	0.20	
			2	26	10	16	1.00	
			3	10	4	50	8.34	
	4	1	1	42	26	3	0.20	
			2	26	10	17	1.06	
			3	10	4	65	10.83	
	5	1	1	42	26	3	0.20	
			2	26	10	27	1.69	
			3	10	4	85	14.18	
			4	4	0	130	32.50	215
	6	1	1	42	26	3	0.20	
			2	26	10	27	1.69	
			3	10	4	100	16.67	
			4	4	0	130	32.50	245
	7	1	1	42	26	3	0.20	
			2	26	10	30	1.88	
			3	10	4	100	16.67	
			4	4	0	130	32.50	260
	8	1	1	42	26	3	0.20	
			2	26	10	35	2.19	
			3	10	4	100	16.67	
			4	4	0	130	32.50	268
	Over 8 ...	1	1	42	26	3	0.20	
			2	26	10	60	3.75	
3			10	4	100	16.67		
4			4	0	130	32.50	293	
44	1/2	1	44	28	3	0.20		
		2	28	12	16	1.00		
		3	12	4	8	1.00		
		4	4	0	16	4.00	43	
	1	1	1	44	28	3	0.20	
			2	28	12	16	1.00	
			3	12	4	20	2.50	
			4	4	0	25	6.25	64
	1-1/2	1	1	44	28	3	0.20	
			2	28	12	16	1.00	
			3	12	4	27	3.38	
			4	4	0	72	18.00	118

DECOMPRESSION TABLE NO. 2 — Continued

Decompression Data								
Working Chamber Pressure p. s. i. g.	Working Period Hours	Stage No.	Pressure Reduction p. s. i. g.		Time In Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes	
			From	To				
44	2	1	44	28	3	0.20		
		2	28	12	16	1.00		
		3	12	4	40	5.00		
		4	4	0	95	23.75	154	
	3	1	1	44	28	3	0.20	
			2	28	12	16	1.00	
			3	12	4	60	7.50	
			4	4	0	120	30.00	199
	4	1	1	44	28	3	0.20	
			2	28	12	16	1.00	
			3	12	4	85	10.62	
			4	4	0	130	32.50	234
	5	1	1	44	28	3	0.20	
			2	28	12	16	1.00	
			3	12	4	105	13.13	
			4	4	0	130	32.50	254
	6	1	1	44	28	3	0.20	
			2	28	12	16	1.00	
			3	12	4	115	14.38	
			4	4	0	130	32.50	264
	7	1	1	44	28	3	0.20	
			2	28	12	16	1.00	
			3	12	4	120	15.00	
			4	4	0	130	32.50	269
	8	1	1	44	28	3	0.20	
			2	28	12	16	1.00	
			3	12	4	120	15.00	
			4	4	0	130	32.50	269
Over 8 ...	1	1	44	28	3	0.20		
		2	28	12	40	2.50		
		3	12	4	120	15.00		
		4	4	0	130	32.50	293	
46	1/2	1	46	30	3	0.20		
		2	30	14	16	1.00		
		3	14	4	10	1.00		
		4	4	0	15	3.75	44	
	1	1	1	46	30	3	0.20	
			2	30	14	16	1.00	
			3	14	4	25	2.50	
			4	4	0	30	7.50	74
	1-1/2	1	1	46	30	3	0.20	
			2	30	14	16	1.00	
			3	14	4	35	3.50	
			4	4	0	85	21.20	139

DECOMPRESSION TABLE NO. 2 — Continued

Decompression Data							
Working Chamber Pressure p. s. i. g.	Working Period Hours	Stage No.	Pressure Reduction p. s. i. g.		Time In Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes
			From	To			
46.....	2.....	1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	47	4.70	
		4	4	0	105	26.25	171
	3.....	1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	65	6.50	
	4.....	4	4	0	130	32.50	214
		1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	95	9.50	
	5.....	4	4	0	130	32.50	244
		1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	120	12.00	
	6.....	4	4	0	130	32.50	269
		1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	125	12.50	
	7.....	4	4	0	130	32.50	274
		1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	140	14.00	
	8.....	4	4	0	130	32.50	289
		1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	150	15.00	
	Over 8 ...	4	4	0	130	32.50	299
1		46	30	3	0.20		
2		30	14	25	1.56		
3		14	4	160	16.00		
48.....	1/2.....	4	4	0	130	32.50	318
		1	48	32	3	0.20	
		2	32	16	16	1.00	
		3	16	4	12	1.00	
	1.....	4	4	0	20	5.00	51
		1	48	32	3	0.20	
		2	32	16	16	1.00	
		3	16	4	35	2.92	
	1-1/2.....	4	4	0	35	8.75	89
		1	48	32	3	0.20	
		2	32	16	16	1.00	
		3	16	4	45	3.75	
		4	4	0	80	20.00	144

DECOMPRESSION TABLE NO. 2 — Continued

Decompression Data								
Working Chamber Pressure p. s. i. g.	Working Period Hours	Stage No.	Pressure Reduction p. s. i. g.		Time In Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes	
			From	To				
50	3	1	50	34	3	0.20		
		2	34	18	16	1.00		
		3	18	4	100	7.15		
		4	4	0	130	32.50	249	
	4	1	1	50	34	3	0.20	
			2	34	18	16	1.00	
			3	18	4	130	8.58	
			4	4	0	130	32.50	279
	5	1	1	50	34	3	0.20	
			2	34	18	16	1.00	
			3	18	4	160	11.42	
			4	4	0	130	32.50	309
6	1	1	50	34	3	0.20		
		2	34	18	16	1.00		
		3	18	4	180	12.85		
		4	4	0	130	32.50	329	

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No Change

4123:1-3-17 Cutting and welding.

(A) Reserved.

(B) Definitions.

- (1) "Fire-resistive construction" means a method of construction which prevents or retards the passage of hot gases or flames as defined by the fire-resistance rating.
- (2) "Fire-resistance rating" means the measured time in hours or fractions thereof that the material or construction will withstand fire exposure, as determined by fire tests conducted in conformity to recognized standards.

(C) Responsibility.

- (1) The employer shall verbally and through demonstration instruct the employee in the safe operation and maintenance of cutting and welding equipment.
- (2) It shall be the duty of the employee to operate such equipment in accordance with such instructions.

(D) Maximum pressure.

Under no condition shall acetylene be generated, piped (except in approved cylinder manifolds), or utilized at a pressure in excess of fifteen pounds per square inch gauge pressure.

(E) Gas welding and cutting.

(1) Equipment.

Only approved equipment, such as torches, regulators, or pressure-reducing valves, acetylene generators, manifolds, cylinders, and containers shall be used.

(2) Cylinders and containers.

(a) Marking.

Compressed gas cylinders shall be legibly marked, for the purpose of identifying the content, with either the chemical or the trade name of the gas. Such marking shall be by means of stenciling, stamping, or labeling, and shall not be readily removed.

(b) Storage.

- (i) Oxygen cylinders in storage shall be separated from fuel-gas cylinders or combustible materials (especially oil or grease), a minimum distance of twenty feet or by a noncombustible barrier no less than five feet high, having a fire-resistance rating of no less than one-half hour.
- (ii) Cylinders, when not in use, shall be protected from any heat-radiating objects or open flame which could cause the cylinder to rupture or could cause the fusible plug to melt.

(c) Valve protection caps.

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- (i) All cylinders with a water weight capacity of over thirty pounds shall be equipped with means of connecting a valve protection cap or with a collar or recess to protect the valve.
- (ii) Employees shall be responsible for using valve protection caps when cylinders are moved from place to place or put in storage.
- (iii) Where carriers are provided for moving cylinders which are connected for use, capping shall not be required but employees shall be responsible for seeing that cylinder valves are closed and pressure is released from regulators, hoses, and torches.

(d) Regulator protection.

Welders and cutters shall be instructed to close valves on oxygen and acetylene cylinders and bleed off hose pressure at the end of each workshift, to prevent malfunction of the regulators.

(e) Transporting cylinders by crane or derrick.

When cylinders are hoisted, they shall be secured on a cradle, slingboard, or pallet. They shall not be hoisted or transported by means of magnets or choker slings.

(f) Facilities for securely fastening cylinders; responsibility.

The employer shall provide facilities for securely fastening cylinders of compressed gas in an upright position.

(3) Hose and hose connections.

(a) Hose.

(i) Identification.

The color red shall be used for acetylene and other fuel-gas hose. The color green shall be used for oxygen hose. The color black shall be used for inert-gas and air hose.

(ii) Hose in which flashback has occurred.

Any length of hose in which a flashback has occurred and burned in the hose shall be taken out of service.

(iii) Single hose with more than one gas passage.

The use of a single hose having more than one gas passage, in which a wall failure would permit the flow of one gas into the other gas passage, is prohibited.

(iv) Hoses taped together - limitation.

When parallel lengths of oxygen and acetylene hoses are taped together for convenience and to prevent tangling, no more than four inches out of twelve inches shall be covered by tape.

(v) Damaged or defective hose.

Hose showing leaks, burns, worn places, or other defects rendering it unfit for service shall have the damaged portion removed.

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(b) Hose connections and couplings.

- (i) Hose connections for oxygen and fuel-gas shall be distinguished from each other. Hose connections shall be clamped or otherwise securely fastened in a manner that will withstand, without leakage, twice the pressure to which they are normally subjected in service, but in no case less than three hundred pounds per square inch.
- (ii) Hose couplings shall be of the type that cannot be unlocked or disconnected by means of a straight pull without rotary motion.

(c) Pressure reducing regulators.

Oxygen and fuel-gas pressure regulators, including their related gauges, shall be in proper working order while in use.

(F) Arc welding and cutting.

(1) Manual electrode holders.

- (a) Only manual electrode holders which are specifically designed for arc welding and cutting, and are of a capacity capable of safely handling the maximum rated current required by the electrodes, shall be used.
- (b) Any current-carrying parts passing through the portion of the holder which the arc welder or cutter grips in his hand, and the outer surfaces of the jaws of the holder, shall be fully insulated against the maximum voltage encountered to ground.

(2) Welding cables and connectors.

- (a) All arc welding and cutting cables shall be of the completely insulated, flexible type, capable of handling the maximum current requirements of the work in progress, taking into account the duty cycle under which the arc welding or cutting unit is working.
- (b) Cables with splices within ten feet of the holder shall not be used except that cables with standard insulated connectors or with splices whose insulating quality is equal to that of the cables are permitted.
- (c) When it becomes necessary to connect or splice lengths of cable one to another, substantial insulated connectors of a capacity at least equivalent to that of the cable shall be used. If connections are effected by means of cable lugs, they shall be securely fastened together to give good electrical contact, and the exposed metal parts of the lugs shall be completely insulated.
- (d) Cables in need of repair shall not be used.

(3) Ground returns and machine grounding.

- (a) A ground return cable shall have a safe current-carrying capacity equal to or exceeding the specified maximum output capacity of the arc welding or cutting unit which it services. When a single ground return cable services more than one unit, the safe current-carrying capacity shall equal or exceed the total specified maximum output capacities of all the units which it services.
- (b) Pipelines containing gases or flammable liquids or conduits containing electrical circuits, shall not be

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used as a ground return.

- (c) When a structure or pipeline is employed as a ground return circuit, it shall be determined that the required electrical contact exists at all joints. The generation of an arc, sparks, or heat at any point shall cause rejection of the structures as a ground circuit.
- (d) When a structure or pipeline is continuously employed as a ground return circuit, all joints shall be bonded, and periodic inspections shall be conducted to ensure that no condition of electrolysis or fire hazard exists by virtue of such use.
- (e) The frames of all arc welding and cutting machines shall be grounded either through a third wire in the cable containing the circuit conductor or through a separate wire which is grounded at the source of the current. Grounding circuits, other than by means of the structure, shall be checked to ensure that the circuit between the ground and the grounded power conductor has resistance low enough to permit sufficient current to flow to cause the fuse or circuit breaker to interrupt the current.
- (f) All ground connections shall be inspected to ensure that they are mechanically secure and electrically adequate for the required current.

(4) Operating instructions.

Employers shall instruct employees in the safe means of arc welding and cutting as follows:

- (a) When electrode holders are to be left unattended, the electrodes shall be removed and the holders shall be so placed or protected that they cannot make electrical contact with employees or conducting objects.
- (b) Hot electrode holders shall not be dipped in water.
- (c) When the arc welder or cutter has occasion to leave work or to stop work for any appreciable length of time, or when the arc welding or cutting unit is to be moved, the power supply switch to the equipment shall be opened.

(5) Shielding.

Arc welding and cutting operations shall be shielded by noncombustible or flameproof screens which will protect employees working in the vicinity from the direct rays of the arc.

(6) Overcurrent protection.

All welding machines shall be protected by an overcurrent device.

(7) Disconnecting means.

- (a) A disconnecting means shall be provided in the supply for each alternating-current transformer and direct-current rectifier arc welder which is not equipped with a disconnect mounted as an integral part of the welder.
- (b) The disconnecting means shall be a switch or circuit breaker, and its rating shall be no less than that necessary to accommodate overcurrent protection.

(G) Welding or cutting of containers.

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No welding, cutting, or work utilizing a torch shall be performed on used drums, barrels, tanks, or other containers until they have been cleaned and purged of materials which when subjected to heat might produce flammable or toxic vapors.

(H) Eye and ear protection.

See rule 4123:1-3-03 of the Administrative Code, "Personal protective equipment".

(I) Protection from sparks or falling objects.

(1) Cutting or welding shall be permitted only in areas that are or have been made fire safe.

(2) Screens or shields shall be provided for the protection of employees or combustible materials exposed to falling objects or sparks.

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Amend

4123:1-3-18 Heating, ventilating and exhaust equipment.

(A) Scope.

This rule relates to methods of controlling air contaminants (as defined in paragraph (B) of this rule) which have been established as hazardous.

~~(1)(1) This rule relates to methods of controlling air contaminants (as defined in paragraph (B) of this rule) which have been established as hazardous.~~

~~(2)(2) Appendix, "Occupational exposure limits (OEL)," to this rule, is for information and guide purposes only and is not to be construed as specific requirements of this rule.~~

(B) Definitions.

(1) "Air contaminants" as used in this rule, means ~~hazardous~~ airborne concentrations of fibrosis-producing or toxic dusts, toxic fumes, toxic mists, toxic vapors, or toxic vapors, or toxic gases, or a combination of these, ~~suspended in the atmosphere.~~

(2) "Collector" - see "separator."

(3) "Confined space" means any tank, vessel, container, or pit so enclosed that adequate ventilation is not obtained by natural air movement.

(4) "Duct" means any pipe, flue, or channel forming a part of a ventilating system used to convey air, dusts, fumes, mists, vapors, or gases.

(5) "Dust" means ~~particles of solid~~ solid particulate matter, other than fumes, ~~no more than one hundred microns in their greatest dimension~~ generally less than one hundred micrometers in aerodynamic diameter.

(6) "Exhaust system" means a complete suction system, including all hoods, ducts, fans, separators, and receptacles, when required, and any other part necessary for the proper installation and operation thereof.

(7) "Fan" means the equipment which creates the movement of air in a mechanical system of ventilation.

(8) "FPM" means the rate of lineal air movement in feet per minute.

(9) "~~Fumes~~ Fume means solid ~~partieles~~ particulates generated by the condensation ~~from the vapor of vapors~~ or ~~gaseous states~~ gases, usually of metallic elements ~~and often accompanied by oxidation.~~

(10) "Gas" means a formless fluid occupying the space of enclosure.

(11) "Hazardous concentrations" as applied to air contaminants, means concentrations which are known ~~to the employer to be in excess of those which would not normally result in injury to an employee's health if the employee had not been previously exposed to such air contaminants~~ of recognized occupational exposure limits such as, but not exclusively, the OSHA Permissible Exposure Limits (OSHA-PEL).

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[National Institute for Occupational Safety and Health Recommended Exposure Limits \(NIOSH-REL\) or American Conference of Governmental Industrial Hygienists' Threshold Limit Values \(ACGIH\)TLV®](#)

- (12) "Hood" means that part of an exhaust system into which ~~the contaminated air~~ [contaminants or dust, fumes, mist, vapor, or gas](#) first ~~enters~~[enter](#).
- (13) "Mist" means liquid droplets or wet solids suspended in air.
- (14) "Separator (collector)" means that part of an exhaust system, ~~the purpose of which is~~ [designed](#) to separate the entrained material from the [conveying](#) air ~~which conveys it~~.
- (15) "Vapor" means the gaseous form of a substance normally in the liquid or solid state.
- (16) "Velocity" means:
- (a) "Capture velocity" means the velocity at any point in front of the hood necessary to overcome the opposing air currents and to capture the contaminated air by causing it to flow into the exhaust hood.
 - (b) "Duct velocity" means the velocity of air ~~or gas~~ in a duct.
 - (c) "Transport velocity" means the velocity of air required to keep the material ~~being exhausted in the exhaust system~~ [entrained in the conveying air](#).
- (17) "Ventilation" means:
- (a) "Dilution ventilation" means ventilation provided to reduce the concentration of air contaminants in the atmosphere of all of or part of the place of employment.
 - (b) "General ventilation" means ventilation of the general atmosphere in the place of employment.
 - (c) "Local exhaust ventilation" means that type of ventilation in which suction is applied at the point of generation or escape of air contaminants.
- (C) Temporary heating devices.
- (1) General.

When heaters are used, ventilation shall be provided to maintain the health and safety of employees.
 - (2) Solid fuel salamanders.

Solid fuel salamanders are prohibited in buildings and on scaffolds.
 - (3) Oil-fired heaters.
 - (a) Flammable liquid-fired heaters shall be equipped with a primary safety control to stop the flow of fuel in the event of flame failure.
 - (b) Heaters designed for barometric or gravity oil feed shall be used only with the integral tanks.
 - (c) Heaters specifically designed and approved for use with separate supply tanks may be directly

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connected for gravity feed, or an automatic pump, from a supply tank.

(4) Liquefied petroleum gas (LP-gas).

(a) Approval of equipment and systems.

Each system shall have containers, valves, connectors, manifold valve assemblies, and regulators of an approved type.

(b) Container valves and container accessories.

Valves, fittings, and accessories connected directly to the container, including primary shut-off valves, shall have a rated working pressure of no less than two hundred fifty P.S.I.G. and shall be of material and design suitable for LP-gas service.

(c) Dispensing.

Filling of portable containers mounted on skids from storage containers shall be performed no less than fifty feet from the nearest building.

(d) Containers and regulating equipment installed outside of buildings or structures.

Containers shall be upright upon firm foundations or otherwise firmly secured. The possible effect on the outlet piping of settling shall be guarded against by a flexible connection or special fitting.

(e) Containers and equipment used inside of buildings or structures.

- (i) When operational requirements make use of portable containers necessary, and their location outside of buildings or structures is impracticable, containers and equipment shall be permitted to be used inside of buildings or structures.
- (ii) "Containers in use" means connected for use.
- (iii) Valves on containers having water capacity greater than fifty pounds (nominal twenty pounds LP-gas capacity) shall be protected from damage while in use or storage.
- (iv) Hose used for LP-gas shall have a working pressure of no less than two hundred fifty P.S.I.G. The use of aluminum piping or tubing is prohibited.
- (v) Portable heaters, including salamanders, shall be equipped with an approved automatic device to shut off the flow of gas to the main burner, and pilot, in the event of flame failure, except that this provision does not apply to portable heaters under seven thousand five hundred B.t.u. per hour, input when used with containers having a maximum water capacity of two and one-half pounds. Portable heaters, having inputs above fifty thousand B.t.u. per hour, shall be equipped with either a pilot, which must be lighted and proved before the main burner can be turned on, or an electrical ignition system.
- (vi) Containers, regulating equipment, manifolds, piping, tubing, and hose shall be located to avoid exposure to high temperatures or physical damage.
- (vii) Containers having a water capacity greater than two and one-half pounds (nominal one pound LP-gas capacity) connected for use shall stand on a firm and level surface and shall be secured

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in an upright position.

- (viii) The maximum water capacity of individual containers shall be two hundred forty-five pounds (nominal one hundred pounds LP-gas capacity).
 - (ix) For temporary heating, heaters (other than integral heater-container units) shall be located no less than six feet from any LP-gas container.
 - (x) When heaters are connected to containers for use in an unpartitioned area on the same floor, the total water capacity of containers, manifolded together for connection to a heater or heaters, shall be no greater than seven hundred thirty-five pounds (nominal three hundred pounds LP-gas capacity). Such manifolds shall be separated by no less than twenty feet.
- (f) Multiple container systems.
- (i) Valves in the assembly of multiple container systems shall be arranged so that replacement of containers can be made without shutting off the flow of gas in the system.
 - (ii) Heaters shall be equipped with an approved regulator in the supply line between the fuel cylinder and the heater unit. Cylinder connectors shall be provided with an excess flow valve.
- (g) Storage of LP-gas containers.
- Storage of LP-gas within buildings is prohibited.
- (h) Storage outside of buildings.
- (i) Storage outside of buildings for containers awaiting use, shall be located away from the nearest building or group of buildings, in accordance with the following:

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Table 4123:1-3-18(C)(4)(h)

Quantity of LP-Gas Stored:	Distance (feet)
500 lbs. or less	0
501 to 6,000 lbs.....	10
6,001 to 10,000 lbs.....	20
Over 10,000 lbs.....	25

(ii) Containers shall be in a ventilated enclosure and also protected against tampering.

(D) Control of air contaminants.

(1) General.

Air contaminants shall be minimized by one or more of the following methods:

- (a) Substitute nonhazardous, or less hazardous material;
- (b) Confine or isolate the contaminant;
- (c) Remove at the source by local exhaust ventilation;
- (d) ~~Remove~~ Reduce the airborne concentration by dilution ventilation;
- (e) ~~Remove~~ Reduce the airborne concentration by general ventilation;
- (f) Using wet methods to allay ~~dusts~~ dust generation. Note: Good housekeeping is of definite value in minimizing air contaminants created by dusts.

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(2) Asbestos.

- (a) Mixing asbestos shall be done wet or in an enclosed, ventilated area.
- (b) The employer shall provide and shall require the employee to wear approved respirators when mixing, sawing, spraying, applying, and cleaning up where asbestos is used.
- (c) Damaged bags or containers of asbestos shall be wrapped or enclosed in an airtight container before handling.
- (d) When cleaning up, all surfaces shall be sprayed with water or shall be vacuumed by high-efficiency particulate air (HEPA) filtered equipment capable of trapping and retaining at least 99.97 per cent of all monodispersed particles of 0.3 micrometers in diameter or larger.

(E) Exhaust systems: machinery and equipment.

(1) Grinding, polishing and buffing.

(a) Abrasive wheels and belts.

(i) Abrasive wheels and belts shall be hooded and exhausted when there is a hazardous concentration of air contaminants.

(ii) This does not apply to abrasive wheels or belts:

(a) Upon which water, oil, or other liquid substance is used at the point of the grinding contact;
or

(b) ~~To small~~ Small abrasive wheels used occasionally for tool grinding or other routine maintenance tasks.

(b) Separate exhaust systems.

Abrasive wheel and buffing wheel exhaust systems shall be separate when the dust from the buffing wheel is of flammable or combustible material.

(2) Manufacturing processes.

When toxic materials are generated in hazardous concentrations during their application, drying, or handling, they shall be minimized or eliminated.

(3) Internal combustion engines.

Hazardous concentrations of air contaminants produced by internal combustion engines shall be exhausted.

(F) Exhaust systems - structural requirements.

(1) Exhaust or ventilating fan.

Each exhaust or ventilating fan located seven feet or less above the floor or normal working level shall be guarded.

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(2) ~~Ductwork~~Ducts.

The ~~ductwork of the~~ exhaust system shall be ducts of a size suitable for conducting the contaminated air outdoors, or the exhaust ~~ductwork ducts~~ shall provide no less than the minimum transport velocity necessary to remove the particulate material ~~produced by the operation being performed~~, to a collector.

(3) Discharge.

The outlet from every separator or from every collector shall discharge the air contaminants collected by the exhaust system, in such manner that the discharged materials shall not re-enter the working area in hazardous concentrations.

(4) Location of air supply openings or inlets.

Air supply openings or inlets through which air enters the building or room in which the local exhaust system is in operation shall be isolated from any known source of contamination ~~from outside of the building~~.

(G) Confined spaces.

Under no circumstances shall a confined space be entered to make any of the following prescribed tests.

(1) No employer shall permit entrance into any confined space unless a confined space entry procedure, incorporating one of the following, is used:

(a) Air sampling shall be performed by qualified, trained personnel prior to and periodically during occupancy to determine either that:

(i) The atmosphere within the confined space contains an adequate quantity of oxygen (19.5 to 23.5 per cent) and harmful atmospheric contaminants have been removed or diluted to safe concentrations; or

(ii) Adequate mechanically induced dilution ventilation is used prior to entry and continued in use during occupancy to ensure that no less than 19.5 per cent oxygen is maintained in the confined space.

(b) ~~A supplied air respirator or self-contained breathing apparatus~~ An atmosphere-supplying respirator with escape bottle is provided and used.

(2) When the confined space has been exposed to, contained, or is likely to have combustible gases within its confines (such as sewage treatment plants), it shall not be entered if any reading in excess of ten per cent of its lower flammable limit (LFL) is obtained on a combustible gas indicator (see Appendix III to rule 4123:1-3-16 of the Administrative Code).

(3) If tests under paragraph (G)(1)(a) or (G)(2) of this rule indicate that the atmosphere in the space to be entered contains:

(a) A concentration of flammable vapor or gas in excess of ten per cent of its LFL; and/or,

(b) A concentration of toxic contaminants above the threshold limit value; and/or,

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(c) Less than 19.5 per cent oxygen;

Then appropriate control measures shall be instituted. Control measures may consist of forced or natural ventilation, use of personal protective equipment, a combination of these, or other effective control techniques.

(H) Procedures.

(1) Procedure for safe entry.

(a) A procedure for safe entry into confined spaces shall be established and used.

(b) The following are recommended procedures to comply with standards:

(i) Designate at least one trained person to be responsible for adherence to entry procedures and require written approval by that person before permitting anyone to enter the confined space;

(ii) Post danger signs or by any other equally effective means, of the existence and location of the permit spaces.

Note: A sign reading "Danger -- Permit - Required Confined Space, Do Not Enter," or using other similar language would satisfy the requirement for a sign.

(iii) Provide periodic instruction and training in proper entry procedures to be used;

(iv) Standby personnel where provided shall be required at all times to be in communication with the employee within the confined space; an alarm or two-way radio system for the standby employee will be effective;

(v) Approved rescue equipment should be available; since entry ports for confined spaces vary in size, precaution should be used in obtaining proper size equipment;

(vi) Establish procedures to prevent ignition of combustible atmospheres or re-entry of gases or liquids by locking out switches and blanking off transmission pipes; use nonsparking tools;

(vii) Prevent generation of contaminants by neutralizing or flushing out residual materials;

(viii) In testing for contaminants use only approved instruments maintained in proper working order;

(ix) Continual monitoring of oxygen and contaminant concentrations during occupancy;

(x) If atmosphere-supplying respiratory equipment is used off ~~of an air compressor piped system~~, this system shall meet the specifications of the "Compressed Gas Association (CGA)," to assure a supply of ~~uncontaminated~~ Grade D or better air;

(xi) When ~~supplied air or self-contained~~ atmospheric-supplying respiratory apparatus is used, personnel should be trained in the proper use of such apparatus.

(xii) Many employers use tags to show that a confined space may be entered safely. An example of such a tag is as follows:

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CONFINED SPACE ENTRY PERMIT					
					Date: _____
Area or Equipment to be Entered _____					
Location _____					
Purpose of Entry _____					
Testing Instruments Used _____					
Ventilation Equipment Provided _____					
Rescue Equipment Provided _____					
Pipes Blanked Off & Switches Locked Out _____					
Periodic Checks Prior to Entry	Time	Oxygen %	% LEL Reading	Tested By	Comments
1.					
2.					
3.					
4.					
5.					
6.					
7.					
THIS CONFINED SPACE HAS BEEN INSPECTED AND FOUND SAFE FOR ENTRY FOR PERIOD SHOWN					
Signed _____			_____		
(Person in Charge)			Date/Time		

(2) Emergency rescue procedures.

- (a) In all cases when an employee is stationed outside a compartment, tank, or space, as a tender for the employees working inside, the tender shall have immediately available for emergency use all necessary personal protective equipment. The tender shall wear the personal protective equipment if exposed for prolonged periods which are hazardous to the tender's health.
- (b) When entering a toxic or flammable atmosphere, an employee shall be provided with and use an adequate, attended, lifeline.

4123:1-3-18

APPENDIX

OCCUPATIONAL EXPOSURE LIMITS (OEL)

This Appendix is for information and guide purposes only. The information contained in this Appendix is not to be construed as specific requirements of this code.

The time-weighted average concentration of air contaminants breathed by employees should not exceed the following occupational exposure limit for an eight-hour daily exposure.

Occupational exposure limits refer to time-weighted average (TWA) concentrations for an eight-hour work day and forty-hour-work week. They should be used as guides in the control of health hazards and should not be used as fine lines between safe and dangerous concentrations.

These limits are intended for use in the practice of industrial hygiene. They are not intended for use, or for modification for use as proof or disproof of an existing disease or physical condition.

Occupational exposure limits should not be used as the sole criterion for establishing evidence of hazards to health but the evaluation of a possible hazard should also be subject to other pertinent factors, such as the nature of the contaminant and the frequency and duration of the exposure, and clinical evidence of the harmful effects.

"Skin" Notation

Listed substances followed by the designation "skin" refer to the potential contribution to the overall exposure by the cutaneous route including mucous membranes and eye, either airborne, or more particularly, by direct contact with the substance. Vehicles can alter skin absorption. This attention-calling designation is intended to suggest appropriate measures for the prevention of cutaneous absorption so that the occupational exposure limit is not invalidated.

"C" (Ceiling) Values

A listed value bearing a "C" designation refers to a "ceiling" value that should not be exceeded; all values should fluctuate below the listed value. This, in effect, makes the "C" designation a maximal allowable concentration (MAC). In

general, the bases for assigning or not assigning a "C" value rest on whether excursions of concentration above a proposed limit for periods up to fifteen (15) minutes may result in a) intolerable irritation, b) chronic, or irreversible tissue change, or c) narcosis of sufficient degree to increase accident proneness, impair self-rescue or materially reduce work efficiency.

Excursion Factors

For all substances not bearing "C" notation

OEL	(ppm or mg/m ³),	Excursion
OEL > 0 – 1		Factor = 3
OEL > 1 – 10	"	" = 2
OEL > 10 – 100	"	" = 1.5
OEL > 100 – 1000	"	" = 1.25

The number of occasions the excursion above the OEL is permitted is governed by conformity with the time-weighted average OEL.

TABLE OF OCCUPATIONAL EXPOSURE LIMITS (OEL)

Substance	ppma	mg/m ³ b
Abate -----		10
Acetaldehyde -----	100	180
Acetic acid -----	10	25
C Acetic anhydride -----	5	20
Acetone -----	1,000	2,400
Acetonitrile -----	40	70
Acetylene dichloride, see 1, 2-Dichloroethylene -----		
Acetylene tetrabromide -----	1	14
Acrolein -----	0.1	0.25
Acrylamide - Skin -----	0.3	
Acrylonitrile - Skin -----	20	45
Aldrin - Skin -----		0.25
Allyl alcohol - Skin -----	2	5
Allyl chloride -----	1	3
Allyl glycidyl ether (AGE) - Skin -----	5	22
Allyl propyl disulfide -----	2	12

Substance	ppma	mg/m3b
2-Aminoethanol, see Ethanolamine -----		
2-Aminopyridine -----	0.5	2
C Ammonia -----	50	36
Ammonium chloride, fume -----		10
Ammonium sulfamate (Ammate) -----		10
n-Amyl acetate -----	100	525
sec-Amyl acetate -----	125	650
Aniline - Skin -----	5	19
Anisidine (o-, p-isomers) - Skin -----	0.1	0.5
Antimony & compounds (as Sb) -----		0.5
ANTU (alpha naphthyl thiourea) -----		0.3
Arsenic & compounds (as As) -----		0.5
Arsine -----	0.05	0.2
Azinphos methyl - Skin -----		0.2
Baygon (Propoxur) -----		0.5
Barium (soluble compounds) -----		0.5
C Benzene - Skin -----	10	32
p-Benzoquinone, see Quinone -----		
Benzoyl peroxide -----		5
Benzyl chloride -----	1	5
Beryllium -----		0.002
Biphenyl -----	0.2	1
Bismuth telluride -----		10
Bismuth telluride (Se-doped) -----		5
Boron oxide -----		10
Boron tribromide -----	1	10
C Boron trifluoride -----	1	3
Bromine -----	0.1	0.7
Bromine pentafluoride -----	0.1	0.7
Bromoform - Skin -----	0.5	5
Butadiene (1, 3-butadiene) -----	1,000	2,200
Butane -----	600	1,420
Butanethiol, see Butyl mercaptan -----		
2-Butanone (see Methyl Ethyl Ketone) -----		
2-Butoxy ethanol (Butyl Cellosolve) - Skin (see Cellosolves; Butyl Cellosolve) -----		
Butyl acetate (n-butyl acetate) -----	150	710
sec-Butyl acetate -----	200	950

Chlorine -----	1	3
Chlorine dioxide -----	0.1	0.3
C Chlorine trifluoride -----	0.1	0.4
C Chloroacetaldehyde -----	1	3
a-Chloroacetophenone (phenacylchloride)-----	0.05	0.3
Chlorobenzene (monochlorobenzene) -----	75	350
o-Chlorobenzylidene malononitrile (OCBM) - Skin -----	0.05	0.4
Chlorobromomethane -----	200	1,050
2-Chloro-1, 3-butadiene (see Chloroprene) -----		
Chlorodifluoromethane -----	1,000	3,500
Chlorodiphenyl (42% Chlorine) - Skin -----		1
Chlorodiphenyl (54% Chlorine) - Skin -----		0.5
1-Chloro, 2, 3-epoxypropane (see Epichlorhydrin) -----		
2-Chloroethanol (see Ethylene chlorohydrin) -----		
Chloroethylene (see Vinyl chloride) -----		
Chloroform (Trichloromethane) -----	10	50
bis-Chloromethyl ether -----	0.001	0.003
1-Chloro-1-nitropropane -----	20	100
Chloropicrin -----	0.1	0.7
Chloroprene (2-chloro-1, 3-butadiene) - Skin -----	25	90
Chlorpyrifos (Dursban®) - Skin -----		0.2
o-Chlorostyrene -----	50	285
o-Chlorotoluene -----	50	250
2-Chloro-6-(trichloromethyl) pyridine (N-Serve®) -----		10
Chromates, certain insoluble forms -----		0.1
Chromic acid and chromates (as CrO3)-----		0.1
Chromium, sol. chromic, chromous salts as Cr -----		0.5
Clopidol (Coyden®) -----		
Cobalt, metal fume & dust -----		0.05
Copper fume -----		0.2
Dusts and Mists -----		1
Cotton Dust (raw) -----		0.2
Crag® herbicide -----		10
Cresol (all isomers)--Skin -----	5	22
Crotonaldehyde -----	2	6
Crufomate (Ruelene®) -----		50
Substance	ppma	mg/m3b

Cumene - Skin -----	50	245
Cyanide (as CN) - Skin -----	5	
Cyanogen -----	10	20
Cyclohexane -----	300	1,050
Cyclohexanol -----	50	200
Cyclohexanone -----	50	200
Cyclohexene -----	300	1,015
Cyclohexylamine - Skin -----	10	40
Cyclopentadiene -----	75	200
2, 4-D -----		10
DDT -----		1
DDVP (see Dichlorvos) -----		
Decaborane - Skin -----	0.05	0.3
Demeton® - Skin -----	0.01	0.1
Diacetone alcohol (4-hydroxy-4-methyl- 2-pentanone) --	50	240
1, 2-Diaminoethane (see Ethylenediamine) -----		
Diazinon - Skin -----		0.1
Diazomethane -----	0.2	0.4
Diborane -----	0.1	0.1
1, 2-Dibromoethane (ethylene dibromide) Skin -----	20	145
Dibrom® -----		
2-N Dibutylaminoethanol - Skin -----	2	14
Dibutyl phosphate -----	1	5
Dibutylphthalate -----		5
C Dichloroacetylene -----	0.1	0.4
C o-Dichlorobenzene -----	50	300
p-Dichlorobenzene -----	75	450
Dichlorodifluoro-methane -----	500	2,475
1, 3-Dichloro-5, 5-dimethyl hydantoin -----		0.2
1, 1-Dichloroethane -----	200	820
1, 2-Dichloroethane -----	50	200
1, 2-Dichloroethylene -----	200	790
Dichloroethyl ether - Skin -----	5	30
Dichloromethane (see Methylene chloride) -----		
Dichloromonofluoromethane -----	1,000	4,200
C 1, 1-Dichloro-1-nitroethane -----	10	60
1, 2-Dichloropropane (see Propylenedichloride) -----		
Dichlorotetrafluoroethane -----	1,000	7,000
Dichlorvos (DDVP) - Skin -----	0.1	1
Dicyclopentadiene -----	5.0	27
Dicyclopentadienyliron -----		10
Substance	ppma	mg/m3b

Dieldrin - Skin -----		0.25
Diethylamine -----	25	75
Diethylamino ethanol - Skin -----	10	50
Diethylene triamine - Skin -----	1	4
Diethylether (see Ethyl ether) -----		
Diethylphthalate -----		5
Difluorodibromomethane -----	100	860
C Diglycidyl ether (DGE) -----	0.5	2.8
Dihydroxybenzene (see Hydroquinone) -----		
Diisobutyl ketone -----	25	150
Diisopropylamine - Skin -----	5	20
Dimethoxymethane (see Methylal) -----		
Dimethyl acetamide - Skin -----	10	35
Dimethylamine -----	10	18
Dimethylaminobenzene (see Xylidene) -----		
Dimethylaniline (N-dimethylaniline) - Skin -----	5	25
Dimethylbenzene (see Xylene) -----		
Dimethyl 1, 2-dibromo-2-dichloroethyl phosphate (see Dibrom) -----		
Dimethylformamide - Skin -----	10	30
2, 6-Dimethylheptanone (see Diisobutyl ketone) -----		
1, 1-Dimethylhydrazine - Skin -----	0.5	1
Dimethylphthalate -----		5
C Dimethyl sulfate - Skin -----	1	5
Dinitrobenzene (all isomers) - Skin -----	0.15	1
Dinitro-o-cresol - Skin -----		0.2
3, 5-Dinitro-o-toluamide (Zoalene®) -----		5.0
Dinitrotoluene - Skin -----		1.5
Dioxane, technical grade - Skin -----	50	180
Diphenyl (see Biphenyl) -----		
Diphenyl amine -----		10
Diphenylmethane diisocyanate (see Methylene bisphenyl isocyanate [MDI] -----		
Dipropylene glycol methyl ether - Skin -----	100	600
Diquat -----		0.5
Di-sec, octyl phthalate (Di-2-ethyl- hexylphthalate) -----		5
Substance	ppma	mg/m3b

Disulfuram -----		2
Disyston - Skin -----		0.1
2, 6-Ditert-butyl-p-cresol -----		10
Dyfonate -----		0.1
Endosulfan (Thiodan®) - Skin-----		0.1
Endrin - Skin -----		0.1
Epichlorhydrin - Skin -----	5	19
EPN - Skin -----		0.5
1, 2-Epoxypropane (see Propylene oxide) -----		
2, 3-Epoxy-1-propanol (see Glycidol) -----		
Ethanethiol (see Ethyl mercaptan)-----		
Ethanolamine -----	3	6
Ethion (Nialate®) - Skin -----		0.4
2-Ethoxyethanol (see Cellosolves: Ethyl Cellosolve)-----		
Skin -----		
2-Ethoxyethylacetate (see Cellosolves: Ethyl Cellosolve Acetate) - Skin -----		
Ethyl acetate -----	400	1,400
Ethyl acrylate - Skin -----	25	100
Ethyl alcohol (ethanol) -----	1,000	1,900
Ethylamine -----	10	18
Ethyl sec-amyl ketone (5-methyl-3- heptanone) -----	25	130
Ethyl benzene -----	100	435
Ethyl bromide -----	200	890
Ethyl butyl ketone (3-Heptanone) -----	50	230
Ethyl chloride -----	1,000	2,600
Ethyl ether -----	400	1,200
Ethyl formate -----	100	300
Ethyl mercaptan -----	0.5	1
Ethyl silicate -----	100	850
C Ethylene chlorohydrin - Skin -----	1	3
Ethylenediamine -----	10	25
Ethylene dibromide (see 1, 2-Dibromoethane) -----		
Ethylene dichloride (see 1, 2-Dichloroethane) -----		
Ethylene glycol, particulate -----		10
Ethylene glycol, vapor -----	100	260
Substance	ppma	mg/m3b

C Ethylene glycol dinitrate and/or Nitroglycerin - Skin -----	0.2 -	
Ethylene glycol monomethyl ether acetate (see Cellosolves: Methyl cellosolve acetate) - Skin ---		
Ethylene oxide -----	50	90
Ethylenimine - Skin -----	0.5	1
Ethylidene chloride (see 1, 1-Dichloroethane) -----		
C Ethylidene norbornene -----	5	25
N-Ethylmorpholine - Skin -----	20	94
Fensulfothion (Dasanit) -----		0.1
Ferbam -----		10
Ferrovandium dust -----		1
Fluoride (as F) -----		2.5
Fluorine -----	1	2
Fluorotrichloromethane -----	1,000	5,600
C Formaldehyde -----	2	3
Formamide -----	20	30
Formic acid -----	5	9
Furfural - Skin -----	5	20
Furfuryl alcohol -----	5	20
Germanium tetrahydride -----	0.2	0.6
Glutaraldehyde, activated and unactivated -----	0.3	1.2
Glycidol (2, 3-Epoxy-1-propanol) -----	50	150
Glycol monoethyl ether (see 2-Ethoxyethanol) -----		
Guthion® (see Azinphosmethyl) -----		
Hafnium -----		0.5
Heptachlor - Skin -----		0.5
Heptane (n-heptane) -----	400	1,640
Hexachlorocyclopentadiene -----	0.01	0.11
Hexachloroethane - Skin -----	1	10
Hexachloronaphthalene - Skin -----		0.2
Hexafluoroacetone -----	0.1	0.7
Hexane (n-hexane) -----	100	350
2-Hexanone (Methylbutyl ketone) - Skin -----	25	102
Hexone (Methyl isobutyl ketone) - Skin -----	100	410
sec-Hexyl acetate -----	50	300
C Hexylene glycol -----	25	120
Hydrazine - Skin -----	1	1.3
Hydrogen bromide -----	3	10
C Hydrogen chloride -----	5	7
C Hydrogen cyanide - Skin -----	10	11
Substance	ppma	mg/m3b

Hydrogen fluoride -----	3	2
Hydrogen peroxide -----	1	1.4
Hydrogen selenide -----	0.05	0.2
C Hydrogen sulfide -----	10	15
Hydrogenated terphenyls -----	0.5 -	
Hydroquinone -----		2
Indene -----	10	45
Indium and compounds, as In -----		0.1
C Iodine -----	0.1	1
Iodoform -----	0.2	3.2
Iron oxide fume -----		5
Iron pentacarbonyl -----	0.01	0.08
Iron salts, soluble, as Fe -----	- 1	
Isoamyl acetate -----	100	525
Isoamyl alcohol -----	100	360
Isobutyl acetate -----	150	700
Isobutyl alcohol -----	50	151
Substance ppm mg/m ³ b		
C Isophorone -----	5	25
Isopropyl acetate -----	250	950
Isopropyl alcohol - Skin -----	400	980
Isopropylamine -----	5	12
Isopropyl ether -----	250	1,050
Isopropyl glycidyl ether (IGE) -----	50	240
Ketene -----	0.5	0.9
Lead, inorg., fumes and dusts, as Pb -----	-	0.15
Lead arsenate, as Pb -----	-	0.15
Lindane - Skin -----	-	0.5
Lithium hydride -----	-	0.025
L.P.G. (Liquefied petroleum gas) -----	1,000	1,800
Magnesium oxide fume -----	-	10
Malathion - Skin -----	-	10
Maleic anhydride -----	0.25	1
C Manganese and compounds, as Mn -----	-	5
Manganese cyclopentadienyl tricarbonyl (as Mn) - Skin -----	-	0.1
Mercury (Alkyl compounds) - Skin, as Hg -----	0.001	0.01
Mercury (All forms except alkyl) as Hg -----	-	0.05
Mesityl oxide -----	25	100
Methanethiol, (see Methyl mercaptan) -----	-	-
Methoxychlor -----	-	10
2-Methoxyethanol (see		

Cellosolves: Methyl cellosolve) -	
Skin -----	- -
Methyl acetate -----	200 610
Methyl acetylene (propyne) -----	1,000 1,650
Methyl acetylene-propadiene mixture	
(MAPP) -----	1,000 1,800
Methyl acrylate - Skin -----	10 35
Methyl acrylonitrile - Skin -----	1 3
Methylal (dimethoxymethane) -----	1,000 3,100
Methyl alcohol (methanol) - Skin -----	200 260
Methylamine -----	10 12
Methyl amyl alcohol (see	
Methyl isobutyl carbinol) -----	- -
Methyl 2-cyanoacrylate -----	2 8
Methyl isoamyl ketone -----	100 475
Methyl n-amyl ketone (2-Heptanone) -----	100 465
Methyl bromide - Skin -----	15 60
Methyl butyl ketone (see	
2-Hexanone) -----	- -
Methyl cellosolve - 2-Methoxyethanol	
(see	
Cellosolves: Methyl cellosolve) -----	- -
Methyl cellosolve acetate - Ethylene	
glycol monomethyl ether acetate (see	
Cellosolves: Methyl cellosolve	
acetate) -----	- -
Substance ppma mg/m3b	
Methyl chloride -----	100 210
Methyl chloroform -----	350 1,900
Methylcyclohexane -----	400 1,600
Methylcyclohexanol -----	50 235
o-Methylcyclohexanone - Skin -----	50 230
Methylcyclopentadienyl manganese tri-	
carbonyl (as Mn) - Skin -----	0.1 0.2
Methyl demeton - Skin -----	- 0.5
Methyl ethyl ketone (MEK) 2-Butanone -----	200 590
C Methyl ethyl ketone peroxide -----	0.2 1.5
Methyl formate -----	100 250
Methyl iodide - Skin -----	5 28
Methyl isobutyl carbinol - Skin -----	25 100
Methyl isobutyl ketone (see	
Hexone) -----	- -
Methyl isocyanate - Skin -----	0.02 0.05
Methyl mercaptan -----	0.5 1
Methyl methacrylate -----	100 410
Methyl parathion - Skin -----	- 0.2

Methyl propyl ketone (see 2-Pentanone) -----	-	-
C Methyl silicate -----	5	30
C a-Methyl styrene -----	100	480
C Methylene bisphenyl isocyanate (MDI) -----	0.02	0.2
Methylene chloride (dichloromethane) -----	100	360
C Methylene bis (4-cyclohexylisocyanate) -----	0.01	0.11
Molybdenum (as Mo),soluble compounds -----	-	5
Insoluble compounds -----	-	10
Monomethyl aniline - Skin -----	2	9
C Monomethyl hydrazine - Skin -----	0.2	0.35
Morpholine - Skin -----	20	70
Naphthalene -----	10	50
Nickel carbonyl -----	0.05	0.35
Nickel, metal and insoluble compounds (as Ni) -----	-	1
Nickel, soluble salts (as Ni)-----	-	0.1
Nicotine - Skin -----	-	0.5
Nitric acid -----	2	5
Nitric oxide -----	25	30
p-Nitroaniline - Skin -----	1	6
Nitrobenzene - Skin -----	1	5
p-Nitrochlorobenzene - Skin -----	-	1
Nitroethane -----	100	310
C Nitrogen dioxide -----	5	9
Nitrogen trifluoride -----	10	29
Nitroglycerin - Skin -----	0.2	2
Nitromethane -----	100	250
1-Nitropropane -----	25	90
2-Nitropropane -----	25	90
Nitrotoluene - Skin -----	5	30
Nitrotrichloromethane (see Chloropicrin) -----	-	-
Nonane -----	200	1,050
Substance ppma mg/m ³ b		
Octachloronaphthalene - Skin -----	-	0.1
Octane -----	300	1,380
Oil mist, particulate -----	-	5
Osmium tetroxide, as Os -----	0.0002	0.002
Oxalic acid -----	-	1
Oxygen difluoride -----	0.05	0.1
Ozone -----	0.1	0.2
Paraffin wax fume -----	-	2
Paraquat		

(respirable size) -----	- 0.1
Parathion -	
Skin -----	- 0.1
Pentaborane -----	0.005 0.01
Pentachloronaphthalene - Skin -----	- 0.5
Pentachlorophenol - Skin -----	- 0.5
Pentane -----	600 1,680
2-Pentanone -----	200 700
Perchloroethylene - Skin -----	100 670
Perchloromethyl mercaptan -----	0.1 0.8
Perchloryl fluoride -----	3 14
Phenol - Skin -----	5 19
Phenothiazine - Skin -----	- 5
p-Phenylene diamine - Skin -----	- 0.1
Phenyl ether (vapor) -----	1 7
Phenyl ether-Diphenyl mixture (vapor) -----	1 7
Phenylethylene (see	
Styrene) -----	-
Phenyl glycidyl ether (PGE) -----	10 60
Phenylhydrazine - Skin -----	5 22
C Phenylphosphine -----	0.05 0.25
Phorate (ThimetR) - Skin -----	- 0.05
Phosdrin (MevinphosR) - Skin -----	0.01 0.1
C Phosgene (carbonyl chloride) -----	0.05 0.2
Phosphine -----	0.3 0.4
Phosphoric acid -----	- 1
Phosphorus (yellow) -----	- 0.1
Phosphorus pentachloride -----	- 1
Phosphorus pentasulfide -----	- 1
Phosphorus trichloride -----	0.5 3
Phthalic anhydride -----	1 6
Picloram (TordonR) -----	- 10
Picric acid - Skin -----	- 0.1
PivalR (2-Pivalyl-1, 3-indandione) -----	- 0.1
Platinum (Soluble Salts) as Pt -----	- 0.002
Polychlorobiphenyls (see	
Chlorodiphenyls -----	-
Potassium hydroxide -----	- 2
Propargyl alcohol - Skin -----	1 2
n-Propyl acetate -----	200 840
Propyl alcohol - Skin -----	200 500
n-Propyl nitrate -----	25 110
Propylene dichloride (1, 2-Dichloropro-	
pane) -----	75 350
C 1, 2-Propylene glycol dinitrate - Skin -----	0.05 0.35
Substance ppm mg/m ³	

Propylene glycol monomethyl ether -----	100	360
Propylene imine - Skin -----	2	5
Propylene oxide -----	100	240
Propyne (see Methylacetylene) -----	-	-
Pyrethrum -----	-	5
Pyridine -----	5	15
Quinone -----	0.1	0.4
RDX - Skin -----	-	1.5
Resorcinol -----	10	45
Rhodium, Metal fume and dusts (as Rh) -----	-	0.1
Soluble salts -----	-	0.001
Ronnel -----	-	10
Rosin Core Solder pyrolysis products (as formaldehyde) -----	-	0.1
Rotenone (commercial) -----	-	5
Selenium compounds (as Se) -----	-	0.2
Selenium hexafluoride (as Se) -----	0.05	0.4
SevinR (see Carbaryl) -----	-	-
Silane (see Silicon tetrahydride) -----	-	-
Silicon tetrahydride (Silane) -----	0.5	0.7
Silver, metal and soluble compounds (as Ag) -----	-	0.01
C Sodium azide -----	0.1	0.26
Sodium fluoroacetate (1080) - Skin -----	-	0.05
C Sodium hydroxide -----	-	2.0
Stibine -----	0.1	0.5
Stoddard solvent -----	100	-
Strychnine -----	-	0.15
Styrene, monomer (Phenylethylene) -----	100	420
C Subtilisins (Proteolytic enzymes as 100% pure crystalline enzyme) -----	-	0.00006
Succindialhyde (see Glutaraldehyde) -----	-	-
Sulfur dioxide -----	5	13
Sulfur hexafluoride -----	1,000	6,000
Sulfuric acid -----	-	1
Sulfur monochloride -----	1	6
Sulfur pentafluoride -----	0.025	0.25
Sulfur tetrafluoride -----	0.1	0.4
Sulfuryl fluoride -----	5	20
Systox (see DemetonR) -----	-	-
2, 4, 5-T -----	-	10

Tantalum -----	- 5
TEDP - Skin -----	- 0.2
Tellurium -----	- 0.1
Tellurium hexafluoride (as Te) -----	0.02 0.2
TEPP - Skin -----	0.004 0.05
Substance ppma mg/m ³ b	
C Terphenyls -----	1 9
1, 1, 1, 2-Tetrachloro-2, 2-difluoro-ethane -----	500 4,170
1, 1, 2, 2-Tetrachloro-1, 2-difluoro-ethane -----	500 4,170
1, 1, 2, 2-Tetrachloroethane - Skin -----	5 35
Tetrachloroethylene (see Perchloroethylene) -----	-
Tetrachloromethane (see Carbon tetrachloride) -----	-
Tetrachloronaphthalene - Skin -----	- 2
Tetraethyl lead (as Pb) - Skin -----	- 0.100
Tetrahydrofuran -----	200 590
Tetramethyl lead (as Pb) - Skin -----	- 0.150
Tetramethyl succinonitrile - Skin -----	0.5 3
Tetranitromethane -----	1 8
Tetryl (2, 4, 6-trinitrophenyl-methylnitramine) - Skin -----	- 1.5
Thallium (soluble compounds) - Skin (as Tl) -----	- 0.1
4, 4'-Thiobis (6-tert. butyl m-cresol)-----	- 10
ThiramR -----	- 5
Tin (inorganic compounds, except SnH ₄ and SnO ₂) as Sn -----	- 2
Tin (organic compounds) - Skin (as Sn) -----	- 0.1
Toluene (toluol) - Skin -----	100 375
C Toluene-2, 4-diisocyanate (TDI) -----	0.02 0.14
o-Toluidine -----	5 22
Toxaphene (see Chlorinated camphene) -----	-
Tributyl phosphate -----	- 5
1, 1, 1-Trichloroethane (see Methyl chloroform) -----	-
1, 1, 2-Trichloroethane - Skin -----	10 45
Trichloroethylene -----	100 535
Trichloromethane (see Chloroform) -----	-
Trichloronaphthalene - Skin -----	- 5
1, 2, 3-Trichloropropane -----	50 300
1, 1, 2-Trichloro 1, 2, 2-trifluoro-	

ethane -----	1,000	7,600
Triethylamine -----	25	100
Tricyclohexyltin hydroxide (PlictranR) --- -	5	
Trifluoromonobromomethane -----	1,000	6,100
Trimethyl benzene -----	25	120
2, 4, 6-Trinitrophenol (see Picric acid) -----		
2, 4, 6-Trinitrophenyl-methylnitramine (see Tetryl) -----		
C 2, 4, 6-Trinitrotoluene (TNT) - Skin -----	0.05	0.5
Triorthocresyl phosphate -----	-	0.1
Triphenylamine -----	-	5
Triphenyl phosphate -----	-	3
Tungsten & compounds, as W		
Soluble -----	-	1
Insoluble -----	-	5
Substance ppma mg/m ³ b		
Turpentine -----	100	560
Uranium (natural) soluble & insoluble compounds, as U -----	-	0.2
Vanadium (V ₂ O ₅), as V		
Dust -----	-	0.5
C Fume -----	-	0.05
Vinyl acetate -----	10	30
Vinyl benzene (see Styrene) -----		
Vinyl bromide -----	250	100
Vinyl chloride -----	1	2.5
Vinyl cyanide (see Acrylonitrile) -----		
Vinylidene chloride -----	10	40
Vinyl toluene -----	100	480
Warfarin -----	-	0.1
Wood dust (nonallergenic) -----	-	5
Xylene (o-, m-, p-isomers) - Skin -----	100	435
C m-Xylene a, a'-diamine -----	-	0.1
Xylidine - Skin -----	5	25
Yttrium -----	-	1
Zinc chloride fume -----	-	1
Zinc oxide fume -----	-	5
Zirconium compounds (as Zr) -----	-	5

a) Parts of vapor or gas per million parts of contaminated air by volume at 25°C and 760mm. Hg. pressure.

b) Approximate milligrams of substance per cubic meter of air.

(R) Registered Trade Name.

MINERAL DUSTS

Substance

SILICA, SiO2

Crystalline

Quartz ----- OEL in mppcf: 300

% quartz + 10

OEL for respirable dust in mg/m3:

10 mg/m3

% Respirable quartz + 2

Cristobalite -----Use one-half the value calculated from the count or respirable mass formulae for quartz.

Tridymite -----Use one-half the value calculated from formulae for quartz.

Silica, fused -----Use quartz formulae.

Tripoli ----- Use quartz formulae.

Silica, amorphous including natural

Diatomaceous Earth ----- 20 mppcf
1 mg/m3 Respirable dust

LESS THAN 1% QUARTZ

Asbestos, all forms ----- 2 fibers/cc > 5 micrometers in length

Graphite (natural) ----- 15 mppcf*

Mica ----- 20 mppcf*

Mineral wool fiber ----- 30 mppcf*

Perlite ----- 30 mppcf*

Portland Cement ----- 30 mppcf*

Soapstone ----- 20 mppcf*

Talc (nonasbestiform) -----20 mppcf*

Talc (fibrous) use
Asbestos limit.

Tremolite, see Asbestos

COAL DUST

(bituminous) 2 mg/m³ (respirable dust fraction << 5% quartz).

If > 5% quartz, use respirable mass formula.

mppcf - Millions of particles per cubic foot of air, based on impinger samples counted by light-field technics.

* Or 5 mg/m³ for respirable dust.

NUISANCE PARTICULATES

30 mppcf or 5 mg/m³ of respirable dust << 1% quartz

Conversion factors:

mppcf X 35.3 = million particles per cubic meter

= particles per c.c.

SOME NUISANCE PARTICULATES

OEL, 30 mppcf or 5 mg/m³ (respirable)

Alundum (Al ₂ O ₃)	Kaolin
Calcium carbonate	Limestone
Calcium silicate	Magnesite
Cellulose (paper fiber)	Marble
Portland Cement	Mineral Wool Fiber
Corundum (Al ₂ O ₃)	Pentaerythritol
Emery	Plaster of Paris
Glass, fibrous or dust	Rouge
Glycerin Mist	Silicon
Graphite (synthetic)	Silicon Carbide
Gypsum	Starch
Vegetable oil mists	Sucrose
(except castor, cashew nut, or similar irritant oils)	Tin Oxide
	Titanium Dioxide
	Zinc Stearate
	Zinc oxide dust

SOME SIMPLE ASPHYXIANTS*

Acetylene
Argon
Butane
Ethane
Ethylene
Helium

Hydrogen
Methane
Neon
Nitrous oxide
Propane

*The minimal oxygen shall not be less than 19% under normal atmospheric pressure.

CARCINOGENS

Substances in industrial use that have proven carcinogenic in man, or have induced cancer in animals under appropriate experimental conditions:

4-Aminodiphenyl (p-Xenylamine)*
Antimony trioxide
Arsenic trioxide production
Asbestos, all forms
Benzidine production*
beta-Naphthylamine*
bis (chloromethyl) ether
Chromite ore processing
Nickel sulfide roasting, fume & dust
4-Nitrodiphenyl*
Particulate Polycyclic Aromatic Hydrocarbons
Sulfur dioxide
Vinyl chloride

Industrial substances suspect of carcinogenic potential for man:

Benzene	Hexamethyl phosphoramidate
Benz(a)pyrene	Hydrazine
Beryllium	4,4'-Methylene bis(2-chloroaniline)
Cadmium oxide production	4,4'-Methylene dianiline
Chloroform	Methyl methacrylate
Chromates of lead & zinc	Monomethyl hydrazine
3, 3'-Dichlorobenzidine	Nitrosamines
Dimethylcarbonyl chloride	Propane sulfone
1, 1-Dimethyl hydrazine	beta-Propiolactone
Dimethyl sulfate	Thallium
Epichlorhydrin	Vinyl cyclohexene dioxide

For the above, worker exposure by all routes should be carefully controlled.

Cigarette smoking can enhance the incidence of respiratory cancers from these substances or processes.

* No exposure or contact by any route - respiratory, skin or oral, as detected by the most sensitive methods - should be permitted.

"No exposure or contact" means hermitizing the process or operation by the best practicable engineering methods. The worker should be properly equipped to insure virtually no contact with the carcinogen.

EXPLANATORY NOTE - Guide for Collecting and Measuring Samples:

- 1) At least three atmospheric samples, spaced at intervals to yield an average measurement of exposure over the entire cycle of operation under test shall be collected in the breathing zone of the employee or wherever such exposures are suspected.
- 2) For the purposes of this code, the sampling and analysis of contaminated air and the interpretation of the data in relation to the recommended occupational exposure limits shall be done using established sampling and analysis procedures.
- 3) Temporary concentrations in excess of the recommended occupational exposure limits shall not be permitted if exposure to such concentrations for a period of one hour or less may result in an adverse effect on health.
- 4) For the purpose of the above recommended occupational exposure limits respirable dust shall be considered all dust below ten (10) microns in size and seventy-five (75) percent below five (5) microns.

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No Change

4123:1-3-19 Demolition.

(A) Reserved.

(B) Definitions.

(1) "Chute" means a trough or tube used to guide and transport sliding objects, material, or debris from a higher to a lower level.

(2) "Demolition" means to dismantle, raze, destroy, or wreck any fixed building or structure.

(C) Preparatory operations.

(1) Except where necessary to maintain a utility service all steam, gas, sanitary sewer and electric lines shall be shut off from beyond the building or structure before demolition operations begin. Sanitary sewer connections shall be closed with a plug of concrete or some other suitable material at the entrance to the building, inside the building wall or immediately outside the building wall. Where it is necessary to maintain all or any of the service utilities, such service lines shall be protected from damage. In each case, any utility company which is involved shall be notified in advance.

(2) When employees are required to work within a structure to be demolished which has been damaged by fire, flood, explosion, or other cause, the walls or floor shall be shored or braced.

(3) When any type of hazardous chemicals, gases, explosives, flammable materials, or similarly dangerous substances has been used in the pipes, tanks, or other equipment on the property the hazardous situation shall be eliminated.

(4) Where a hazard exists from fragmentation of glass, such hazard shall be removed.

(5) During the period before demolition begins in a particular area wall openings less than forty-two inches above the floor and floor openings other than material drops shall be protected.

(D) Material and debris.

(1) Chutes for removal of material and debris.

(a) Chutes provided for the removal of material and debris from areas above the first floor level shall be so constructed that the material and debris cannot leave the chute before reaching the discharge end.

(b) When employees are required to work in or pass through the area at the discharge end of chutes, such area shall be guarded except where the chute discharges into a bin, conveyor, truck or other container.

(c) Chute openings into which employees dump debris shall be protected by a guardrail approximately forty-two inches in height and, where material is dumped from mechanical equipment or wheelbarrows, toeboards shall be provided.

(2) Existing elevators used for removal of material and debris.

When existing elevators are used for the removal of material and debris, employees shall be instructed

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not to load elevators beyond the rated capacity. Material hoists, when used, shall conform to the requirements of paragraph (D)(2) of rule 4123:1-3-07 of the Administrative Code.

(3) Removal of material and debris through floor openings.

Any openings cut in a floor for the disposal of material and debris shall be no larger in size than twenty-five per cent of the aggregate of the total floor area, unless the lateral supports of the removed flooring remain in place. Floors weakened or otherwise made unsafe by demolition operations shall be shored to carry safely the intended imposed load from demolition operations.

(4) Storage.

Storage space into which material and debris are dumped shall be blocked off, except for openings necessary for their removal. Such openings shall be kept closed at all times when material or debris is not being removed.

(E) Removal of employees.

All employees shall be removed from areas directly below floors or similar elevations prior to the demolition of walls, sections of walls, chimneys or other parts of the building which may fall in mass upon such upper floors or elevations.

(F) Scaffolding and walkways.

(1) Scaffolding.

In demolishing masonry walls with hand labor, scaffolding shall be provided unless an interior floor is located no more than twelve feet below the working level. All scaffolds used in demolition work shall be substantially supported and shall conform to the requirements of rule 4123:1-3-10 of the Administrative Code.

(2) Walkways.

Walkways or ladders shall be provided to enable employees to safely reach or leave any scaffold or wall.

(G) Stairways.

Stairways in use shall be substantially supported.

(H) Removal of steel construction.

(1) Employees not required to work from or ride demolition equipment.

Employees shall not be required to work from or ride crane loads, hooks, demolition balls or buckets designed to carry materials.

(2) Dropping structural steel.

Employees shall not be required to drop structural steel except into a specially barricaded or otherwise fully protected area.

(3) Shoring floor.

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Prior to erecting any derrick or other hoisting device on any floor support, shoring shall be designed and erected to provide a factor of safety of no less than four.

(I) Demolition balls and clamshell buckets.

(1) Barricading area.

The area affected by demolition balls and clamshell buckets shall be barricaded to protect employees. Only those employees necessary for the performance of these operations shall be required to be in the barricaded area when these operations are being performed.

(2) Attachment and weight.

A demolition ball shall be attached to the load line with a swivel-type connection to prevent twisting of the load line, and shall be attached so that the weight cannot become accidentally disconnected. The weight of the demolition ball shall not exceed fifty per cent of the crane's rated load based on the maximum length and angle of the boom.

(3) Protection of windows in crane cabs.

Windows in crane cabs used with balling operations shall be protected with heavy-gauge metal screening having openings large enough that the operator's vision is not obscured, but no larger than two inches, or with safety glass that will provide equivalent protection.

(J) Selective demolition by explosives.

Selective demolition by explosives shall be conducted in accordance with the applicable sections of rule 4123:1-3-15 of the Administrative Code.

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Amend

4123:1-3-20 Steel erection.

(A) Reserved.

(B) Reserved.

(C) Flooring requirements.

(1) Permanent flooring - skeleton steel construction in tiered buildings.

(a) The permanent floors shall be installed as the erection of structural members progresses, and there shall be no more than eight stories between the erection floor and the uppermost permanent floor, except where the structural integrity is maintained as a result of the design.

(b) At no time shall there be more than four floors or forty-eight feet of unfinished bolting or welding above the foundation or uppermost permanently secured floor.

(2) Temporary flooring - skeleton steel construction in tiered buildings.

(a) The derrick or erection floor shall be solidly planked or decked over its entire surface except for access openings. Planking or decking of equivalent strength shall be of proper thickness to carry the working load. Planking shall be no less than two inches thick, full size undressed, and shall be laid tight and secured to prevent movement.

(b) On buildings or structures not adaptable to temporary floors, and where scaffolds are not used, each employee exposed to a potential fall distance exceeding two stories or thirty feet shall have a personal fall arrest system or safety nets shall be installed and maintained. The nets shall be hung with sufficient clearance to prevent contacts with the surface or structures below.

(c) Floor periphery - safety railing.

A safety railing of one-quarter-inch wire rope or equal shall be installed, approximately forty-two inches high, around the periphery of all temporary-planked or temporary-metal-decked floors of tier buildings and other multi-floored structures during structural steel assembly.

(d) Where skeleton steel erection is being done, a tightly planked and substantial floor shall be maintained within two stories or thirty feet, whichever is less.

(e) When gathering and stacking temporary floor planks from the last panel, the employees assigned to such work shall be protected by a safety ~~belts or~~ harness with safety lines attached to the structure.

(3) Flooring - other construction.

(a) In the erection of a building having double wood floor construction, the rough flooring shall be completed as the building progresses, including the tier below the one on which floor joists are being installed.

(b) For single wood floor or other flooring systems, the floor immediately below the story where the floor joists are being installed shall be kept planked or decked over.

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(D) Structural steel assembly.

- (1) During the final placing of solid web structural members, the load shall not be released from the hoisting line until the members are secured with no less than two bolts, or the equivalent, at each connection, and drawn up wrench tight.
- (2) Open web steel joists shall not be placed on any structural steel framework unless such framework is securely bolted or welded.
- (3) In steel framing, where bar joists are utilized, and columns are not framed in at least two directions with structural steel members, bar joists shall be field-bolted at columns to provide lateral stability during construction.
- (4) Where longspan joists or trusses, sixty feet or longer, are used, a row or rows of bolted bridging shall be installed to provide lateral stability during construction prior to slacking of hoisting line.
- (5) No load shall be placed on open web steel joists until they are permanently anchored.
- (6) Tag lines shall be used for controlling loads.

(E) Bolting, riveting, fitting-up and plumbing-up.

(1) General requirements.

- (a) Containers shall be provided for storing or carrying rivets, bolts, and drift pins, and secured against accidental displacement when aloft.
- (b) Before any adjustments or repairs are made on pneumatic hand tools, the pressure in hose lines shall be released and the tool shall be disconnected from the power source.
- (c) Air hose couplings shall be linked together at each joint by a chain or other device or method to reduce whipping in the event of accidental disconnect.

(2) Bolting.

- (a) When bolts or drift pins are being knocked out, means shall be provided to keep them from falling.
- (b) Impact wrenches shall be provided with a locking device for retaining the socket.

(3) Riveting.

- (a) When rivet heads are knocked off, or backed out, means shall be provided to keep them from falling.
- (b) A safety wire shall be properly installed on the snap and on the handle of the pneumatic riveting hammer. The wire size shall be no less than "No. 9 (B&S Gauge)", leaving the handle and annealed "No. 14" on the snap or equivalent.

(4) Plumbing-up.

- (a) Connections of the equipment used in plumbing-up shall be properly secured.
- (b) Plumbing-up guys related equipment shall be placed so that employees can get at the connection points.

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- (5) Planking shall be of proper thickness and width to carry the intended working load and shall provide a factor of safety of no less than four.
- (6) Metal decking of sufficient strength shall be laid tight and secured to prevent movement.
- (7) Planks shall overlap the bearing on each end by no less than twelve inches.
- (8) Wire mesh, exterior plywood, or equivalent, shall be used around columns where planks do not fit tightly.
- (9) Provisions shall be made to secure temporary flooring against displacement.
- (10) All unused openings in floors, temporary or permanent, shall be completely planked over or guarded.
- (11) Employees shall be provided with a safety ~~belts or~~ harness and lifelines, securely fastened to a permanent part of the structure, when they are working on float scaffolds.

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Amend

4123:1-3-21 Diving operations.

(A) Reserved.

(B) Reserved.

(C) Diving procedures.

(1) Supervision.

A diver, lead diver, or dive supervisor, hereafter referred to only as 'supervisor', shall be designated and shall be in charge of all diving operations.

(2) Timekeeper.

One member selected from within the crew shall be designated and instructed by the supervisor to perform the duties of timekeeper for each dive.

(3) Activities of others.

All parties whose activities in the area could create a hazard to the diving operations shall be so notified by the supervisor and be kept informed when such operations commence and when they are concluded.

(D) Personnel.

All diving personnel shall be properly qualified physically and by training or experience to safely conduct a diving operation.

(1) Diver physical condition.

Divers suffering from severe colds, sinus infections, ear trouble, alcoholic intoxication or its after-effects, acute illness or under the influence of drugs shall not be required to dive.

(a) Frequency of examination.

All diving personnel must undergo a thorough physical examination prior to initial exposure to hyperbaric conditions. Subsequent to initial exam, all diving personnel shall be re-examined at twelve-month intervals.

(b) Physician statement.

A statement is to be provided to the diver's employer certifying the diver's physical qualification or lack of qualification to engage in diving activities. The statement is to include the name of the diver, date and location of the examination, name of examining physician, address of location at which the medical record is stored, and the qualification or disqualification of the diver.

(2) Diver equipment.

Divers shall only use equipment with which they have been thoroughly trained.

(E) Equipment.

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(1) Responsibility.

The employer shall be responsible for furnishing all safety equipment. Where divers provide their own protective equipment, such equipment shall give equal or greater protection than that furnished by the employer.

(2) Operating conditions.

All equipment used in diving operations shall be in proper operating condition and thoroughly tested, under the supervision of the diving supervisor, prior to use.

(3) Gas supply.

There shall be both a primary and a secondary source of compressed air for each dive.

(4) Protection of hoses.

All hoses leading to and from the diver's life support which are exposed to potential damage as a result of falling objects, personnel, traffic, etc., shall be protected.

(5) Decompression chambers.

- (a) For any dives in excess of one hundred feet of water requiring stage decompression a decompression chamber and a qualified attendant shall be available at the job site.
- (b) The decompression chamber shall be located to provide easy access and allow for recompression to the required depth within a maximum of five minutes unless the decompression schedule in use requires a shorter surface interval.
- (c) A single lock chamber shall not be used.

(F) Procedures during dive.

(1) Water entry and exit.

- (a) A means capable of supporting the diver shall be provided for entering and exiting the water.
- (b) The means provided for exiting the water shall extend below the water surface.
- (c) A means shall be provided to assist an injured diver from the water or into a bell.

(2) In the absence of a physician, an employee who has a valid certificate in first aid training, including training in oxygen resuscitation equipment, shall be available at the job site at all times.

(3) The diver's hose shall be attached to a safety harness and not the weight belt except on deep-sea gear.

(4) The diver shall carry a sharp knife as a standard piece of diving equipment.

(G) Surface-supplied diving operations.

(1) Topside jobsite.

- (a) Warning signals, such as an international "A" flag, shall be displayed during diving operations.

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- (b) All diving compressors must be situated so that exhaust fumes or other harmful contaminants do not enter the compressor intake.
- (c) An accurate method of determining the depth of each dive must be provided.
- (d) Divers shall not be required to dive if work is being performed by other personnel overhead where such overhead work creates a hazard to the diver.
- (e) A [diving safety manual that cover all diving operations, emergency care, recompression and a set of appropriate decompression tables](#) shall be available at the diving site. ~~(For examples, see appendix to this rule).~~
- (f) At the job site there shall be a list of telephone numbers and locations for: nearest decompression chamber, medical doctor, and transportation.
- (g) A propeller guard shall be installed on all craft used in all liveboating operations.
- (h) Voice communications shall be provided between the dive tender and the boat operator.

(2) Underwater jobsite.

- (a) A diver's bottom time, or the "residual nitrogen time", from repetitive dives must not exceed ~~"O" group limit as shown in the appendix to this rule. If a diver becomes an "O" group diver twice in a twelve hour period, he shall not be permitted to dive again for twelve hours. (See the appendix to this rule for tables)~~ [exceed those limits spelled out in the employers diving safety manual that cover all diving operations, emergency care, recompression. A dive performed within twelve hours of surfacing from a previous dive is a repetitive dive. The period between dives is the surface interval. Excess nitrogen requires twelve hours to be effectively lost from the body, as referenced in appropriate decompression tables.](#)
- (b) A diver shall wear a bail-out bottle during all liveboating operations (boat underway).
- (c) Prior to all lifting operations a signal system shall be established and reviewed with all personnel involved with the dive.

(3) Standby diver.

- (a) A standby diver must be ready to reach the primary diver when the operation involves dives in excess of one hundred feet, any dive requiring stage decompression, or during any operation where the primary diver cannot surface by straight ascent. When two divers are in the water working together, they can be considered as standing by for each other if one can reach the other within three minutes.
- (b) The standby diver is required to tend the primary diver at the point of entry into wrecks, tunnels, etc.

(H) Self-contained diving (scuba).

(1) Basic in-water requirements.

Scuba procedures may only be used in situations in which one of the following techniques is provided:

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- (a) A "buddy" system, i.e. two divers in the water maintaining constant visual or physical contact with each other; or
- (b) Voice communications between the scuba diver and the surface and if wireless communications are used, a locating means must be provided; or
- (c) A safety line between the diver and a surface tender which provides a means of communications through the use of pull signals on the safety line.

(2) Equipment.

- (a) Equipment shall be the open circuit, demand regulator type with a valid interstate commerce commission (ICC) stamp on the air tank.
- (b) Both tank and weight belt shall be equipped with quick release buckles.
- (c) A knife and safety vest are required to be used.

(I) Emergency procedures.

Emergency procedures shall be established to provide for ~~such of~~ the following circumstances as may be applicable and shall be reviewed by the diver and the surface support crew before the dive:

- (1) Loss of voice communications in the water or in the chamber;
- (2) Interruption of the surface gas supply;
- (3) Severance of the diver's hose bundle;
- (4) Entanglement or entrapment;
- (5) Occurrence of oxygen poisoning;
- (6) Occurrence of decompression sickness;
- (7) Occurrence of unplanned buoyant ascent.

(J) Underwater cutting and welding.

(1) Disconnect switch.

A disconnect switch shall be used in the electrical circuit and shall be located in such a position that the diving tender on the intercommunication system can operate or oversee its operation at all times when the diver is below the surface. The disconnect switch shall be in the open position except when the diver is actually cutting or welding.

(2) Insulated gloves.

Rubber or other insulated gloves shall be provided and shall be used by the diver during underwater electric cutting and welding operations.

(K) Record keeping - diving operations.

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An individual record or log entry for each diving exposure including the following data is to be maintained:

- (1) Location;
- (2) Divers, tenders' and supervisor's names;
- (3) Water depth;
- (4) Bottom time;
- (5) Type of equipment used;
- (6) Estimated environmental conditions;
- (7) Decompression schedule used;
- (8) Gas used and composition;
- (9) Type of work performed;
- (10) Unusual conditions; and
- (11) Repetitive dive designations or time of last exposure.

[\(12\) Record of hospitalizations.](#)

[\(13\) Safe practices manuals.](#)

(L) Hose and fittings.

(1) Testing and replacement.

- (a) Hose and fittings shall be tested at least once a year to one and one-half times their maximum working pressure. If exposed to rough usage or unusual conditions it shall be inspected more frequently.
- (b) Hose showing abrasion of outer cover which exposes the reinforcement, shall be replaced.
- (c) Couplings that are distorted, have damaged threads, or show an excessive amount of corrosion shall be replaced.
- (d) Hose which has sustained other damage must be pressure tested to one and one-half times the maximum working pressure plus one hundred pounds per square inch, prior to use.
- (e) Records shall be kept of all pressure tests and the test dates; and they shall be signed by the individual responsible for each of them.

(2) Marking.

Each hose section shall be given a serial number for record keeping purposes.

(3) Fittings.

Connections shall be of a type that cannot be accidentally disengaged from the gas supply.

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(4) Oxygen piping.

Hard piping systems, fittings and tubings carrying pure, high pressure (up to two thousand five hundred pounds per square inch) oxygen shall be of corrosion resistant metals, such as copper, brass, "300" series stainless steel or monel.

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Rescind

~~APPENDIX TO RULE 4123: 1-3-21~~

~~Taken from~~

~~**U.S. Navy Diving Manual**~~

~~Prepared by~~

~~**National Association of Underwater Instructors**~~

~~Table 1-9. Decompression procedures~~

~~General Instructions for Air Diving
Need for Decompression~~

~~A quantity of nitrogen is taken up by the body during every dive. The amount absorbed depends upon the depth of the dive and the exposure (bottom) time. If the quantity of nitrogen dissolved in the body tissues exceeds a certain critical amount, the ascent must be delayed to allow the body tissue to remove the excess nitrogen. Decompression sickness results from failure to delay the ascent and to allow this process of gradual desaturation. A specified time at a specific depth for purposes of desaturation is called a decompression stop.~~

~~*No-Decompression Schedules*~~

~~Dives that are not long or deep enough to require decompression stops are no-decompression dives. Dives to 33 feet or less do not require decompression stops. As the depth increases, the allowable bottom time for no-decompression dives decreases. Five minutes at 190 feet is the deepest no-decompression schedule. These dives are all listed in the No-Decompression Limits and Repetitive Group Designation Table for No-Decompression Dives (No-Decompression Table (table 1-11)), and only require compliance with the 60-foot-per-minute rate of ascent.~~

~~*Schedules That Require Decompression Stops*~~

~~All dives beyond the limits of the No-Decompression Table require decompression stops. These dives are listed in the Navy Standard Air Decompression Table (table 1-10). Comply exactly with instructions except as modified by surface decompression procedures.~~

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~~*Variations in Rate of Ascent*~~

~~Ascend from all dives at the rate of 60 feet per minute.
In the event you are unable to maintain the 60-foot-per-minute rate of ascent:~~

- ~~(a) If the delay was at a depth greater than 50 feet: increase the bottom time by the difference between the time used in ascent and the time that should have been used at a rate of 60 feet per minute. Decompress according to the requirements of the new total bottom time.~~
- ~~(b) If the delay was at a depth less than 50 feet: increase the first stop by the difference between the time used in ascent and the time that should have been used at the rate of 60 feet per minute.~~

~~*Repetitive Dive Procedure*~~

~~A dive performed within 12 hours of surfacing from a previous dive is a repetitive dive. The period between dives is the surface interval. Excess nitrogen requires 12 hours to be effectively lost from the body. These tables are designed to protect the diver from the effects of this residual nitrogen. Allow a minimum surface interval of 10 minutes between all dives. For any interval under 10 minutes, add the bottom time of the previous dives to that of the repetitive dive and choose the decompression schedule for the total bottom time and the deepest dive. Specific instructions are given for the use of each table in the following order:~~

- ~~(1) The *No-Decompression Table* or the *Navy Standard Air Decompression Table* gives the repetitive group designation for all schedules which may precede a repetitive dive.~~
- ~~(2) The *Surface Interval Credit Table* gives credit for the desaturation occurring during the surface interval.~~
- ~~(3) The *Repetitive Dive Timetable* gives the number of minutes of residual nitrogen time to add to the actual bottom time of the repetitive dive to obtain decompression for the residual nitrogen.~~
- ~~(4) The *No-Decompression Table* or the *Navy Standard Air Decompression Table* gives the decompression required for the repetitive dive.~~

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~~U.S. Navy Standard Air Decompression Table Instructions for Use~~

~~Time of decompression stops in the table is in minutes.~~

~~Enter the table at the exact or the next greater depth than the maximum depth attained during the dive. Select the listed bottom time that is exactly equal to or is next greater than the bottom time of the dive. Maintain the diver's chest as close as possible to each decompression depth for the number of minutes listed. The rate of ascent *between* stops is not critical for stops of 50 feet or less. Commence timing each stop on arrival at the decompression depth and resume ascent when the specified time has lapsed.~~

~~For example a dive to 82 feet for 36 minutes. To determine the proper decompression procedure: The next greater depth listed in this table is 90 feet. The next greater bottom time listed opposite 90 feet is 40. Stop 7 minutes at 10 feet in accordance with the 90/40 schedule.~~

~~For example a dive to 100 feet for 30 minutes. It is known that the depth did not exceed 110 feet. To determine the proper decompression schedule: The exact depth of 110 feet is listed. The exact bottom time of 30 minutes is listed opposite 110 feet. Decompress according to the 110/30 schedule unless the dive was particularly cold or arduous. In that case, go to the schedule for the next deeper and longer dive, i.e., 120/40.~~

~~NOTES ON DECOMPRESSION AND REPETITIVE DIVING PREPARED BY NAUI~~

~~Decompression Sickness~~

- ~~1. All scuba divers should know the cause, symptoms, treatment, and prevention of decompression sickness, plus have available the telephone number, location and method of transportation to the nearest chamber. Call ahead to the chamber to be sure it is operational.~~
- ~~2. Factors which increase the likelihood of decompression sickness are: Extreme water temperatures, dehydration, age, obesity, poor physical condition, fatigue, alcoholic indulgence, old injuries which cause poor circulation, and heavy work during the dive.~~
- ~~3. The most frequent errors related to the treatment of decompression sickness are the failure: To report symptoms or signs early, to treat doubtful cases, to treat promptly, to~~

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~~treat adequately, to recognize serious symptoms, and to keep the patient near the chamber after treatment.~~

~~Decompression Tables~~

- ~~4. There is no safety factor built into the U.S. Navy Standard Air Decompression Table.~~
- ~~5. A "no decompression dive" is a dive which requires no decompression stops; it still causes nitrogen to go into solution within the body. This nitrogen must be taken into account as residual nitrogen in repetitive diving. The ascent rate of 60 feet per minute is a form of decompression.~~
- ~~6. Bottom time starts when the diver leaves the surface and ends only when the diver starts a direct ascent back to the surface.~~
- ~~7. If a dive was particularly cold or arduous, or the depth/time determination may be inaccurate, or some factor increases the likelihood of decompression sickness, decompress for the next deeper and longer dive.~~
- ~~8. After diving, do not fly for 12 hours, or, if you must fly, use the tables for altitude diving (see Skin Diver Magazine, November 1970).~~
- ~~9. An exception to the tables occurs when a repetitive dive is to the same or greater depth than the previous dive and the surface interval is short enough that the residual nitrogen time from Table 11-13 is greater than the actual bottom time of the previous dive. In this case, add the actual bottom time of the previous dive to the actual bottom time of the repetitive dive and decompress for the total bottom time and deepest dive.~~
- ~~10. Plan repetitive dives so that each successive dive is to a lesser depth. This will aid in the elimination of nitrogen and decrease the need for decompression stops. Always keep surface intervals as long as possible.~~
- ~~11. Plan your dive and dive your plan; always having an alternate plan if the actual depth and/or time of the dive is greater than planned.~~

~~Reasons for Repetitive Dive Planning~~

- ~~12. To avoid decompression stops:
 - ~~a. Be able to use tables to compute maximum time of a repetitive dive without decompression stops.~~~~

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- ~~b. Be able to use tables to compute minimum surface interval needed to avoid decompression stops.~~
- ~~13. To stay within a particular decompression schedule or repetitive group.~~
- ~~14. To dive maximum depth or time on limited air.~~
- ~~15. To make minimum decompression stops.~~
- ~~16. To make the dive and take whatever decompression stops are required.~~

EMERGENCY INFORMATION AND NUMBERS

USCG: Telephone **Radio**

POLICE: State **County** **City**

FIRE DEPARTMENT **AMBULANCE** **HARBOR PATROL**

~~CHAMBERS.~~

1. **Location** **Day** **Night**

2. **Location** **Day** **Night**

M.D. QUALIFIED IN UNDERWATER MEDICINE:

Name **Day** **Night**

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Table 1-10.—*U.S. Navy Standard Air Decompression Table*

Depth (feet)	Bottom Time (min)	Time to first stop (min: sec)	Decompression stops (feet)					Total ascent (min: sec)	Repetitive group
			50	40	30	20	10		
40	200						0	0:40	(*)
	210	0:30					2	2:40	N
	230	0:30					7	7:40	N
	250	0:30					11	11:40	O
	270	0:30					15	15:40	O
	300	0:30					19	19:40	Z
50	100						0	0:50	(*)
	110	0:40					3	3:50	L
	120	0:40					5	5:50	M
	140	0:40					10	10:50	M
	160	0:40					21	21:50	N
	180	0:40					29	29:50	O
	200	0:40					35	35:50	O
	220	0:40					40	40:50	Z
60	240	0:40					47	47:50	Z
	60						0	1:00	(*)
	70	0:50					2	3:00	K
	80	0:50					7	8:00	L
	100	0:50					14	15:00	M
	120	0:50					26	27:00	N
	140	0:50					39	40:00	O
	160	0:50					48	49:00	Z
70	180	0:50					56	57:00	Z
	200	0:40				1	69	71:00	Z
	50						0	1:10	(*)
	60	1:00					8	9:10	K
	70	1:00					14	15:10	L
	80	1:00					18	19:10	M
	90	1:00					23	24:10	N
	100	1:00					33	34:10	N
80	110	0:50				2	41	44:10	O
	120	0:50				4	47	52:10	O
	130	0:50				6	52	59:10	O
	140	0:50				8	56	65:10	Z
	150	0:50				9	61	71:10	Z
	160	0:50				13	72	86:10	Z
	170	0:50				19	79	99:10	Z
	40						0	1:20	(*)
	50	1:10					10	11:20	K
	60	1:10					17	18:20	L
90	70	1:10					23	24:20	M
	80	1:00				2	31	34:20	N
	90	1:00				7	39	47:20	N
	100	1:00				11	46	58:20	O
	110	1:00				13	53	67:20	O
	120	1:00				17	56	74:20	Z
	130	1:00				19	63	83:20	Z
	140	1:00				26	69	96:20	Z
	150	1:00				32	77	110:20	Z
	30						0	1:30	(*)
90	40	1:20					7	8:30	J
	50	1:20					18	19:30	L
	60	1:20					25	26:30	M
	70	1:10				7	30	38:30	N
	80	1:10				13	40	54:30	N
	90	1:10				18	48	67:30	O
	100	1:10				21	54	76:30	Z

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Table 1-10.—U.S. Navy Standard Air Decompression Table—Continued

Depth (feet)	Bottom Time (min)	Time to first stop (min: sec)	Decompression stops (feet)					Total ascent (min: sec)	Repetitive group
			50	40	30	20	10		
100	110	1:10				24	61	86:30	Z
	120	1:10				32	68	101:30	Z
	130	1:00			5	36	74	116:30	Z
	25						0	1:40	(*)
	30	1:30					3	4:40	I
	40	1:30					15	16:40	K
	50	1:20				2	24	27:40	L
	60	1:20				9	28	38:40	N
	70	1:20				17	39	57:40	O
	80	1:20				23	48	72:40	O
110	90	1:10			3	23	57	84:40	Z
	100	1:10			7	23	66	97:40	Z
	110	1:10			10	34	72	117:40	Z
	120	1:10			12	41	78	132:40	Z
	20						0	1:50	(*)
	25	1:40					3	4:50	H
	30	1:40					7	8:50	J
	40	1:30				2	21	24:50	L
	50	1:30				8	26	35:50	M
	60	1:30				18	36	55:50	N
120	70	1:20			1	23	48	73:50	O
	80	1:20			7	23	57	88:50	Z
	90	1:20			12	30	64	107:50	Z
	100	1:20			15	37	72	125:50	Z
	15						0	2:00	(*)
	20	1:50					2	4:00	H
	25	1:50					6	8:00	I
	30	1:50					14	16:00	J
	40	1:40				5	25	32:00	L
	50	1:40				15	31	48:00	N
130	60	1:30			2	22	45	71:00	O
	70	1:30			9	23	55	89:00	O
	80	1:30			15	27	63	107:00	Z
	90	1:30			19	37	74	132:00	Z
	100	1:30			23	45	80	150:00	Z
	10						0	2:10	(*)
	15	2:00					1	3:10	F
	20	2:00					4	6:10	H
	25	2:00					10	12:10	J
	30	1:50				3	18	23:10	M
140	40	1:50				10	25	37:10	N
	50	1:40			3	21	37	63:10	O
	60	1:40			9	23	52	86:10	Z
	70	1:40			16	24	61	103:10	Z
	80	1:30		3	19	35	72	131:10	Z
	90	1:30		8	19	45	80	154:10	Z
	10						0	2:20	(*)
	15	2:10					2	4:20	G
	20	2:10					6	8:20	I
	25	2:00				2	14	18:20	J
150	30	2:00				5	21	28:20	K
	40	1:50			2	16	26	46:20	N
	50	1:50			6	24	44	76:20	O
	60	1:50			16	23	56	97:20	Z
	70	1:40		4	19	32	68	125:20	Z
	80	1:40		10	23	41	79	155:20	Z
	5						0	2:30	C

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Table 1-10.—*U.S. Navy Standard Air Decompression Table*—Continued

Depth (feet)	Bottom Time (min)	Time to first stop (min: sec)	Decompression stops (feet)					Total ascent (min: sec)	Repetitive group	
			50	40	30	20	10			
160	10	2:20	1	3:30	E	
	15	2:20	3	5:30	G	
	20	2:10	2	7	11:30	H	
	25	2:10	4	17	23:30	K	
	30	2:10	8	24	34:30	L	
	40	2:00	5	19	33	59:30	N	
	50	2:00	12	23	51	88:30	O	
	60	1:50	3	19	26	62	112:30	Z	
	70	1:50	11	19	39	75	146:30	Z	
	80	1:40	1	17	19	50	84	173:30	Z
	5	0	2:40	D	
	10	2:30	1	3:40	F	
	15	2:20	1	4	7:40	H	
	20	2:20	3	11	16:40	J	
25	2:20	.....	.....	.....	7	20	29:40	K
30	2:10	.....	.....	2	11	25	40:40	M
40	2:10	.....	.....	7	23	39	71:40	N
50	2:00	.....	2	16	23	55	98:40	Z	
60	2:00	.....	9	19	33	69	132:40	Z	
70	1:50	1	17	22	44	80	166:40	Z	
170	5	.....	.....	.....	.....	0	2:50	D
10	2:40	.....	.....	.....	.....	2	4:50	F
15	2:30	.....	.....	.....	2	5	9:50	H
20	2:30	.....	.....	.....	4	15	21:50	J
25	2:20	.....	.....	2	7	23	34:50	L
30	2:20	.....	.....	4	13	26	45:50	M
40	2:10	.....	1	10	23	45	81:50	O	
50	2:10	.....	5	18	23	61	109:50	Z	
60	2:00	2	15	22	37	74	152:50	Z	
70	2:00	8	17	19	51	86	183:50	Z	
180	5	.....	.....	.....	.....	0	3:00	D
10	2:50	.....	.....	.....	.....	3	6:00	F
15	2:40	.....	.....	.....	3	6	12:00	I
20	2:30	.....	.....	1	5	17	26:00	K
25	2:30	.....	.....	3	10	24	40:00	L
30	2:30	.....	.....	6	17	27	53:00	N
40	2:20	.....	3	14	23	50	93:00	O	
50	2:10	2	9	19	30	65	128:00	Z	
60	2:10	5	16	19	44	81	168:00	Z	
190	5	.....	.....	.....	.....	0	3:10	D
10	2:50	.....	.....	.....	1	3	7:10	G
15	2:50	.....	.....	.....	4	7	14:10	I
20	2:40	.....	.....	2	6	20	31:10	K
25	2:40	.....	.....	5	11	25	44:10	M
30	2:30	1	8	19	32	63:10	N	
40	2:30	8	14	23	55	103:10	O	
50	2:20	4	13	22	33	72	147:10	Z	
60	2:20	10	17	19	50	84	183:10	Z	

*See table 1-11 for repetitive groups in no-decompression dives.

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Table 1-11.—*No-decompression limits and repetitive group designation table for no-decompression air dives*

Depth (feet)	No-decompression limits (min)	Repetitive groups (air dives)														
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
10	.....	60	120	210	300	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	.....	35	70	110	160	225	350	.....	.....	.....	.....	.....	.....	.....	.....	.....
20	.....	25	50	75	100	135	180	240	325	.....	.....	.....	.....	.....	.....	.....
25	.....	20	35	55	75	100	125	160	195	245	315	.....	.....	.....	.....	.....
30	.....	15	30	45	60	75	95	120	145	170	205	250	310	.....	.....	.....
35	310	5	15	25	40	50	60	80	100	120	140	160	190	220	270	310
40	200	5	15	25	30	40	50	70	80	100	110	130	150	170	200	.....
50	100	.....	10	15	25	30	40	50	60	70	80	90	100	.....	.....	.....
60	60	.....	10	15	20	25	30	40	50	55	60	.....	.....	.....	.....	.....
70	50	.....	5	10	15	20	30	35	40	45	50	.....	.....	.....	.....	.....
80	40	.....	5	10	15	20	25	30	35	40	.....	.....	.....	.....	.....	.....
90	30	.....	5	10	12	15	20	25	30	.....	.....	.....	.....	.....	.....	.....
100	25	.....	5	7	10	15	20	22	25	.....	.....	.....	.....	.....	.....	.....
110	20	.....	.....	5	10	13	15	20	.....	.....	.....	.....	.....	.....	.....	.....
120	15	.....	.....	5	10	12	15	.....	.....	.....	.....	.....	.....	.....	.....	.....
130	10	.....	.....	5	8	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
140	10	.....	.....	5	7	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
150	5	.....	.....	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
160	5	.....	.....	.....	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
170	5	.....	.....	.....	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
180	5	.....	.....	.....	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
190	5	.....	.....	.....	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Instructions for Use

~~I. — No-decompression limits:~~

~~This column shows at various depths greater than 30 feet the allowable diving times (in minutes) which permit surfacing directly at 60 feet a minute with no decompression stops. Longer exposure times require the use of the Standard Air Decompression Table (table 1-10).~~

~~II. — Repetitive group designation table:~~

~~The tabulated exposure times (or bottom times) are in minutes. The times at the various depths in each vertical column are the maximum exposures during which a diver will remain within the group listed at the head of the column.~~

~~To find the repetitive group designation at surfacing for dives involving exposures up to and including the no-~~

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~~decompression limits: Enter the table on the exact or next greater depth than that to which exposed and select the listed exposure time exact or next greater than the actual exposure time. The repetitive group designation is indicated by the letter at the head of the vertical column where the selected exposure time is listed.~~

~~For example: A dive was to 32 feet for 45 minutes. Enter the table along the 35-foot depth line since it is next greater than 32 feet. The table shows that since group D is left after 40 minutes' exposure and group E after 50 minutes, group E (at the head of the column where the 50-minute exposure is listed) is the proper selection.~~

~~Exposure times for depths less than 40 feet are listed only up to approximately 5 hours since this is considered to be beyond field requirements for this table.~~

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Table 1-12.—*Surface Interval Credit Table for air decompression dives*
[Repetitive group at the end of the surface interval (air dive)]

Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
0:10	0:23	0:35	0:49	1:03	1:19	1:37	1:56	2:18	2:43	3:11	3:46	4:30	5:28	6:57	10:00
0:22	0:34	0:48	1:02	1:18	1:36	1:55	2:17	2:42	3:10	3:45	4:29	5:27	6:56	10:05	12:00*
O	0:10	0:24	0:37	0:52	1:08	1:25	1:44	2:05	2:30	3:00	3:34	4:18	5:17	6:45	9:55
	0:23	0:36	0:51	1:07	1:24	1:43	2:04	2:29	2:59	3:33	4:17	5:16	6:44	9:54	12:00*
	N	0:10	0:25	0:40	0:55	1:12	1:31	1:54	2:19	2:48	3:23	4:05	5:04	6:33	9:44
		0:24	0:39	0:54	1:11	1:30	1:53	2:18	2:47	3:22	4:04	5:03	6:32	9:43	12:00*
		M	0:10	0:26	0:43	1:00	1:19	1:40	2:06	2:35	3:09	3:53	4:50	6:19	9:29
			0:25	0:42	0:59	1:18	1:39	2:05	2:34	3:08	3:52	4:49	6:18	9:28	12:00*
			L	0:10	0:27	0:46	1:05	1:26	1:50	2:20	2:54	3:37	4:36	6:03	9:13
				0:26	0:45	1:04	1:25	1:49	2:19	2:53	3:36	4:35	6:02	9:12	12:00*
				K	0:10	0:29	0:50	1:12	1:36	2:04	2:39	3:22	4:20	5:49	8:59
					0:28	0:49	1:11	1:35	2:03	2:38	3:21	4:19	5:48	8:58	12:00*
					J	0:10	0:32	0:55	1:20	1:48	2:21	3:05	4:03	5:41	8:41
						0:31	0:54	1:19	1:47	2:20	3:04	4:02	5:40	8:40	12:00*
						I	0:10	0:34	1:00	1:30	2:03	2:45	3:44	5:13	8:22
							0:33	0:59	1:29	2:02	2:44	3:43	5:12	8:21	12:00*
							H	0:10	0:37	1:07	1:42	2:24	3:21	4:50	8:00
								0:36	1:06	1:41	2:23	3:20	4:49	7:59	12:00*
								G	0:10	0:41	1:16	2:00	2:59	4:26	7:36
									0:40	1:15	1:59	2:58	4:25	7:35	12:00*
									F	0:10	0:46	1:30	2:29	3:58	7:06
										0:45	1:29	2:28	3:57	7:05	12:00*
										E	0:10	0:55	1:58	3:23	6:33
											0:54	1:57	3:22	6:32	12:00*
											D	0:10	1:10	2:39	5:49
												1:09	2:38	5:48	12:00*
												C	0:10	1:40	2:50
													1:39	2:49	12:00*
													B	0:10	2:11
														2:10	12:00*
														A	0:10
															12:00*

Instructions for Use

Surface interval time in the table is in hours and minutes (7:59 means 7 hours and 59 minutes). The surface interval must be at least 10 minutes.

Find the repetitive group designation letter (from the previous dive schedule) on the diagonal slope. Enter the table horizontally to select the surface interval time that is exactly between the actual surface interval times shown. The repetitive group designation for the end of the surface interval is at the head of the vertical column where

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~~the selected surface interval time is listed. For example, a previous dive was to 110 feet for 30 minutes. The diver remains on the surface 1 hour and 30 minutes and wishes to find the new repetitive group designation: The repetitive group from the last column of the 110/30 schedule in the Standard Air Decompression Tables is "J." Enter the surface interval credit table along the horizontal line labeled "J." The 1 hour and 30 minute surface interval lies between the times 1:20 and 1:47. Therefore, the diver has lost sufficient inert gas to place him in group "G" (at the head of the vertical column selected).~~

~~"Note.—Dives following surface intervals of more than 12 hours are not considered repetitive dives. Actual bottom times in the Standard Air Decompression Tables may be used in computing decompression for such dives.~~

TABLE 1-13.—*Repetitive dive timetable for air dives*

Repetitive groups	Repetitive dive depth (ft) (air dives)															
	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190
A	7	6	5	4	4	3	3	3	3	3	2	2	2	2	2	2
B	17	13	11	9	8	7	7	6	6	6	5	5	4	4	4	4
C	25	21	17	15	13	11	10	10	9	8	7	7	6	6	6	6
D	37	29	24	20	18	16	14	13	12	11	10	9	9	8	8	8
E	49	38	30	26	23	20	18	16	15	13	12	12	11	10	10	10
F	61	47	36	31	28	24	22	20	18	16	15	14	13	13	12	11
G	73	56	44	37	32	29	26	24	21	19	18	17	16	15	14	13
H	87	66	52	43	38	33	30	27	25	22	20	19	18	17	16	15
I	101	76	61	50	43	38	34	31	28	25	23	22	20	19	18	17
J	116	87	70	57	48	43	38	34	32	28	26	24	23	22	20	19
K	138	99	79	64	54	47	43	38	35	31	29	27	26	24	22	21
L	161	111	88	72	61	53	48	42	39	35	32	30	28	26	25	24
M	187	124	97	80	68	58	52	47	43	38	35	32	31	29	27	26
N	213	142	107	87	73	64	57	51	46	40	38	35	33	31	29	28
O	241	160	117	96	80	70	62	55	50	44	40	38	36	34	31	30
Z	257	169	122	100	84	73	64	57	52	46	42	40	37	35	32	31

Instructions for Use

~~The bottom times listed in this table are called "residual nitrogen times" and are the times a diver is to consider he has already spent on bottom when he starts a repetitive dive to a specific depth. They are in minutes.~~

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~~Enter the table horizontally with the repetitive group designation from the Surface Interval Credit Table. The time in each vertical column is the number of minutes that would be required (at the depth listed at the head of the column) to saturate to the particular group. For example: The final group designation from the Surface Interval Credit Table, on the basis of a previous dive and surface interval, is "H." To plan a dive to 110 feet, determine the residual nitrogen time for this depth required by the repetitive group designation: Enter this table along the horizontal line labeled "H." The table shows that one must start a dive to 110 feet as though he had already been on the bottom for 27 minutes. This information can then be applied to the Standard Air Decompression Table or No-Decompression Table in a number of ways:~~

- ~~(1) Assuming a diver is going to finish a job and take whatever decompression is required, he must add 27 minutes to his actual bottom time and be prepared to take decompression according to the 110-foot schedules for the sum or equivalent single dive time.~~

- ~~(2) Assuming one wishes to make a quick inspection dive for the minimum decompression, he will decompress according to the 110/30 schedule for a dive of 3 minutes or less ($27 + 3 = 30$). For a dive of over 3 minutes but less than 13, he will decompress according to the 110/40 schedule ($27 + 13 = 40$).~~

- ~~(3) Assuming that one does not want to exceed the 110/50 schedule and the amount of decompression it requires, he will have to start ascent before 23 minutes of actual bottom time ($50 - 27 = 23$).~~

- ~~(4) Assuming that a diver has air for approximately 45 minutes bottom time and decompression stops, the possible dives can be computed: A dive of 13 minutes will require 23 minutes of decompression (110/40 schedule), for a total submerged time of 36 minutes. A dive of 13 to 23 minutes will require 34 minutes of decompression (110/50 schedule), for a total submerged time of 47 to 57 minutes. Therefore, to be safe, the diver will have to start ascent before 13 minutes or a standby air source will have to be provided.~~

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A NU-WAY TO USE THE U.S. NAVY REPETITIVE DIVE TABLES

TABLE 1-12 (1-7) SURFACE INTERVAL CREDIT TABLE

12:00 0:10	12:00 2:11	12:00 2:50	12:00 5:49	12:00 6:33	12:00 7:06	12:00 7:36	12:00 8:00	12:00 8:22	12:00 8:41	12:00 8:59	12:00 9:13	12:00 9:29	12:00 9:44	12:00 9:55	12:00 10:06
A	2:10 0:10	2:49 1:40	5:48 2:39	6:32 3:23	7:05 3:58	7:35 4:26	7:59 4:50	8:21 5:13	8:40 5:41	8:58 5:49	9:12 6:03	9:28 6:19	9:43 6:33	9:54 6:45	10:05 6:57
	B	1:39 0:10	2:38 1:10	3:22 1:58	3:57 2:29	4:25 2:59	4:49 3:21	5:12 3:44	5:40 4:03	5:48 4:20	6:02 4:36	6:18 4:50	6:32 5:04	6:44 5:17	6:56 5:28
		C	1:09 0:10	1:57 0:55	2:28 1:30	2:58 2:00	3:20 2:24	3:43 2:45	4:02 3:05	4:19 3:22	4:35 3:37	4:49 3:53	5:03 4:05	5:16 4:18	5:27 4:30
			D	0:54 0:10	1:29 0:46	1:59 1:16	2:23 1:42	2:44 2:03	3:04 2:21	3:21 2:39	3:36 2:54	3:52 3:09	4:04 3:23	4:17 3:34	4:29 3:46
				E	0:45 0:10	1:15 0:41	1:41 1:07	2:02 1:30	2:20 1:48	2:38 2:04	2:53 2:20	3:08 2:35	3:22 2:48	3:33 3:00	3:45 3:11
					F	0:40 0:10	1:06 0:37	1:29 1:00	1:47 1:20	2:03 1:36	2:19 1:50	2:34 2:06	2:47 2:19	2:59 2:30	3:10 2:43
						G	0:36 0:10	0:59 0:34	1:19 0:55	1:35 1:12	1:49 1:26	2:05 1:40	2:18 1:54	2:29 2:05	2:42 2:18
							H	0:33 0:10	0:54 0:32	1:11 0:50	1:25 1:05	1:39 1:19	1:53 1:31	2:04 1:44	2:17 1:56
								I	0:31 0:10	0:49 0:29	1:04 0:46	1:18 1:00	1:30 1:12	1:43 1:25	1:55 1:37
									J	0:28 0:10	0:45 0:27	0:59 0:43	1:11 0:55	1:24 1:08	1:36 1:19
										K	0:26 0:10	0:42 0:26	0:54 0:40	1:07 0:52	1:18 1:03
											L	0:25 0:10	0:39 0:25	0:51 0:37	1:02 0:49
												M	0:24 0:10	0:36 0:24	0:48 0:35
													N	0:23 0:10	0:34 0:23
														O	0:22 0:10
															Z

DEPTH (FEET)	NO DECOM PRESSION LIMITS	REPETITIVE GROUPS														
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
10	—	60	120	210	300											
15	—	35	70	110	160	225	350									
20	—	25	50	75	100	135	180	240	325							
25	—	20	35	55	75	100	125	160	195	245	315					
30	—	15	30	45	60	75	95	120	145	170	205	250	310			
35	310	5	15	25	40	50	60	80	100	120	140	160	190	220	270	310
40	200	5	15	25	30	40	50	70	80	100	110	130	150	170	200	
50	100	—	10	15	25	30	40	50	60	70	80	90	100			
60	60	—	10	15	20	25	30	40	50	55	60					
70	50	—	5	10	15	20	30	35	40	45	50					
80	40	—	5	10	15	20	25	30	35	40						
90	30	—	5	10	12	15	20	25	30							
100	25	—	5	7	10	15	20	22	25							
110	20	—	—	5	10	13	15	20								
120	15	—	—	5	10	12	15									
130	10	—	—	5	8	10										
140	10	—	—	5	7	10										
150	5	—	—	5												
160	5	—	—	—	5											
170	5	—	—	—	5											
180	5	—	—	—	5											
190	5	—	—	—	5											

TABLE 1-11 (1-6) "NO DECOMPRESSION" LIMITS AND REPETITIVE GROUP DESIGNATION TABLE FOR "NO DECOMPRESSION" DIVES

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TABLE 1-13 (1-8) REPETITIVE DIVE TABLE

A	7	6	5	4	4	3	3	3	3	3	2	2	2	2	2	2
B	17	13	11	9	8	7	7	6	6	6	5	5	4	4	4	4
C	25	21	17	15	13	11	10	10	9	8	7	7	6	6	6	6
D	37	29	24	20	18	16	14	13	12	11	10	9	9	8	8	8
E	49	38	30	26	23	20	18	16	15	13	12	12	11	10	10	10
F	61	47	36	31	28	24	22	20	18	16	15	14	13	13	12	11
G	73	56	44	37	32	29	26	24	21	19	18	17	16	15	14	13
H	87	66	52	43	38	33	30	27	25	22	20	19	18	17	16	15
I	101	76	61	50	43	38	34	31	28	25	23	22	20	19	18	17
J	116	87	70	57	48	43	38	34	32	28	26	24	23	22	20	19
K	138	99	79	64	54	47	43	38	35	31	29	27	26	24	22	21
L	161	111	88	72	61	53	48	42	39	35	32	30	28	26	25	24
M	187	124	97	80	68	58	52	47	43	38	35	32	31	29	27	26
N	213	142	107	87	73	64	57	51	46	40	38	35	33	31	29	28
O	241	160	117	96	80	70	62	55	50	44	40	38	36	34	31	30
Z	257	169	122	100	84	73	64	57	52	46	42	40	37	35	32	31
NEW GROUP																
	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'	160'	170'	180'	190'
REPETITIVE DIVE DEPTH (FT)																

INSTRUCTIONS FOR USE

~~All tabulated bottom times are in minutes: all tabulated depths are in feet~~
~~Use of table 1-11~~ ~~To find the repetitive group designation at surfacing for dives involving exposures up to and including the "no decompression limits": enter table 1-11 on the exact or next greater depth than that to which exposed, and select the listed exposure time exact or next greater than the actual exposure time. The repetitive group designation is indicated by the letter at the head of the vertical column where the selected exposure time is listed.~~

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~~Use of table 1-12 — Continue the vertical motion along the straight line joining the repetitive group designation on table 1-11 to the repetitive group designation on table 1-12. Enter the table vertically to select the elapsed surface interval time. The new repetitive group designation for the surface interval is to the right of the horizontal column where the elapsed surface interval time is listed.~~

~~Use of table 1-13 — Continue the righthanded motion to enter table 1-13 on the horizontal column to the right of the new repetitive group designation. The time in each vertical column is the number of minutes that would be required (at the depth listed at the bottom of the column) to saturate to the particular group.~~

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New

APPENDIX TO RULE 4123: 1-3-21

EMERGENCY INFORMATION AND NUMBERS

USCG: Telephone **Radio**

POLICE: State **County** **City**

FIRE DEPARTMENT **AMBULANCE** **HARBOR PATROL**

CHAMBERS:

1. **Location** **Day** **Night**

2. **Location** **Day** **Night**

M.D. QUALIFIED IN UNDERWATER MEDICINE:

Name **Day** **Night**

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Table 1-12.—*Surface Interval Credit Table for air decompression dives*
[Repetitive group at the end of the surface interval (air dive)]

Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
0:10	0:23	0:35	0:49	1:03	1:19	1:37	1:56	2:18	2:43	3:11	3:46	4:30	5:28	6:57	10:00
0:22	0:34	0:48	1:02	1:18	1:36	1:55	2:17	2:42	3:10	3:45	4:29	5:27	6:56	10:05	12:00*
O	0:10	0:24	0:37	0:52	1:08	1:25	1:44	2:05	2:30	3:00	3:34	4:18	5:17	6:45	9:55
	0:23	0:36	0:51	1:07	1:24	1:43	2:04	2:29	2:59	3:33	4:17	5:16	6:44	9:54	12:00*
	N	0:10	0:25	0:40	0:55	1:12	1:31	1:54	2:19	2:48	3:23	4:05	5:04	6:33	9:44
		0:24	0:39	0:54	1:11	1:30	1:53	2:18	2:47	3:22	4:04	5:03	6:32	9:43	12:00*
		M	0:10	0:26	0:43	1:00	1:19	1:40	2:06	2:35	3:09	3:53	4:50	6:19	9:29
			0:25	0:42	0:59	1:18	1:39	2:05	2:34	3:08	3:52	4:49	6:18	9:28	12:00*
			L	0:10	0:27	0:46	1:05	1:26	1:50	2:20	2:54	3:37	4:36	6:03	9:13
				0:26	0:45	1:04	1:25	1:49	2:19	2:53	3:36	4:35	6:02	9:12	12:00*
				K	0:10	0:29	0:50	1:12	1:36	2:04	2:39	3:22	4:20	5:49	8:59
					0:28	0:49	1:11	1:35	2:03	2:38	3:21	4:19	5:48	8:58	12:00*
					J	0:10	0:32	0:55	1:20	1:48	2:21	3:05	4:03	5:41	8:41
						0:31	0:54	1:19	1:47	2:20	3:04	4:02	5:40	8:40	12:00*
						I	0:10	0:34	1:00	1:30	2:03	2:45	3:44	5:13	8:22
							0:33	0:59	1:29	2:02	2:44	3:43	5:12	8:21	12:00*
							H	0:10	0:37	1:07	1:42	2:24	3:21	4:50	8:00
								0:36	1:06	1:41	2:23	3:20	4:49	7:59	12:00*
								G	0:10	0:41	1:16	2:00	2:59	4:26	7:36
									0:40	1:15	1:59	2:58	4:25	7:35	12:00*
									F	0:10	0:46	1:30	2:29	3:58	7:06
										0:45	1:29	2:28	3:57	7:05	12:00*
										E	0:10	0:55	1:58	3:23	6:33
											0:54	1:57	3:22	6:32	12:00*
											D	0:10	1:10	2:39	5:49
												1:09	2:38	5:48	12:00*
												C	0:10	1:40	2:50
													1:39	2:49	12:00*
													B	0:10	2:11
														2:10	12:00*
														A	0:10
															12:00*

Repetitive group at the beginning of the surface interval from previous dive

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TABLE 1-13.—*Repetitive dive timetable for air dives*

Repetitive groups	Repetitive dive depth (ft) (air dives)															
	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190
A	7	6	5	4	4	3	3	3	3	3	2	2	2	2	2	2
B	17	13	11	9	8	7	7	6	6	6	5	5	4	4	4	4
C	25	21	17	15	13	11	10	10	9	8	7	7	6	6	6	6
D	37	29	24	20	18	16	14	13	12	11	10	9	9	8	8	8
E	49	38	30	26	23	20	18	16	15	13	12	12	11	10	10	10
F	61	47	36	31	28	24	22	20	18	16	15	14	13	13	12	11
G	73	56	44	37	32	29	26	24	21	19	18	17	16	15	14	13
H	87	66	52	43	38	33	30	27	25	22	20	19	18	17	16	15
I	101	76	61	50	43	38	34	31	28	25	23	22	20	19	18	17
J	116	87	70	57	48	43	38	34	32	28	26	24	23	22	20	19
K	138	99	79	64	54	47	43	38	35	31	29	27	26	24	22	21
L	161	111	88	72	61	53	48	42	39	35	32	30	28	26	25	24
M	187	124	97	80	68	58	52	47	43	38	35	32	31	29	27	26
N	213	142	107	87	73	64	57	51	46	40	38	35	33	31	29	28
O	241	160	117	96	80	70	62	55	50	44	40	38	36	34	31	30
Z	257	169	122	100	84	73	64	57	52	46	42	40	37	35	32	31

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TABLE 1-13 (1-8) REPETITIVE DIVE TABLE

A	7	6	5	4	4	3	3	3	3	3	2	2	2	2	2	2
B	17	13	11	9	8	7	7	6	6	6	5	5	4	4	4	4
C	25	21	17	15	13	11	10	10	9	8	7	7	6	6	6	6
D	37	29	24	20	18	16	14	13	12	11	10	9	9	8	8	8
E	49	38	30	26	23	20	18	16	15	13	12	12	11	10	10	10
F	61	47	36	31	28	24	22	20	18	16	15	14	13	13	12	11
G	73	56	44	37	32	29	26	24	21	19	18	17	16	15	14	13
H	87	66	52	43	38	33	30	27	25	22	20	19	18	17	16	15
I	101	76	61	50	43	38	34	31	28	25	23	22	20	19	18	17
J	116	87	70	57	48	43	38	34	32	28	26	24	23	22	20	19
K	138	99	79	64	54	47	43	38	35	31	29	27	26	24	22	21
L	161	111	88	72	61	53	48	42	39	35	32	30	28	26	25	24
M	187	124	97	80	68	58	52	47	43	38	35	32	31	29	27	26
N	213	142	107	87	73	64	57	51	46	40	38	35	33	31	29	28
O	241	160	117	96	80	70	62	55	50	44	40	38	36	34	31	30
Z	257	169	122	100	84	73	64	57	52	46	42	40	37	35	32	31
NEW GROUP																
	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'	160'	170'	180'	190'
REPETITIVE DIVE DEPTH (FT)																

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4123:1-3-22 Woodworking machines, power saws, and other tools and equipment.

(A) Reserved.

(B) Definitions.

- (1) "Cutting wheels" means organic bonded wheels designed for use with power driven equipment for a multitude of operations variously known as cutting, cutting-off, grooving, slotting, coping, jointing, etc.
- (2) "Grinding wheels" means wheels composed of a uniform mixture of an abrasive material and a bond formed or molded into a single piece and designed for use with power driven equipment to reduce the dimensions of other materials held against them on the periphery or a side surface.

(C) Woodworking machines.

(1) Boring and mortising machines.

(a) Mortising machines (except hollow chisel mortisers).

Mortising machines, except hollow chisel mortisers shall be provided with thumb stops at each side of the chisel or with equivalent protection.

(b) Chain mortisers.

The top of the cutting chain and driving mechanism shall be guarded.

(c) Bits.

Bits on all automatic boring machines shall be guarded at the points of operation.

(d) Chuck design.

Safety bit chucks with no projecting set screws shall be used.

(e) This section shall not apply to lock and butt mortising machines.

(2) Sanding machines.

(a) Belt sanders.

Belt sanders shall have both pulleys guarded in such manner as to guard the points where the belt runs onto the pulleys. The edges of the unused run of the belt shall be guarded.

(b) Disc sanders.

Disc sanders shall have a guard so arranged as to enclose the periphery and back of the revolving disc, except such portion of the face of the disc above the table (if table is used) as may be required for the application of the material to be finished.

(c) Drum sanders.

Drum sanders shall have a guard so arranged as to enclose the revolving drum, except such portion of the drum above the table (if table is used) as may be required for the application of the material to be finished.

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(3) Wood shapers.

(a) Cutting heads - guarding.

The cutting heads of each wood shaper, hand-fed panel raiser or other similar machine, not automatically fed, shall be guarded. The diameter of circular shaper guards shall be no less than the greatest diameter of the cutter. When single cutter knives in shaper heads are used, the shaper heads shall be balanced.

(b) Routers.

The pulleys, spindles, and cutting tools shall be guarded. Turnplates, jigs, and fixtures which keep the operator's hands out of the danger zone may be provided as an alternative.

(D) Power driven saws.

All cracked saw blades shall be removed from service.

(1) Circular saws.

The exposed portion of the saw blade [above the table and](#) under the table shall be guarded.

(a) Rip saw (manual feed).

A hood type guard shall be provided, the design of which shall:

- (i) When not in use, cover the saw blade at all times;
- (ii) When in use, automatically adjust itself to the thickness of and remain in contact with the material being cut when the stock encounters the saw blade, or may be a fixed or manually adjusted hood or guard provided the space between the bottom of the guard and the material being cut does not exceed three-eighths inch at any time;
- (iii) The guard shall prevent a kick-back, or a separate attachment that will prevent a kick-back shall be provided. "Kick-back" devices shall be effective for all thicknesses of material that are cut;
- (iv) A spreader shall also be provided and securely fastened at the rear of the saw in alignment with the saw blade, except where a roller wheel is provided at the back of the saw. The spreader shall be slightly thinner than the saw kerf and slightly thicker than the saw disc, to prevent the material from squeezing the saw blade.

(v) Alternate method.

Where the method of guarding as specified above is impossible, a substantial jig, fixture or template may be used which shall be designed to keep the hands of the operator out of the danger zone.

(b) Portable circular power saws.

Portable circular power saws shall have a hood type guard over the upper half of the blade. The lower half of the saw blade shall be guarded with a retracting guard which is designed to automatically adjust to the material being cut.

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(c) Swing cutoff.

(i) A hood type guard shall be attached to the frame and shall completely cover the upper half of the saw blade, the arbor end, and the point of operation at all positions of the saw.

(ii) Automatic return.

The saw shall return automatically to the back of the table when released at any point of its travel without rebound of the blade.

(d) Radial arm saws.

(i) The upper hood shall completely enclose the upper portion of the blade down to a point that will include the end of the saw arbor. The upper hood shall be constructed in such a manner and of such material that it will protect the operator from flying splinters, broken saw teeth, etc., and will deflect sawdust away from the operator. ~~Except where a jig or fixture is used the~~ The sides of the lower exposed portion of the blade shall be guarded to the full diameter of the blade by a device that will automatically adjust itself to the thickness of the stock and remain in contact with stock being cut.

(ii) The hood type guard shall be so designed as to prevent a kick-back when used for ripping or a separate attachment that will prevent a kick-back shall be provided. "Kick-back" devices shall be effective for all thicknesses of material that are cut.

(iii) A stop shall be installed which shall prevent the saw from traveling beyond the front edge of the table.

(iv) The direction of the saw rotation shall be conspicuously marked on the hood.

(v) The saw shall return automatically to the back of the table when released at any point of its travel without rebound of the blade.

(e) Masonry.

(i) Guarding.

A hood type guard shall be provided over the wheel of masonry saws.

(ii) Blades.

Only reinforced abrasive blades or diamond blades shall be used on masonry saws.

(2) Band saws and band knives.

All portions of the saw blade or band blade shall be enclosed or guarded, except for the working portion of the blade between the bottom of the guide rolls and the table. Band saw wheels shall be fully enclosed. The outside of the periphery of the enclosure shall be solid. The front and back of the band wheels shall be either enclosed by solid material or by wire mesh or perforated metal, the dimensions and material of which shall be in accordance with appendix I to rule 4123:1-3-05 of the Revised Code.

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(E) Portable chain saws.

Portable chain saws shall have all guards and handles, as provided by the manufacturer, in place, all controls functioning properly and mufflers operative. Electrically powered chain saws shall comply with paragraph (H) of this rule.

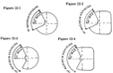
(F) Power grinders.

(1) External grinding machines.

On all portable grinding machines used for external grinding, a substantial guard shall be provided unless the grinding wheels are equipped with protection flanges, bands or chucks except that these requirements shall not apply if grinding wheels are less than ~~three~~two inches in diameter and are operated at a peripheral speed not exceeding three thousand feet per minute (fpm). The exposure (unguarded portion) of the grinding wheel periphery shall be as small as the work will permit for external grinding. Where the nature of the work is such that the material acts as a shield to the periphery of the grinding wheel, the material shall be construed as constituting a guard and no additional guard shall be required.

(2) Bench or floor stand.

The angular exposure of the grinding wheel periphery and sides for safety guards used on machines known as bench or floor stands shall not exceed ninety degrees or one-fourth of the periphery and such exposure shall begin at a point no more than sixty-five degrees above the horizontal plane of the wheel spindle (see "Figures 22-1 and 22-2"), provided that whenever the nature of the work requires contact with the wheel below the horizontal plane of the spindle, the exposure shall not exceed one hundred twenty-five degrees (see "Figures 22-3 and 22-4").



(3) Work rests.

On off-hand grinding machines work rests shall be used to support the work. They shall be of rigid construction and designed to be adjustable to compensate for wheel wear. Work rests shall be kept adjusted to a maximum opening of one-eighth inch to prevent the work from being jammed between the wheel and the rest. The employer shall instruct the employee to securely clamp the work rest after each adjustment. The employer shall also instruct the employee not to adjust the work rest with the wheel in motion.

~~(a) (a) On off-hand grinding machines work rests shall be used to support the work. They shall be of rigid construction and designed to be adjustable to compensate for wheel wear. Work rests shall be kept adjusted to a maximum opening of one-eighth inch to prevent the work from being jammed between the wheel and the rest. The employer shall instruct the employee to securely clamp the work rest after each adjustment. The employer shall also instruct the employee not to adjust the work rest with the wheel in motion.~~

~~(b) (b) The work rest shall be used to support the work wherever practicable.~~

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~~(e) (c) Wherever the nature of the work requires contact with the wheel below the horizontal plane of the spindle, work rests need not be used.~~

(G) Pneumatically powered tools.

All pneumatically powered portable tools shall be equipped with an automatic shutoff valve ("dead-man" control) so arranged as to close the air inlet valve when the pressure of the operator's hand is removed. Each tool shall be equipped with a retainer where accidental ejection is possible.

(H) Grounding.

All electrically powered portable tools and equipment with exposed noncurrent-carrying metal parts shall be grounded. Portable tools and equipment protected by an approved system of double insulation, or its equivalent, need not be grounded. Where such an approved system is employed the equipment shall be distinctively marked.

(I) Power cutoff and pressure control devices.

(1) Portable powered tools.

All hand-held powered drills, tappers, fastener drives, horizontal, vertical, and angle grinders with wheels greater than two inches in diameter, disc sanders with discs greater than two inches in diameter, belt sanders, reciprocating saws, saber, scroll, and jig saws with blade shanks greater than a nominal one-fourth inch, and other similarly operating powered tools shall be equipped with a constant pressure switch or control, and may have a lock-on control provided that turn-off can be accomplished by a single motion of the same finger or fingers that turn it on.

(2) Use of compressed air tools.

- (a) In operations requiring the use of compressed air tools the wearing of eye protection is required in all cases.
- (b) The employer shall instruct the employee that compressed air shall not be used for personal cleaning purposes.

(J) Portable pneumatically powered fasteners.

(1) Actuating mechanism.

- (a) Two separate and distinct operations shall be required to activate the fastener. The final activating movement, such as depressing a trigger, shall be separate from the prerequisite that the fastener be held firmly against the work surface before it will operate.
- (b) The fastener shall be designed so that it cannot fire during loading or during preparation to fire, or if the fastener should be dropped while loaded.

(2) Air hose.

Hose and hose connections used for conducting compressed air to utilization equipment shall be those designed for the pressure and service to which they are subjected.

(3) Pressure regulator.

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The fastener shall be equipped with a pressure regulator or other device to prevent air pressure from exceeding the maximum design capacity of the fastener.

(K) Portable safety containers.

Approved portable safety containers shall be provided for handling flammable liquids with a flash point ~~(closed cup) below one hundred thirty-eight and two-tenths degrees Fahrenheit~~ one hundred forty degrees Fahrenheit in quantities of one gallon or more. The containers shall be legibly marked "flammable".

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4123:1-3-23 Helicopters.

(A) Reserved.

(B) Reserved.

(C) Slings and tag lines.

Loads shall be balanced and securely fastened. Tag lines where used shall be of a length that will not permit their being drawn up into the rotors. Pressed sleeve, swedged eyes, or equivalent means shall be used for all freely suspended loads to prevent hand splices from spinning open or cable clamps from loosening.

(D) Cargo hooks.

All electrically operated cargo hooks shall have the electrical activating device so designed and installed as to prevent inadvertent operation. In addition, the cargo hooks shall be equipped with an emergency mechanical control for releasing the load. Hooks shall be tested prior to each day's operation to determine that the release functions properly, both electrically and mechanically.

(E) Personal protective equipment.

Personal protective equipment shall be provided and shall consist of complete eye protection and a hard hat secured by a chinstrap.

(F) Housekeeping.

Good housekeeping shall be maintained in all helicopter loading and unloading areas.

(G) Weight limitation.

The weight of an external load shall not exceed the helicopter manufacturer's rating.

(H) Signal systems.

The employer shall instruct the aircrew and ground personnel on the signal systems to be used and shall review the system with the employees in advance of hoisting the load. This applies to both radio and hand signal systems. Hand signals, where used, shall be as shown in "Illustration 23-1, Helicopter Hand Signals".

(I) Communications.

There shall be constant reliable communication between the pilot and a designated employee of the ground crew who acts as a signalman during the period of loading and unloading. ~~Where hand signals are used the~~ The signalman shall be clearly distinguishable from other ground personnel.

(J) Fires.

Open fires are prohibited in areas where they could be spread by the rotor downwash.

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4123:1-3-24 Roof car suspended platforms - construction.

(A) Roof car.

- (1) The horizontal speed of a roof car shall be no more than fifty feet per minute.
- (2) A roof car may not be moved horizontally unless means are in place to prevent the car from moving outside the areas provided for roof car travel.
- (3) The roof car shall be designed and installed in such a manner as to remain stable and upright under every loading condition.
- (4) A roof car shall be so positioned and anchored to the structure as to ~~insure~~ ensure that the working platform is placed and retained in proper position for vertical travel.
- (5) The operating device controlling movement of a roof car shall be of the continuous pressure weatherproof electric type and shall be located on the roof car, the working platform, or both. If located on both, such operating devices shall be interlocked so that control is possible only from one at a time.
- (6) The operating device controlling movement of a roof car shall not be operable until the working platform is at its uppermost position for travel and is not in contact with the building face or fixed vertical guides in the face of the building, and until all protective devices and interlocks are in a position for movement.
- (7) If the access to the roof car at any point of its travel is not over the roof area, standard guardrails with self-closing, self-locking gates shall be provided on the roof car.

(B) Working platforms.

- (1) ~~The working platform shall be of girder or truss construction and shall be capable of supporting its rated load under any position of loading.~~ Each suspended unit component, except suspension ropes and guardrail systems, shall be capable of supporting, without failure, at least four times the maximum intended live load applied or transmitted to that component.
- (2) Each working platform shall bear the manufacturer's load rating plate, conspicuously posted and legible, stating the maximum permissible load.
- (3) The vertical speed of a working platform suspended by four or more hoisting ropes shall be no more than seventy-five feet per minute.
- (4) The vertical speed of a working platform suspended by less than four hoisting ropes shall be no more than thirty-five feet per minute.
- (5) The working platform shall be no less than twenty-four inches wide.
- (6) The working platform shall be provided with toeboards and with permanent guardrails no less than thirty-six inches high, and no more than forty-two inches high at the front (building side). At the rear, and on the sides, a standard guardrail and toeboard shall be provided. An intermediate guardrail shall be provided around the entire platform between the top guardrail and the toeboard.
- (7) The platform flooring shall be of the nonskid type.

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- (8) Where access gates are provided, they shall be self-closing and self-locking. Such gates are required where access to the working platform is not over the roof area.
- (9) A means shall be provided to prevent inadvertent horizontal movement of the working platform.
- (10) The operating device controlling vertical movement of the working platform shall be located on the working platform and shall be of the continuous pressure weatherproof electric type.
- (11) The operating device controlling vertical movement shall be operable only when all electrical protective devices and interlocks on the working platform are in normal operating position, and the roof car is at an established operating point.
- (12) On roof-powered platforms, an emergency electric operating device shall be provided near the hoisting machine for use in the event of failure of the normal operating device for the working platform or failure of the traveling cable system. This emergency device shall be mounted in a locked compartment and shall have a legend mounted thereon reading: "For Emergency Operation Only. Establish Communication With Personnel On Working Platform Before Use." A key for unlocking the compartment housing the emergency operating device shall be mounted in a break-glass receptacle located near the device.

(C) Hoisting equipment.

- (1) Hoisting equipment shall consist of a power-driven drum or drums contained in the roof car (i.e., roof-powered platform) or contained on the working platform (i.e., self-powered platform).
- (2) Hoisting equipment shall be power-operated in both up and down directions.
- (3) Where exposed to contact, rotating shafts, drums, couplings, other mechanisms and gears shall be guarded.
- (4) Friction devices or clutches shall not be used for connecting the main driving mechanism to the drum or drums. Belt- or chain-driven machines are prohibited.
- (5) Hoisting motors shall be electric and of weatherproof construction.
- (6) Hoisting motors shall be directly connected to the hoisting machinery. Motor couplings, if used, shall be of steel construction.
- (7) Hoisting machines shall have two independent braking means, each designed to stop and hold the working platform with one hundred twenty-five per cent of rated load.

(D) Hoisting ropes and winding drums.

- (1) Each hoisting rope shall be made of wire and shall be no less than five-sixteenths-inch diameter.
- (2) Working platforms shall be suspended by no less than two ropes with a safety factor of ten as calculated under the following formula:

$$F = S \times N/W$$

Where

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S = manufacturer's rated breaking strength of one rope

N = number of ropes under load

W = maximum static load on all ropes with the platform and its rated load at any point of its travel

- (3) Where winding drums are used, the rope shall be wound in level layers.
 - (4) Winding drums shall have no less than three turns of rope remaining when the working platform is at its lowest possible point of travel.
 - (5) Where the working platform is suspended by more than two ropes, the nondrum ends of the ropes shall be provided with individual shackle rods which will permit individual adjustment of rope lengths.
 - (6) The lengthening or repairing of wire ropes by splicing is prohibited.
 - (7) More than two reverse bends in each rope are prohibited.
 - (8) Wire rope shall not be used if, ~~in any length of eight diameters, the total number of visible broken wires exceeds ten per cent of the total number of wires~~ they are not maintained and used in accordance with procedures recommended by the wire rope manufacturer; broken wires exceeding three wires in one strand or six wires in one rope lay; a broken wire within eighteen inches of the end attachments; the outer wire wear exceeds one-third of the original outer wire diameter, or if the rope shows other signs of excessive wear, corrosion, or defect.
- (E) Electrical protective devices.
- (1) Electrical protective devices and interlocks shall be of the weatherproof type.
 - (2) When a traveling cable storage reel is used, an electric contact shall be provided and so connected that it will cause the relay for vertical travel to open if the tension on the traveling cable exceeds safe limits.
 - (3) An automatic overload device shall be provided to cut off electrical power to the circuit in all hoisting motors for travel in the up direction, should the load applied to the hoisting ropes at either end of the working platform exceed one hundred twenty-five per cent of its normal tension with rated load as shown on the manufacturer's data plate on the working platform.
 - (4) An automatic device shall be provided for each hoisting rope which will cut off electrical power to the hoisting motor or motors in the down direction and will apply the brakes if any hoisting rope becomes slack.
 - (5) Upper and lower directional limit devices shall be provided to prevent the travel of the working platform beyond the normal upper and lower limits of travel.
 - (6) Directional limit devices, if driven from the hoisting machine by chains, tapes, or cables, shall incorporate a device to disconnect the electric power from the hoisting machine and apply both the primary and secondary brakes in the event of failure of the driving means.
 - (7) On platforms with four or more ropes, final terminal stopping devices for the working platform shall be provided as a secondary means of preventing the working platform from over-traveling at the terminals.

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(8) Emergency stop switches shall be provided in or adjacent to each operating device.

(9) Electrical cord strain relief anchors and grip or equivalent means shall be provided to prevent the electrical cord from pulling on the receptacle.

(F) Emergency communications.

A means of two-way communication shall be provided for each roof car suspended platform for use in an emergency.

(G) Fall protection.

Each employee shall have a personal fall arrest system.

~~(H) (H) Installations or constructions built or contracted for prior to the effective date of this rule shall be deemed to comply with the provisions of these requirements if such installations or constructions comply either with the provisions of these requirements or with the provisions of any applicable specific requirement which was in effect at the time contracted for or built.~~