

**NOTE: This publication, developed to assist residential construction employers in providing safe and healthful workplaces, contains Federal OSHA standards most applicable to this industry. The 23 states that operate OSHA-approved state plans have equivalent construction standards but may also have some different or additional requirements. For information on state requirements, please contact the specific state in question. See the listing of OSHA-approved state plans at [www.osha.gov/oshdir/states.html](http://www.osha.gov/oshdir/states.html) for addresses, telephone numbers, and links to state websites.**

**SELECTED CONSTRUCTION REGULATIONS (SCOR)  
FOR THE HOME BUILDING INDUSTRY  
(29 CFR 1926)**

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## Preface

The Occupational Safety and Health Administration (OSHA) has published this document to assist residential construction employers and employees in providing safe and healthful workplaces. This publication identifies OSHA standards applicable to the hazards most commonly found at work sites in the residential construction industry and those most likely to have a significant positive impact on the safety and health practices of contractors within this industry.

This publication does not itself alter or determine compliance responsibilities as contained in OSHA standards and the *Occupational Safety and Health Act of 1970*. Consequently, OSHA notes that other standards not included in this document remain applicable to the residential construction industry and abatement actions must be implemented by the contractor.

For the complete text of all OSHA standards for the construction industry, please see *Title 29 of the Code of Federal Regulations (CFR) Part 1926*. The *CFR* is sold by and available from the U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954, (202) 512-1800 (phone), or (202) 512-2250 (fax). All OSHA regulations are also available online at <http://www.osha.gov/>.

## Subpart A - General

### **§ 1926.1 - Purpose and scope.**

(a) This part sets forth the safety and health standards promulgated by the Secretary of Labor under section 107 of the Contract Work Hours and Safety Standards Act. The standards are published in Subpart C of this part and following subparts.

(b) Subpart B of this part contains statements of general policy and interpretations of section 107 of the Contract Work Hours and Safety Standards Act having general applicability.

### **§ 1926.2 - Variances from safety and health standards.**

(a) Variances from standards which are, or may be, published in this part may be granted under the same circumstances where variances may be granted under section 6(b)(A) or 6(d) of the Williams-Steiger Occupational Safety and Health Act of 1970 (29 U.S.C. 65). The procedures for the granting of variances and for related relief under this part are those published in Part 1905 of this title.

(b) Any requests for variances under this section shall also be considered requests for variances under the Williams-Steiger Occupational Safety and Health Act of 1970, and any requests for variances under Williams-Steiger Occupational Safety and Health Act with respect to construction safety or health standards shall be considered to be also variances under the Construction Safety Act. Any variance from a construction safety or health standard which is contained in this part and which is incorporated by reference in Part 1910 of this title shall be deemed a variance from the standard under both the Construction Safety

Act and the Williams-Steiger Occupational Safety and Health Act of 1970.

### **§ 1926.3 - Inspections - right of entry.**

(a) It shall be a condition of each contract which is subject to section 107 of the Contract Work Hours and Safety Standards Act that the Secretary of Labor or any authorized representative shall have a right of entry to any site of contract performance for the following purposes:

(a)(1) To inspect or investigate the matter of compliance with the safety and health standards contained in Subpart C of this part and following subparts; and

(a)(2) To carry out the duties of the Secretary under section 107(b) of the Act.

(b) For the purpose of carrying out his investigative duties under the Act, the Secretary of Labor may, by agreement, use with or without reimbursement the services, personnel, and facilities of any State or Federal agency. Any agreements with States under this section shall be similar to those provided for under the Walsh-Healey Public Contracts Act under 41 CFR Part 50-205.

### **§ 1926.4 - Rules of practice for administrative adjudications for enforcement of safety and health standards.**

(a) The rules of practice for administrative adjudications for the enforcement of the safety and health standards contained in Subpart C of this part and the following subparts shall be the same as those published in Part 6 of this title with respect to safety and health violations of the Service Contract Act of 1965 (69 Stat. 1035), except as provided in paragraph (b) of this section.

(b) In the case of debarment, the findings required by section 107(d) of the Act

shall be made by the hearing examiner or the Assistant Secretary of Labor for Occupational Safety and Health, as the case may be. Whenever, as provided in section 107(d)(2), a contractor requests termination of debarment before the end of the 3-year period prescribed in that section, the request shall be filed in writing with the Assistant Secretary of Labor for Occupational Safety and Health who shall publish a notice in the FEDERAL REGISTER that the request has been received and afford interested persons an opportunity to be heard upon the request, and thereafter the provisions of Part 6 of this title shall apply with respect to prehearing conferences, hearings and related matters, and decisions and orders.

**Subpart B - General Interpretations**

**§ 1926.10 - Scope of subpart.**

(a) This subpart contains the general rules of the Secretary of Labor interpreting and applying the construction safety and health provisions of section 107 of the Contract Work Hours and Safety Standards Act (83 Stat. 96). Section 107 requires as a condition of each contract which is entered into under legislation subject to Reorganization Plan Number 14 of 1950 (64 Stat. 1267), and which is for construction, alteration, and/or repair, including painting and decorating, that no contractor or subcontractor contracting for any part of the contract work shall require any laborer or mechanic employed in the performance of the contract to work in surroundings or under working conditions which are unsanitary, hazardous,

or dangerous to his health or safety, as determined under construction safety and health standards promulgated by the Secretary by regulation.

**§ 1926.11 - Coverage under section 103 of the act distinguished.**

(a) *Coverage under section 103.* It is important to note that the coverage of section 107 differs from that for the overtime requirements of the Contract Work Hours and Safety Standards Act. The application of the overtime requirements is governed by section 103, which subject to specific exemptions, includes:

(1) Federal contracts requiring or involving the employment of laborers or mechanics (thus including, but not limited to, contracts for construction), and

(2) contracts assisted in whole or in part by Federal loans, grants, or guarantees under any statute "providing wage standards for such work." The statutes "providing wage standards for such work" include statutes for construction which require the payment of minimum wages in accordance with prevailing wage findings by the Secretary of Labor in accordance with the Davis-Bacon Act. A provision to section 103 excludes from the overtime requirements work where the Federal assistance is only in the form of a loan guarantee or insurance.

(b) *Coverage under section 107.* To be covered by section 107 of the Contract Work Hours and Safety Standards Act, a contract must be one which

(1) is entered into under a statute that is subject to Reorganization Plan No. 14 of 1950 (64 Stat. 1267); and

(2) is for "construction, alteration, and/or repair, including painting and decorating."

**§ 1926.13 - Interpretation of statutory terms.**

agrees to perform any part of the labor or

(a) The terms *construction*, *alteration*, and *repair* used in section 107 of the Act are also used in section 1 of the Davis-Bacon Act (40 U.S.C. 276a), providing minimum wage protection on Federal construction contracts, and section 1 of the Miller Act (40 U.S.C. 270a), providing performance and payment bond protection on Federal construction contracts. Similarly, the terms *contractor* and *subcontractor* are used in those statutes, as well as in Copeland (Anti-Kickback) Act (40 U.S.C. 276c) and the Contract Work Hours and Safety Standards Act itself, which apply concurrently with the Miller Act and the Davis-Bacon Act on Federal construction contracts and also apply to most federally assisted construction contracts. The use of the same or identical terms in these statutes which apply concurrently with section 107 of the Act have considerable precedential value in ascertaining the coverage of section 107.

(b) It should be noted that section 1 of the Davis-Bacon Act limits minimum wage protection to laborers and mechanics "employed directly" upon the "site of the work." There is no comparable limitation in section 107 of the Act. Section 107 expressly requires as a self-executing condition of each covered contract that no contractor or subcontractor shall require "any laborer or mechanic employed in the performance of the contract to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health or safety" as these health and safety standards are applied in the rules of the Secretary of Labor.

(c) The term *subcontractor* under section 107 is considered to mean a person who

**Federal contract for "mixed" types of performance****General Interpretations**

material requirements of a contract for construction, alteration or repair. Cf. *MacEvoy Co. v. United States*, 322 U.S. 102, 108-9 (1944). A person who undertakes to perform a portion of a contract involving the furnishing of supplies or materials will be considered a "subcontractor" under this part and section 107 if the work in question involves the performance of construction work and is to be performed:

(1) Directly on or near the construction site, or

(2) by the employer for the specific project on a customized basis. Thus, a supplier of materials which will become an integral part of the construction is a "subcontractor" if the supplier fabricates or assembles the goods or materials in question specifically for the construction project and the work involved may be said to be construction activity. If the goods or materials in question are ordinarily sold to other customers from regular inventory, the supplier is not a "subcontractor." Generally, the furnishing of prestressed concrete beams and prestressed structural steel would be considered manufacturing; therefore a supplier of such materials would not be considered a "subcontractor." An example of material supplied "for the specific project on a customized basis" as that phrase is used in this section would be ventilating ducts, fabricated in a shop away from the construction job site and specifically cut for the project according to design specifications. On the other hand, if a contractor buys standard size nails from a foundry, the foundry would not be a covered "subcontractor." Ordinarily a contract for the supplying of construction equipment to a contractor would not, in and of itself, be considered a "subcontractor" for purposes of this part.

**§ 1926.14 - Federal contract for "mixed" types of performance.**

(a) It is the intent of the Congress to provide safety and health protection of Federal, federally financed, or federally assisted construction. See, for example, H. Report No. 91-241, 91st Cong., first session, p. 1 (1969). Thus, it is clear that when a Federal contract calls for mixed types of performance, such as both manufacturing and construction, section 107 would apply to the construction. By its express terms, section 107 applies to a contract which is "for construction, alteration, and/or repair." Such a contract is not required to be exclusively for such services. The application of the section is not limited to contracts which permit an overall characterization as "construction contracts." The text of section 107 is not so limited.

(b) When the mixed types of performances include both construction and manufacturing, see also 1926.15(b) concerning the relationship between the Walsh-Healey Public Contracts Act and section 107.

**§ 1926.15 - Relationship to the Service Contract Act; Walsh-Healey Public Contracts Act.**

(a) A contract for "construction" is one for nonpersonal service. See, e.g., 41 CFR 1-1.208. Section 2(e) of the Service Contract Act of 1965 requires as a condition of every Federal contract (and bid specification therefor) exceeding \$2,500, the "principal purpose" of which is to furnish services to the United States through the use of "service employees," that certain safety and health standards be met. See 29 CFR Part 1925, which contains the Department rules concerning these standards. Section 7 of the

Service Contract Act provides that the Act

shall not apply to "any contract of the United States or District of Columbia for construction, alteration, and/or repair, including painting and decorating of public buildings or public works." It is clear from the legislative history of section 107 that no gaps in coverage between the two statutes are intended.

(b) The Walsh-Healey Public Contracts Act requires that contracts entered into by any Federal agency for the manufacture or furnishing of materials, supplies, articles, and equipment in any amount exceeding \$10,000 must contain, among other provisions, a requirement that "no part of such contract will be performed nor will any of the materials, supplies, articles or equipment to be manufactured or furnished under said contract be manufactured or fabricated in any plants, factories, buildings, or surroundings or under working conditions which are unsanitary or hazardous or dangerous to the health and safety of employees engaged in the performance of said contract." The rules of the Secretary concerning these standards are published in 41 CFR Part 50-204, and express the Secretary of Labor's interpretation and application of section 1(e) of the Walsh-Healey Public Contracts Act to certain particular working conditions. None of the described working conditions are intended to deal with construction activities, although such activities may conceivably be a part of a contract which is subject to the Walsh-Healey Public Contracts Act. Nevertheless, such activities remain subject to the general statutory duty prescribed by section 1(e). Section 103(b) of the Contract Work Hours and Safety Standards Act provides, among other things, that the Act shall not apply to any work required to be done in accordance with the provisions of the Walsh-Healey

**Subpart C**  
**General Safety and Health Provisions**

**§ 1926.20**  
**General safety and health provisions**

Public Contracts Act.

provisions of the Act.

**§ 1926.16 - Rules of construction.**

(a) The prime contractor and any subcontractors may make their own arrangements with respect to obligations which might be more appropriately treated on a jobsite basis rather than individually. Thus, for example, the prime contractor and his subcontractors may wish to make an express agreement that the prime contractor or one of the subcontractors will provide all required first-aid or toilet facilities, thus relieving the subcontractors from the actual, but not any legal, responsibility (or, as the case may be, relieving the other subcontractors from this responsibility). In no case shall the prime contractor be relieved of overall responsibility for compliance with the requirements of this part for all work to be performed under the contract.

(b) By contracting for full performance of a contract subject to section 107 of the Act, the prime contractor assumes all obligations prescribed as employer obligations under the standards contained in this part, whether or not he subcontracts any part of the work.

(c) To the extent that a subcontractor of any tier agrees to perform any part of the contract, he also assumes responsibility for complying with the standards in this part with respect to that part. Thus, the prime contractor assumes the entire responsibility under the contract and the subcontractor assumes responsibility with respect to his portion of the work. With respect to subcontracted work, the prime contractor and any subcontractor or subcontractors shall be deemed to have joint responsibility.

(d) Where joint responsibility exists, both the prime contractor and his subcontractor or subcontractors, regardless of tier, shall be considered subject to the enforcement

**Subpart C - General Safety and Health Provisions**

**§ 1926.20 - General safety and health provisions.**

(a) *Contractor requirements.*

(a)(1) Section 107 of the Act requires that it shall be a condition of each contract which is entered into under legislation subject to Reorganization Plan Number 14 of 1950 (64 Stat. 1267), as defined in 1926.12, and is for construction, alteration, and/or repair, including painting and decorating, that no contractor or subcontractor for any part of the contract work shall require any laborer or mechanic employed in the performance of the contract to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health or safety.

(b) *Accident prevention responsibilities.*

(b)(1) It shall be the responsibility of the employer to initiate and maintain such programs as may be necessary to comply with this part.

(b)(2) Such programs shall provide for frequent and regular inspections of the job sites, materials, and equipment to be made by competent persons designated by the employers.

(b)(3) The use of any machinery, tool, material, or equipment which is not in compliance with any applicable requirement of this part is prohibited. Such machine, tool, material, or equipment shall either be identified as unsafe by tagging or locking the controls to render them inoperable or shall be physically removed from its place of operation.

(b)(4) The employer shall permit only

those employees qualified by training or experience to operate equipment and machinery.

of the safety and health training programs the Secretary provides.

(c) The standards contained in this part shall apply with respect to employments performed in a workplace in a State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, Guam, Trust Territory of the Pacific Islands, Wake Island, Outer Continental Shelf lands defined in the Outer Continental Shelf Lands Act, Johnston Island, and the Canal Zone.

(d)(1) If a particular standard is specifically applicable to a condition, practice, means, method, operation, or process, it shall prevail over any different general standard which might otherwise be applicable to the same condition, practice, means, method, operation, or process.

(d)(2) On the other hand, any standard shall apply according to its terms to any employment and place of employment in any industry, even though particular standards are also prescribed for the industry to the extent that none of such particular standards applies.

(e) In the event a standard protects on its face a class of persons larger than employees, the standard shall be applicable under this part only to employees and their employment and places of employment.

**§ 1926.21 - Safety training and education.**

(a) *General requirements.* The Secretary shall, pursuant to section 107(f) of the Act, establish and supervise programs for the education and training of employers and employees in the recognition, avoidance and prevention of unsafe conditions in employments covered by the act.

(b) *Employer responsibility.*

(b)(1) The employer should avail himself

(b)(2) The employer shall instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury.

(b)(3) Employees required to handle or use poisons, caustics, and other harmful substances shall be instructed regarding the safe handling and use, and be made aware of the potential hazards, personal hygiene, and personal protective measures required.

(b)(4) In job site areas where harmful plants or animals are present, employees who may be exposed shall be instructed regarding the potential hazards, and how to avoid injury, and the first aid procedures to be used in the event of injury.

(b)(5) Employees required to handle or use flammable liquids, gases, or toxic materials shall be instructed in the safe handling and use of these materials and made aware of the specific requirements contained in Subparts D, F, and other applicable subparts of this part.

(b)(6)(i) All employees required to enter into confined or enclosed spaces shall be instructed as to the nature of the hazards involved, the necessary precautions to be taken, and in the use of protective and emergency equipment required. The employer shall comply with any specific regulations that apply to work in dangerous or potentially dangerous areas.

(b)(6)(ii) For purposes of paragraph (b)(6)(i) of this section, *confined* or *enclosed space* means any space having a limited means of egress, which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere. Confined or enclosed spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or

exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open top spaces more than 4 feet in depth such as pits, tubs, vaults, and vessels.

**§ 1926.23 - First aid and medical attention.**

First aid services and provisions for medical care shall be made available by the employer for every employee covered by these regulations. Regulations prescribing specific requirements for first aid, medical attention, and emergency facilities are contained in Subpart D of this part.

**§ 1926.24 - Fire protection and prevention.**

The employer shall be responsible for the development and maintenance of an effective fire protection and prevention program at the job site throughout all phases of the construction, repair, alteration, or demolition work. The employer shall ensure the availability of the fire protection and suppression equipment required by Subpart F of this part.

**§ 1926.25 - Housekeeping.**

(a) 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.

(b) Combustible scrap and debris shall be removed at regular intervals during the course of construction. Safe means shall be provided to facilitate such removal.

(c) Containers shall be provided for the collection and separation of waste, trash, oily and used rags, and other refuse. Containers used for garbage and other oily, flammable, or hazardous wastes, such as caustics, acids,

harmful dusts, etc. shall be equipped with covers. Garbage and other waste shall be disposed of at frequent and regular intervals.

**§ 1926.26 - Illumination.**

Construction areas, aisles, stairs, ramps, runways, corridors, offices, shops, and storage areas where work is in progress shall be lighted with either natural or artificial illumination. The minimum illumination requirements for work areas are contained in Subpart D of this part.

**§ 1926.27 - Sanitation.**

Health and sanitation requirements for drinking water are contained in Subpart D of this part.

**§ 1926.28 - Personal protective equipment.**

(a) The employer is responsible for requiring the wearing of appropriate personal protective equipment in all operations where there is an exposure to hazardous conditions or where this part indicates the need for using such equipment to reduce the hazards to the employees.

(b) Regulations governing the use, selection, and maintenance of personal protective and lifesaving equipment are described under Subpart E of this part.

**§ 1926.31 - Incorporation by reference.**

(a) The specifications, standards and codes of agencies of the U.S. Government and organizations which are not agencies of the U.S. Government, to the extent they are legally incorporated by reference in this part, have the same force and effect as other standards in this part. The locations where these specifications, standards, and codes may be examined are as follows:

(1) Offices of the Occupational Safety and Health Administration, U.S. Department of Labor, Frances Perkins Building, Washington, DC. 20210.

(2) The Regional and Field Offices of the Occupational Safety and Health Administration, which are listed in the U.S. Government Manual.

(b) Any changes in the specifications, standards and codes incorporated by reference in this part and an official historic file of such changes are available at the offices referred to in paragraph (a) of this section. All questions as to the applicability of such changes should also be referred to these offices.

**§ 1926.32 - Definitions.**

The following definitions shall apply in the application of the regulations in this part:

(a) *Act* means section 107 of the Contract Work Hours and Safety Standards Act, commonly known as the Construction Safety Act (86 Stat. 96; 40 U.S.C. 333).

(b) *ANSI* means American National Standards Institute.

(c) *Approved* means sanctioned, endorsed, accredited, certified, or accepted as satisfactory by a duly constituted and nationally recognized authority or agency.

(d) *Authorized person* means a person approved or assigned by the employer to perform a specific type of duty or duties or to be at a specific location or locations at the jobsite.

(e) *Administration* means the Occupational Safety and Health Administration.

(f) *Competent person* means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective

measures to eliminate them.

(g) *Construction work*. For purposes of this section, "Construction work" means work for construction, alteration, and/or repair, including painting and decorating.

(h) *Defect* means any characteristic or condition which tends to weaken or reduce the strength of the tool, object, or structure of which it is a part.

(i) *Designated person* means "authorized person" as defined in paragraph (d) of this section.

(j) *Employee* means every laborer or mechanic under the Act regardless of the contractual relationship which may be alleged to exist between the laborer and mechanic and the contractor or subcontractor who engaged him. "Laborer and mechanic" are not defined in the Act, but the identical terms are used in the Davis-Bacon Act (40 U.S.C. 276a), which provides for minimum wage protection on Federal and federally assisted construction contracts. The use of the same term in a statute which often applies concurrently with section 107 of the Act has considerable presidential value in ascertaining the meaning of "laborer and mechanic" as used in the Act. *Laborer* generally means one who performs manual labor or who labors at an occupation requiring physical strength; *mechanic* generally means a worker skilled with tools. See 18 Comp. Gen. 341.

(k) *Employer* means contractor or subcontractor within the meaning of the Act and of this part.

(l) *Hazardous substance* means a substance which, by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, or otherwise harmful, is likely to cause death or injury.

(m) *Qualified* means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive

knowledge, training, and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

(n) *Safety factor* means the ratio of the ultimate breaking strength of a member or piece of material or equipment to the actual working stress or safe load when in use.

(o) *Secretary* means the Secretary of Labor.

(p) *SAE* means Society of Automotive Engineers.

(q) *Shall* means mandatory.

(r) *Should* means recommended.

(s) *Suitable* means that which fits, and has the qualities or qualifications to meet a given purpose, occasion, condition, function, or circumstance.

**§ 1926.33 - Access to employee exposure and medical records.**

Note: The requirements applicable to construction work under this section are identical to those set forth at 1910.1020 of this chapter.

**§ 1926.34 - Means of egress.**

(a) *General.* In every building or structure exits shall be so arranged and maintained as to provide free and unobstructed egress from all parts of the building or structure at all times when it is occupied. No lock or fastening to prevent free escape from the inside of any building shall be installed except in mental, penal, or corrective institutions where supervisory personnel is continually on duty and effective provisions are made to remove occupants in case of fire or other emergency.

(b) *Exit marking.* Exits shall be marked by a readily visible sign. Access to exits shall be marked by readily visible signs in

all cases where the exit or way to reach it is not immediately visible to the occupants.

(c) *Maintenance and workmanship.* Means of egress shall be continually maintained free of all obstructions or impediments to full instant use in the case of fire or other emergency.

**Subpart D - Occupational Health and Environmental Controls**

**§ 1926.50 - Medical services and first aid.**

(a) The employer shall insure the availability of medical personnel for advice and consultation on matters of occupational health.

(b) Provisions shall be made prior to commencement of the project for prompt medical attention in case of serious injury.

(c) In the absence of an infirmary, clinic, hospital, or physician, that is reasonably accessible in terms of time and distance to the worksite, which is available for the treatment of injured employees, a person who has a valid certificate in first-aid training from the U.S. Bureau of Mines, the American Red Cross, or equivalent training that can be verified by documentary evidence, shall be available at the worksite to render first aid.

(d)(1) First-aid supplies approved by the consulting physician shall be easily accessible when required.

(d)(2) The first-aid kit shall consist of materials approved by the consulting physician in a weatherproof container with individual sealed packages for each type of item. The contents of the first-aid kit shall

**§ 1926.51**  
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be checked by the employer before being sent out on each job and at least weekly on each job to ensure that the expended items are replaced.

(e) Proper equipment for prompt transportation of the injured person to a physician or hospital, or a communication system for contacting necessary ambulance service, shall be provided.

(f) The telephone numbers of the physicians, hospitals, or ambulances shall be conspicuously posted.

(g) Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use.

**§ 1926.51 - Sanitation.**

(a) *Potable water.*

(a)(1) An adequate supply of potable water shall be provided in all places of employment.

(a)(2) Portable containers used to dispense drinking water shall be capable of being tightly closed, and equipped with a tap. Water shall not be dipped from containers.

(a)(3) Any container used to distribute drinking water shall be clearly marked as to the nature of its contents and not used for any other purpose.

(a)(4) The common drinking cup is prohibited.

(a)(5) Where single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.

(a)(6) *Potable water* means water which meets the quality standards prescribed in the U.S. Public Health Service Drinking Water

Standards, published in 42 CFR part 72, or water which is approved for drinking purposes by the State or local authority having jurisdiction.

(b) *Nonpotable water.*

(b)(1) Outlets for nonpotable water, such as water for industrial or firefighting purposes only, shall be identified by signs meeting the requirements of Subpart G of this part, to indicate clearly that the water is unsafe and is not to be used for drinking, washing, or cooking purposes.

(b)(2) There shall be no cross-connection, open or potential, between a system furnishing potable water and a system furnishing nonpotable water.

(c) *Toilets at construction jobsites.*

(c)(1) Toilets shall be provided for employees according to the following table:

**TABLE D-1**

Number of Employees	Minimum Number of Facilities
20 or less	1
20 or more	1 toilet seat and 1 urinal per 40 workers
200 or more	1 toilet seat and 1 urinal per 50 workers

(f) *Washing facilities.*

(f)(1) The employer shall provide adequate washing facilities for employees engaged in the application of paints, coating, herbicides, or insecticides, or in other operations where contaminants may be harmful to the employees. Such facilities shall be in near proximity to the worksite and shall be so equipped as to enable employees to remove such substances.

(f)(2) *General.* Washing facilities shall be maintained in a sanitary condition.

**§ 1926.52 - Occupational noise exposure.**

(a) Protection against the effects of noise exposure shall be provided when the sound levels exceed those shown in Table D-2 of this section when measured on the A-scale of a standard sound level meter at slow response.

(b) When employees are subjected to sound levels exceeding those listed in Table D-2 of this section, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels within the levels of the table, personal protective equipment as required in Subpart E, shall be provided and used to reduce sound levels within the levels of the table.

**TABLE D-2**  
**Permissible Noise Exposures**

Duration per Day, Hours	Sound Level dBA Slow Response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

(c) If the variations in noise level involve maxima at intervals of 1 second or less, it is to be considered continuous.

(d)(1) In all cases where the sound levels exceed the values shown herein, a continuing, effective hearing conservation program shall be administered.

(d)(2)(i) When the daily noise exposure is composed of two or more periods of noise

exposure of different levels, their combined effect should be considered, rather than the individual effect of each. Exposure to different levels for various periods of time shall be computed according to the formula set forth in paragraph (d)(2)(ii) of this section.

(d)(2)(ii)  $F_e = (T_1 / L_1) + (T_2 / L_2) + \dots + (T_n / L_n)$  where:

- $F_e$  = The equivalent noise exposure factor.
- $T$  = The period of noise exposure at any essentially constant level.
- $L$  = The duration of the permissible noise exposure at the constant level (from Table D-2).

If the value of  $F_e$  exceeds unity (1) the exposure exceeds permissible levels.

(d)(2)(iii) A sample computation showing an application of the formula in paragraph (d)(2)(ii) of this section is as follows. An employee is exposed at these levels for these periods:

110 db A 1/4 hour.  
 100 db A 1/2 hour.  
 90 db A 1 1/2 hours.  
 $F_e = (1/4/1/2) + (1/2/2) + (1 1/2/8)$   
 $F_e = 0.500 + 0.25 + 0.188$   
 $F_e = 0.938$

Since the value of  $F_e$  does not exceed unity, the exposure is within permissible limits.

(e) Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

**§ 1926.54 - Nonionizing radiation.**

(a) Only qualified and trained employees shall be assigned to install, adjust, and operate laser equipment.

(b) Proof of qualification of the laser equipment operator shall be available and in

possession of the operator at all times.

(c) Employees, when working in areas in which a potential exposure to direct or reflected laser light greater than 0.005 watts (5 milliwatts) exists, shall be provided with antilaser eye protection devices as specified in Subpart E of this part.

(d) Areas in which lasers are used shall be posted with standard laser warning placards.

(e) 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.

(f) Only mechanical or electronic means shall be used as a detector for guiding the internal alignment of the laser.

(g) The laser beam shall not be directed at employees.

(h) 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.

(i) Laser equipment shall bear a label to indicate maximum output.

(j) Employees shall not be exposed to light intensities above:

(j)(1) Direct staring: 1 micro-watt per square centimeter;

(j)(2) Incidental observing: 1 milliwatt per square centimeter;

(j)(3) Diffused reflected light: 2 1/2 watts per square centimeter.

(k) Laser unit in operation should be set up above the heads of the employees, when possible.

§ 1926.55 - Gases, vapors, fumes,

dusts, and mists.

(a) Exposure of employees to inhalation, ingestion, skin absorption, or contact with any material or substance at a concentration above those specified in the "Threshold Limit Values of Airborne Contaminants for 1970" of the American Conference of Governmental Industrial Hygienists, shall be avoided. See Appendix A to this section.

(b) To achieve compliance with paragraph (a) of this section, administrative or engineering controls must first be implemented whenever feasible. When such controls are not feasible to achieve full compliance, protective equipment or other protective measures shall be used to keep the exposure of employees to air contaminants within the limits prescribed in this section. Any equipment and technical measures used for this purpose must first be approved for each particular use by a competent industrial hygienist or other technically qualified person. Whenever respirators are used, their use shall comply with 1926.103.

(c) Paragraphs (a) and (b) of this section do not apply to the exposure of employees to airborne asbestos, tremolite, anthophyllite, or actinolite dust. Whenever any employee is exposed to airborne asbestos, tremolite, anthophyllite, or actinolite dust, the requirements of 1910.1101 or 1926.58 of this title shall apply.

(d) Paragraphs (a) and (b) of this section do not apply to the exposure of employees to formaldehyde. Whenever any employee is exposed to formaldehyde, the requirements of 1910.1048 of this title shall apply.

§ 1926.55 - Appendix A - Gases, vapors, fumes, dusts, and mists.

NOTE: Because of the length of the table, explanatory Footnotes applicable to all

**Subpart D**

**§ 1926.55**

**Occupational Health and  
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**Appendix A - Gases, vapors,  
fumes, dusts, and mists**

substances are given below. Footnotes  
specific only to a limited number of  
substances are also shown within the table.

**Footnotes for Appendix A**

- <sup>2</sup> See Mineral Dusts Table.
- <sup>3</sup> Use Asbestos Limit 1926.58.
- <sup>4</sup> See 1926.58
- \* The PELs are 8-hour TWAs unless otherwise noted; a (C) designation denotes a ceiling limit.
- \*\* As determined from breathing-zone air samples.
- <sup>a</sup> Parts of vapor or gas per million parts of contaminated air by volume at 25 degrees C and 760 torr.
- <sup>b</sup> Milligrams of substance per cubic meter of air. When entry is in this column only, the value is exact; when listed with a ppm entry, it is approximate.
- <sup>d</sup> The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound, measured as the metal, the CAS number for the metal is given - not CAS numbers for the individual compounds.
- <sup>g</sup> For sectors excluded from 1926.1128 the limit is 10 ppm TWA.
- <sup>j</sup> Millions of particles per cubic foot of air, based on impinger samples counted by light-field techniques.
- <sup>k</sup> The percentage of crystalline silica in the formula is the amount determined from airborne samples, except in those instances in which other methods have been shown to be applicable.
- <sup>m</sup> Covers all organic and inorganic particulates not otherwise regulated. Same as Particulates Not Otherwise Regulated.

The 1970 TLV uses letter designations instead of a numerical value as follows:

- <sup>A(2)</sup> Polytetrafluoroethylene decomposition products. Because these products decompose in part by hydrolysis in alkaline solution, they can be quantitatively determined in air as fluoride to provide an index of exposure. No TLV is recommended pending determination of the toxicity of the products, but air concentrations should be minimal.
- <sup>A(3)</sup> Gasoline and/or Petroleum distillates. The composition of these materials varies greatly and thus a single TLV for all types of these materials is no longer applicable. The content of benzene, other aromatics and additives should be determined to arrive at the appropriate TLV.
- <sup>E</sup> Simple asphyxiants. The limiting factor is the available oxygen which shall be at least 19.5 percent and be within the requirements addressing explosion in part 1926.

### THRESHOLD LIMIT VALUES OF AIRBORNE CONTAMINANTS FOR CONSTRUCTION

Substance	CAS No. <sup>d</sup>	ppm <sup>a</sup>	mg/m <sup>3b</sup>	Skin Designation
Abate; see Temephos.				
Acetaldehyde	75-07-0	200	360	
Acetic acid.	64-19-7	10	25	
Acetic anhydride	108-24-7	5	20	

Substance	CAS No. <sup>d</sup>	ppm <sup>a</sup>	mg/m <sup>3b</sup>	Skin Designation
Acetone	67-64-1	1000	2400	
Acetonitrile	75-05-8	40	70	
2-Acetylaminofluorene; see 1926.1114	53-96-3			
Acetylene	74-86-2	<sup>e</sup>		
Acetylene dichloride; see 1, 2-Dichloroethylene				
Acetylene tetrabromide	79-27-6	1	14	
Acrolein	107-02-8	0.1	0.25	
Acrylamide	79-06-1		0.3	X
Acrylonitrile; see 1926.1145	107-13-1			
Aldrin	309-00-2		0.25	X
Allyl alcohol	107-18-6	2	5	X
Allyl chloride	107-05-1	1	3	
Allyl glycidyl ether (AGE)	106-92-3	(C)10	(C)45	
Allyl propyl disulfide	2179-59-1	2	12	
alpha-Alumina	1344-28-1			
Total dust				
Respirable fraction				
Alundum; see alpha-Alumina				
4-Aminodiphenyl; see 1926.1111	92-67-1			
2-Aminoethanol; see Ethanolamine				
2-Aminopyridine	504-29-0	0.5	2	
Ammonia	7664-41-7	50	35	
Ammonium sulfamate	7773-06-0			
Total dust			15	
Respirable fraction			5	
n-Amyl acetate	628-63-7	100	525	
sec-Amyl acetate	626-38-0	125	650	
Aniline and homologs	62-53-3	5	19	X
Anisidine (o-, p-isomers)	29191-52-4		0.5	X
Antimony and compounds (as Sb)	7440-36-0		0.5	
ANTU (alpha Naphthylthiourea)	86-88-4		0.3	
Argon	7440-37-1	<sup>e</sup>		
Arsenic, inorganic compounds (as As); see 1926.1118	7440-38-2			
Arsenic, organic compounds (as As)	7440-38-2		0.5	
Arsine	7784-42-1	0.05	0.2	
Asbestos; see 1926.58				
Azinphos-methyl	86-50-0		0.2	X
Barium, soluble compounds (as Ba)	7440-39-3		0.5	
Benzene <sup>g</sup> ; see 1926.1128	71-43-2			
Benzidine; see 1926.1110	92-87-5			
p-Benzoquinone; see Quinone				
Benzo <sup>a</sup> pyrene; see Coaltarpitch volatiles				
Benzoyl peroxide	94-36-0		5	
Benzyl chloride	100-44-7	1	5	
Beryllium and beryllium compounds (as Be)	7440-41-7		0.002	
Biphenyl; see Diphenyl				
Bisphenol A; see Diglycidyl ether				
Boron oxide	1303-86-2			

Substance	CAS No. <sup>d</sup>	ppm <sup>a</sup>	mg/m <sup>3b</sup>	Skin Designation
Total dust			15	
Boron tribromide	10294-33-4	1	10	
Boron trifluoride	7637-07-2	(C)1	(C)3	
Bromine	7726-95-6	0.1	0.7	
Bromine pentafluoride	7789-30-2	0.1	0.7	
Bromoform	75-25-2	0.5	5	X
Butadiene (1, 3-Butadiene); See 29 CFR 1910.1051; 29 CFR 1910.19	106-99-0	1 ppm/5 ppm STEL		
Butanethiol; see Butyl mercaptan				
2-Butanone (Methyl ethyl ketone)	78-93-3	200	590	
2-Butoxyethanol	111-76-2	50	240	X
n-Butyl acetate	123-86-4	150	710	
sec-Butyl acetate	105-46-4	200	950	
tert-Butyl acetate	540-88-5	200	950	
n-Butyl alcohol	71-36-3	100	300	
sec-Butyl alcohol	78-92-2	150	450	
tert-Butyl alcohol	75-65-0	100	300	
Butylamine	109-73-9	(C)5	(C)15	X
tert-Butyl chromate (as CrO <sub>3</sub> )	1189-85-1		(C)0.1	X
n-Butyl glycidyl ether (BGE)	2426-08-6	50	270	
Butyl mercaptan	109-79-5	0.5	1.5	
p-tert-Butyltoluene	98-51-1	10	60	
Cadmium (as Cd); see 1910.1027	7440-43-9			
Calcium Carbonate	1317-65-3			
Total dust				
Respirable fraction				
Calcium oxide	1305-78-8		5	
Calcium sulfate	7778-18-9			
Total dust			15	
Respirable fraction			5	
Camphor, synthetic	76-22-2		2	
Carbaryl (Sevin)	63-25-2		5	
Carbon black	1333-86-4		3.5	
Carbon dioxide	124-38-9	5000	9000	
Carbon disulfide	75-15-0	20	60	X
Carbon monoxide	630-08-0	50	55	
Carbon tetrachloride	56-23-5	10	65	X
Cellulose	9004-34-6			
Total dust				
Respirable fraction				
Chlordane	57-74-9		0.5	X
Chlorinated camphene	8001-35-2		0.5	X
Chlorinated diphenyl oxide	55720-99-5		0.5	
Chlorine	7782-50-5	1	3	
Chlorine dioxide	10049-04-4	0.1	0.3	
Chlorine trifluoride	7790-91-2	(C)0.1	(C)0.4	
Chloroacetaldehyde	107-20-0	(C)1	(C)3	
a-Chloroacetophenone (Phenacyl chloride)	532-27-4	0.05	0.3	
Chlorobenzene	108-90-7	75	350	

Substance	CAS No. <sup>d</sup>	ppm <sup>a</sup>	mg/m <sup>3b</sup>	Skin Designation
o-Chlorobenzylidene malononitrile	2698-41-1	0.05	0.4	
Chlorobromomethane	74-97-5	200	1050	
2-Chloro-1, 3-butadiene; See beta-Chloroprene				
Chlorodiphenyl (42 percent Chlorine) (PCB)	53469-21-9		1	X
Chlorodiphenyl (54 percent Chlorine) (PCB)	11097-69-1		0.5	X
1-Chloro-2, 3-epoxypropane; See Epichlorohydrin				
2-Chloroethanol; See Ethylene chlorohydrin				
Chloroethylene; See Vinylchloride				
Chloroform (Trichloromethane)	67-66-3	(C)50	(C)240	
bis (Chloromethyl) ether; see 1926.1108	542-88-1			
Chloromethyl methyl ether; see 1926.1106	107-30-2			
1-Chloro-1-nitropropane	600-25-9	20	100	
Chloropicrin	76-06-2	0.1	0.7	
beta-Chloroprene	126-99-8	25	90	X
Chromic acid and chromates (as CrO <sub>3</sub> )	Varies with compound		0.1	
Chromium (II) compounds (as Cr)	7440-47-3		0.5	
Chromium (III) compounds (as Cr)	7440-47-3		0.5	
Chromium metal and insol. salts (as Cr)	7440-47-3		1	
Chrysene; see Coal tar pitch volatiles				
Coal tar pitch volatiles (benzene soluble fraction), anthracene, BaP, phenanthrene, acridine, chrysene, pyrene	65996-93-2		0.2	
Cobalt metal, dust, and fume (as Co)	7440-48-4		0.1	
Coke oven emissions; see 1926.1129			0.15	
Copper	7440-50-8			
Fume (as Cu)			0.1	
Dusts and mists (as Cu)			1	
Corundum; see Emery				
Cottondust (raw)			1	
Cragherbicide (Sesone)	136-78-7			
Total dust				
Respirable fraction				
Cresol, all isomers	1319-77-3	5	22	X
Crotonaldehyde	123-73-9	2	6	
	4170-30-3			
Cumene	98-82-8	50	245	X
Cyanides (as CN)	Varies with Compound		5	X
Cyanogen	460-19-5	10		
Cyclohexane	110-82-7	300	1050	
Cyclohexanol	108-93-0	50	200	
Cyclohexanone	108-94-1	50	200	
Cyclohexene	110-83-8	300	1015	
Cyclonite	121-82-4		1.5	X
Cyclopentadiene	542-92-7	75	200	
DDT, see Dichlorodiphenyltrichloroethane				
DDVP, see Dichlorvos				
2, 4-D (Dichlorophenoxyacetic acid)	94-75-7		10	

Substance	CAS No. <sup>d</sup>	ppm <sup>a</sup>	mg/m <sup>3b</sup>	Skin Designation
Decaborane	17702-41-9	0.05	0.3	X
Demeton (Systox)	8065-48-3		0.1	X
Diacetone alcohol (4-Hydroxy-4-methyl-2-pentanone)	123-42-2	50	240	
1, 2-Diaminoethane; see Ethylenediamine				
Diazomethane	334-88-3	0.2	0.4	
Diborane	19287-45-7	0.1	0.1	
1, 2-Dibromo-3-chloropropane (DBCP); see 1926.1144	96-12-8			
1, 2-Dibromoethane; see Ethylene dibromide				
Dibutyl phosphate	107-66-4	1	5	
Dibutyl phthalate	84-74-2		5	
Dichloroacetylene	7572-29-4	(C)0.1	(C)0.4	
o-Dichlorobenzene	95-50-1	(C)50	(C)300	
p-Dichlorobenzene	106-46-7	75	450	
3, 3'-Dichlorobenzidine; see 1926.1107	91-94-1			
Dichlorodifluoromethane	75-71-8	1000	4950	
1, 3-Dichloro-5, 5-dimethyl hydantoin	118-52-5		0.2	
Dichlorodiphenyltrichloroethane (DDT)	50-29-3		1	X
1, 1-Dichloroethane	75-34-3	100	400	
1, 2-Dichloroethane; see Ethylene dichloride				
1, 2-Dichloroethylene	540-59-0	200	790	
Dichloroethyl ether	111-44-4	(C)15	(C)90	X
Dichloromethane; see Methylene chloride				
Dichloromonofluoromethane	75-43-4	1000	4200	
1, 1-Dichloro-1-nitroethane	594-72-9	(C)10	(C)60	
1, 2-Dichloropropane; see Propylene dichloride				
Dichlorotetrafluoroethane	76-14-2	1000	7000	
Dichlorvos (DDVP)	62-73-7		1	X
Dieldrin	60-57-1		0.25	X
Diethylamine	109-89-7	25	75	
2-Diethylaminoethanol	100-37-8	10	50	X
Diethylene triamine	111-40-0	(C)10	(C)42	X
Diethyl ether; see Ethyl ether				
Difluorodibromomethane	75-61-6	100	860	
Diglycidyl ether (DGE)	2238-07-5	(C)0.5	(C)2.8	
Dihydroxybenzene; see Hydroquinone				
Diisobutyl ketone	108-83-8	50	290	
Diisopropylamine	108-18-9	5	20	X
4-Dimethylaminoazobenzene; see 1926.1115	60-11-7			
Dimethoxymethane; see Methylal				
Dimethyl acetamide	127-19-5	10	35	X
Dimethylamine	124-40-3	10	18	
Dimethylaminobenzene; see Xylidine				
Dimethylaniline (N, N-Dimethylaniline)	121-69-7	5	25	X
Dimethylbenzene; see Xylene				
Dimethyl-1, 2-dibromo-2, 2-dichloroethyl phosphate	300-76-5		3	
Dimethylformamide	68-12-2	10	30	X
2, 6-Dimethyl-4-heptanone; see Diisobutyl ketone				

Substance	CAS No. <sup>d</sup>	ppm <sup>a</sup>	mg/m <sup>3b</sup>	Skin Designation
1, 1-Dimethylhydrazine	57-14-7	0.5	1	X
Dimethylphthalate	131-11-3		5	
Dimethyl sulfate	77-78-1	1	5	X
Dinitrobenzene (all isomers)			1	X
(ortho)	528-29-0			
(meta)	99-65-0			
(para)	100-25-4			
Dinitro-o-cresol	534-52-1		0.2	X
Dinitrotoluene	25321-14-6		1.5	X
Dioxane (Diethylene dioxide)	123-91-1	100	360	X
Diphenyl (Biphenyl)	92-52-4	0.2	1	
Diphenylamine	122-39-4		10	
Diphenylmethane diisocyanate; see Methylene bisphenyl isocyanate				
Dipropylene glycol methyl ether	34590-94-8	100	600	X
Di-sec octyl phthalate (Di-2-ethylhexyl) phthalate)	117-81-7		5	
Emery Total dust Respirable fraction	12415-34-8			
Endosulfan	115-29-7		0.1	X
Endrin	72-20-8		0.1	X
Epichlorohydrin	106-89-8	5	19	X
EPN	2104-64-5		0.5	X
1, 2-Epoxypropane; see Propylene oxide				
2, 3-Epoxy-1-propanol; see Glycidol				
Ethane	74-84-0	E		
Ethanethiol; see Ethyl mercaptan				
Ethanolamine	141-43-5	3	6	
2-Ethoxyethanol (Cellosolve)	110-80-5	200	740	X
2-Ethoxyethyl acetate (Cellosolve acetate)	111-15-9	100	540	X
Ethyl acetate	141-78-6	400	1400	
Ethyl acrylate	140-88-5	25	100	X
Ethyl alcohol (Ethanol)	64-17-5	1000	1900	
Ethylamine	75-04-7	10	18	
Ethyl amyl ketone (5-Methyl-3-heptanone)	541-85-5	25	130	
Ethyl benzene	100-41-4	100	435	
Ethyl bromide	74-96-4	200	890	
Ethyl butylketone (3-Heptanone)	106-35-4	50	230	
Ethyl chloride	75-00-3	1000	2600	
Ethyl ether	60-29-7	400	1200	
Ethyl formate	109-94-4	100	300	
Ethyl mercaptan	75-08-1	0.5	1	
Ethyl silicate	78-10-4	100 <sub>E</sub>	850	
Ethylene	74-85-1			
Ethylene chlorohydrin	107-07-3	5	16	X
Ethylenediamine	107-15-3	10	25	
Ethylene dibromide	106-93-4	(C)25	(C)190	X
Ethylene dichloride (1, 2-Dichloroethane)	107-06-2	50	200	

Substance	CAS No. <sup>d</sup>	ppm <sup>a</sup>	mg/m <sup>3b</sup>	Skin Designation
Ethylene glycol dinitrate	628-96-6	(C)0.2	(C)1	X
Ethylene glycol methyl acetate; see Methyl cellosolve acetate				
Ethyleneimine; see 1926.1112	151-56-4			
Ethylene oxide; see 1926.1147	75-21-8			
Ethylidene chloride; see 1, 1-Dichloroethane				
N-Ethylmorpholine	100-74-3	20	94	X
Ferbam	14484-64-1			
Total dust			15	
Ferrovandium dust	12604-58-9		1	
Fibrous Glass				
Total dust				
Respirable fraction				
Fluorides (as F)	Varies with compound		2.5	
Fluorine	7782-41-4	0.1	0.2	
Fluorotrichloromethane (Trichlorofluoromethane)	75-69-4	1000	5600	
Formaldehyde; see 1926.1148	50-00-0			
Formic acid	64-18-6	5	9	
Furfural	98-01-1	5	20	X
Furfuryl alcohol	98-00-0	50	200 <sup>A(3)</sup>	
Gasoline	8006-61-9			
Glycerin (mist)	56-81-5			
Total dust				
Respirable fraction				
Glycidol	556-52-5	50	150	
Glycol monoethyl ether; see 2-Ethoxyethanol				
Graphite, natural				
respirable dust	7782-42-5	2	2	2
Graphite, synthetic				
Total dust				
Respirable fraction				
Guthion; see Azinphos methyl				
Gypsum	13397-24-5			
Total dust				
Respirable fraction				
Hafnium	7440-58-6		0.5	
Helium	7440-59-7	E		
Heptachlor	76-44-8		0.5	X
Heptane (n-Heptane)	142-82-5	500	2000	
Hexachloroethane	67-72-1	1	10	X
Hexachloronaphthalene	1335-87-1		0.2	X
n-Hexane	110-54-3	500	1800	
2-Hexanone (Methyl n-butyl ketone)	591-78-6	100	410	
Hexone (Methylisobutyl ketone)	108-10-1	100	410	
sec-Hexyl acetate	108-84-9	50	300	
Hydrazine	302-01-2	1 <sup>E</sup>	1.3	X
Hydrogen	1333-74-0			
Hydrogen bromide	10035-10-6	3	10	

Substance	CAS No. <sup>d</sup>	ppm <sup>a</sup>	mg/m <sup>3b</sup>	Skin Designation
Hydrogen chloride	7647-01-0	(C)5	(C)7	
Hydrogen cyanide	74-90-8	10	11	X
Hydrogen fluoride (as F)	7664-39-3	3	2	
Hydrogen peroxide	7722-84-1	1	1.4	
Hydrogen selenide (as Se)	7783-07-5	0.05	0.2	
Hydrogen sulfide	7783-06-4	10	15	
Hydroquinone	123-31-9		2	
Indene	95-13-6	10	45	
Indium and compounds (as in)	7440-74-6		0.1	
Iodine	7553-56-2	(C)0.1	(C)1	
Iron oxide fume	1309-37-1		10	
Iron salts (soluble) (as Fe)	Varies with compound		1	
Isomyl acetate	123-92-2	100	525	
Isomyl alcohol (primary and secondary)	123-51-3	100	360	
Isobutyl acetate	110-19-0	150	700	
Isobutyl alcohol	78-83-1	100	300	
Isophorone	78-59-1	25	140	
Isopropyl acetate	108-21-4	250	950	
Isopropyl alcohol	67-63-0	400	980	
Isopropylamine	75-31-0	5	12	
Isopropyl ether	108-20-3	500	2100	
Isopropyl glycidyl ether(IGE)	4016-14-2	50	240	
Kaolin	1332-58-7			
Total dust				
Respirable fraction				
Ketene	463-51-4	0.5	0.9	
Lead inorganic (as Pb); see 1926.62	7439-92-1			
Limestone	1317-65-3			
Total dust				
Respirable fraction				
Lindane	58-89-9		0.5	X
Lithium hydride	7580-67-8		0.025	
L.P.G. (Liquified petroleum gas)	68476-85-7	1000	1800	
Magnesite	546-93-0			
Total dust				
Respirable fraction				
Magnesium oxide fume	1309-48-4			
Total Particulate			15	
Malathion	121-75-5			
Total dust			15	X
Maleic anhydride	108-31-6	0.25		
Manganese compounds (as Mn)	7439-96-5		(C)5	
Manganese fume (as Mn)	7439-96-5		(C)5	
Marble	1317-65-3			
Total dust				
Respirable fraction				
Mercury (aryl and inorganic) (as Hg)	7439-97-6		0.1	X
Mercury (organo) alkyl compounds (as Hg)	7439-97-6		0.01	X

Substance	CAS No. <sup>d</sup>	ppm <sup>a</sup>	mg/m <sup>3b</sup>	Skin Designation
Mercury (vapor) (as Hg)	7439-97-6		0.1	X
Mesityl oxide	141-79-7	25 <sub>E</sub>	100	
Methane	74-82-8			
Methanethiol; see Methyl mercaptan				
Methoxychlor	72-43-5			
Total dust			15	
2-Methoxyethanol; (Methyl cellosolve)	109-86-4	25	80	X
2-Methoxyethyl acetate (Methyl cellosolve acetate)	110-49-6	25	120	X
Methyl acetate	79-20-9	200	610	
Methyl acetylene (Propyne)	74-99-7	1000	1650	
Methyl acetylene propadiene mixture (MAPP)		1000	1800	
Methyl acrylate	96-33-3	10	35	X
Methylal (Dimethoxy-methane)	109-87-5	1000	3100	
Methyl alcohol	67-56-1	200	260	
Methylamine	74-89-5	10	12	
Methyl amyl alcohol; see Methyl Isobutyl carbinol				
Methyl n-amyl ketone	110-43-0	100	465	
Methyl bromide	74-83-9	(C)20	(C)80	X
Methyl butyl ketone; see 2-Hexanone				
Methyl cellosolve; see 2-Methoxyethanol				
Methyl cellosolve acetate; see 2-Methoxyethyl acetate				
Methyl chloride	74-87-3	100	210	
Methyl chloroform (1, 1, 1-Trichloroethane)	71-55-6	350	1900	
Methylcyclohexane	108-87-2	500	2000	
Methylcyclohexanol	25639-42-3	100	470	
o-Methylcyclohexanone	583-60-8	100	460	X
*Methylenechloride; see 1910.1052				
Methyl ethyl ketone (MEK); see 2-Butanone				
Methyl formate	107-31-3	100	250	
Methyl hydrazine (Monomethyl hydrazine)	60-34-4	(C)0.2	(C)0.35	X
Methyl iodide	74-88-4	5	28	X
Methyl isoamyl ketone	110-12-3	100	475	
Methyl isobutyl carbinol	108-11-2	25	100	X
Methyl isobutyl ketone; see Hexone				
Methyl isocyanate	624-83-9	0.02	0.05	X
Methyl mercaptan	74-93-1	0.5	1	
Methyl methacrylate	80-62-6	100	410	
Methyl propylketone; see 2-Pentanone				
Methyl silicate	681-84-5	(C)5	(C)30	
alpha-Methyl styrene	98-83-9	(C)100	(C)480	
Methylene bisphenyl isocyanate (MDI)	101-68-8	(C)0.02	(C)0.2	
Methyl enedlaniline (MDA)	101-77-9			
Mica; see Silicates				
Molybdenum (as Mo)	7439-98-7			
Soluble compounds			5	
Insoluble Compounds				
Total dust			15	
Monomethyl aniline	100-61-8	2	9	X

Substance	CAS No. <sup>d</sup>	ppm <sup>a</sup>	mg/m <sup>3b</sup>	Skin Designation
Monomethyl hydrazine; see Methyl hydrazine				
Morpholine	110-91-8	20	70	X
Naphtha (Coal tar)	8030-30-6	100	400	
Naphthalene	91-20-3	10	50	
alpha-Naphthylamine; see 1926.1104	134-32-7			
beta-Naphthylamine; see 1926.1109	91-59-8			
Neon	7440-01-9	E		
Nickel carbonyl (as Ni)	13463-39-3	0.001	0.007	
Nickel, metal and insoluble compounds (as Ni)	7440-02-0		1	
Nickel, soluble compounds (as Ni)	7440-02-0		1	
Nicotine	54-11-5		0.5	X
Nitric acid	7697-37-2	2	5	
Nitric oxide	10102-43-9	25	30	
p-Nitroaniline	100-01-6	1	6	X
Nitrobenzene	98-95-3	1	5	X
p-Nitrochlorobenzene	100-00-5		1	X
4-Nitrodiphenyl; see 1926.1103	92-93-3			
Nitroethane	79-24-3	100 <sub>E</sub>	310	
Nitrogen	7727-37-9			
Nitrogen dioxide	10102-44-0	(C)5	(C)9	
Nitrogen trifluoride	7783-54-2	10	29	
Nitroglycerin	55-63-0	(C)0.2	(C)2	X
Nitromethane	75-52-5	100	250	
1-Nitropropane	108-03-2	25	90	
2-Nitropropane	79-46-9	25	90	
N-Nitrosodimethylamine; see 1926.1116	62-79-9			
Nitrotoluene (all isomers)		5	30	X
o-isomer	88-72-2			
m-isomer	99-08-1			
p-isomer	99-99-0			
Nitrotrichloromethane; see Chloropicrin				
Nitrous oxide	10024-97-2	E		
Octachloronaphthalene	2234-13-1		0.1	X
Octane	111-65-9	400	1900	
Oil mist, mineral	8012-95-1		5	
Osmium tetroxide (as Os)	20816-12-0		0.002	
Oxalic acid	144-62-7		1	
Oxygen difluoride	7783-41-7	0.05	0.1	
Ozone	10028-15-6	0.1	0.2	
Paraquat, respirable dust	4685-14-7 1910-42-5 2074-50-2		0.5	X
Parathion	56-38-2		0.1	X
Particulates not otherwise regulated				
Total dust organic and inorganic			15	
PCB; see Chlorodiphenyl (42% and 54% chlorine)				
Pentaborane	19624-22-7	0.005	0.01	
Pentachloronaphthalene	1321-64-8		0.5	X
Pentachlorophenol	87-86-5		0.5	X

Substance	CAS No. <sup>d</sup>	ppm <sup>a</sup>	mg/m <sup>3b</sup>	Skin Designation
Pentaerythritol	115-77-5			
Total dust				
Respirable fraction				
Pentane	109-66-0	500	1500	
2-Pentanone (Methyl propyl ketone)	107-87-9	200	700	
Perchloroethylene (Tetrachloroethylene)	127-18-4	100	670	
Perchloromethyl mercaptan	594-42-3	0.1	0.8	
Perchloryl fluoride	7616-94-6	3	13.5 <sub>A(3)</sub>	
Petroleum distillates (Naphtha) (Rubber Solvent)				
Phenol	108-95-2	5	19	X
p-Phenylene diamine	106-50-3		0.1	X
Phenyl ether, vapor	101-84-8	1	7	
Phenyl ether-biphenyl mixture, vapor		1	7	
Phenylethylene; see Styrene				
Phenyl glycidyl ether (PGE)	122-60-1	10	60	
Phenylhydrazine	100-63-0	5	22	X
Phosdrin (Mevinphos)	7786-34-7		0.1	X
Phosgene (Carbonyl chloride)	75-44-5	0.1	0.4	
Phosphine	7803-51-2	0.3	0.4	
Phosphoric acid	7664-38-2		1	
Phosphorus (yellow)	7723-14-0		0.1	
Phosphorus pentachloride	10026-13-8		1	
Phosphorus pentasulfide	1314-80-3		1	
Phosphorus trichloride	7719-12-2	0.5	3	
Phthalic anhydride	85-44-9	2	12	
Picric acid	88-89-1		0.1	X
Pindone (2-Pivalyl-1, 3-indandione)	83-26-1		0.1	
Plaster of paris	26499-65-0			
Total dust				
Respirable fraction				
Platinum (as Pt)	7440-06-4			
Metal				
Soluble Salts			0.002	
Polytetrafluoroethylene decomposition products			<sub>A(2)</sub>	
Portland cement	65997-15-1			
Total dust			15	
Respirable fraction			5	
Propane	74-98-6	<sup>E</sup>		
Propargyl alcohol	107-19-7	1		X
beta-Propiolactone; see 1926.1113	57-57-8			
n-Propyl acetate	109-60-4	200	840	
n-Propyl alcohol	71-23-8	200	500	
n-Propyl nitrate	627-13-4	25	110	
Propylene dichloride	78-87-5	75	350	
Propylene imine	75-55-8	2	5	X
Propylene oxide	75-56-9	100	240	
Propyne; see Methyl acetylene				

Substance	CAS No. <sup>d</sup>	ppm <sup>a</sup>	mg/m <sup>3b</sup>	Skin Designation
Pyrethrum	8003-34-7		5	
Pyridine	110-86-1	5	15	
Quinone	106-51-4	0.1	0.4	
RDX: see Cyclonite				
Rhodium (as Rh), metal fume and insoluble compounds	7440-16-6		0.1	
Rhodium (as Rh), soluble compounds	7440-16-6		0.001	
Ronnel	299-84-3		10	
Rotenone	83-79-4		5	
Rouge				
Total dust				
Respirable fraction				
Selenium compounds (as Se)	7782-49-2		0.2	
Selenium hexafluoride (as Se)	7783-79-1	0.05 <sub>2</sub>	0.4 <sub>2</sub>	2
Silica, amorphous, precipitated and gel	112926-00-8		2	2
Silica, amorphous, diatomaceous earth, containing less than 1 percent crystalline silica	61790-53-2	2	2	2
Silica, crystalline cristobalite, respirable dust	14464-46-1	2	2	2
Silica, crystalline quartz, respirable dust	14808-60-7	2	2	2
Silica, crystalline tripoli (as quartz), respirable dust	1317-95-9	2	2	2
Silica, crystalline tridymite, respirable dust	15468-32-3	2	2	2
Silica, fused, respirable dust	60676-86-0	2	2	2
Silicates (less than 1 percent crystalline silica) Mica (respirable dust)	12001-26-2		2	2
Soapstone, Total dust		2	2	2
Soapstone, respirable dust		2	2	2
Talc (containing asbestos); use asbestos limit; see 1926.58				
Talc (containing no asbestos), respirable dust	14807-96-6	2	2	2
Tremolite, abestiform; see 1926.58				
Silicon carbide	409-21-2			
Total dust				
Respirable fraction				
Silver, metal and soluble compounds (as Ag)	7440-22-4		0.01	
Soapstone; see Silicates				
Sodium fluoroacetate	62-74-8		0.05	X
Sodium hydroxide	1310-73-2		2	
Starch	9005-25-8			
Total dust				
Respirable fraction				
Stibine	7803-52-3	0.1	0.5	
Stoddard solvent	8052-41-3	200	1150	
Strychnine	57-24-9		0.15	
Styrene	100-42-5	(C)100	(C)420	
Sucrose	57-50-1			
Total dust				
Respirable fraction				
Sulfur dioxide	7446-09-5	5	13	

Substance	CAS No. <sup>d</sup>	ppm <sup>a</sup>	mg/m <sup>3b</sup>	Skin Designation
Sulfur hexafluoride	2551-62-4	1000	6000	
Sulfuric acid	7664-93-9		1	
Sulfur monochloride	10025-67-9	1	6	
Sulfur pentafluoride	5714-22-7	0.025	0.25	
Sulfuryl fluoride	2699-79-8	5	20	
Systox; see Demeton				
2, 4, 5-T (2, 4, 5-tri-chlorophenoxyacetic acid)	93-76-5		10	
Talc; see Silicates				
Tantalum, metal and oxide dust	7440-25-7		5	
TEDP (Sulfotep)	3689-24-5		0.2	X
Teflon decomposition products			A2	
Tellurium and compounds (as Te)	13494-80-9		0.1	
Tellurium hexafluoride (as Te)	7783-80-4	0.02	0.2	
Temephos	3383-96-8			
Total dust				
Respirable fraction				
TEPP (Tetraethyl pyrophosphate)	107-49-3		0.05	X
Terphenylis	26140-60-3	(C)1	(C)9	
1, 1, 1, 2-Tetrachloro-2, 2-difluoroethane	76-11-9	500	4170	
1, 1, 2, 2-Tetrachloro-1, 2-difluoroethane	76-12-0	500	4170	
1, 1, 2, 2-Tetrachloroethane	79-34-5	5	35	X
Tetrachoroethylene; see Perchloroethylene				
Tetrachloromethane; see Carbon tetrachloride				
Tetrachloronaphthalene	1335-88-2		2	X
Tetraethyl lead (as Pb)	78-00-2		0.1	X
Tetrahydrofuran	109-99-9	200	590	
Tetramethyl lead, (as Pb)	75-74-1		0.15	X
Tetramethyl succinonitrile	3333-52-6	0.5	3	X
Tetranitromethane	509-14-8	1	8	
Tetryl (2, 4, 6-Trinitrophenylmethyl- nitramine)	479-45-8		1.5	X
Thallium, soluble compounds (as Tl)	7440-28-0		0.1	X
Thiram	137-26-8		5	
Tin, inorganic compounds (except oxides) (as Sn)	7440-31-5		2	
Tin, organic compounds (as Sn)	7440-31-5		0.1	
Tin oxide (as Sn)	21651-19-4			
Total dust				
Respirable fraction				
Titanium dioxide	13463-67-7			
Total dust				
Toluene	108-88-3	200	750	
Toluene-2, 4-diisocyanate (TDI)	584-84-9	(C)0.02	(C)0.14	
o-Toluidine	95-53-4	5	22	X
Toxaphene; see Chlorinated camphene				
Tremolite; see Silicates				
Tributyl phosphate	126-73-8		5	
1, 1, 1-Trichloroethane; see Methyl chloroform				
1, 1, 2-Trichloroethane	79-00-5	10	45	X
Trichloroethylene	79-01-6	100	535	

Substance	CAS No. <sup>d</sup>	ppm <sup>a</sup>	mg/m <sup>3b</sup>	Skin Designation
Trichloromethane; see Chloroform				
Trichloronaphthalene	1321-65-9		5	X
1, 2, 3-Trichloropropane	96-18-4	50	300	
1, 1, 2-Trichloro-1, 2, 2-trifluoroethane	76-13-1	1000	7600	
Triethylamine	121-44-8	25	100	
Trifluorobromomethane	75-63-8	1000	6100	
Trimethyl benzene	25551-13-7	25	120	
2, 4, 6-Trinitrophenyl; see Picric acid				
2, 4, 6-Trinitrophenylmethyl nitramine; see Tetryl				
2, 4, 6-Trinitrotoluene (TNT)	118-96-7		1.5	X
Triorthocresyl phosphate	78-30-8		0.1	
Triphenyl phosphate	115-86-6		3	
Tungsten (as W)	7440-33-7			
Insoluble compounds			5	
Soluble compounds			1	
Turpentine	8006-64-2	100	560	
Uranium (as U)	7440-61-1			
Soluble compounds			0.2	
Insoluble compounds			0.2	
Vanadium	1314-62-1			
Respirable dust (as V <sub>2</sub> O <sub>5</sub> )			(C)0.5	
Fume (as V <sub>2</sub> O <sub>5</sub> )			(C)0.1	
Vegetable oil mist				
Total dust				
Respirable fraction				
Vinyl benzene; see Styrene				
Vinyl chloride; see 1926.1117	75-01-4			
Vinyl cyanide; see Acrylonitrile				
Vinyl toluene	25013-15-4	100	480	
Warfarin	81-81-2		0.1	
Xylenes (o-, m-, p-isomers)	1330-20-7	100	435	
Xylidine	1300-73-8	5	25	X
Yttrium	7440-65-5		1	
Zinc chloride fume	7646-85-7		1	
Zinc oxide fume	1314-13-2		5	
Zinc oxide	1314-13-2			
Total dust			15	
Respirable fraction			5	
Zirconium compounds (as Zr)	7440-67-7		5	

## MINERAL DUSTS

Substance	mppcf <sup>j</sup>
<p>SILICA:</p> <p>Crystalline Quartz. Threshold limit calculated from the formula</p> $\frac{250^k}{\% \text{ SiO}_2 + 5}$ <p>Cristobalite. Amorphous, including natural diatomaceous earth</p> <p>SILICATES (less than 1 percent crystalline silica)</p> <p>Mica</p> <p>Portland cement</p> <p>Soapstone</p> <p>Talc (non-asbestiform)</p> <p>Talc (fibrous), use asbestos limit</p> <p>Graphite (natural)</p>	<p>250<sup>k</sup></p> <p>20</p> <p>20</p> <p>50</p> <p>20</p> <p>20</p> <p>—</p> <p>15</p>
<p>Inert or Nuisance Particulates<sup>m</sup>: "[Inert or Nuisance Dusts includes all mineral, inorganic, and organic dusts as indicated by examples in TLV's Appendix D]"</p> <p>Conversion factors. mppcf X 35.3 = million particles per cubic meter = particles per c.c.</p>	<p>50 (or 15 mg/m<sup>3</sup> whichever is the smaller) of total dust less than 1% SiO<sub>2</sub></p>

**§ 1926.56 - Illumination.**

(a) *General.* Construction areas, ramps, runways, corridors, offices, shops, and storage areas shall be lighted to not less than the minimum illumination intensities listed in Table D-3 while any work is in progress:

(b) *Other areas.* For areas or operations not covered above, refer to the American National Standard A11.1-1965, R1970, Practice for Industrial Lighting, for recommended values of illumination.

**§ 1926.57 - Ventilation.**

(a) *General.* Whenever hazardous substances such as dusts, fumes, mists, vapors, or gases exist or are produced in the course of construction work, their concentrations

shall not exceed the limits specified in 1926.55(a). When ventilation is used as an engineering control method, the system shall be installed and operated according to the requirements of this section.

**§ 1926.59 - Hazard communication.**

*Note:* The requirements applicable to construction work under this section are identical to those set forth at 29 CFR 1910.1200 (General Industry Standards).

**§ 1926.62 - Lead.**

*Note:* The requirement applicable to residential construction activities involving exposure to lead are found in the full text of the standard, 29 CFR 1926.62 (Lead).

**TABLE D-3  
Minimum Illumination Intensities in Foot-candles**

Foot-Candles	Area of Operation
5	General construction area lighting.
3	General construction areas, concrete placement, excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas.
5	Indoors: warehouses, corridors, hallways, and exitways.
5	Tunnels, shafts, and general underground work areas: (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines approved cap lights shall be acceptable for use in the tunnel heading)
10	General construction plant and shops (e.g., batch plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts and active store rooms, mess halls, and indoor toilets and workrooms.)

30	First aid stations, infirmaries, and offices.
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## Subpart E - Personal Protective and Life Saving Equipment

meet the requirements and specifications in American National Standard for Men's Safety-Toe Footwear, Z41.1-1967.

### **§ 1926.95 - Criteria for personal protective equipment.**

(a) *Application.* Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

(b) *Employee-owned equipment.* Where employees provide their own protective equipment, the employer shall be responsible to assure its adequacy, including proper maintenance, and sanitation of such equipment.

(c) *Design.* All personal protective equipment shall be of safe design and construction for the work to be performed.

### **§ 1926.96 - Occupational foot protection.**

Safety-toe footwear for employees shall

**§ 1926.100 - Head protection.**

for

(a) Employees working in areas where there is a possible danger of head injury from impact, or from falling or flying objects, or from electrical shock and burns, shall be protected

by protective helmets.

(b) Helmets for the protection of employees against impact and penetration of falling and flying objects shall meet the specifications contained in American National Standards Institute, Z89.1-1969, Safety Requirements for Industrial Head Protection.

(c) Helmets for the head protection of employees exposed to high voltage electrical shock and burns shall meet the specifications contained in American National Standards Institute, Z89.2-1971.

**§ 1926.101 - Hearing protection.**

(a) Wherever it is not feasible to reduce the noise levels or duration of exposures to those specified in Table D-2, Permissible Noise Exposures, in 1926.52, ear protective devices shall be provided and used.

(b) Ear protective devices inserted in the ear shall be fitted or determined individually by competent persons.

(c) Plain cotton is not an acceptable protective device.

**§ 1926.102 - Eye and face protection.**

(a) *General.*

(a)(1) Employees shall be provided with eye and face protection equipment when machines or operations present potential eye or face injury from physical, chemical, or radiation agents.

(a)(2) Eye and face protection equipment required by this Part shall meet the requirements specified in American National Standards Institute, Z87.1-1968, Practice

Occupational and Educational Eye and Face Protection.

(a)(3) Employees whose vision requires the use of corrective lenses in spectacles, when required by this regulation to wear eye protection, shall be protected by goggles or spectacles of one of the following types:

(a)(3)(i) Spectacles whose protective lenses provide optical correction;

(a)(3)(ii) Goggles that can be worn over corrective spectacles without disturbing the adjustment of the spectacles;

(a)(3)(iii) Goggles that incorporate corrective lenses mounted behind the protective lenses.

(a)(4) Face and eye protection equipment shall be kept clean and in good repair.

The use of this type equipment with structural or optical defects shall be prohibited.

(a)(5) Table E-1 shall be used as a guide in the selection of face and eye protection for the hazards and operations noted.

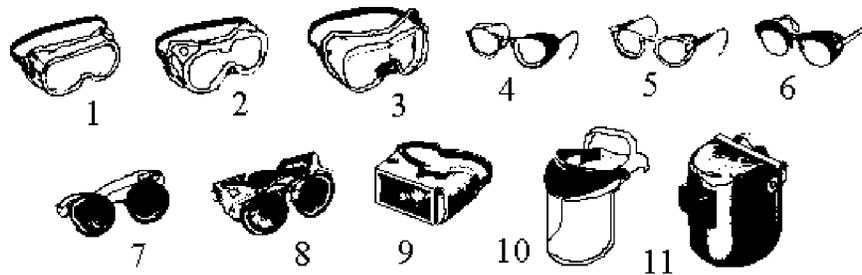
(a)(6) Protectors shall meet the following minimum requirements:

(a)(6)(i) They shall provide adequate protection against the particular hazards for which they are designed.

(a)(6)(ii) They shall be reasonably comfortable when worn under the designated conditions.

(a)(6)(iii) They shall fit snugly and shall not unduly interfere with the movements of the wearer.

TABLE E-1 - Eye and Face Protector Selection Guide



1. GOGGLES, Flexible Fitting - Regular Ventilation
2. GOGGLES, Flexible Fitting - Hooded Ventilation
3. GOGGLES, Cushioned Fitting - Rigid Body
4. SPECTACLES, Metal Frame, with Sideshields <sup>1</sup>
5. SPECTACLES, Plastic Frame - with Sideshields <sup>2</sup>
6. SPECTACLES, Metal-Plastic Frame - with Sideshields <sup>1</sup>
7. WELDING GOGGLES, Eyecup Type - Tinted Lenses <sup>2</sup>
- 7A. CHIPPING GOGGLES, Eyecup Type - Clear Safety Lenses
8. WELDING GOGGLES, Coversec Type - Tinted Lenses <sup>2</sup>
- 8A. CHIPPING GOGGLES, Coverspec Type - Clear Safety Lenses
9. WELDING GOGGLES, Coverspec Type - Tinted Plate Lens <sup>2</sup>
10. FACE SHIELD (Available with Plastic or Mesh Window)
11. WELDING HELMETS<sup>2</sup>

<sup>1</sup> Non-side shield spectacles are available for limited hazard use requiring only frontal protection.

<sup>2</sup> See Table E-2, in paragraph (b) of this section, Filter Lens Shade Numbers for Protection Against Radiant Energy.

**Subpart E**

**§ 1926.103**

**Personal Protective and  
Life Saving Equipment**

**Respiratory protection**

Applications

Operation	Hazards	Recommended protectors
Acetylene-Burning, Acetylene-Cutting, Acetylene-Welding	Sparks, harmful rays, molten metal, flying particles	7, 8, 9
Chemical Handling	Splash, acid burns, fumes	2, 10 (For severe exposure add 10 over 2)
Chipping	Flying particles	1, 3, 4, 5, 6, 7A, 8A
Electric (arc) welding	Sparks, intense rays, molten metal	9, 11, (11 in combination with 4, 5, 6, in tinted lenses advisable)
Furnace operations	Glare, heat, molten metal	7, 8, 9 (For severe exposure add 10)
Grinding-Light	Flying particles	1, 3, 4, 5, 6, 10
Grinding-Heavy	Flying particles	1, 3, 7A, 8A (For severe exposure add 10)
Laboratory	Chemical splash, glass breakage	2 (10 when in combination with 4, 5, 6)
Machining	Flying particles	1, 3, 4, 5, 6, 10
Molten metals	Heat, glare, sparks, splash	7, 8, (10 in combination with 4, 5, 6, in tinted lenses)
Spot welding	Flying particles, sparks	1, 3, 4, 5, 6, 10

(a)(6)(iv) They shall be durable.

(a)(6)(v) They shall be capable of being disinfected.

(a)(6)(vi) They shall be easily cleanable.

(a)(7) Every protector shall be distinctly marked to facilitate identification only of the manufacturer.

(a)(8) When limitations or precautions are indicated by the manufacturer, they shall be transmitted to the user and care taken to see that such limitations and precautions are strictly observed.

(b) Protection against radiant energy.

(b)(1) Selection of shade numbers for welding filter. Table E-2 shall be used as a guide for the selection of the proper shade

numbers of filter lenses or plates used in welding. Shades more dense than those listed may be used to suit the individual's needs.

**§ 1926.103 - Respiratory protection.**

(a) General.

(a)(1) In emergencies, or when controls required by Subpart D of this part either fail or are inadequate to prevent harmful exposure to employees, appropriate respiratory protective devices shall be provided by the employer and shall be used.

(a)(2) Respiratory protective devices shall be approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health or

acceptable to the U.S. Department of

**TABLE E-2. - Filter Lens Shade Numbers for Protection Against Radiant Energy**

Welding operation	Shade number
Shielded metal-arc welding 1/16-, 3/32-, 1/8-, 5/32- inch diameter electrodes .....	10
Gas-shielded arc welding (nonferrous) 1/16-, 3/32-, 1/8-, 5/32-inch diameter electrodes .....	11
Gas-shielded arc welding (ferrous) 1/16-, 3/32-, 1/8-, 5/32-inch diameter electrodes .....	12
Shielded metal-arc welding 3/16-, 7/32-, 1/4-inch diameter electrodes .....	12
5/16-, 3/8-inch diameter electrodes .....	14
Atomic hydrogen welding .....	10-14
Carbon-arc welding .....	14
Soldering .....	2
Torch brazing .....	3 or 4
Light cutting, up to 1 inch .....	3 or 4
Medium cutting, 1 inch to 6 inches .....	4 or 5
Heavy cutting, over 6 inches .....	5 or 6
Gas welding (light), up to 1/8-inch .....	4 or 5
Gas welding (medium), 1/8-inch to 1/2-inch .....	5 or 6
Gas welding (heavy), over 1/2-inch .....	6 or 8

Labor for the specific contaminant to which the employee is exposed.

**(b) Respirator selection.**

**(b)(1)** The chemical and physical properties of the contaminant, as well as the toxicity and concentration of the hazardous material, shall be considered in selecting the proper respirators.

**(b)(2)** The nature and extent of the hazard, work requirements, and conditions, as well as the limitations and characteristics of the available respirators, shall also be factors considered in making the proper selection.

**(b)(3)** The following table lists the types of respirators required for protection in dangerous atmospheres:

**(c) Selection, issuance, use and care of respirators.**

**(c)(1)** Employees required to use respiratory protective equipment approved for use in atmospheres immediately dangerous to

life shall be thoroughly trained in its use. Employees required to use other types of respiratory protective equipment shall be instructed in the use and limitations of such equipment.

**(c)(2)** Respiratory protective equipment shall be inspected regularly and maintained in good condition. Gas mask canisters and chemical cartridges shall be replaced as necessary so as to provide complete protection. Mechanical filters shall be cleaned or replaced as necessary so as to avoid undue resistance to breathing.

**(c)(3)** Respiratory protective equipment which has been previously used shall be cleaned and disinfected before it is issued by the employer to another employee. Emergency rescue equipment shall be cleaned and disinfected immediately after each use.

**(d) Permissible practice.**

**(d)(1)** In the control of those occupational

**Personal Protective and Life Saving Equipment**

**Respiratory protection**

diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This

**TABLE E-4. - Selection of Respirators**

Hazard	Respirator (See Note)
Oxygen deficiency	Self-contained breathing apparatus. Hose mask with blower. Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.
Gas and vapor contaminants immediately dangerous to life and health	Self-contained breathing apparatus. Hose mask with blower. Air-purifying full facepiece respirator (for escape only). Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.
Not immediately dangerous to life and health	Air-line respirator. Hose mask without blower. Air-purifying, half-mask or mouthpiece respirator with chemical cartridge.
Particulate contaminants immediately dangerous to life and health	Self contained breathing apparatus. Hose mask with blower. Air purifying, full facepiece respirator with appropriate filter. Self-rescue mouthpiece respirator (for escape only). Combination air-line respirator with auxiliary self-contained air supply or an air-storage receiver with alarm.
Not immediately dangerous to life and health	Air-purifying, half-mask or mouthpiece respirator with filter pad or cartridge. Air-line respirator. Air-line abrasive-blasting respirator. Hose-mask without blower.
Combination gas, vapor, and particulate contaminants immediately dangerous to life and health	Self-contained breathing apparatus. Hose mask with blower. Air-purifying, full facepiece respirator with chemical canister and appropriate filter (gas mask with filter). Self-rescue mouthpiece respirator (for escape only). Combination air-line respirator with auxiliary self-contained air-supply or an air-storage receiver with alarm.
Not immediately dangerous to life and health	Air-line respirator. Hose mask without blower. Air-purifying, half-mask or mouthpiece respirator with chemical cartridge and appropriate filter.

**NOTE:** For the purpose of this part, *immediately dangerous to life and health* is defined as a condition that either poses an immediate threat of severe exposure to contaminants such as radioactive materials, which are likely to have adverse delayed effects on health.

shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible,

or while they are being instituted, appropriate respirators shall be used pursuant to the following requirements. ( d ) ( 2 ) Respirators shall be provided by the employer when such equipment is necessary to protect the health of the employee. The employer

shall provide the respirators which are applicable and suitable for the purpose intended. The employer shall be responsible for the establishment and maintenance of a respiratory protective program which shall include the requirements outlined in paragraph (e) of this section.

(d)(3) The employee shall use the provided respiratory protection in accordance with instructions and training received.

(e) *Requirements for a minimal acceptable program.*

(e)(1) Written standard operating procedures governing the selection and use of respirators shall be established.

(e)(2) Respirators shall be selected on the basis of hazards to which the worker is exposed.

(e)(3) The user shall be instructed and trained in the proper use of respirators and their limitations.

(e)(5) Respirators shall be regularly cleaned and disinfected. Those used by more than one worker shall be thoroughly cleaned and disinfected after each use.

(e)(6) Respirators shall be stored in a convenient, clean, and sanitary location.

(e)(7) Respirators used routinely shall be inspected during cleaning. Worn or deteriorated parts shall be replaced. Respirators for emergency use such as self-contained devices shall be thoroughly inspected at least once a month and after each use.

(e)(8) Appropriate surveillance of work area conditions and degree of employee exposure or stress shall be maintained.

(e)(9) There shall be regular inspection and evaluation to determine the continued effectiveness of the program.

(e)(10) Persons should not be assigned to tasks requiring use of respirators unless it has been determined that they are physically able

to perform the work and use the equipment. The local physician shall determine what health and physical conditions are pertinent. The respirator user's medical status should be reviewed periodically (for instance, annually).

(e)(11) Respirators shall be selected from among those jointly approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health under the provisions of 30 CFR part 11.

(f) *Air quality.*

(f)(1) Compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration shall be of high purity. Oxygen shall meet the requirements of the United States Pharmacopoeia for medical or breathing oxygen. Breathing air shall meet at least the requirements of the specification for Grade D breathing air as described in Compressed Gas Association Commodity Specification G-7.1-1966. Compressed oxygen shall not be used in supplied-air respirators or in open circuit self-contained breathing apparatus that have previously used compressed air. Oxygen must never be used with air line respirators.

(f)(2) Breathing air may be supplied to respirators from cylinders or air compressors.

(f)(2)(i) Cylinders shall be tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR part 178).

(f)(2)(ii) The compressor for supplying air shall be equipped with necessary safety and standby devices. A breathing air-type compressor shall be used. Compressors shall be constructed and situated so as to avoid entry of contaminated air into the system and suitable in-line air purifying sorbent beds and filters installed to further assure breathing air quality. A receiver of sufficient capacity to

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enable the respirator wearer to escape from a contaminated atmosphere in event of compressor failure, and alarms to indicate compressor failure and overheating shall be installed in the system. If an oil-lubricated compressor is used, it shall have a high-temperature or carbon monoxide alarm, or both. If only a high-temperature alarm is used, the air from the compressor shall be frequently tested for carbon monoxide to insure that it meets the specifications in paragraph (f)(1) of this section.

**(f)(3)** Air line couplings shall be incompatible with outlets for other gas systems to prevent inadvertent servicing of air line respirators with nonrespirable gases or oxygen.

**(f)(4)** Breathing gas containers shall be marked in accordance with American National Standard Method of Marking Portable Compressed Gas Containers to Identify the Material Contained, Z48.1-1954; Federal Specification BB-A-1034a, June 21, 1968, Air, Compressed for Breathing Purposes; or Interim Federal Specification GG-B-00675b, April 27, 1965, Breathing Apparatus, Self-Contained.

**(g) Use of respirators.**

**(g)(1)** Standard procedures shall be developed for respirator use. These should include all information and guidance necessary for their proper selection, use, and care. Possible emergency and routine uses of respirators should be anticipated and planned for.

**(g)(2)** The correct respirator shall be specified for each job. The respirator type is usually specified in the work procedures by a qualified individual supervising the respiratory protective program. The individual issuing them shall be adequately instructed to insure that the correct respirator is issued.

**(g)(3)** Written procedures shall be prepared covering safe use of respirators in dangerous atmospheres that might be encountered in normal operations or in emergencies. Personnel shall be familiar with these procedures and the available respirators.

**(g)(3)(i)** In areas where the wearer, with failure of the respirator, could be overcome by a toxic or oxygen-deficient atmosphere, at least one additional man shall be present. Communications (visual, voice, or signal line) shall be maintained between both or all individuals present. Planning shall be such that one individual will be unaffected by any likely incident and have the proper rescue equipment to be able to assist the other(s) in case of emergency.

**(g)(3)(ii)** When self-contained breathing apparatus or hose masks with blowers are used in atmospheres immediately dangerous to life or health, standby men must be present with suitable rescue equipment.

**(g)(3)(iii)** Persons using air line respirators in atmospheres immediately hazardous to life or health shall be equipped with safety harnesses and safety lines for lifting or removing persons from hazardous atmospheres or other and equivalent provisions for the rescue of persons from hazardous atmospheres shall be used. A standby man or men with suitable self-contained breathing apparatus shall be at the nearest fresh air base for emergency rescue.

**(g)(4)** Respiratory protection is no better than the respirator in use, even though it is worn conscientiously. Frequent random inspections shall be conducted by a qualified individual to assure that respirators are properly selected, used, cleaned, and maintained.

**(g)(5)** For safe use of any respirator, it is essential that the user be properly instructed

in its selection, use, and maintenance. Both supervisors and workers shall be so instructed by competent persons. Training shall provide the men an opportunity to handle the respirator, have it fitted properly, test its face-piece-to-face seal, wear it in normal air for a long familiarity period, and, finally, to wear it in a test atmosphere.

(g)(5)(i) Every respirator wearer shall receive fitting instructions including demonstrations and practice in how the respirator should be worn, how to adjust it, and how to determine if it fits properly. Respirators shall not be worn when conditions prevent a good face seal. Such conditions may be a growth of beard, sideburns, a skull cap that projects under the facepiece, or temple pieces on glasses. Also, the absence of one or both dentures can seriously affect the fit of a facepiece. The worker's diligence in observing these factors shall be evaluated by periodic check. To assure proper protection, the facepiece fit shall be checked by the wearer each time he puts on the respirator. This may be done by following the manufacturer's facepiece fitting instructions.

(g)(5)(ii) Providing respiratory protection for individuals wearing corrective glasses is a serious problem. A proper seal cannot be established if the temple bars of eye glasses extend through the sealing edge of the full facepiece. As a temporary measure, glasses with short temple bars or without temple bars may be taped to the wearer's head. Wearing of contact lenses in contaminated atmospheres with a respirator shall not be allowed. Systems have been developed for mounting corrective lenses inside full facepieces. When a workman must wear corrective lenses as part of the facepiece, the facepiece and lenses shall be fitted by qualified individuals to provide good vision, comfort, and a gas-tight

seal.

(g)(5)(iii) If corrective spectacles or goggles are required, they shall be worn so as not to affect the fit of the facepiece. Proper selection of equipment will minimize or avoid this problem.

(h) *Maintenance and care of respirators.*

(h)(1) A program for maintenance and care of respirators shall be adjusted to the type of plant, working conditions, and hazards involved, and shall include the following basic services:

(h)(1)(i) Inspection for defects (including a leak check),

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- (h)(1)(ii) Cleaning and disinfecting,
- (h)(1)(iii) Repair,
- (h)(1)(iv) Storage

Equipment shall be properly maintained to retain its original effectiveness.

(h)(2)(i) All respirators shall be inspected routinely before and after each use. A respirator that is not routinely used but is kept ready for emergency use shall be inspected after each use and at least monthly to assure that it is in satisfactory working condition.

(h)(2)(ii) Self-contained breathing apparatus shall be inspected monthly. Air and oxygen cylinders shall be fully charged according to the manufacturer's instructions. It shall be determined that the regulator and warning devices function properly.

(h)(2)(iii) Respirator inspection shall include a check of the tightness of connections and the condition of the facepiece, headbands, valves, connecting tube, and canisters. Rubber or elastomer parts shall be inspected for pliability and signs of deterioration. Stretching and manipulating rubber or elastomer parts with massaging action will keep them pliable and flexible and prevent them from taking a set during storage.

(h)(2)(iv) A record shall be kept of inspection dates and findings for respirators maintained for emergency use.

(h)(3) Routinely used respirators shall be collected, cleaned, and disinfected as frequently as necessary to insure that proper protection is provided for the wearer. Respirators maintained for emergency use shall be cleaned and disinfected after each use.

(h)(4) Replacement or repairs shall be done only by experienced persons with parts designed for the respirator. No attempt shall be made to replace components or to make adjustment or repairs beyond the manufac-

turer's recommendations. Reducing or admission valves or regulators shall be returned to the manufacturer or to a trained technician for adjustment or repair.

(h)(5)(i) After inspection, cleaning, and necessary repair, respirators shall be stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Respirators placed at stations and work areas for emergency use should be quickly accessible at all times and should be stored in compartments built for the purpose. The compartments should be clearly marked. Routinely used respirators, such as dust respirators, may be placed in plastic bags. Respirators should not be stored in such places as lockers or tool boxes unless they are in carrying cases or cartons.

(h)(5)(ii) Respirators should be packed or stored so that the facepiece and exhalation valve will rest in a normal position and function will not be impaired by the elastomer setting in an abnormal position.

(h)(5)(iii) Instructions for proper storage of emergency respirators, such as gas masks and self-contained breathing apparatus, are found in "use and care" instructions usually mounted inside the carrying case lid.

(i) *Identification of gas mask canisters.*

(i)(1) The primary means of identifying a gas mask canister shall be by means of properly worded labels. The secondary means of identifying a gas mask canister shall be by a color code.

(i)(2) All who issue or use gas masks falling within the scope of this section shall see that all gas mask canisters purchased or used by them are properly labeled and colored in accordance with these requirements before they are placed in service and that the labels and colors are properly maintained at all times thereafter until the canisters have completely served their purpose.

**(i)(3)** On each canister shall appear in bold letters the following:

**(i)(3)(i)**

Canister for \_\_\_\_\_  
(Name for atmospheric contaminant)  
or  
Type N Gas Mask Canister

**(i)(3)(ii)** In addition, essentially the following wording shall appear beneath the appropriate phrase on the canister label:

"For respiratory protection in atmospheres containing not more than \_\_\_\_\_ percent by volume of \_\_\_\_\_."  
(Name of atmospheric contaminant)

**(i)(4)** Canisters having a special high-efficiency filter for protection against radionuclides and other highly toxic particulates shall be labeled with a statement of the type and degree of protection afforded by the filter. The label shall be affixed to the neck end of, or to the gray stripe which is around and near the top of, the canister. The degree of protection shall be marked as the percent of penetration of the canister by a 0.3 - micron-diameter dioctyl phthalate (DOP) smoke at a flow rate of 85 liters per minute.

**(i)(5)** Each canister shall have a label warning that gas masks should be used only in atmospheres containing sufficient oxygen to support life (at least 16 percent by volume), since gas mask canisters are only designed to neutralize or remove contaminants from the air.

**(i)(6)** Each gas mask canister shall be painted a distinctive color or combination of colors indicated in Table E-5. All colors used shall be such that they are clearly

**TABLE E-5**

Atmospheric contaminants to be protected against	Colors assigned <sup>1</sup>
Acid gases .....	White.
Hydrocyanic acid gas .....	White with 1/2-inch green stripe completely around the canister near the bottom.
Chlorine gas .....	White with 1/2-inch yellow stripe completely around the canister near the bottom.
Organic vapors.....	Black.
Ammonia gas .....	Green.
Acid gases and ammonia gas .....	Green with 1/2-inch white stripe completely around the canister near the bottom.
Carbon monoxide .....	Blue.
Acid gases and organic vapors .....	Yellow.
Hydrocyanic acid gas and chloropicrin vapor .....	Yellow with 1/2-inch blue stripe completely around the canister near the bottom
Acid gases, organic vapors, and ammonia gases .	Brown.
Radioactive materials, excepting tritium and noble gases .....	Purple (Magenta).
Particulates (dusts, fumes, mists, fogs, or smokes) in combination with any of the above gases or vapors .....	Canister color for contaminant, as designated above, with 1/2-inch gray stripe completely around the canister near the top.
All of the above atmospheric contaminants .....	Red with 1/2-inch gray stripe completely around the canister near the top.

<sup>1</sup>Gray shall not be assigned as the main color for a canister designed to remove acids or vapors.

**NOTE:** Orange shall be used as a complete body, or stripe color to represent gases not included in this table. The user will need to refer to the canister label to determine the degree of protection the canister will afford.

identifiable by the user and clearly distinguishable from one another. The color coating used shall offer a high degree of resistance to chipping, scaling, peeling, blistering, fading, and the effects of the ordinary atmospheres to which they may be exposed under normal conditions of storage and use. Appropriately colored pressure sensitive tape may be used for the stripes.

**§ 1926.104 - Safety belts, lifelines, and lanyards.**

(a) Lifelines, safety belts, and lanyards shall be used only for employee safeguarding. Any lifeline, safety belt, or lanyard actually subjected to in-service loading, as distinguished from static load testing, shall be immediately removed from service and shall

not be used again for employee safeguarding.

(b) Lifelines shall be secured above the point of operation to an anchorage or structural member capable of supporting a minimum dead weight of 5,400 pounds.

(c) Lifelines used on rock-scaling operations, or in areas where the lifeline may be subjected to cutting or abrasion, shall be a minimum of 7/8-inch wire core manila rope. For all other lifeline applications, a minimum of 3/4-inch manila or equivalent, with a minimum breaking strength of 5,400 pounds, shall be used.

(d) Safety belt lanyard shall be a minimum of 1/2-inch nylon, or equivalent, with a maximum length to provide for a fall of no greater than 6 feet. The rope shall have a nominal breaking strength of 5,400 pounds.

(e) All safety belt and lanyard hardware shall be drop forged or pressed steel, cadmium plated in accordance with type 1, Class B plating specified in Federal Specification QQ-P-416. Surface shall be smooth and free of sharp edges.

(f) All safety belt and lanyard hardware, except rivets, shall be capable of withstanding a tensile loading of 4,000 pounds without cracking, breaking, or taking a permanent deformation.

## **Subpart F - Fire Protection and Prevention**

### **§ 1926.150 - Fire protection.**

**(a) General requirements.**

(a)(1) The employer shall be responsible for the development of a fire protection program to be followed throughout all phases of the construction and demolition work, and he shall provide for the firefighting equipment as specified in this subpart. As fire hazards occur, there shall be no delay in providing the necessary equipment.

(a)(2) Access to all available firefighting equipment shall be maintained at all times.

(a)(3) All firefighting equipment, provided by the employer, shall be conspicuously located.

(a)(4) All firefighting equipment shall be periodically inspected and maintained in operating condition. Defective equipment shall be immediately replaced.

**(b) Water supply.**

(b)(1) A temporary or permanent water

supply, of sufficient volume, duration, and pressure, required to properly operate the firefighting equipment shall be made available as soon as combustible materials accumulate.

(b)(2) Where underground water mains are to be provided, they shall be installed, completed, and made available for use as soon as practicable.

**(c) Portable firefighting equipment.**

(c)(1) Fire extinguishers and small hose lines.

(c)(1)(i) A fire extinguisher, rated not less than 2A, shall be provided for each 3,000 square feet of the protected building area, or major fraction thereof. Travel distance from any point of the protected area to the nearest fire extinguisher shall not exceed 100 feet.

(c)(1)(ii) One 55-gallon open drum of water with two fire pails may be substituted for a fire extinguisher having a 2A rating.

(c)(1)(iii) A 1/2-inch diameter garden-type hose line, not to exceed 100 feet in length and equipped with a nozzle, may be substituted for a 2A-rated fire extinguisher, providing it is capable of discharging a minimum of 5 gallons per minute with a minimum hose stream range of 30 feet horizontally. The garden-type hose lines shall be mounted on conventional racks or reels. The number and location of hose racks or reels shall be such that at least one hose stream can be applied to all points in the area.

(c)(1)(iv) One or more fire extinguishers, rated not less than 2A, shall be provided on each floor. In multistory buildings, at least one fire extinguisher shall be located adjacent to stairway.

(c)(1)(v) Extinguishers and water drums, subject to freezing, shall be protected from freezing.

(c)(1)(vi) A fire extinguisher, rated not less than 10B, shall be provided within 50

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feet of wherever more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are being used on the jobsite. This requirement does not apply to the integral fuel tanks of motor vehicles.

(c)(1)(vii) Carbon tetrachloride and other toxic vaporizing liquid fire extinguishers are prohibited.

(c)(1)(viii) Portable fire extinguishers shall be inspected periodically and maintained in accordance with Maintenance and Use of Portable Fire Extinguishers, NFPA No. 10A-1970.

(c)(1)(ix) Fire extinguishers which have been listed or approved by a nationally recognized testing laboratory, shall be used to meet the requirements of this subpart.

(c)(1)(x) Table F-1 may be used as a guide for selecting the appropriate portable fire extinguishers.

(e) *Fire alarm devices.*

(e)(1) An alarm system, e.g., telephone system, siren, etc., shall be established by the employer whereby employees on the site and the local fire department can be alerted for an emergency.

(e)(2) The alarm code and reporting instructions shall be conspicuously posted at phones and at employee entrances.

**§ 1926.151 - Fire prevention.**

(a) *Ignition hazards.*

(a)(1) Electrical wiring and equipment for light, heat, or power purposes shall be installed in compliance with the requirements of Subpart K of this part.

(a)(2) Internal combustion engine powered equipment shall be so located that the exhausts are well away from combustible materials. When the exhausts are piped to outside the building under construction, a clearance of at least 6 inches shall be maintained between such piping and

combustible material.

(a)(3) Smoking shall be prohibited at or in the vicinity of operations which constitute a fire hazard, and shall be conspicuously posted: "No Smoking or Open Flame."

(b) *Temporary buildings.*

(b)(1) No temporary building shall be erected where it will adversely affect any means of exit.

(b)(3) Temporary buildings, located other than inside another building and not used for the storage, handling, or use of flammable or combustible liquids, flammable gases, explosives, or blasting agents, or similar hazardous occupancies, shall be located at a distance of not less than 10 feet from another building or structure. Groups of temporary buildings, not exceeding 2,000 square feet in aggregate, shall, for the purposes of this part, be considered a single temporary building.

(c) *Open yard storage.*

(c)(1) Combustible materials shall be piled with due regard to the stability of piles and in no case higher than 20 feet.

(c)(2) Driveways between and around combustible storage piles shall be at least 15 feet wide and maintained free from accumulation of rubbish, equipment, or other articles or materials. Driveways shall be so spaced that a maximum grid system unit of 50 feet by 150 feet is produced.

(c)(3) The entire storage site shall be kept free from accumulation of unnecessary combustible materials. Weeds and grass shall be kept down and a regular procedure provided for the periodic cleanup of the entire area.

(c)(4) When there is a danger of an underground fire, that land shall not be used for combustible or flammable storage.

(c)(5) Method of piling shall be solid wherever possible and in orderly and regular piles. No combustible material shall be stored



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shall be provided at convenient, conspicuously accessible locations in the yard area. Portable fire extinguishers, rated not less than 2A, shall be placed so that maximum travel distance to the nearest unit shall not exceed 100 feet.

of plywood at least 1 inch in thickness, which shall not break down or delaminate under standard fire test conditions. All joints shall be rabbeted and shall be fastened in two directions with flathead wood screws. When more than one door is used, there shall be a rabbeted overlap of not less than 1 inch. Steel hinges shall be mounted in such a manner as to not lose their holding capacity due to loosening or burning out of the screws when subjected to fire. Such cabinets shall be painted inside and out with fire retardant paint.

**§ 1926.152 - Flammable and combustible liquids.**

(a) *General requirements.*

(a)(1) Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids. Approved metal safety cans shall be used for the handling and use of flammable liquids in quantities greater than one gallon, except that this shall not apply to those flammable liquid materials which are highly viscid (extremely hard to pour), which may be used and handled in original shipping containers. For quantities of one gallon or less, only the original container or approved metal safety cans shall be used for storage, use, and handling of flammable liquids.

(a)(2) Flammable or combustible liquids shall not be stored in areas used for exits, stairways, or normally used for the safe passage of people.

(b) *Indoor storage of flammable and combustible liquids.*

(b)(1) No more than 25 gallons of flammable or combustible liquids shall be stored in a room outside of an approved storage cabinet. For storage of liquefied petroleum gas, see 1926.153.

(b)(2) Quantities of flammable and combustible liquid in excess of 25 gallons shall be stored in an acceptable or approved cabinet meeting the following requirements:

(b)(2)(i) Acceptable wooden storage cabinets shall be constructed in the following manner, or equivalent: The bottom, sides, and top shall be constructed of an exterior grade

(b)(2)(ii) Approved metal storage cabinets will be acceptable.

(b)(2)(iii) Cabinets shall be labeled in conspicuous lettering, "Flammable-Keep Fire Away."

(b)(3) Not more than 60 gallons of flammable or 120 gallons of combustible liquids shall be stored in any one storage cabinet. Not more than three such cabinets may be located in a single storage area. Quantities in excess of this shall be stored in an inside storage room.

(f) *Handling liquids at point of final use.*

(f)(1) Flammable liquids shall be kept in closed containers when not actually in use.

(f)(2) Leakage or spillage of flammable or combustible liquids shall be disposed of promptly and safely.

(f)(3) Flammable liquids may be used only where there are no open flames or other sources of ignition within 50 feet of the operation, unless conditions warrant greater clearance.

**§ 1926.153 - Liquefied petroleum gas (LP-Gas).**

(a) *Approval of equipment and systems.*

(a)(1) Each system shall have containers, valves, connectors, manifold valve assemblies, and regulators of an approved

type.

(a)(2) All cylinders shall meet the Department of Transportation specification identification requirements published in 49 CFR Part 178, Shipping Container Specifications.

(a)(3) *Definition.* As used in this section, *Containers* - All vessels, such as tanks, cylinders, or drums, used for transportation or storing liquefied petroleum gases.

(b) *Welding on LP-Gas containers.* Welding is prohibited on containers.

(c) *Container valves and container accessories.*

(c)(1) Valves, fittings, and accessories connected directly to the container, including primary shut off valves, shall have a rated working pressure of at least 250 p.s.i.g. and shall be of material and design suitable for LP-Gas service.

(c)(2) Connections to containers, except safety relief connections, liquid level gauging devices, and plugged openings, shall have shutoff valves located as close to the container as practicable.

(d) *Safety devices.*

(d)(1) Every container and every vaporizer shall be provided with one or more approved safety relief valves or devices. These valves shall be arranged to afford free vent to the outer air with discharge not less than 5 feet horizontally away from any opening into a building which is below such discharge.

(d)(2) Shutoff valves shall not be installed between the safety relief device and the container, or the equipment or piping to which the safety relief device is connected, except that a shutoff valve may be used where the arrangement of this valve is such that full required capacity flow through the safety relief device is always afforded.

(d)(3) Container safety relief devices and

regulator relief vents shall be located not less than 5 feet in any direction from air openings into sealed combustion system appliances or mechanical ventilation air intakes.

(f) *Requirements for appliances.*

(f)(1) LP-Gas consuming appliances shall be approved types.

(f)(2) Any appliance that was originally manufactured for operation with a gaseous fuel other than LP-Gas, and is in good condition, may be used with LP-Gas only after it is properly converted, adapted, and tested for performance with LP-Gas before the appliance is placed in use.

(g) *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.

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

(h)(1) When operational requirements make portable use of 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 in accordance with paragraphs (h)(2) through (11) of this section.

(h)(2) *Containers in use* means connected for use.

(h)(3) Systems utilizing containers having a water capacity greater than 2 1/2 pounds (nominal 1 pound LP-Gas capacity) shall be equipped with excess flow valves. Such excess flow valves shall be either integral with the container valves or in the connections to the container valve outlets.

(h)(4) Regulators shall be either directly connected to the container valves or to manifolds connected to the container valves.

Liquefied petroleum gas (LP-Gas)

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The regulator shall be suitable for use with LP-Gas. Manifolds and fittings connecting containers to pressure regulator inlets shall be designed for at least 250 p.s.i.g. service pressure.

(h)(5) Valves on containers having water capacity greater than 50 pounds (nominal 20 pounds LP-Gas capacity) shall be protected from damage while in use or storage.

(h)(6) Aluminum piping or tubing shall not be used.

(h)(7) Hose shall be designed for a working pressure of at least 250 p.s.i.g. Design, construction, and performance of hose, and hose connections shall have their suitability determined by listing by a nationally recognized testing agency. The hose length shall be as short as practicable. Hoses shall be long enough to permit compliance with spacing provisions of paragraphs (h)(1) through (13) of this section, without kinking or straining, or causing hose to be so close to a burner as to be damaged by heat.

(h)(8) 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 if used, in the event of flame failure. Such heaters, having inputs above 50,000 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.

NOTE: The provisions of this subparagraph do not apply to portable heaters under 7,500 B.t.u. per hour input when used with containers having a maximum water capacity of 2 1/2 pounds.

(h)(9) Container valves, connectors, regulators, manifolds, piping, and tubing shall not be used as structural supports for heaters.

(h)(10) Containers, regulating equipment, manifolds, pipe, tubing, and hose shall be located to minimize exposure to high temperatures or physical damage.

(h)(11) Containers having a water capacity greater than 2 1/2 pounds (nominal

1 pound LP-Gas capacity) connected for use shall stand on a firm and substantially level surface and, when necessary, shall be secured in an upright position.

**(h)(12)** The maximum water capacity of individual containers shall be 245 pounds (nominal 100 pounds LP-Gas capacity).

**(h)(13)** For temporary heating, heaters (other than integral heater-container units) shall be located at least 6 feet from any LP-Gas container. This shall not prohibit the use of heaters specifically designed for attachment to the container or to a supporting standard, provided they are designed and installed so as to prevent direct or radiant heat application from the heater onto the containers. Blower and radiant type heaters shall not be directed toward any LP-Gas container within 20 feet.

**(h)(14)** If two or more heater-container units, of either the integral or nonintegral type, are located in an unpartitioned area on the same floor, the container or containers of each unit shall be separated from the container or containers of any other unit by at least 20 feet.

**(h)(15)** 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 not be greater than 735 pounds (nominal 300 pounds LP-Gas capacity). Such manifolds shall be separated by at least 20 feet.

**(h)(16)** Storage of containers awaiting use shall be in accordance with paragraphs (j) and (k) of this section.

**(i) Multiple container systems.**

**(i)(1)** 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. This provision is not to be construed

as requiring an automatic changeover device.

**(i)(2)** 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 to minimize the flow of gas in the event the fuel line becomes ruptured.

**(i)(3)** Regulators and low-pressure relief devices shall be rigidly attached to the cylinder valves, cylinders, supporting standards, the building walls, or otherwise rigidly secured, and shall be so installed or protected from the elements.

**(j) Storage of LPG containers.** Storage of LPG within buildings is prohibited.

**(k) Storage outside of buildings.**

**(k)(1)** Storage outside of buildings, for containers awaiting use, shall be located from the nearest building or group of buildings, in accordance with the following:

**TABLE F-3**

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

**(k)(2)** Containers shall be in a suitable ventilated enclosure or otherwise protected against tampering.

**(l) Fire protection.** Storage locations shall be provided with at least one approved portable fire extinguisher having a rating of not less than 20-B:C.

**(n)** When LP-Gas and one or more other gases are stored or used in the same area, the containers shall be marked to identify their content. Marking shall be in compliance with American National Standard Z48.1-1954, "Method of Marking Portable Compressed Gas Containers To Identify the Material

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Contained."

(o) *Damage from vehicles.* When damage to LP-Gas systems from vehicular traffic is a possibility, precautions against such damage shall be taken.

**§ 1926.154 - Temporary heating devices.**

(a) *Ventilation.*

(a)(1) Fresh air shall be supplied in sufficient quantities to maintain the health and safety of workmen. Where natural means of fresh air supply is inadequate, mechanical ventilation shall be provided.

(a)(2) When heaters are used in confined spaces, special care shall be taken to provide sufficient ventilation in order to ensure proper combustion, maintain the health and safety of workmen, and limit temperature rise in the area.

(b) *Clearance and mounting.*

(b)(1) Temporary heating devices shall be installed to provide clearance to combustible material not less than the amount shown in Table F-4.

**TABLE F-4**

Heating appliances	Minimum clearance, (inches)		
	Sides	Rear	Chimney Connector
Room heater, circulating type	12	12	18
Room heater, radiant type	36	36	18

(b)(2) Temporary heating devices, which are listed for installation with lesser clearances than specified in Table F-4, may be installed in accordance with their approval.

(b)(3) Heaters not suitable for use on wood floors shall not be set directly upon

them or other combustible materials. When such heaters are used, they shall rest on suitable heat insulating material or at least 1-inch concrete, or equivalent. The insulating material shall extend beyond the heater 2 feet or more in all directions.

(b)(4) Heaters used in the vicinity of combustible tarpaulins, canvas, or similar coverings shall be located at least 10 feet from the coverings. The coverings shall be securely fastened to prevent ignition or upsetting of the heater due to wind action on the covering or other material.

(c) *Stability.* Heaters, when in use, shall be set horizontally level, unless otherwise permitted by the manufacturer's markings.

(d) *Solid fuel salamanders.* Solid fuel salamanders are prohibited in buildings and on scaffolds.

(e) *Oil-fired heaters.*

(e)(1) Flammable liquid-fired heaters shall be equipped with a primary safety control to stop the flow of fuel in the event of flame failure. Barometric or gravity oil feed shall not be considered a primary safety control.

(e)(2) Heaters designed for barometric or gravity oil feed shall be used only with the integral tanks.

(e)(4) Heaters specifically designed and approved for use with separate supply tanks may be directly connected for gravity feed, or an automatic pump, from a supply tank.

**§ 1926.155 - Definitions applicable to this subpart.**

(a) *Approved,* for the purpose of this subpart, means equipment that has been listed or approved by a nationally recognized testing laboratory such as Factory Mutual Engineering Corp., or Underwriters' Laboratories, Inc., or Federal agencies such as Bureau of Mines, or U.S. Coast Guard, which issue approvals for such equipment.

(b) *Closed container* means a container so sealed by means of a lid or other device that neither liquid nor vapor will escape from it at ordinary temperatures.

(c) *Combustible liquids* mean any liquid having a flash point at or above 140 deg. F. (60 deg. C.), and below 200 deg. F. (93.4 deg. C.).

(d) *Combustion* means any chemical process that involves oxidation sufficient to produce light or heat.

(f) *Fire resistance* means so resistant to fire that, for specified time and under conditions of a standard heat intensity, it will not fail structurally and will not permit the side away from the fire to become hotter than a specified temperature. For purposes of this part, fire resistance shall be determined by the Standard Methods of Fire Tests of Building Construction and Materials, NFPA 251-1969.

(g) *Flammable* means capable of being easily ignited, burning intensely, or having a rapid rate of flame spread.

(h) *Flammable liquids* means any liquid having a flash point below 140 deg. F. and having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100 deg F.

(i) *Flash point* of the liquid means the temperature at which it gives off vapor sufficient to form an ignitable mixture with the air near the surface of the liquid or within the vessel used as determined by appropriate test procedure and apparatus as specified below.

(i)(1) The flash point of liquids having a viscosity less than 45 Saybolt Universal Second(s) at 100 deg. F. (37.8 deg. C.) and a flash point below 175 deg. F. (79.4 deg. C.) shall be determined in accordance with the Standard Method of Test for Flash Point by the Tag Closed Tester, ASTM D-56-69.

(i)(2) The flash point of liquids having a

viscosity of 45 Saybolt Universal Second(s) or more at 175 deg. F. (79.4 deg C.) or higher shall be determined in accordance with the Standard Method of Test for Flash

Point by the Pensky Martens Closed Tester, ASTM D-93-69.

(j) *Liquefied petroleum gases, LPG and LP Gas* mean and include any material which is composed predominantly of any of the following hydrocarbons, or mixtures of them, such as propane, propylene, butane (normal butane or iso-butane), and butylenes.

(k) *Portable tank* means a closed container having a liquid capacity more than 60 U.S. gallons, and not intended for fixed installation.

(l) *Safety can* means an approved closed container, of not more than 5 gallons capacity, having a flash-arresting screen, spring-closing lid and spout cover and so designed that it will safely relieve internal pressure when subjected to fire exposure.

(m) *Vapor pressure* means the pressure, measured in pounds per square inch (absolute), exerted by a volatile liquid as determined by the "Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method)." (ASTM D-323-58).

## **Subpart G - Signs, Signals, and Barricades**

### **§ 1926.200 - Accident prevention signs and tags.**

(a) *General.* Signs and symbols required by this subpart shall be visible at all times when work is being performed, and shall be removed or covered promptly when the hazards no longer exist.

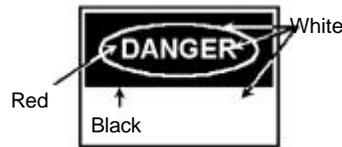
(b) *Danger signs.*

(b)(1) Danger signs (see Figure G-1) shall be used only where an immediate hazard exists.

(b)(2) Danger signs shall have red as the predominating color for the upper panel;

black outline on the borders; and a white lower panel for additional sign wording.

**FIGURE G-1. - DANGER**



(c) *Caution signs.*

(c)(1) Caution signs (see Figure G-2) shall be used only to warn against potential hazards or to caution against unsafe practices.

**FIGURE G-2. - CAUTION**



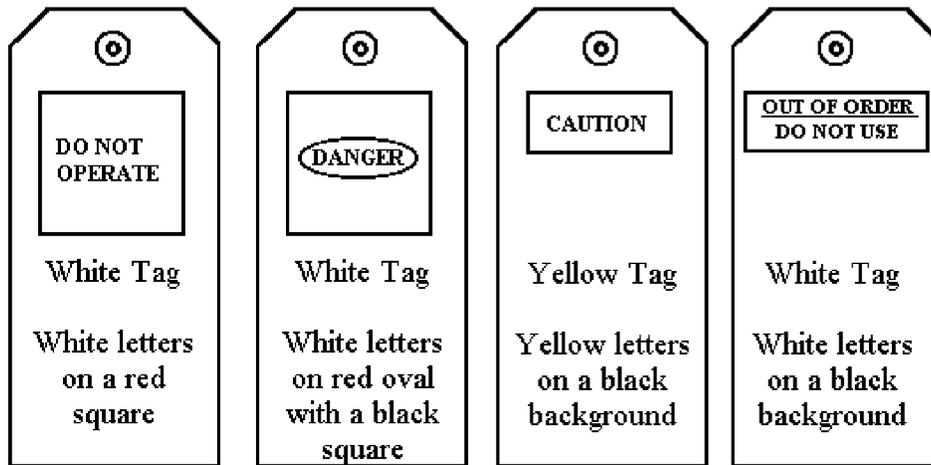
(c)(2) Caution signs shall have yellow as the predominating color; black upper panel and borders: yellow lettering of "caution" on the black panel; and the lower yellow panel for additional sign wording. Black lettering shall be used for additional wording.

(c)(3) Standard color of the background shall be yellow; and the panel, black with yellow letters. Any letters used against the yellow background shall be black. The colors shall be those of opaque glossy samples as specified in Table 1 of American National Standard Z53.1-1967.

(d) *Exit signs.* Exit signs, when required, shall be lettered in legible red letters, not less than 6 inches high, on a white field and the principal stroke of the letters shall be at least three-fourths inch in width.

(e) *Safety instruction signs.* Safety instruction signs, when used, shall be white

TABLE G-1



Basic Stock (Background)	Safety Colors (ink)	Copy Specification (Letters)
White	Red	Do Not Operate
White	Black and Red	Danger
Yellow	Black	Caution
White	Black	Out of Order Do not Use

with green upper panel with white letters to convey the principal message. Any additional wording on the sign shall be black letters on the white background.

(f) *Directional signs.* Directional signs, other than automotive traffic signs specified in paragraph (g) of this section, shall be white with a black panel and a white directional symbol. Any additional wording on the sign shall be black letters on the white background.

(g) *Traffic signs.*

(g)(1) Construction areas shall be posted

with legible traffic signs at points of hazard.

(g)(2) All traffic control signs or devices used for protection of construction workmen shall conform to American National Standards Institute D6.1-1971, Manual on Uniform Traffic Control Devices for Streets and Highways.

(h) *Accident prevention tags.*

(h)(1) Accident prevention tags shall be used as a temporary means of warning employees of an existing hazard, such as defective tools, equipment, etc. They shall not be used in place of, or as a substitute for,

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accident prevention signs.

(h)(2) Specifications for accident prevention tags similar to those in Table G-1 shall apply.

(i) *Additional rules.* American National Standards Institute (ANSI) Z35.1-1968, Specifications for Accident Prevention Signs, and Z35.2-1968, Specifications for Accident Prevention Tags, contain rules which are additional to the rules prescribed in this section. The employer shall comply with ANSI Z35.1-1968 and Z35.2-1968 with respect to rules not specifically prescribed in this subpart.

**§ 1926.203 - Definitions applicable to this subpart.**

(a) *Barricade* means an obstruction to deter the passage of persons or vehicles.

(b) *Signs* are the warnings of hazard, temporarily or permanently affixed or placed, at locations where hazards exist.

(c) *Signals* are moving signs, provided by workers, such as flagmen, or by devices, such as flashing lights, to warn of possible or existing hazards.

(d) *Tags* are temporary signs, usually attached to a piece of equipment or part of a structure, to warn of existing or immediate hazards.

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**§ 1926.251 - Rigging equipment for material handling.**

(a) *General.*

(a)(1) Rigging equipment for material handling shall be inspected prior to use on each shift and as necessary during its use to

ensure that it is safe. Defective rigging equipment shall be removed from service.

(a)(2) Rigging equipment shall not be loaded in excess of its recommended safe working load, as prescribed in Tables H-1 through H-20 in this subpart, following 1926.252(e) for the specific equipment.

(a)(3) Rigging equipment, when not in use, shall be removed from the immediate work area so as not to present a hazard to employees.

(a)(4) Special custom design grabs, hooks, clamps, or other lifting accessories, for such units as modular panels, prefabricated structures and similar materials, shall be marked to indicate the safe working loads and shall be proof-tested prior to use to 125 percent of their rated load.

(a)(5) *Scope.* This section applies to slings used in conjunction with other material handling equipment for the movement of material by hoisting, in employments covered by this part. The types of slings covered are those made from alloy steel chain, wire rope, metal mesh, natural or synthetic fiber rope (conventional three strand construction), and synthetic web (nylon, polyester, and polypropylene).

(a)(6) *Inspections.* Each day before being used, the sling and all fastenings and attachments shall be inspected for damage or defects by a competent person designated by the employer. Additional inspections shall be performed during sling use, where service conditions warrant. Damaged or defective slings shall be immediately removed from service.

(c) *Wire rope.*

(c)(1) Tables H-3 through H-14 shall be used to determine the safe working loads of various sizes and classifications of improved plow steel wire rope and wire rope slings with various types of terminals. For sizes,

classifications, and grades not included in these tables, the safe working load recommended by the manufacturer for specific, identifiable products shall be followed, provided that a safety factor of not less than 5 is maintained.

(c)(2) Protruding ends of strands in splices on slings and bridles shall be covered or blunted.

(c)(3) Wire rope shall not be secured by knots, except on haul back lines on scrapers.

(c)(4) The following limitations shall apply to the use of wire rope:

(c)(4)(i) An eye splice made in any wire rope shall have not less than three full tucks. However, this requirement shall not operate to preclude the use of another form of splice or connection which can be shown to be as efficient and which is not otherwise prohibited.

(c)(4)(ii) Except for eye splices in the ends of wires and for endless rope slings, each wire rope used in hoisting or lowering, or in pulling loads, shall consist of one continuous piece without knot or splice.

(c)(4)(iii) Eyes in wire rope bridles, slings, or bull wires shall not be formed by wire rope clips or knots.

(c)(4)(iv) Wire rope shall not be used if, in any length of eight diameters, the total number of visible broken wires exceeds 10 percent of the total number of wires, or if the rope shows other signs of excessive wear, corrosion, or defect.

(c)(5) When U-bolt wire rope clips are used to form eyes, Table H-20 shall be used to determine the number and spacing of clips.

(c)(5)(i) When used for eye splices, the U-bolt shall be applied so that the "U" section is in contact with the dead end of the rope.

(c)(6) Slings shall not be shortened with knots or bolts or other makeshift devices.

(c)(7) Sling legs shall not be kinked.

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(c)(8) Slings used in a basket hitch shall have the loads balanced to prevent slippage.

(c)(9) Slings shall be padded or protected from the sharp edges of their loads.

(c)(10) Hands or fingers shall not be placed between the sling and its load while the sling is being tightened around the load.

(c)(11) Shock loading is prohibited.

(c)(12) A sling shall not be pulled from under a load when the load is resting on the sling.

(c)(13) *Minimum sling lengths.*

(c)(13)(i) Cable laid and 6 X 19 and 6 X 37 slings shall have minimum clear length of wire rope 10 times the component rope diameter between splices, sleeves or end fittings.

(c)(13)(ii) Braided slings shall have a minimum clear length of wire rope 40 times the component rope diameter between the loops or end fittings.

(c)(13)(iii) Cable laid grommets, strand laid grommets and endless slings shall have a minimum circumferential length of 96 times their body diameter.

(c)(14) *Safe operating temperatures.* Fiber core wire rope slings of all grades shall be permanently removed from service if they are exposed to temperatures in excess of 200 deg. F (93.33 deg. C). When nonfiber core wire rope slings of any grade are used at temperatures above 400 deg. F (204.44 deg. C) or below minus 60 deg. F (15.55 deg. C), recommendations of the sling manufacturer regarding use at that temperature shall be followed.

(c)(15) *End attachments.*

(c)(15)(i) Welding of end attachments, except covers to thimbles, shall be performed prior to the assembly of the sling.

(c)(15)(ii) All welded end attachments shall not be used unless proof tested by the manufacturer or equivalent entity at twice

their rated capacity prior to initial use. The employer shall retain a certificate of proof test, and make it available for examination.

(d) *Natural rope, and synthetic fiber-*

(d)(1) General. When using natural or synthetic fiber rope slings, Tables H-15, 16, 17, and 18 shall apply.

(d)(2) All splices in rope slings provided by the employer shall be made in accordance with fiber rope manufacturers recommendations.

(d)(2)(i) In manila rope, eye splices shall contain at least three full tucks, and short splices shall contain at least six full tucks (three on each side of the center line of the splice).

(d)(2)(ii) In layed synthetic fiber rope, eye splices shall contain at least four full tucks, and short splices shall contain at least eight full tucks (four on each side of the center line of the splice).

(d)(2)(iii) Strand end tails shall not be trimmed short (flush with the surface of the rope) immediately adjacent to the full tucks. This precaution applies to both eye and short splices and all types of fiber rope. For fiber ropes under 1-inch diameter, the tails shall project at least six rope diameters beyond the last full tuck. For fiber ropes 1-inch diameter and larger, the tails shall project at least 6 inches beyond the last full tuck. In applications where the projecting tails may be objectionable, the tails shall be tapered and spliced into the body of the rope using at least two additional tucks (which will require a tail length of approximately six rope diameters beyond the last full tuck).

(d)(2)(iv) For all eye splices, the eye shall be sufficiently large to provide an included angle of not greater than 60 deg. at the splice when the eye is placed over the load or support.

(d)(2)(v) Knots shall not be used in lieu of splices.

(d)(3) *Safe operating temperatures.* Natural and synthetic fiber rope slings, except for wet frozen slings, may be used in a temperature range from minus 20 deg. F (-28.88 deg. C) to plus 180 deg. F (82.2 deg. C) without decreasing the working load limit. For operations outside this temperature range and for wet frozen slings, the sling manufacturer's recommendations shall be followed.

(d)(4) *Splicing.* Spliced fiber rope slings shall not be used unless they have been spliced in accordance with the following minimum requirements and in accordance with any additional recommendations of the manufacturer:

(d)(4)(i) In manila rope, eye splices shall consist of at least three full tucks, and short splices shall consist of at least six full tucks, three on each side of the splice center line.

(d)(4)(ii) In synthetic fiber rope, eye splices shall consist of at least four full tucks, and short splices shall consist of at least eight full tucks, four on each side of the center line.

(d)(4)(iii) Strand end tails shall not be trimmed flush with the surface of the rope immediately adjacent to the full tucks. This applies to all types of fiber rope and both eye and short splices. For fiber rope under 1 inch (2.54 cm) in diameter, the tail shall project at least six rope diameters beyond the last full tuck. For fiber rope 1 inch (2.54 cm) in diameter and larger, the tail shall project at least 6 inches (15.24 cm) beyond the last full tuck. Where a projecting tail interferes with the use of the sling, the tail shall be tapered and spliced into the body of the rope using at least two additional tucks (which will require a tail length of approxi-

mately six rope diameters beyond the last full tuck).

(d)(4)(iv) Fiber rope slings shall have a minimum clear length of rope between eye splices equal to 10 times the rope diameter.

(d)(4)(v) Knots shall not be used in lieu of splices.

(d)(4)(vi) Clamps not designed specifically for fiber ropes shall not be used for splicing.

(d)(4)(vii) For all eye splices, the eye shall be of such size to provide an included angle of not greater than 60 degrees at the splice when the eye is placed over the load or support.

(d)(5) *End attachments.* Fiber rope slings shall not be used if end attachments in contact with the rope have sharp edges or projections.

(d)(6) *Removal from service.* Natural and synthetic fiber rope slings shall be immediately removed from service if any of the following conditions are present:

(d)(6)(i) Abnormal wear.

(d)(6)(ii) Powdered fiber between strands.

(d)(6)(iii) Broken or cut fibers.

(d)(6)(iv) Variations in the size or roundness of strands.

(d)(6)(v) Discoloration or rotting.

(d)(6)(vi) Distortion of hardware in the sling.

(e) *Synthetic webbing (nylon, polyester, and polypropylene).*

(e)(1) The employer shall have each synthetic web sling marked or coded to show:

(e)(1)(i) Name or trademark of manufacturer.

(e)(1)(ii) Rated capacities for the type of hitch.

(e)(1)(iii) Type of material.

(e)(2) Rated capacity shall not be exceeded.

(e)(3) *Webbing.* Synthetic webbing shall be of uniform thickness and width and selvage

**Subpart H**

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**Materials Handling, Storage, Use, and Disposal**

**Rigging equipment for material handling**

edges shall not be split from the webbing's width.

(e)(4) *Fittings*. Fittings shall be:

(e)(4)(i) Of a minimum breaking strength equal to that of the sling; and

(e)(4)(ii) Free of all sharp edges that could in any way damage the webbing.

(e)(5) *Attachment of end fittings to webbing and formation of eyes*. Stitching shall be the only method used to attach end fittings to webbing and to form eyes. The thread shall be in an even pattern and contain a sufficient number of stitches to develop the full breaking strength of the sling.

(e)(6) *Environmental conditions*. When synthetic web slings are used, the following precautions shall be taken:

(e)(6)(i) Nylon web slings shall not be used where fumes, vapors, sprays, mists or liquids of acids or phenolics are present.

(e)(6)(ii) Polyester and polypropylene web slings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present.

(e)(6)(iii) Web slings with aluminum fittings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present.

(e)(7) *Safe operating temperatures*. Synthetic web slings of polyester and nylon shall not be used at temperatures in excess of 180 deg. F (82.2 deg. C). Polypropylene web slings shall not be used at temperatures in excess of 200 deg. F (93.33 deg. C).

(e)(8) *Removal from service*. Synthetic web slings shall be immediately removed from service if any of the following conditions are present:

(e)(8)(i) Acid or caustic burns;

(e)(8)(ii) Melting or charring of any part of the sling surface;

(e)(8)(iii) Snags, punctures, tears or cuts;

(e)(8)(iv) Broken or worn stitches; or

(e)(8)(v) Distortion of fittings.

(f) *Shackles and hooks*.

(f)(1) Table H-19 shall be used to determine the safe working loads of various sizes of shackles, except that higher safe working loads are permissible when recommended by the manufacturer for specific, identifiable products, provided that a safety factor of not less than 5 is maintained.

(f)(2) The manufacturer's recommendations shall be followed in determining the safe working loads of the various sizes and types of specific and identifiable hooks. All hooks for which no applicable manufacturer's recommendations are available shall be tested to twice the intended safe working load before they are initially put into use. The employer shall maintain a record of the dates and results of such tests.

**TABLE H - 1  
RATED CAPACITY (WORKING LOAD LIMIT),  
FOR ALLOY STEEL CHAIN SLINGS<sup>1</sup>**

Rated Capacity (Working Load Limit), Pounds  
[Horizontal angles shown in parentheses]<sup>3</sup>

Chain size, inches	Single branch sling-- 90° loading	Double sling vertical angle <sup>2</sup>			Triple and quadruple sling vertical angle <sup>2</sup>		
		30° (60°)	45° (45°)	60° (30°)	30° (60°)	45° (45°)	60° (30°)
1/4	3,250	5,560	4,550	3,250	8,400	6,800	4,900
3/8	6,600	11,400	9,300	6,600	17,000	14,000	9,900
1/2	11,250	19,500	15,900	11,250	29,000	24,000	17,000
5/8	16,500	28,500	23,300	16,500	43,000	35,000	24,500
3/4	23,000	39,800	32,500	23,000	59,500	48,500	34,500
7/8	28,750	49,800	40,600	28,750	74,500	61,000	43,000
1	38,750	67,100	54,800	38,750	101,000	82,000	58,000
1 1/8	44,500	77,000	63,000	44,500	115,500	94,500	66,500
1 1/4	57,500	99,500	81,000	57,500	149,000	121,500	86,000
1 3/8	67,000	116,000	94,000	67,000	174,000	141,000	100,500
1 1/2	80,000	138,000	112,900	80,000	207,000	169,000	119,500
1 3/4	100,000	172,000	140,000	100,000	258,000	210,000	150,000

<sup>1</sup> Other grades of proof tested steel chain include Proof Coil, BBB Coil and Hi-Test Chain. These grades are not recommended for overhead lifting and therefore are not covered by this code.

<sup>2</sup> Rating of multileg slings adjusted for angle of loading measured as the included angle between the inclined leg and the vertical.

<sup>3</sup> Rating of multileg slings adjusted for angle of loading between the inclined leg and the horizontal plane of the load.

**TABLE H - 2  
MAXIMUM ALLOWABLE WEAR AT ANY POINT OF LINK**

Chain size, inches	Max. allowable wear (inch)
1/4	3/64
3/8	5/64
1/2	7/64
5/8	9/64
3/4	5/32
7/8	11/64
1	3/16
1 1/8	7/32
1 1/4	1/4
1 3/8	9/32
1 1/2	5/16
1 3/4	11/32

**TABLE H - 3**  
**RATED CAPACITIES FOR SINGLE LEG SLINGS**  
6x19 and 6x37 Classification Improved Plow Steel Grade Rope With Fiber Core (FC)

Rope		Rated capacities, tons (2,000 lb)								
Dia (inches)	Con-str.	Vertical			Choker			Vertical Basket <sup>1</sup>		
		HT	MS	S	HT	MS	S	HT	MS	S
1/4	6x19	0.49	0.51	0.55	0.37	0.38	0.41	0.99	1.0	1.1
5/16	6x19	0.76	0.79	0.85	0.57	0.59	0.64	1.5	1.6	1.7
3/8	6x19	1.1	1.1	1.2	0.80	0.85	0.91	2.1	2.2	2.4
7/16	6x19	1.4	1.5	1.6	1.1	1.1	1.2	2.9	3.0	3.3
1/2	6x19	1.8	2.0	2.1	1.4	1.5	1.6	3.7	3.9	4.3
9/16	6x19	2.3	2.5	2.7	1.7	1.9	2.0	4.6	5.0	5.4
5/8	6x19	2.8	3.1	3.3	2.1	2.3	2.5	5.6	6.2	6.7
3/4	6x19	3.9	4.4	4.8	2.9	3.3	3.6	7.8	8.8	9.5
7/8	6x19	5.1	5.9	6.4	3.9	4.5	4.8	10.0	12.0	13.0
1	6x19	6.7	7.7	8.4	5.0	5.8	6.3	13.0	15.0	17.0
1 1/8	6x19	8.4	9.5	10.0	6.3	7.1	7.9	17.0	19.0	21.0
1 1/4	6x37	9.8	11.0	12.0	7.4	8.3	9.2	20.0	22.0	25.0
1 3/8	6x37	12.0	13.0	15.0	8.9	10.0	11.0	24.0	27.0	30.0
1 1/2	6x37	14.0	16.0	17.0	10.0	12.0	13.0	28.0	32.0	35.0
1 5/8	6x37	16.0	18.0	21.0	12.0	14.0	15.0	33.0	27.0	41.0
1 3/4	6x37	19.0	21.0	24.0	14.0	16.0	18.0	38.0	43.0	48.0
2	6x37	25.0	28.0	31.0	18.0	21.0	23.0	49.0	55.0	62.0

<sup>1</sup>These values only apply when the D/d ratio for HT slings is 10 or greater, and for MS and S Slings is 20 or greater where: D = Diameter of curvature around which the body of the sling is bent; d = Diameter of rope; HT = Hand Tucked Splice and Hidden Tuck Splice. For hidden tuck splice (IWRC) use values in HT columns; MS = Mechanical Splice; S= Swaged or Zinc Poured Socket.

**TABLE H - 4. - RATED CAPACITIES FOR SINGLE LEG SLINGS**  
6x19 and 6x37 Classification Improved Plow Steel Grade Rope With Independent Wire Rope Core (IWRC)

Rope		Rated capacities, tons (2,000 lb)								
Dia (inches)	Constr.	Vertical			Choker			Vertical Basket <sup>1</sup>		
		HT	MS	S	HT	MS	S	HT	MS	S
1/4	6x19	0.53	0.56	0.59	0.40	0.42	0.44	1.0	1.1	1.2
5/16	6x19	0.81	0.87	0.92	0.61	0.65	0.69	1.6	1.7	1.8
3/8	6x19	1.1	1.2	1.3	0.86	0.93	0.98	2.3	2.5	2.6
7/16	6x19	1.5	1.7	1.8	1.2	1.3	1.3	3.1	3.4	3.5
1/2	6x19	2.0	2.2	2.3	1.5	1.6	1.7	3.9	4.4	4.6
9/16	6x19	2.5	2.7	2.9	1.8	2.1	2.2	4.9	5.5	5.8
5/8	6x19	3.0	3.4	3.6	2.2	2.5	2.7	6.0	6.8	7.2
3/4	6x19	4.2	4.9	5.1	3.1	3.6	3.8	8.4	9.7	10.0
7/8	6x19	5.5	6.6	6.9	4.1	4.9	5.2	11.0	13.0	14.0
1	6x19	7.2	8.5	9.0	5.4	6.4	6.7	14.0	17.0	18.0
1 1/8	6x19	9.0	10.0	11.0	6.8	7.8	8.5	18.0	21.0	23.0
1 1/4	6x37	10.0	12.0	13.0	7.9	9.2	9.9	21.0	24.0	26.0
1 3/8	6x37	13.0	15.0	16.0	9.6	11.0	12.0	25.0	29.0	32.0
1 1/2	6x37	15.0	17.0	19.0	11.0	13.0	14.0	30.0	35.0	38.0
1 5/8	6x37	18.0	20.0	22.0	13.0	15.0	17.0	35.0	41.0	44.0
1 3/4	6x37	20.0	24.0	26.0	15.0	18.0	19.0	41.0	47.0	51.0
2	6x37	26.0	30.0	33.0	20.0	23.0	25.0	53.0	61.0	66.0

<sup>1</sup> These values only apply when the D/d ratio for HT slings is 10 or greater, and for MS and S slings is 20 or greater where: D = Diameter of curvature around which the body of the sling is bent; d= Diameter of rope; HT= Hand Tucked Splice. For hidden tuck splice (IWRC) use Table H-3 values in HT column; MS = Mechanical Splice; S = Swaged or Zinc Poured Socket.

**TABLE H - 5. - RATED CAPACITIES FOR SINGLE LEG SLINGS**

Cable Laid Rope -- Mechanical Splice Only,  
7x7x7 & 7X7X19 Constructions Galvanized Aircraft Grade Rope  
7x6x19 IWRC Construction Improved Plow Steel Grade Rope

Rope		Rated capacities, tons (2,000 lb.)		
Dia (inches)	Constr	Vertical	Choker	Vertical basket <sup>1</sup>
1/4	7x7x7	0.50	0.38	1.0
3/8	7x7x7	1.1	0.81	2.2
1/2	7x7x7	1.8	1.4	3.7
5/8	7x7x7	2.8	2.1	5.5
3/4	7x7x7	3.8	2.9	7.6
5/8	7x7x19	2.9	2.2	5.8
3/4	7x7x19	4.1	3.0	8.1
7/8	7x7x19	5.4	4.0	11.0
1	7x7x19	6.9	5.1	14.0
1 1/8	7x7x19	8.2	6.2	16.0
1 1/4	7x7x19	9.9	7.4	20.0
3/4	<sup>2</sup> 7x6x19	3.8	2.8	7.6
7/8	<sup>2</sup> 7x6x19	5.0	3.8	10.0
1	<sup>2</sup> 7x6x19	6.4	4.8	13.0
1 1/8	<sup>2</sup> 7x6x19	7.7	5.8	15.0
1 1/4	<sup>2</sup> 7x6x19	9.2	6.9	18.0
1 5/16	<sup>2</sup> 7x6x19	10.0	7.5	20.0
1 3/8	<sup>2</sup> 7x6x19	11.0	8.2	22.0
1 1/2	<sup>2</sup> 7x6x19	13.0	9.6	26.0

<sup>1</sup> These values only apply when the D/d ratio is 10 or greater where:

D = Diameter of curvature around which the body of the sling is bent;

d = Diameter of rope.

<sup>2</sup> IWRC

**TABLE H - 6. - RATED CAPACITIES FOR SINGLE LEG SLINGS**

8-Part and 6-Part Braided Rope, 6x7 and 6x19 Construction Improved  
 Plow Steel Grade Rope, 7x7 Construction Galvanized Aircraft Grade Rope

Component Rope		Rated capacities, tons (2,000 lb)					
Dia (inches)	Constr.	Vertical		Choker		Basket vertical to 30° <sup>1</sup>	
		8-Part	6-Part	8-Part	6-Part	8-Part	6-Part
3/32	6x7	0.42	0.32	0.32	0.24	0.74	0.55
1/8	6x7	0.76	0.57	0.57	0.42	1.3	0.98
3/16	6x7	1.7	1.3	1.3	0.94	2.9	2.2
3/32	7x7	0.51	0.39	0.39	0.29	0.89	0.67
1/8	7x7	0.95	0.71	0.71	0.53	1.6	1.2
3/16	7x7	2.1	1.5	1.5	1.2	3.6	2.7
3/16	6x19	1.7	1.3	1.3	0.98	3.0	2.2
1/4	6x19	3.1	2.3	2.3	1.7	5.3	4.0
5/16	6x19	4.8	3.6	3.6	2.7	8.3	6.2
3/8	6x19	6.8	5.1	5.1	3.8	12.0	8.9
7/16	6x19	9.3	6.9	6.9	5.2	16.0	12.0
1/2	6x19	12.0	9.0	9.0	6.7	21.0	15.0
9/16	6x19	15.0	11.0	11.0	8.5	26.0	20.0
5/8	6x19	19.0	14.0	14.0	10.0	32.0	24.0
3/4	6x19	27.0	20.0	20.0	15.0	46.0	35.0
7/8	6x19	36.0	27.0	27.0	20.0	62.0	47.0
1	6x19	47.0	35.0	35.0	26.0	81.0	61.0

<sup>1</sup>These values only apply when the D/d ratio is 20 or greater where: D = Diameter of curvature around which the body of the sling is bent; d = Diameter of component rope.

**TABLE H - 7. - RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS**

6x19 and 6x37 Classification Improved Plow Steel Grade Rope With Fiber Core (FC)

Rope		Rated capacities, tons (2,000 lb)											
Dia (inches)	Constr.	2-Leg bridle slings						3-Leg bridle slings					
		30° <sup>1</sup> (60°) <sup>2</sup>		45° angle		60° <sup>1</sup> (30°) <sup>2</sup>		30° <sup>1</sup> (60°) <sup>2</sup>		45° angle		60° <sup>1</sup> (30°) <sup>2</sup>	
		HT	MS	HT	MS	HT	MS	HT	MS	HT	MS	HT	MS
1/4	6x19	0.85	0.88	0.70	0.72	0.49	0.51	1.3	1.3	1.0	1.1	0.74	0.76
5/16	6x19	1.3	1.4	1.1	1.1	0.76	0.79	2.0	2.0	1.6	1.7	1.1	1.2
3/8	6x19	1.8	1.9	1.5	1.6	1.1	1.1	2.8	2.9	2.3	2.4	1.6	1.7
7/16	6x19	2.5	2.6	2.0	2.2	1.4	1.5	3.7	4.0	3.0	3.2	2.1	2.3
1/2	6x19	3.2	3.4	2.6	2.8	1.8	2.0	4.8	5.1	3.9	4.2	2.8	3.0
9/16	6x19	4.0	4.3	3.2	3.5	2.3	2.5	6.0	6.5	4.9	5.3	3.4	3.7
5/8	6x19	4.8	5.3	4.0	4.4	2.8	3.1	7.3	8.0	5.9	6.5	4.2	4.6
3/4	6x19	6.8	7.6	5.5	6.2	3.9	4.4	10.0	11.0	8.3	9.3	5.8	6.6
7/8	6x19	8.9	10.0	7.3	8.4	5.1	5.9	13.0	15.0	11.0	13.0	7.7	8.9
1	6x19	11.0	13.0	9.4	11.0	6.7	7.7	17.0	20.0	14.0	16.0	10.0	11.0
11/8	6x19	14.0	16.0	12.0	13.0	8.4	9.5	22.0	24.0	18.0	20.0	13.0	14.0
11/4	6x37	17.0	19.0	14.0	16.0	9.8	11.0	25.0	29.0	21.0	23.0	15.0	17.0
13/8	6x37	20.0	23.0	17.0	19.0	12.0	13.0	31.0	35.0	25.0	28.0	18.0	20.0
11/2	6x37	24.0	27.0	20.0	22.0	14.0	16.0	36.0	41.0	30.0	33.0	21.0	24.0
15/8	6x37	28.0	32.0	23.0	26.0	16.0	18.0	43.0	48.0	35.0	39.0	25.0	28.0
13/4	6x37	33.0	37.0	27.0	30.0	19.0	21.0	49.0	56.0	40.0	45.0	28.0	32.0
2	6x37	43.0	48.0	35.0	39.0	25.0	28.0	64.0	72.0	52.0	59.0	37.0	41.0

<sup>1</sup> Vertical angles.      <sup>2</sup> Horizontal angles.      HT = Hand Tucked Splice.      MS = Mechanical Splice.

**TABLE H - 8. - RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS**  
6x19 and 6x37 Classification Improved Plow Steel Grade Rope With Independent Wire Rope Core (IWRC)

Rope		Rated capacities, tons (2,000 lb)											
Dia (inches)	Constr.	2-Leg bridle slings						3-Leg bridle slings					
		30° <sup>1</sup> (60°) <sup>2</sup>		45° angle		60° <sup>1</sup> (30°) <sup>2</sup>		30° <sup>1</sup> (60°) <sup>2</sup>		45° angle		60° <sup>1</sup> (30°) <sup>2</sup>	
		HT	MS	HT	MS	HT	MS	HT	MS	HT	MS	HT	MS
1/4	6x19	0.92	0.97	0.75	0.79	0.53	0.56	1.4	1.4	1.1	1.2	0.79	0.84
5/16	6x19	1.4	1.5	1.1	1.2	0.81	0.87	2.1	2.3	1.7	1.8	1.2	1.3
3/8	6x19	2.0	2.1	1.6	1.8	1.1	1.2	3.0	3.2	2.4	2.6	1.7	1.9
7/16	6x19	2.7	2.9	2.2	2.4	1.5	1.7	4.0	4.4	3.3	3.6	2.3	2.5
1/2	6x19	3.4	3.8	2.8	3.1	2.0	2.2	5.1	5.7	4.2	4.6	3.0	3.3
9/16	6x19	4.3	4.8	3.5	3.9	2.5	2.7	6.4	7.1	5.2	5.8	3.7	4.1
5/8	6x19	5.2	5.9	4.2	4.8	3.0	3.4	7.8	8.8	6.4	7.2	4.5	5.1
3/4	6x19	7.3	8.4	5.9	6.9	4.2	4.9	11.0	13.0	8.9	10.0	6.3	7.3
7/8	6x19	9.6	11.0	7.8	9.3	5.5	6.6	14.0	17.0	12.0	14.0	8.3	9.9
1	6x19	12.0	15.0	10.0	12.0	7.2	8.5	19.0	22.0	15.0	18.0	11.0	13.0
1 1/8	6x19	16.0	18.0	13.0	15.0	9.0	10.0	23.0	27.0	19.0	22.0	13.0	16.0
1 1/4	6x37	18.0	21.0	15.0	17.0	10.0	12.0	27.0	32.0	22.0	26.0	16.0	18.0
1 3/8	6x37	22.0	25.0	18.0	21.0	13.0	15.0	33.0	38.0	27.0	31.0	19.0	22.0
1 1/2	6x37	26.0	30.0	21.0	25.0	15.0	17.0	39.0	45.0	32.0	37.0	23.0	26.0
1 5/8	6x37	31.0	35.0	25.0	29.0	18.0	20.0	46.0	53.0	38.0	43.0	27.0	31.0
1 3/4	6x37	35.0	41.0	29.0	33.0	20.0	24.0	53.0	61.0	43.0	50.0	31.0	35.0
2	6x37	46.0	53.0	37.0	43.0	26.0	30.0	68.0	79.0	56.0	65.0	40.0	46.0

<sup>1</sup> Vertical angles.      <sup>2</sup> Horizontal angles.      HT = Hand Tucked Splice.      MS = Mechanical Splice.

**TABLE H - 9. - RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS**  
Cable Laid Rope - Mechanical Splice Only, 7x7x7 and 7x7x19 Construction  
Galvanized Aircraft Grade Rope, 7x6x19 IWRC Construction Improved Plow Steel Grade Rope

Rope		Rated capacities, tons (2,000 lb)						
Dia (inches)	Constr.	2-Leg bridle slings			3-Leg bridle slings			
		30° <sup>1</sup> (60°) <sup>2</sup>		45° angle	30° <sup>1</sup> (60°) <sup>2</sup>		45° angle	60° <sup>1</sup> (30°) <sup>2</sup>
		HT	MS	HT	MS	HT	MS	
1/4	7x7x7		0.87	0.71	0.50	1.3	1.1	0.75
3/8	7x7x7		1.9	1.5	1.1	2.8	2.3	1.6
1/2	7x7x7		3.2	2.6	1.8	4.8	3.9	2.8
5/8	7x7x7		4.8	3.9	2.8	7.2	5.9	4.2
3/4	7x7x7		6.6	5.4	3.8	9.9	8.1	5.7
5/8	7x7x19		5.0	4.1	2.9	7.5	6.1	4.3
3/4	7x7x19		7.0	5.7	4.1	10.0	8.6	6.1
7/8	7x7x19		9.3	7.6	5.4	14.0	11.0	8.1
1	7x7x19		12.0	9.7	6.9	18.0	14.0	10.0
1 1/8	7x7x19		14.0	12.0	8.2	21.0	17.0	12.0
1 1/4	7x7x19		17.0	14.0	9.9	26.0	21.0	15.0
3/4	7x6x19 IWRC		6.6	5.4	3.8	9.9	8.0	5.7
7/8	7x6x19 IWRC		8.7	7.1	5.0	13.0	11.0	7.5
1	7x6x19 IWRC		11.0	9.0	6.4	17.0	13.0	9.6
1 1/8	7x6x19 IWRC		13.0	11.0	7.7	20.0	16.0	11.0
1 1/4	7x6x19 IWRC		16.0	13.0	9.2	24.0	20.0	14.0
1 5/16	7x6x19 IWRC		17.0	14.0	10.0	26.0	21.0	15.0
1 3/8	7x6x19 IWRC		19.0	15.0	11.0	28.0	23.0	16.0
1 1/2	7x6x19 IWRC		22.0	18.0	13.0	33.0	27.0	19.0

<sup>1</sup> Vertical angles.      <sup>2</sup> Horizontal angles.

**TABLE H- 10. - RATED CAPACITIES FOR 2-LE AND 3-LEG BRIDLE SLINGS**

8-Part and 6-Part Braided Rope, 6x7 and 6x19 Construction Improved  
 Plow Steel Grade Rope, 7x7 Construction Galvanized Aircraft Grade Rope

Rope		Rated capacities, tons (2,000 lb)											
Dia (inches)	Constr.	2-Leg bridle slings						3-Leg bridle slings					
		30° <sup>1</sup> (60°) <sup>2</sup>		45° angle		60° <sup>1</sup> (30°) <sup>2</sup>		30° <sup>1</sup> (60°) <sup>2</sup>		45° angle		60° <sup>1</sup> (30°) <sup>2</sup>	
		8-Part	6-Part	8-Part	6-Part	8-Part	6-part	8-Part	6-Part	8-Part	6-Part	8-Part	6-part
3/32	6x7	0.74	0.55	0.60	0.45	0.42	0.32	1.1	0.83	0.90	0.68	0.64	0.48
1/8	6x7	1.3	0.98	1.1	0.80	0.76	0.57	2.0	1.5	1.6	1.2	1.1	0.85
3/16	6x7	2.9	2.2	2.4	1.8	1.7	1.3	4.4	3.3	3.6	2.7	2.5	1.9
3/32	7x7	0.89	0.67	0.72	0.55	0.51	0.39	1.3	1.0	1.1	0.82	0.77	0.58
1/8	7x7	1.6	1.2	1.3	1.0	0.95	0.71	2.5	1.8	2.0	1.5	1.4	1.1
3/16	7x7	3.6	2.7	2.9	2.2	2.1	1.5	5.4	4.0	4.4	3.3	3.1	2.3
3/16	6x19	3.0	2.2	2.4	1.8	1.7	1.3	4.5	3.4	3.7	2.8	2.6	1.9
1/4	6x19	5.3	4.0	4.3	3.2	3.1	2.3	8.0	6.0	6.5	4.9	4.6	3.4
5/16	6x19	8.3	6.2	6.7	5.0	4.8	3.6	12.0	9.3	10.0	7.6	7.1	5.4
3/8	6x19	12.0	8.9	9.7	7.2	6.8	5.1	18.0	13.0	14.0	11.0	10.0	7.7
7/16	6x19	16.0	12.0	13.0	9.8	9.3	6.9	24.0	18.0	20.0	15.0	14.0	10.0
1/2	6x19	21.0	15.0	17.0	13.0	12.0	9.0	31.0	23.0	25.0	19.0	18.0	13.0
9/16	6x19	26.0	20.0	21.0	16.0	15.0	11.0	39.0	29.0	32.0	24.0	23.0	17.0
5/8	6x19	32.0	24.0	26.0	20.0	19.0	14.0	48.0	36.0	40.0	30.0	28.0	21.0
3/4	6x19	46.0	35.0	38.0	28.0	27.0	20.0	69.0	52.0	56.0	42.0	40.0	30.0
7/8	6x19	62.0	47.0	51.0	38.0	36.0	27.0	94.0	70.0	76.0	57.0	54.0	40.0
1	6x19	81.0	61.0	66.0	50.0	47.0	35.0	122.0	91.0	99.0	74.0	70.0	53.0

<sup>1</sup> Vertical angles.

<sup>2</sup> Horizontal angles.

**TABLE H - 11.**  
**RATED CAPACITIES**  
**FOR STRAND LAID GROMMET -- HAND TUCKED**  
 Improved Plow Steel Grade Rope

Rope Body		Rated capacities, tons (2,000 lb.)		
Dia (inches)	Constr	Vertical	Choker	Vertical basket <sup>1</sup>
1/4	7x19	0.85	0.64	1.7
5/16	7x19	1.3	1.0	2.6
3/8	7x19	1.9	1.4	3.8
7/16	7x19	2.6	1.9	5.2
1/2	7x19	3.3	2.5	6.7
9/16	7x19	4.2	3.1	8.4
5/8	7x19	5.2	3.9	10.0
3/4	7x19	7.4	5.6	15.0
7/8	7x19	10.0	7.5	20.0
1	7x19	13.0	9.7	26.0
1 1/8	7x19	16.0	12.0	32.0
1 1/4	7x37	18.0	14.0	37.0
1 3/8	7x37	22.0	16.0	44.0
1 1/2	7x37	26.0	19.0	52.0

<sup>1</sup> These values only apply when the D/d ratio is 5 or greater where:  
 D=Diameter of curvature around which rope is bent.  
 d=Diameter of rope body.

**TABLE H - 12**  
**RATED CAPACITIES**  
**FOR CABLE LAID GROMMET – HAND TUCKED**  
7x6x7 and 7x6x19 Constructions Improved Plow Steel Grade Rope  
7x7x7 Construction Galvanized Aircraft Grade Rope

Rope Body		Rated capacities, tons (2,000 lb.)		
Dia (inches)	Con-str.	Vertical	Choker	Vertical basket <sup>1</sup>
3/8	7x6x7	1.3	0.95	2.5
9/16	7x6x7	2.8	2.1	5.6
5/8	7x6x7	3.8	2.8	7.6
3/8	7x7x7	1.6	1.2	3.2
9/16	7x7x7	3.5	2.6	6.9
5/8	7x7x7	4.5	3.4	9.0
5/8	7x6x19	3.9	3.0	7.9
3/4	7x6x19	5.1	3.8	10.0
15/16	7x6x19	7.9	5.9	16.0
1 1/8	7x6x19	11.0	8.4	22.0
1 5/16	7x6x19	15.0	11.0	30.0
1 1/2	7x6x19	19.0	14.0	39.0
1 11/16	7x6x19	24.0	18.0	49.0
1 7/8	7x6x19	30.0	22.0	60.0
2 1/4	7x6x19	42.0	31.0	84.0
2 5/8	7x6x19	56.0	42.0	112.0

<sup>1</sup> These values only apply when the D/d ratio is 5 or greater where: D = Diameter of curvature around which cable body is bent, d = Diameter of cable body.

**TABLE H - 13**  
**RATED CAPACITIES FOR STRAND LAID ENDLESS SLINGS -- MECHANICAL JOINT**  
Improved Plow Steel Grade Rope

Rope Body		Rated capacities, tons (2,000 lb.)		
Dia (inches)	Con-str.	Vertical	Choker	Vertical basket <sup>1</sup>
1/4	<sup>2</sup> 6x19	0.92	0.69	1.8
3/8	<sup>2</sup> 6x19	2.0	1.5	4.1
1/2	<sup>2</sup> 6x19	3.6	2.7	7.2
5/8	<sup>2</sup> 6x19	5.6	4.2	11.0
3/4	<sup>2</sup> 6x19	8.0	6.0	16.0
7/8	<sup>2</sup> 6x19	11.0	8.1	21.0
1	<sup>2</sup> 6x19	14.0	10.0	28.0
1 1/8	<sup>2</sup> 6x19	18.0	13.0	35.0
1 1/4	<sup>2</sup> 6x37	21.0	15.0	41.0
1 3/8	<sup>2</sup> 6x37	25.0	19.0	50.0
1 1/2	<sup>2</sup> 6x37	29.0	22.0	59.0

<sup>1</sup> These values only apply when the D/d ratio is

5 or greater where: D=Diameter of curvature  
around which rope is bent, d=Diameter of rope  
body.  
<sup>2</sup> IWRC.

**TABLE H - 14**  
**RATED CAPACITIES FOR**  
**CABLE LAID ENDLESS SLINGS -- MECHANICAL JOINT**  
7x7x7 and 7x7x19 Constructions Galvanized Aircraft Grade Rope  
7x6x19 Construction Improved Plow Steel Grade Rope

Cable Body		Rated capacities, tons (2,000 lb.)		
Dia (inches)	Constr	Vertical	Choker	Vertical basket (1)
1/4	7x7x7	0.83	0.62	1.6
3/8	7x7x7	1.8	1.3	3.5
1/2	7x7x7	3.0	2.3	6.1
5/8	7x7x7	4.5	3.4	9.1
3/4	7x7x7	6.3	4.7	12.0
5/8	7x7x19	4.7	3.5	9.5
3/4	7x7x19	6.7	5.0	13.0
7/8	7x7x19	8.9	6.6	18.0
1	7x7x19	11.0	8.5	22.0
1 1/8	7x7x19	14.0	10.0	28.0
1 1/4	7x7x19	17.0	12.0	33.0
3/4	<sup>2</sup> 7x6x19	6.2	4.7	12.0
7/8	<sup>2</sup> 7x6x19	8.3	6.2	16.0
1	<sup>2</sup> 7x6x19	10.0	7.9	21.0
1 1/8	<sup>2</sup> 7x6x19	13.0	9.7	26.0
1 1/4	<sup>2</sup> 7x6x19	16.0	12.0	31.0
1 3/8	<sup>2</sup> 7x6x19	18.0	14.0	37.0
1 1/2	<sup>2</sup> 7x6x19	22.0	16.0	43.0

<sup>1</sup> These values only apply when the D/d value is 5 or greater where: D=Diameter of curvature around which cable body is bent. d=Diameter of cable body.

<sup>2</sup> IWRC.

**TABLE H -15. -- MANILA ROPE SLINGS**  
 [Angle of rope to vertical shown in parentheses]

Rope dia. nominal in inches	Nominal weight per 100 ft in pounds	Minimum breaking strength in pounds	Rated capacity in pounds (safety factor=5)											
			Eye and eye sling						Endless sling					
			Vertical hitch	Choker hitch	Basket hitch; Angel of rope to horizontal				Vertical hitch	Choker hitch	Basket hitch; Angel of rope to horizontal			
					90° (0°)	60° (30°)	45° (45°)	30° (60°)			90° (0°)	60° (30°)	45° (45°)	30° (60°)
1/2	7.5	2,650	550	250	1,100	900	750	550	950	500	1,900	1,700	1,400	950
9/16	10.4	3,450	700	350	1,400	1,200	1,000	700	1,200	600	2,500	2,200	1,800	1,200
5/8	13.3	4,400	900	450	1,800	1,500	1,200	900	1,600	800	3,200	2,700	2,200	1,600
3/4	16.7	5,400	1,100	550	2,200	1,900	1,500	1,100	2,000	950	3,900	3,400	2,800	2,000
13/16	19.5	6,500	1,300	650	2,600	2,300	1,800	1,300	2,300	1,200	4,700	4,100	3,300	2,300
7/8	22.5	7,700	1,500	750	3,100	2,700	2,200	1,500	2,800	1,400	5,600	4,800	3,900	2,800
1	27.0	9,000	1,800	900	3,600	3,100	2,600	1,800	3,200	1,600	6,500	5,600	4,600	3,200
1 1/16	31.3	10,500	2,100	1,100	4,200	3,600	3,000	2,100	3,800	1,900	7,600	6,600	5,400	3,800
1 1/8	36.0	12,000	2,400	1,200	4,800	4,200	3,400	2,400	4,300	2,200	8,600	7,500	6,100	4,300
1 1/4	41.7	13,500	2,700	1,400	5,400	4,700	3,800	2,700	4,900	2,400	9,700	8,400	6,900	4,900
1 5/16	47.9	15,000	3,000	1,500	6,000	5,200	4,300	3,000	5,400	2,700	11,000	9,400	7,700	5,400
1 1/2	59.9	18,500	3,700	1,850	7,400	6,400	5,200	3,700	6,700	3,300	13,500	11,500	9,400	6,700
1 5/8	74.6	22,500	4,500	2,300	9,000	7,800	6,400	4,500	8,100	4,100	16,000	14,000	11,500	8,000
1 3/4	89.3	26,500	5,300	2,700	10,500	9,260	7,500	5,300	9,500	4,800	19,000	16,500	13,500	9,590
2	107.5	31,000	6,200	3,100	12,500	10,500	8,800	6,200	11,000	5,600	22,500	19,500	16,000	11,000
2 1/3	125.0	36,000	7,200	3,600	14,500	12,500	10,000	7,200	13,000	6,500	26,000	22,500	18,500	13,000
2 1/4	146.0	41,000	8,200	4,100	16,500	14,000	11,500	8,200	15,000	7,400	29,500	25,500	21,000	15,000
2 1/2	166.7	46,500	9,300	4,700	18,500	16,000	13,000	9,300	16,500	8,400	33,500	29,000	23,500	16,500
2 5/8	190.8	52,000	10,500	5,200	21,000	18,000	14,500	10,500	18,500	9,500	37,500	32,500	26,500	18,500

**TABLE H - 16. -- NYLON ROPE SLINGS**

[Angle of rope to vertical shown in parentheses]

Rope dia. nominal in inches	Nominal weight per 100 ft in pounds	Minimum breaking strength in pounds	Rated capacity in pounds (safety factor=9)											
			Eye and eye sling						Endless sling					
			Vertical hitch	Choker hitch	Basket hitch; Angel of rope to horizontal				Vertical hitch	Choker hitch	Basket hitch; Angel of rope to horizontal			
					90° (0°)	60° (30°)	45° (45°)	30° (60°)			90° (0°)	60° (30°)	45° (45°)	30° (60°)
1/2	6.5	6,080	700	350	1,400	1,200	950	700	1,200	600	2,400	2,100	1,700	1,200
9/16	8.3	7,600	850	400	1,700	1,500	1,200	850	1,500	750	3,000	2,600	2,200	1,500
5/8	10.5	9,880	1,100	550	2,200	1,900	1,600	1,100	2,000	1,100	4,000	3,400	2,800	2,000
3/4	14.5	13,490	1,500	750	3,000	2,600	2,100	1,500	2,700	1,400	5,400	4,700	3,800	2,700
13/16	17.0	16,150	1,800	900	3,600	3,100	2,600	1,800	3,200	1,600	6,400	5,600	4,600	3,200
7/8	20.0	19,000	2,100	1,100	4,200	3,700	3,000	2,100	3,800	1,900	7,600	6,600	5,400	3,800
1	26.0	23,750	2,600	1,300	5,300	4,600	3,700	2,600	4,800	2,400	9,500	8,200	6,700	4,800
1 1/16	29.0	27,360	3,000	1,500	6,100	5,300	4,300	3,000	5,500	2,700	11,000	9,500	7,700	5,500
1 1/8	34.0	31,350	3,500	1,700	7,000	6,000	5,000	3,500	6,300	3,100	12,500	11,000	8,900	6,300
1 1/4	40.0	35,625	4,000	2,000	7,900	6,900	5,600	4,000	7,100	3,600	14,500	12,500	10,000	7,100
1 5/16	45.0	40,850	4,500	2,300	9,100	7,900	6,400	4,500	8,200	4,100	16,500	14,000	12,000	8,200
1 1/2	55.0	50,350	5,600	2,800	11,000	9,700	7,900	5,600	10,000	5,000	20,000	17,500	14,000	10,000
1 5/8	68.0	61,750	6,900	3,400	13,500	12,000	9,700	6,900	12,500	6,200	24,500	21,500	17,500	12,500
1 3/4	83.0	74,100	8,200	4,100	16,500	14,500	11,500	8,200	15,000	7,400	29,500	27,500	21,000	15,000
2	95.0	87,400	9,700	4,900	19,500	17,000	13,500	9,700	17,500	8,700	35,000	30,500	24,500	17,500
2 1/8	109.0	100,700	11,000	5,600	22,500	19,500	16,000	11,000	20,000	10,000	40,500	35,000	28,500	20,000
2 1/4	129.0	118,750	13,000	6,600	26,500	23,000	18,500	13,000	24,000	12,000	47,500	41,000	33,500	24,000
2 1/2	149.0	133,000	15,000	7,400	29,500	25,500	21,000	15,000	26,500	13,500	53,000	46,000	37,500	26,500
2 5/8	168.0	153,900	17,100	8,600	34,000	29,500	24,000	17,000	31,000	15,500	61,500	53,500	43,500	31,000

**TABLE H - 17. -- POLYESTER ROPE SLINGS**

[Angle of rope to vertical shown in parentheses]

Rope dia. nominal in inches	Nominal weight per 100 ft in pounds	Minimum breaking strength in pounds	Rated capacity in pounds (safety factor=9)											
			Eye and eye sling						Endless sling					
			Vertical hitch	Choker hitch	Basket hitch; Angel of rope to horizontal				Vertical hitch	Choker hitch	Basket hitch; Angel of rope to horizontal			
					90° (0°)	60° (30°)	45° (45°)	30° (60°)			90° (0°)	60° (30°)	45° (45°)	30° (60°)
1/2	8.0	6,080	700	350	1,400	1,200	950	700	1,200	600	2,400	2,100	1,700	1,200
9/16	10.2	7,600	850	400	1,700	1,500	1,200	850	1,500	750	3,000	2,600	2,200	1,500
5/8	13.0	9,500	1,100	550	2,100	1,800	1,500	1,100	1,900	950	3,800	3,300	2,700	1,900
3/4	17.5	11,875	1,300	650	2,600	2,300	1,900	1,300	2,400	1,200	4,800	4,100	3,400	2,400
13/16	21.0	14,725	1,600	800	3,300	2,800	2,300	1,600	2,900	1,500	5,900	5,100	4,200	2,900
7/8	25.0	17,100	1,900	950	3,800	3,300	2,700	1,900	3,400	1,700	6,800	5,900	4,800	3,400
1	30.5	20,900	2,300	1,200	4,600	4,000	3,300	2,300	4,200	2,100	8,400	7,200	5,900	4,200
1 1/16	34.5	24,225	2,700	1,300	5,400	4,700	3,800	2,700	4,800	2,400	9,700	8,400	6,900	4,800
1 1/8	40.0	28,025	3,100	1,600	6,200	5,400	4,400	3,100	5,600	2,800	11,000	9,700	7,900	5,600
1 1/4	46.3	31,540	3,500	1,800	7,000	6,100	5,000	3,500	6,300	3,200	12,500	11,000	8,900	6,300
1 5/16	52.5	35,625	4,000	2,000	7,900	6,900	5,600	4,000	7,100	3,600	14,500	12,500	10,000	7,100
1 1/2	66.8	44,460	4,900	2,500	9,900	8,600	7,000	4,900	8,900	4,400	18,000	15,500	12,500	8,900
1 5/8	82.0	54,150	6,000	3,000	12,000	10,400	8,500	6,000	11,000	5,500	21,500	19,000	15,500	11,000
1 3/4	98.0	64,410	7,200	3,600	14,500	12,500	10,000	7,200	13,000	6,400	26,000	22,500	18,000	13,000
2	118.0	76,000	8,400	4,200	17,000	14,500	12,000	8,400	15,000	7,600	30,500	26,500	21,500	15,000
2 1/8	135.0	87,400	9,700	4,900	19,500	17,000	13,500	9,700	17,500	8,700	35,000	30,500	24,500	17,500
2 1/4	157.0	101,650	11,500	5,700	22,500	19,500	16,000	11,500	20,500	10,000	40,500	35,000	29,000	20,500
2 1/2	181.0	115,900	13,000	6,400	26,000	22,500	18,000	13,000	23,000	11,500	46,500	40,000	33,000	23,000
2 5/8	205.0	130,150	14,500	7,200	29,000	25,000	20,500	14,500	26,000	13,000	52,000	45,000	37,000	26,000

**TABLE H - 18. -- POLYPROPYLENE ROPE SLINGS**

[Angle of rope to vertical shown in parentheses]

Rope dia. nominal in inches	Nominal weight per 100 ft in pounds	Minimum breaking strength in pounds	Rated capacity in pounds (safety factor=6)											
			Eye and eye sling						Endless sling					
			Vertical hitch	Choker hitch	Basket hitch; Angel of rope to horizontal				Vertical hitch	Choker hitch	Basket hitch; Angel of rope to horizontal			
					90° (0°)	60° (30°)	45° (45°)	30° (60°)			90° (0°)	60° (30°)	45° (45°)	30° (60°)
1/2	4.7	3,990	650	350	1,300	1,200	950	650	1,200	600	2,400	2,100	1,700	1,200
9/16	6.1	4,845	800	400	1,600	1,400	1,100	800	1,500	750	2,900	2,500	2,100	1,500
5/8	7.5	5,890	1,000	500	2,000	1,700	1,400	1,000	1,800	900	3,500	3,100	2,500	1,800
3/4	10.7	8,075	1,300	700	2,700	2,300	1,900	1,300	2,400	1,200	4,900	4,200	3,400	2,400
13/16	12.7	9,405	1,600	800	3,100	2,700	2,200	1,600	2,800	1,400	5,600	4,900	4,000	2,800
7/8	15.0	10,925	1,800	900	3,600	3,200	2,600	1,800	3,300	1,600	6,600	5,700	4,600	3,300
1	18.0	13,300	2,200	1,100	4,400	3,800	3,100	2,200	4,000	2,000	8,000	6,900	5,600	4,000
1/16	20.4	15,200	2,500	1,300	5,100	4,400	3,600	2,500	4,600	2,300	9,100	7,900	6,500	4,600
1 1/8	23.7	17,385	2,900	1,500	5,800	5,000	4,100	2,900	5,200	2,600	10,500	9,000	7,400	5,200
1 1/4	27.0	19,950	3,300	1,700	6,700	5,800	4,700	3,300	6,000	3,000	12,000	10,500	8,500	6,000
1 5/16	30.5	22,325	3,700	1,900	7,400	6,400	5,300	3,700	6,700	3,400	13,500	11,500	9,500	6,700
1 1/2	38.5	28,215	4,700	2,400	9,400	8,100	6,700	4,700	8,500	4,200	17,000	14,500	12,000	8,500
1 5/8	47.5	34,200	5,700	2,900	11,500	9,900	8,100	5,700	10,500	5,100	20,500	18,000	14,500	10,500
1 3/4	57.0	40,850	6,800	3,400	13,500	12,000	9,600	6,800	12,500	6,100	24,500	21,000	17,500	12,500
2	69.0	49,400	8,200	4,100	16,500	14,500	11,500	8,200	15,000	7,400	29,500	25,500	21,000	15,000
2 1/8	80.0	57,950	9,700	4,800	19,500	16,500	13,500	9,700	17,500	8,700	35,000	30,100	24,500	17,500
2 1/4	92.0	65,550	11,000	5,500	22,000	19,000	15,500	11,000	19,500	9,900	39,500	34,000	28,000	19,500
2 1/2	107.0	76,000	12,500	6,300	25,500	22,000	18,000	12,500	23,000	11,500	45,500	39,500	32,500	23,000
2 5/8	120.0	85,500	14,500	7,100	28,500	24,500	20,000	14,500	25,500	13,000	51,500	44,500	36,500	25,500

**TABLE H - 19. - Safe Working Loads for Shackles**  
(In tons of 2,000 pounds)

Material size (inches)	Pin diameter (inches)	Safe working load
1/2	5/8	1.4
5/8	3/4	2.2
3/4	7/8	3.2
7/8	1	4.3
1	1 1/8	5.6
1 1/8	1 1/4	6.7
1 1/4	1 3/8	8.2
1 3/8	1 1/2	10.0
1 1/2	1 5/8	11.9
1 3/4	2	16.2
2	2 1/4	21.2

**TABLE H - 20. - Number and Spacing of U-bolt Wire Rope Clips**

Improved plow steel, rope diameter (inches)	Number of clips		Minimum spacing (inches)
	Drop forged	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 1/4
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

**§ 1926.252 - Disposal of waste materials.**

(a) Whenever materials are dropped more than 20 feet to any point lying outside the exterior walls of the building, an enclosed chute of wood, or equivalent material, shall be used. For the purpose of this paragraph, an enclosed chute is a slide, closed in on all sides, through which material is moved from a high place to a lower one.

(b) When debris is dropped through holes in the floor without the use of chutes, the area onto which the material is dropped shall be completely enclosed with barricades not less than 42 inches high and not less than 6 feet

back from the projected edge of the opening above. Signs warning of the hazard of falling materials shall be posted at each level. Removal shall not be permitted in this lower area until debris handling ceases above.

(c) All scrap lumber, waste material, and rubbish shall be removed from the immediate work area as the work progresses.

(d) Disposal of waste material or debris by burning shall comply with local fire regulations.

(e) All solvent waste, oily rags, and flammable liquids shall be kept in fire resistant covered containers until removed from worksite.

**Subpart I - Tools - Hand and Power**

**§ 1926.300 - General requirements.**

(a) *Condition of tools.* All hand and power tools and similar equipment, whether furnished by the employer or the employee, shall be maintained in a safe condition.

(b) *Guarding.*

(b)(1) When power operated tools are designed to accommodate guards, they shall be equipped with such guards when in use.

(b)(2) Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating or moving parts of equipment shall be guarded if such parts are exposed to contact by employees or otherwise create a hazard. Guarding shall meet the requirements as set forth in American National Standards Institute, B15.1-1953 (R1958), Safety Code for Mechanical Power-Transmission Apparatus.

(b)(3) *Types of guarding.* One or more methods of machine guarding shall be provided to protect the operator and other employees in the machine area from hazards

such as those created by point of operation, ingoing nip points, rotating parts, flying chips and sparks. Examples of guarding methods are - barrier guards, two-hand tripping devices, electronic safety devices, etc.

**(b)(4) Point of operation guarding.**

**(b)(4)(i)** Point of operation is the area on a machine where work is actually performed upon the material being processed.

**(b)(4)(ii)** The point of operation of machines whose operation exposes an employee to injury, shall be guarded. The guarding device shall be in conformity with any appropriate standards therefor, or, in the absence of applicable specific standards, shall be so designed and constructed as to prevent the operator from having any part of his body in the danger zone during the operating cycle.

**(b)(4)(iii)** Special handtools for placing and removing material shall be such as to permit easy handling of material without the operator placing a hand in the danger zone. Such tools shall not be in lieu of other guarding required by this section, but can only be used to supplement protection provided.

**(b)(4)(iv)** The following are some of the machines which usually require point of operation guarding:

- (a) Guillotine cutters.
- (b) Shears.
- (c) Alligator shears.
- (d) Powered presses.
- (e) Milling machines.
- (f) Power saws.
- (g) Jointers.
- (h) Portable power tools.
- (i) Forming rolls and calenders.

**(b)(5) Exposure of blades.** When the periphery of the blades of a fan is less than 7 feet (2.128 m) above the floor or working level, the blades shall be guarded. The guard shall have openings no larger than 1/2 inch (1.27 cm).

**(b)(7) Guarding of abrasive wheel machinery - exposure adjustment.** Safety guards of the types described in paragraphs (b)(8) and (9) of this section, where the operator stands in front of the opening, shall be constructed so that the peripheral protecting member can be adjusted to the constantly decreasing diameter of the wheel. The maximum angular exposure above the horizontal plane of the wheel spindle as specified in paragraphs (b)(8) and (9) of this section shall never be exceeded, and the distance between the wheel periphery and the adjustable tongue or the end of the peripheral member at the top shall never exceed 1/4 inch (0.635 cm). (See Figures I-1 through I-6.)

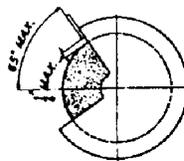


Figure I-1

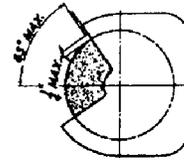


Figure I-2

Correct Showing adjustable tongue giving required angle protection for all sizes of wheel used.

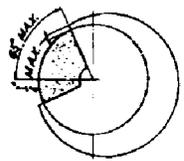


Figure I-3

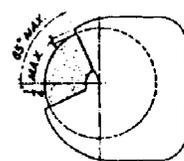


Figure I-4

Correct Showing movable guard with opening small enough to give required protection for the smallest size wheel used.

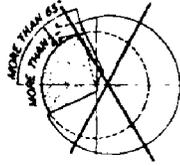


Figure I-5

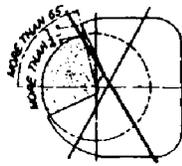


Figure I-6

exceed 125 deg. (See Figures I-9 and I-10.)



Figure I-11

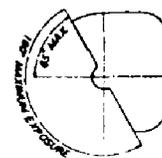


Figure I-12

**Incorrect** Showing movable guard with size of opening correct for full size wheel but too large for smaller wheel.

**(b)(8) Bench and floor stands.** The angular exposure of the grinding wheel periphery and sides for safety guards used on machines known as bench and floor stands should not exceed 90 deg. or one-fourth of the periphery. This exposure shall begin at a point not more than 65 deg. above the horizontal plane of the wheel spindle. (See Figures I-7 and I-8 and paragraph (b)(7) of this section.)

**(b)(9) Cylindrical grinders.** The maximum angular exposure of the grinding wheel periphery and sides for safety guards used on cylindrical grinding machines shall not exceed 180 deg.. This exposure shall begin at a point not more than 65 deg. above the horizontal plane of the wheel spindle. (See Figures I-11 and I-12 and paragraph (b)(7) of this section.)

**(c) Personal protective equipment.** Employees using hand and power tools and exposed to the hazard of falling, flying, abrasive, and splashing objects, or exposed to harmful dusts, fumes, mists, vapors, or gases shall be provided with the particular personal protective equipment necessary to protect them from the hazard. All personal protective equipment shall meet the requirements and be maintained according to Subparts D and E of this part.

**(d) Switches.**

**(d)(1)** All hand-held powered platen sanders, grinders with wheels 2-inch diameter or less, routers, planers, laminate trimmers, nibblers, shears, scroll saws, and jigsaws with blade shanks one-fourth of an inch wide or less may be equipped with only a positive "on-off" control.

**(d)(2)** All hand-held powered drills, tappers, fastener drivers, horizontal, vertical, and angle grinders with wheels greater than 2 inches in diameter, disc sanders, belt sanders, reciprocating saws, saber saws, and other similar operating powered tools shall be

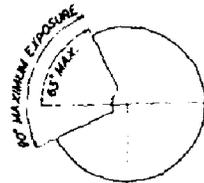


Figure I-9

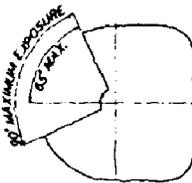


Figure I-10

Whenever the nature of the work requires contact with the wheel below the horizontal plane of the spindle, the exposure shall not

**§ 1926.301**

**Subpart I**

**Hand tools**

**Tools - Hand and Power**

equipped with a momentary contact "on-off" control and may have a lock-on control provided that turnoff can be accomplished by a single motion of the same finger or fingers that turn it on.

(b)(1) Pneumatic power tools shall be secured to the hose or whip by some

(d)(3) All other hand-held powered tools, such as circular saws, chain saws, and percussion tools without positive accessory holding means, shall be equipped with a constant pressure switch that will shut off the power when the pressure is released.

(d)(4) The requirements of this paragraph shall become effective on July 15, 1972.

(d)(5) Exception: This paragraph does not apply to concrete vibrators, concrete breakers, powered tampers, jack hammers, rock drills, and similar hand operated power tools.

**§ 1926.301 - Hand tools.**

(a) Employers shall not issue or permit the use of unsafe hand tools.

(b) Wrenches, including adjustable, pipe, end, and socket wrenches shall not be used when jaws are sprung to the point that slippage occurs.

(c) Impact tools, such as drift pins, wedges, and chisels, shall be kept free of mushroomed heads.

(d) The wooden handles of tools shall be kept free of splinters or cracks and shall be kept tight in the tool.

**§ 1926.302 - Power-operated hand tools.**

(a) *Electric power-operated tools.*

(a)(1) Electric power operated tools shall either be of the approved double-insulated type or grounded in accordance with Subpart K of this part.

(a)(2) The use of electric cords for hoisting or lowering tools shall not be permitted.

(b) *Pneumatic power tools.*

**Tools - Hand and Power****Woodworking tools**

positive means to prevent the tool from becoming accidentally disconnected.

**(b)(2)** Safety clips or retainers shall be securely installed and maintained on pneumatic impact (percussion) tools to prevent attachments from being accidentally expelled.

**(b)(3)** All pneumatically driven nailers, staplers, and other similar equipment provided with automatic fastener feed, which operate at more than 100 p.s.i. pressure at the tool shall have a safety device on the muzzle to prevent the tool from ejecting fasteners, unless the muzzle is in contact with the work surface.

**(b)(4)** Compressed air shall not be used for cleaning purposes except where reduced to less than 30 p.s.i. and then only with effective chip guarding and personal protective equipment which meets the requirements of Subpart E of this part. The 30 p.s.i. requirement does not apply for concrete form, mill scale and similar cleaning purposes.

**(b)(5)** The manufacturer's safe operating pressure for hoses, pipes, valves, filters, and other fittings shall not be exceeded,

**(b)(6)** The use of hoses for hoisting or lowering tools shall not be permitted.

**(b)(7)** All hoses exceeding 1/2-inch inside diameter shall have a safety device at the source of supply or branch line to reduce pressure in case of hose failure.

**(b)(8)** Airless spray guns of the type which atomize paints and fluids at high pressures (1,000 pounds or more per square inch) shall be equipped with automatic or visible manual safety devices which will prevent pulling of the trigger to prevent release of the paint or fluid until the safety device is manually released.

**(b)(9)** In lieu of the above, a diffuser nut which will prevent high pressure, high

velocity release, while the nozzle tip is removed, plus a nozzle tip guard which will prevent the tip from coming into contact with the operator, or other equivalent protection, shall be provided.

**(b)(10)** *Abrasive blast cleaning nozzles.* The blast cleaning nozzles shall be equipped with an operating valve which must be held open manually. A support shall be provided on which the nozzle may be mounted when it is not in use.

**(e)** *Powder-actuated tools.*

**(e)(1)** Only employees who have been trained in the operation of the particular tool in use shall be allowed to operate a powder-actuated tool.

**(e)(2)** 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 the manufacturer's recommended procedure.

**(e)(3)** Any tool found not in proper working order, or that develops a defect during use, shall be immediately removed from service and not used until properly repaired.

**(e)(4)** Personal protective equipment shall be in accordance with Subpart E of this part.

**(e)(5)** Tools shall not be loaded until just prior to the intended firing time. Neither loaded nor empty tools are to be pointed at any employees. Hands shall be kept clear of the open barrel end.

**(e)(6)** Loaded tools shall not be left unattended.

**(e)(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, live rock, face brick, or hollow tile.

**(e)(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.

(e)(9) No fastener shall be driven into a spalled area caused by an unsatisfactory fastening.

(e)(10) Tools shall not be used in an explosive or flammable atmosphere.

(e)(11) All tools shall be used with the correct shield, guard, or attachment recommended by the manufacturer.

(e)(12) Powder-actuated tools used by employees shall meet all other applicable requirements of American National Standards Institute, A10.3-1970, Safety Requirements for Explosive-Actuated Fastening Tools.

**§ 1926.304 - Woodworking tools.**

(d) *Guarding.* All portable, power-driven circular saws shall be equipped with guards above and below the base plate or shoe. The upper guard shall cover the saw to the depth of the teeth, except for the minimum arc required to permit the base to be tilted for bevel cuts. The lower guard shall cover the saw to the depth of the teeth, except for the minimum arc required to allow proper retraction and contact with the work. When the tool is withdrawn from the work, the lower guard shall automatically and instantly return to the covering position.

(e) *Personal protective equipment.* All personal protective equipment provided for use shall conform to Subpart E of this part.

(f) *Other requirements.* All woodworking tools and machinery shall meet other applicable requirements of American National Standards Institute, 01.1-1961, Safety Code for Woodworking Machinery.

(g) *Radial saws.*

(g)(1) 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. 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 to give maximum protection possible for the operation being performed.

(h) *Hand-fed crosscut table saws.*

(h)(1) Each circular crosscut table saw shall be guarded by a hood which shall meet all the requirements of paragraph (i)(1) of this section for hoods for circular ripsaws.

(i) *Hand-fed ripsaws.*

(i)(1) Each circular hand-fed ripsaw shall be guarded by a hood which shall completely enclose the portion of the saw above the table and that portion of the saw above the material being cut. The hood and mounting shall be arranged so that the hood will automatically adjust itself to the thickness of and remain in contact with the material being cut but it shall not offer any considerable resistance to insertion of material to saw or to passage of the material being sawed. The hood shall be made of adequate strength to resist blows and strains incidental to reasonable operation, adjusting, and handling, and shall be so designed as to protect the operator from flying splinters and broken saw teeth. It shall be made of material that is soft enough so that it will be unlikely cause tooth breakage. The hood shall be so mounted as to insure that its operation will be positive, reliable, and in true alignment with the saw; and the mounting shall be adequate in strength to resist any reasonable side thrust or other force tending to throw it out of line.

## Subpart J - Welding and Cutting

### § 1926.350 - Gas welding and cutting.

(a) *Transporting, moving, and storing compressed gas cylinders.*

(a)(1) Valve protection caps shall be in place and secured.

(a)(2) 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.

(a)(3) Cylinders shall be moved by tilting and rolling them on their bottom edges. They shall not be intentionally dropped, struck, or permitted to strike each other violently.

(a)(4) When cylinders are transported by powered vehicles, they shall be secured in a vertical position.

(a)(5) Valve protection caps shall not be used for lifting cylinders from one vertical position to another. Bars shall not be used under valves or valve protection caps to pry cylinders loose when frozen. Warm, not boiling, water shall be used to thaw cylinders loose.

(a)(6) Unless cylinders are firmly secured on a special carrier intended for this purpose, regulators shall be removed and valve protection caps put in place before cylinders are moved.

(a)(7) A suitable cylinder truck, chain, or other steadying device shall be used to keep cylinders from being knocked over while in use.

(a)(8) When work is finished, when cylinders are empty, or when cylinders are moved at any time, the cylinder valve shall be closed.

(a)(9) Compressed gas cylinders shall be secured in an upright position at all times except, if necessary, for short periods of time while cylinders are actually being hoisted or carried.

(a)(10) Oxygen cylinders in storage shall be separated from fuel-gas cylinders or combustible materials (especially oil or grease), a minimum distance of 20 feet (6.1 m) or by a noncombustible barrier at least 5 feet (1.5 m) high having a fire-resistance rating of at least one-half hour.

(a)(11) Inside of buildings, cylinders shall be stored in a well-protected, well-ventilated, dry location, at least 20 feet (6.1 m) from highly combustible materials such as oil or excelsior. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage places shall be located where cylinders will not be knocked over or damaged by passing or falling objects, or subject to tampering by unauthorized persons. Cylinders shall not be kept in unventilated enclosures such as lockers and cupboards.

(a)(12) The in-plant handling, storage, and utilization of all compressed gases in cylinders, portable tanks, rail tankcars, or motor vehicle cargo tanks shall be in accordance with Compressed Gas Association Pamphlet P-1-1965.

(b) *Placing cylinders.*

(b)(1) Cylinders shall be kept far enough away from the actual welding or cutting operation so that sparks, hot slag, or flame will not reach them. When this is impractical, fire resistant shields shall be provided.

(b)(2) Cylinders shall be placed where they cannot become part of an electrical circuit. Electrodes shall not be struck against a cylinder to strike an arc.

(b)(3) Fuel gas cylinders shall be placed with valve end up whenever they are in use.

They shall not be placed in a location where

they would be subject to open flame, hot metal, or other sources of artificial heat.

(b)(4) Cylinders containing oxygen or acetylene or other fuel gas shall not be taken into confined spaces.

(c) *Treatment of cylinders.*

(c)(1) Cylinders, whether full or empty, shall not be used as rollers or supports.

(c)(2) No person other than the gas supplier shall attempt to mix gases in a cylinder. No one except the owner of the cylinder or person authorized by him, shall refill a cylinder. No one shall use a cylinder's contents for purposes other than those intended by the supplier. All cylinders used shall meet the Department of Transportation requirements published in 49 CFR Part 178, Subpart C, Specification for Cylinders.

(c)(3) No damaged or defective cylinder shall be used.

(d) *Use of fuel gas.* The employer shall thoroughly instruct employees in the safe use of fuel gas, as follows:

(d)(1) Before a regulator to a cylinder valve is connected, the valve shall be opened slightly and closed immediately. (This action is generally termed "cracking" and is intended to clear the valve of dust or dirt that might otherwise enter the regulator.) The person cracking the valve shall stand to one side of the outlet, not in front of it. The valve of a fuel gas cylinder shall not be cracked where the gas would reach welding work, sparks, flame, or other possible sources of ignition.

(d)(2) The cylinder valve shall always be opened slowly to prevent damage to the regulator. For quick closing, valves on fuel gas cylinders shall not be opened more than 1 1/2 turns. When a special wrench is required, it shall be left in position on the stem of the valve while the cylinder is in use so that the fuel gas flow can be shut off quickly in case of an emergency. In the case of

manifolded or coupled cylinders, at least one such wrench shall always be available for immediate use. Nothing shall be placed on top of a fuel gas cylinder, when in use, which may damage the safety device or interfere with the quick closing of the valve.

(d)(3) Fuel gas shall not be used from cylinders through torches or other devices which are equipped with shutoff valves without reducing the pressure through a suitable regulator attached to the cylinder valve or manifold.

(d)(4) Before a regulator is removed from a cylinder valve, the cylinder valve shall always be closed and the gas released from the regulator.

(d)(5) If, when the valve on a fuel gas cylinder is opened, there is found to be a leak around the valve stem, the valve shall be closed and the gland nut tightened. If this action does not stop the leak, the use of the cylinder shall be discontinued, and it shall be properly tagged and removed from the work area. In the event that fuel gas should leak from the cylinder valve, rather than from the valve stem, and the gas cannot be shut off, the cylinder shall be properly tagged and removed from the work area. If a regulator attached to a cylinder valve will effectively stop a leak through the valve seat, the cylinder need not be removed from the work area.

(d)(6) If a leak should develop at a fuse plug or other safety device, the cylinder shall be removed from the work area.

(e) *Fuel gas and oxygen manifolds.*

(e)(1) Fuel gas and oxygen manifolds shall bear the name of the substance they contain in letters at least 1-inch high which shall be either painted on the manifold or on a sign permanently attached to it.

(e)(2) Fuel gas and oxygen manifolds shall be placed in safe, well ventilated, and accessible locations. They shall not be located

within enclosed spaces.

(e)(3) Manifold hose connections, including both ends of the supply hose that lead to the manifold, shall be such that the hose cannot be interchanged between fuel gas and oxygen manifolds and supply header connections. Adapters shall not be used to permit the interchange of hose. Hose connections shall be kept free of grease and oil.

(e)(4) When not in use, manifold and header hose connections shall be capped.

(e)(5) Nothing shall be placed on top of a manifold, when in use, which will damage the manifold or interfere with the quick closing of the valves.

(f) *Hose.*

(f)(1) Fuel gas hose and oxygen hose shall be easily distinguishable from each other. The contrast may be made by different colors or by surface characteristics readily distinguishable by the sense of touch. Oxygen and fuel gas hoses shall not be interchangeable. A single hose having more than one gas passage shall not be used.

(f)(2) When parallel sections of oxygen and fuel gas hose are taped together, not more than 4 inches out of 12 inches shall be covered by tape.

(f)(3) All hose in use, carrying acetylene, oxygen, natural or manufactured fuel gas, or any gas or substance which may ignite or enter into combustion, or be in any way harmful to employees, shall be inspected at the beginning of each working shift. Defective hose shall be removed from service.

(f)(4) Hose which has been subject to flashback, or which shows evidence of severe wear or damage, shall be tested to twice the normal pressure to which it is subject, but in no case less than 300 p.s.i. Defective hose, or hose in doubtful condition, shall not be used.

(f)(5) Hose couplings shall be of the type

that cannot be unlocked or disconnected by

means of a straight pull without rotary motion.

(f)(6) Boxes used for the storage of gas hose shall be ventilated.

(f)(7) Hoses, cables, and other equipment shall be kept clear of passageways, ladders and stairs.

(g) *Torches.*

(g)(1) Clogged torch tip openings shall be cleaned with suitable cleaning wires, drills, or other devices designed for such purpose.

(g)(2) Torches in use shall be inspected at the beginning of each working shift for leaking shutoff valves, hose couplings, and tip connections. Defective torches shall not be used.

(g)(3) Torches shall be lighted by friction lighters or other approved devices, and not by matches or from hot work.

(h) *Regulators and gauges.* Oxygen and fuel gas pressure regulators, including their related gauges, shall be in proper working order while in use.

(i) *Oil and grease hazards.* Oxygen cylinders and fittings shall be kept away from oil or grease. Cylinders, cylinder caps and valves, couplings, regulators, hose, and apparatus shall be kept free from oil or greasy substances and shall not be handled with oily hands or gloves. Oxygen shall not be directed at oily surfaces, greasy clothes, or within a fuel oil or other storage tank or vessel.

(j) *Additional rules.* For additional details not covered in this subpart, applicable technical portions of American National Standards Institute, Z49.1-1967, Safety in Welding and Cutting, shall apply.

**§ 1926.352 - Fire prevention.**

(a) When practical, objects to be welded, cut, or heated shall be moved to a designated safe location or, if the objects to be welded, cut, or heated cannot be readily moved, all movable fire hazards in the vicinity shall be

taken to a safe place, or otherwise protected.

(b) If the object to be welded, cut, or heated cannot be moved and if all the fire hazards cannot be removed, positive means shall be taken to confine the heat, sparks, and slag, and to protect the immovable fire hazards from them.

(c) No welding, cutting, or heating shall be done where the application of flammable paints, or the presence of other flammable compounds, or heavy dust concentrations creates a hazard.

(d) Suitable fire extinguishing equipment shall be immediately available in the work area and shall be maintained in a state of readiness for instant use.

(e) When the welding, cutting, or heating operation is such that normal fire prevention precautions are not sufficient, additional personnel shall be assigned to guard against fire while the actual welding, cutting, or heating operation is being performed, and for a sufficient period of time after completion of the work to ensure that no possibility of fire exists. Such personnel shall be instructed as to the specific anticipated fire hazards and how the firefighting equipment provided is to be used.

(f) When welding, cutting, or heating is performed on walls, floors, and ceilings, since direct penetration of sparks or heat transfer may introduce a fire hazard to an adjacent area, the same precautions shall be taken on the opposite side as are taken on the side on which the welding is being performed.

(g) For the elimination of possible fire in enclosed spaces as a result of gas escaping through leaking or improperly closed torch valves, the gas supply to the torch shall be positively shut off at some point outside the enclosed space whenever the torch is not to be used or whenever the torch is left unattended for a substantial period of time,

such as during the lunch period. Overnight and at the change of shifts, the torch and hose shall be removed from the confined space. Open end fuel gas and oxygen hoses shall be immediately removed from enclosed spaces when they are disconnected from the torch or other gas-consuming device.

(h) Except when the contents are being removed or transferred, drums, pails, and other containers which contain or have contained flammable liquids shall be kept closed. Empty containers shall be removed to a safe area apart from hot work operations or open flames.

(i) Drums containers, or hollow structures which have contained toxic or flammable substances shall, before welding, cutting, or heating is undertaken on them, either be filled with water or thoroughly cleaned of such substances and ventilated and tested. For welding, cutting and heating on steel pipelines containing natural gas, the pertinent portions of regulations issued by the Department of Transportation, Office of Pipeline Safety, 49 CFR Part 192, Minimum Federal Safety Standards for Gas Pipelines, shall apply.

(j) Before heat is applied to a drum, container, or hollow structure, a vent or opening shall be provided for the release of any built-up pressure during the application of heat.

## Subpart K - Electrical

### § 1926.400 - Electrical - General.

This subpart addresses electrical safety requirements that are necessary for the practical safeguarding of employees involved in construction work and is divided into four major divisions and applicable definitions as follows:

(a) *Installation safety requirements.*

Installation safety requirements are contained in 1926.402 through 1926.408. Included in this category are electric equipment and installations used to provide electric power and light on jobsites.

(b) *Safety-related work practices.* Safety-related work practices are contained in 1926.416 and 1926.417. In addition to covering the hazards arising from the use of electricity at jobsites, these regulations also cover the hazards arising from the accidental contact, direct or indirect, by employees with all energized lines, above or below ground, passing through or near the jobsite.

(c) *Safety-related maintenance and environmental considerations.* Safety-related maintenance and environmental considerations are contained in 1926.431 and 1926.432.

(d) *Safety requirements for special equipment.* Safety requirements for special equipment are contained in 1926.441.

(e) *Definitions.* Definitions applicable to this Subpart are contained in 1926.449.

#### **§ 1926.402 - Applicability.**

(a) *Covered.* Sections 1926.402 through 1926.408 contain installation safety requirements for electrical equipment and installations used to provide electric power and light at the jobsite. These sections apply to installations, both temporary and permanent, used on the jobsite; but these sections do not apply to existing permanent installations that were in place before the construction activity commenced.

**NOTE:** If the electrical installation is made in accordance with the National Electrical Code ANSI/NFPA 70-1984, exclusive of Formal Interpretations and Tentative Interim Amendments, it will be deemed to be in compliance with 1926.403 through 1926.408, except for 1926.404(b)(1)

and 1926.405(a)(2)(ii)(E), (F), (G), and (J).

(b) *Not covered.* Sections 1926.402 through 1926.408 do not cover installations used for the generation, transmission, and distribution of electric energy, including related communication, metering, control, and transformation installations. (However, these regulations do cover portable and vehicle-mounted generators used to provide power for equipment used at the jobsite.) See Subpart V of this Part for the construction of power distribution and transmission lines.

#### **§ 1926.403 - General requirements.**

(a) *Approval.* All electrical conductors and equipment shall be approved.

(b) *Examination, installation, and use of equipment.*

(b)(1) *Examination.* The employer shall ensure that electrical equipment is free from recognized hazards that are likely to cause death or serious physical harm to employees. Safety of equipment shall be determined on the basis of the following considerations:

(b)(1)(i) Suitability for installation and use in conformity with the provisions of this subpart. Suitability of equipment for an identified purpose may be evidenced by listing, labeling, or certification for that identified purpose.

(b)(1)(ii) Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided.

(b)(1)(iii) Electrical insulation.

(b)(1)(iv) Heating effects under conditions of use.

(b)(1)(v) Arcing effects.

(b)(1)(vi) Classification by type, size, voltage, current capacity, specific use.

(b)(1)(vii) Other factors which contribute to the practical safeguarding of employees using or likely to come in contact with the

equipment.

(b)(2) *Installation and use.* Listed, labeled, or certified equipment shall be installed and used in accordance with instructions included in the listing, labeling, or certification.

(c) *Interrupting rating.* Equipment intended to break current shall have an interrupting rating at system voltage sufficient for the current that must be interrupted.

(d) *Mounting and cooling of equipment-*

(d)(1) *Mounting.* Electric equipment shall be firmly secured to the surface on which it is mounted. Wooden plugs driven into holes in masonry, concrete, plaster, or similar materials shall not be used.

(d)(2) *Cooling.* Electrical equipment which depends upon the natural circulation of air and convection principles for cooling of exposed surfaces shall be installed so that room air flow over such surfaces is not prevented by walls or by adjacent installed equipment. For equipment designed for floor mounting, clearance between top surfaces and adjacent surfaces shall be provided to dissipate rising warm air. Electrical equipment provided with ventilating openings shall be installed so that walls or other obstructions do not prevent the free circulation of air through the equipment.

(e) *Splices.* Conductors shall be spliced or joined with splicing devices designed for the use or by brazing, welding, or soldering with a fusible metal or alloy. Soldered splices shall first be so spliced or joined as to be mechanically and electrically secure without solder and then soldered. All splices and joints and the free ends of conductors shall be covered with an insulation equivalent to that of the conductors or with an insulating device designed for the purpose.

(f) *Arcing parts.* Parts of electric equipment which in ordinary operation

produce arcs, sparks, flames, or molten metal shall be enclosed or separated and isolated from all combustible material.

(g) *Marking.* Electrical equipment shall not be used unless the manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product may be identified is placed on the equipment and unless other markings are provided giving voltage, current, wattage, or other ratings as necessary. The marking shall be of sufficient durability to withstand the environment involved.

(h) *Identification of disconnecting means and circuits.* Each disconnecting means required by this subpart for motors and appliances shall be legibly marked to indicate its purpose, unless located and arranged so the purpose is evident. Each service, feeder, and branch circuit, at its disconnecting means or overcurrent device, shall be legibly marked to indicate its purpose, unless located and arranged so the purpose is evident. These markings shall be of sufficient durability to withstand the environment involved.

(i) *600 Volts, nominal, or less.* This paragraph applies to equipment operating at 600 volts, nominal, or less.

(i)(1) *Working space about electric equipment.* Sufficient access and working space shall be provided and maintained about all electric equipment to permit ready and safe operation and maintenance of such equipment.

(i)(1)(i) *Working clearances.* Except as required or permitted elsewhere in this subpart, the dimension of the working space in the direction of access to live parts operating at 600 volts or less and likely to require examination, adjustment, servicing, or maintenance while alive shall not be less than indicated in Table K-1. In addition to the dimensions shown in Table K-1, workspace

shall not be less than 30 inches (762 mm) wide in front of the electric

**TABLE K-1 - Working Clearances**

Nominal voltage to ground	Minimum clear distance for conditions <sup>1</sup>		
	(a)	(b)	(c)
0 - 150	3 ft <sup>2</sup>	3 ft <sup>2</sup>	3 ft <sup>2</sup>
150 - 600	3 ft <sup>2</sup>	3 ½ ft <sup>2</sup>	4 ft <sup>2</sup>

<sup>1</sup> Conditions (a), (b), and (c) are as follows: [a] Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by insulating material. Insulated wire or insulated busbars operating at not over 300 volts are not considered live parts. [b] Exposed live parts on one side and grounded parts on the other side. [c] Exposed live parts on both sides of the workplace [not guarded as provided in Condition (a)] with the operator between.

<sup>2</sup> Note: For International System of Units (SI): one foot=0.3048m.

equipment. Distances shall be measured from the live parts if they are exposed, or from the enclosure front or opening if the live parts are enclosed. Walls constructed of concrete, brick, or tile are considered to be grounded. Working space is not required in back of assemblies such as dead-front switchboards or motor control centers where there are no renewable or adjustable parts such as fuses or switches on the back and where all connections are accessible from locations other than the back.

**§ 1926.404 - Wiring design and protection.**

(a) *Use and identification of grounded and grounding conductors.*

(a)(1) *Identification of conductors.* A conductor used as a grounded conductor shall be identifiable and distinguishable from all other conductors. A conductor used as an equipment grounding conductor shall be identifiable and distinguishable from all other conductors.

(a)(2) *Polarity of connections.* No

grounded conductor shall be attached to any terminal or lead so as to reverse designated polarity. program shall

**(a)(3) Use of grounding terminals and devices.** A grounding terminal or grounding-type device on a receptacle, cord connector, or attachment plug shall not be used for purposes other than grounding.

**(b) Branch circuits.**

**(b)(1) Ground-fault protection.**

**(b)(1)(i) General.** The employer shall use either ground fault circuit interrupters as specified in paragraph (b)(1)(ii) of this section or an assured equipment grounding conductor program as specified in paragraph (b)(1)(iii) of this section to protect employees on construction sites. These requirements are in addition to any other requirements for equipment grounding conductors.

**(b)(1)(ii) Ground-fault circuit interrupters.** All 120-volt, single-phase 15- and 20-ampere receptacle outlets on construction sites, which are not a part of the permanent wiring of the building or structure and which are in use by employees, shall have approved ground-fault circuit interrupters for personnel protection. Receptacles on a two-wire, single-phase portable or vehicle-mounted generator rated not more than 5kV, where the circuit conductors of the generator are insulated from the generator frame and all other grounded surfaces, need not be protected with ground-fault circuit interrupters.

**(b)(1)(iii) Assured equipment grounding conductor program.** The employer shall establish and implement an assured equipment grounding conductor program on construction sites covering all cord sets, receptacles which are not a part of the building or structure, and equipment connected by cord and plug which are available for use or used by employees. This

comply with the following minimum requirements: incident which can be reasonably suspected

**(b)(1)(iii)(A)** A written description of the program, including the specific procedures adopted by the employer, shall be available at the jobsite for inspection and copying by the Assistant Secretary and any affected employee.

**(b)(1)(iii)(B)** The employer shall designate one or more competent persons (as defined in 1926.32(f)) to implement the program.

**(b)(1)(iii)(C)** Each cord set, attachment cap, plug and receptacle of cord sets, and any equipment connected by cord and plug, except cord sets and receptacles which are fixed and not exposed to damage, shall be visually inspected before each day's use for external defects, such as deformed or missing pins or insulation damage, and for indications of possible internal damage. Equipment found damaged or defective shall not be used until repaired.

**(b)(1)(iii)(D)** The following tests shall be performed on all cord sets, receptacles which are not a part of the permanent wiring of the building or structure, and cord- and plug-connected equipment required to be grounded:

(1) All equipment grounding conductors shall be tested for continuity and shall be electrically continuous.

(2) Each receptacle and attachment cap or plug shall be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor shall be connected to its proper terminal.

**(b)(1)(iii)(E)** All required tests shall be performed:

(1) Before first use;

(2) Before equipment is returned to service following any repairs;

(3) Before equipment is used after any

to have caused damage (for example, when a cord set is run over); and

(4) At intervals not to exceed 3 months, except that cord sets and receptacles which are fixed and not exposed to damage shall be tested at intervals not exceeding 6 months.

(b)(1)(iii)(F) The employer shall not make available or permit the use by employees of any equipment which has not met the requirements of this paragraph (b)(1)(iii) of this section.

(b)(1)(iii)(G) Tests performed as required in this paragraph shall be recorded. This test record shall identify each receptacle, cord set, and cord- and plug-connected equipment that passed the test and shall indicate the last date it was tested or the interval for which it was tested. This record shall be kept by means of logs, color coding, or other effective means and shall be maintained until replaced by a more current record. The record shall be made available on the jobsite for inspection by the Assistant Secretary and any affected employee.

(b)(2) *Outlet devices.* Outlet devices shall have an ampere rating not less than the load to be served and shall comply with the following:

(b)(2)(i) *Single receptacles.* A single receptacle installed on an individual branch circuit shall have an ampere rating of not less than that of the branch circuit.

(b)(2)(ii) *Two or more receptacles.* Where connected to a branch circuit supplying two or more receptacles or outlets, receptacle ratings shall conform to the values listed in Table K-4.

(b)(2)(iii) *Receptacles used for the connection of motors.* The rating of an attachment plug or receptacle used for cord- and plug-connection of a motor to a branch circuit shall not exceed 15 amperes at 125 volts or 10 amperes at 250 volts if individual

overload protection is omitted.

**TABLE K-4. - Receptacle Ratings for Various Size Circuits**

Circuit rating amperes	Receptacle rating amperes
15	Not over 15.
20	15 or 20.
30	30.
40	40 or 50.
50	50.

(c)(1)(iii) *Clearance from building openings.* Conductors shall have a clearance of at least 3 feet (914 mm) from windows, doors, fire escapes, or similar locations. Conductors run above the top level of a window are considered to be out of reach from that window and, therefore, do not have to be 3 feet (914 mm) away.

(c)(1)(iv) *Clearance over roofs.* Conductors above roof space accessible to employees on foot shall have a clearance from the highest point of the roof surface of not less than 8 feet (2.44 m) vertical clearance for insulated conductors, not less than 10 feet (3.05 m) vertical or diagonal clearance for covered conductors, and not less than 15 feet (4.57 m) for bare conductors, except that:

(c)(1)(iv)(A) Where the roof space is also accessible to vehicular traffic, the vertical clearance shall not be less than 18 feet (5.49 m), or

(c)(1)(iv)(B) Where the roof space is not normally accessible to employees on foot, fully insulated conductors shall have a vertical or diagonal clearance of not less than 3 feet (914 mm), or

(c)(1)(iv)(C) Where the voltage between conductors is 300 volts or less and the roof has a slope of not less than 4 inches (102 mm) in 12 inches (305 mm), the clearance from roofs shall be at least 3 feet (914 mm), or

(c)(1)(iv)(D) Where the voltage between conductors is 300 volts or less and the conductors do not pass over more than 4 feet (1.22 m) of the overhang portion of the roof and they are terminated at a through-the-roof raceway or support, the clearance from roofs shall be at least 18 inches (457 mm).

(c)(2) *Location of outdoor lamps.* Lamps for outdoor lighting shall be located below all live conductors, transformers, or other electric equipment, unless such equipment is controlled by a disconnecting means that can be locked in the open position or unless adequate clearances or other safeguards are provided for relamping operations.

(d) *Services.*

(d)(1) *Disconnecting means.*

(d)(1)(i) *General.* Means shall be provided to disconnect all conductors in a building or other structure from the service-entrance conductors. The disconnecting means shall plainly indicate whether it is in the open or closed position and shall be installed at a readily accessible location nearest the point of entrance of the service-entrance conductors.

(d)(1)(ii) *Simultaneous opening of poles.* Each service disconnecting means shall simultaneously disconnect all ungrounded conductors.

(d)(2) *Services over 600 volts, nominal.* The following additional requirements apply to services over 600 volts, nominal.

(d)(2)(i) *Guarding.* Service-entrance conductors installed as open wires shall be guarded to make them accessible only to qualified persons.

(d)(2)(ii) *Warning signs.* Signs warning of high voltage shall be posted where unauthorized employees might come in contact with live parts.

(e) *Overcurrent protection.*

(e)(1) *600 volts, nominal, or less.* The

following requirements apply to overcurrent protection of circuits rated 600 volts, nominal, or less.

(e)(1)(i) *Protection of conductors and equipment.* Conductors and equipment shall be protected from overcurrent in accordance with their ability to safely conduct current. Conductors shall have sufficient ampacity to carry the load.

(e)(1)(ii) *Grounded conductors.* Except for motor-running overload protection, overcurrent devices shall not interrupt the continuity of the grounded conductor unless all conductors of the circuit are opened simultaneously.

(e)(1)(iii) *Disconnection of fuses and thermal cutouts.* Except for devices provided for current-limiting on the supply side of the service disconnecting means, all cartridge fuses which are accessible to other than qualified persons and all fuses and thermal cutouts on circuits over 150 volts to ground shall be provided with disconnecting means. This disconnecting means shall be installed so that the fuse or thermal cutout can be disconnected from its supply without disrupting service to equipment and circuits unrelated to those protected by the overcurrent device.

(e)(1)(iv) *Location in or on premises.* Overcurrent devices shall be readily accessible. Overcurrent devices shall not be located where they could create an employee safety hazard by being exposed to physical damage or located in the vicinity of easily ignitable material.

(e)(1)(v) *Arcing or suddenly moving parts.* Fuses and circuit breakers shall be so located or shielded that employees will not be burned or otherwise injured by their operation.

(e)(1)(vi) *Circuit breakers.*

(e)(1)(vi)(A) Circuit breakers shall clearly

indicate whether they are in the open (off) or closed (on) position.

**(e)(1)(vi)(B)** Where circuit breaker handles on switchboards are operated vertically rather than horizontally or rotationally, the up position of the handle shall be the closed (on) position.

**(e)(1)(vi)(C)** If used as switches in 120-volt, fluorescent lighting circuits, circuit breakers shall be marked "SWD."

**(e)(2)** *Over 600 volts, nominal.* Feeders and branch circuits over 600 volts, nominal, shall have short-circuit protection.

**(f)** *Grounding.* Paragraphs (f)(1) through (f)(11) of this section contain grounding requirements for systems, circuits, and equipment.

**(f)(1)** *Systems to be grounded.* The following systems which supply premises wiring shall be grounded:

**(f)(1)(i)** *Three-wire DC systems.* All 3-wire DC systems shall have their neutral conductor grounded.

**(f)(1)(ii)** *Two-wire DC systems.* Two-wire DC systems operating at over 50 volts through 300 volts between conductors shall be grounded unless they are rectifier-derived from an AC system complying with paragraphs (f)(1)(iii), (f)(1)(iv), and (f)(1)(v) of this section.

**(f)(1)(iii)** *AC circuits, less than 50 volts.* AC circuits of less than 50 volts shall be grounded if they are installed as overhead conductors outside of buildings or if they are supplied by transformers and the transformer primary supply system is ungrounded or exceeds 150 volts to ground.

**(f)(1)(iv)** *AC systems, 50 volts to 1000 volts.* AC systems of 50 volts to 1000 volts shall be grounded under any of the following conditions, unless exempted by paragraph (f)(1)(v) of this section:

**(f)(1)(iv)(A)** If the system can be so grounded that the maximum voltage to ground on the ungrounded conductors does not

exceed 150 volts;

(f)(1)(iv)(B) If the system is nominally rated 480Y/277 volt, 3-phase, 4-wire in which the neutral is used as a circuit conductor;

(f)(1)(iv)(C) If the system is nominally rated 240/120 volt, 3-phase, 4-wire in which the midpoint of one phase is used as a circuit conductor; or

(f)(1)(iv)(D) If a service conductor is uninsulated.

(f)(1)(v) *Exceptions.* AC systems of 50 volts to 1000 volts are not required to be grounded if the system is separately derived and is supplied by a transformer that has a primary voltage rating less than 1000 volts, provided all of the following conditions are met:

(f)(1)(v)(A) The system is used exclusively for control circuits,

(f)(1)(v)(B) The conditions of maintenance and supervision assure that only qualified persons will service the installation,

(f)(1)(v)(C) Continuity of control power is required, and

(f)(1)(v)(D) Ground detectors are installed on the control system.

(f)(2) *Separately derived systems.* Where paragraph (f)(1) of this section requires grounding of wiring systems whose power is derived from generator, transformer, or converter windings and has no direct electrical connection, including a solidly connected grounded circuit conductor, to supply conductors originating in another system, paragraph (f)(5) of this section shall also apply.

(f)(3) *Portable and vehicle-mounted generators.*

(f)(3)(i) *Portable generators.* Under the following conditions, the frame of a portable generator need not be grounded and may serve as the grounding electrode for a system supplied by the generator:

**(f)(3)(i)(A)** The generator supplies only equipment mounted on the generator and/or cord- and plug-connected equipment through receptacles mounted on the generator, and

**(f)(3)(i)(B)** The noncurrent-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are bonded to the generator frame.

**(f)(3)(ii)** *Vehicle-mounted generators.* Under the following conditions the frame of a vehicle may serve as the grounding electrode for a system supplied by a generator located on the vehicle:

**(f)(3)(ii)(A)** The frame of the generator is bonded to the vehicle frame, and

**(f)(3)(ii)(B)** The generator supplies only equipment located on the vehicle and/or cord- and plug-connected equipment through receptacles mounted on the vehicle or on the generator, and

**(f)(3)(ii)(C)** The noncurrent-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are bonded to the generator frame, and

**(f)(3)(ii)(D)** The system complies with all other provisions of this section.

**(f)(3)(iii)** *Neutral conductor bonding.* A neutral conductor shall be bonded to the generator frame if the generator is a component of a separately derived system. No other conductor need be bonded to the generator frame.

**(f)(4)** *Conductors to be grounded.* For AC premises wiring systems the identified conductor shall be grounded.

**(f)(5)** *Grounding connections.*

**(f)(5)(i)** *Grounded system.* For a grounded system, a grounding electrode conductor shall be used to connect both the equipment grounding conductor and the grounded circuit conductor to the grounding electrode. Both the equipment grounding

conductor and the grounding electrode conductor shall be connected to the grounded circuit conductor on the supply side of the service disconnecting means, or on the supply side of the system disconnecting means or overcurrent devices if the system is separately derived.

**(f)(6)** *Grounding path.* The path to ground from circuits, equipment, and enclosures shall be permanent and continuous.

**(f)(7)** *Supports, enclosures, and equipment to be grounded.*

**(f)(7)(i)** *Supports and enclosures for conductors.* Metal cable trays, metal raceways, and metal enclosures for conductors shall be grounded, except that:

**(f)(7)(i)(A)** Metal enclosures such as sleeves that are used to protect cable assemblies from physical damage need not be grounded; and

**(f)(7)(i)(B)** Metal enclosures for conductors added to existing installations of open wire, knob-and-tube wiring, and nonmetallic-sheathed cable need not be grounded if all of the following conditions are met:

**(f)(7)(i)(B)(1)** Runs are less than 25 feet (7.62 m);

**(f)(7)(i)(B)(2)** Enclosures are free from probable contact with ground, grounded metal, metal laths, or other conductive materials; and

**(f)(7)(i)(B)(3)** Enclosures are guarded against employee contact.

**(f)(7)(ii)** *Service equipment enclosures.* Metal enclosures for service equipment shall be grounded.

**(f)(7)(iii)** *Fixed equipment.* Exposed noncurrent-carrying metal parts of fixed equipment which may become energized shall be grounded under any of the following conditions:

**(f)(7)(iii)(A)** If within 8 feet (2.44 m) vertically or 5 feet (1.52 m) horizontally of ground or grounded metal objects and subject to employee contact.

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(f)(7)(iii)(B) If located in a wet or damp location and subject to employee contact.

(f)(7)(iii)(C) If in electrical contact with metal.

(f)(7)(iii)(E) If supplied by a metal-clad, metal-sheathed, or grounded metal raceway wiring method.

(f)(7)(iii)(F) If equipment operates with any terminal at over 150 volts to ground; however, the following need not be grounded:

(f)(7)(iii)(F)(1) Enclosures for switches or circuit breakers used for other than service equipment and accessible to qualified persons only;

(f)(7)(iii)(F)(2) Metal frames of electrically heated appliances which are permanently and effectively insulated from ground; and

(f)(7)(iii)(F)(3) The cases of distribution apparatus such as transformers and capacitors mounted on wooden poles at a height exceeding 8 feet (2.44 m) above ground or grade level.

(f)(7)(iv) *Equipment connected by cord and plug.* Under any of the conditions described in paragraphs (f)(7)(iv)(A) through (f)(7)(iv)(C) of this section, exposed noncurrent-carrying metal parts of cord- and plug-connected equipment which may become energized shall be grounded:

(f)(7)(iv)(A) If in a hazardous (classified) location (see 1926.407).

(f)(7)(iv)(B) If operated at over 150 volts to ground, except for guarded motors and metal frames of electrically heated appliances if the appliance frames are permanently and effectively insulated from ground.

(f)(7)(iv)(C) If the equipment is one of the types listed in paragraphs (f)(7)(iv)(C)(1) through (f)(7)(iv)(C)(5) of this section. However, even though the equipment may be one of these types, it

need not be grounded if it is exempted by paragraph (f)(7)(iv)(C)(6).

(1) Hand held motor-operated tools;

(2) Cord- and plug-connected equipment used in damp or wet locations or by employees standing on the ground or on metal floors or working inside of metal tanks or boilers;

(3) Portable and mobile X-ray and associated equipment;

(4) Tools likely to be used in wet and/or conductive locations;

(5) Portable hand lamps.

(6) Tools likely to be used in wet and/or conductive locations need not be grounded if supplied through an isolating transformer with an ungrounded secondary of not over 50 volts. Listed or labeled portable tools and appliances protected by a system of double insulation, or its equivalent, need not be grounded. If such a system is employed, the equipment shall be distinctively marked to indicate that the tool or appliance utilizes a system of double insulation.

(f)(7)(v) *Nonelectrical equipment.* The metal parts of the following nonelectrical equipment shall be grounded: Frames and tracks of electrically operated cranes; frames of nonelectrically driven elevator cars to which electric conductors are attached; hand-operated metal shifting ropes or cables of electric elevators, and metal partitions, grill work, and similar metal enclosures around equipment of over 1kV between conductors.

(f)(8) *Methods of grounding equipment.*

(f)(8)(i) *With circuit conductors.*

Noncurrent-carrying metal parts of fixed equipment, if required to be grounded by this subpart, shall be grounded by an equipment grounding conductor which is contained within the same raceway, cable, or cord, or runs with or encloses the circuit conductors. For DC circuits only, the equip-

ment grounding conductor may be run separately from the circuit conductors.

**(f)(8)(ii)** *Grounding conductor.* A conductor used for grounding fixed or movable equipment shall have capacity to conduct safely any fault current which may be imposed on it.

**(f)(8)(iii)** *Equipment considered effectively grounded.* Electric equipment is considered to be effectively grounded if it is secured to, and in electrical contact with, a metal rack or structure that is provided for its support and the metal rack or structure is grounded by the method specified for the noncurrent-carrying metal parts of fixed equipment in paragraph (f)(8)(i) of this section. Metal car frames supported by metal hoisting cables attached to or running over metal sheaves or drums of grounded elevator machines are also considered to be effectively grounded.

**(f)(9)** *Bonding.* If bonding conductors are used to assure electrical continuity, they shall have the capacity to conduct any fault current which may be imposed.

**(f)(10)** *Made electrodes.* If made electrodes are used, they shall be free from nonconductive coatings, such as paint or enamel; and, if practicable, they shall be embedded below permanent moisture level. A single electrode consisting of a rod, pipe or plate which has a resistance to ground greater than 25 ohms shall be augmented by one additional electrode installed no closer than 6 feet (1.83 m) to the first electrode.

**§ 1926.405 - Wiring methods, components, and equipment for general use.**

**(a)** *Wiring methods.* The provisions of this paragraph do not apply to conductors which form an integral part of equipment such

as motors, controllers, motor control centers and like equipment.

**Wiring methods, components,  
and equipment for general use****Electrical**

**(a)(1)** *General requirements.*

**(a)(1)(i)** *Electrical continuity of metal raceways and enclosures.* Metal raceways, cable armor, and other metal enclosures for conductors shall be metallically joined together into a continuous electric conductor and shall be so connected to all boxes, fittings, and cabinets as to provide effective electrical continuity.

**(a)(1)(ii)** *Wiring in ducts.* No wiring systems of any type shall be installed in ducts used to transport dust, loose stock or flammable vapors. No wiring system of any type shall be installed in any duct used for vapor removal or in any shaft containing only such ducts.

**(a)(2)** *Temporary wiring.*

**(a)(2)(i)** *Scope.* The provisions of paragraph (a)(2) of this section apply to temporary electrical power and lighting wiring methods which may be of a class less than would be required for a permanent installation. Except as specifically modified in paragraph (a)(2) of this section, all other requirements of this subpart for permanent wiring shall apply to temporary wiring installations. Temporary wiring shall be removed immediately upon completion of construction or the purpose for which the wiring was installed.

**(a)(2)(ii)** *General requirements for temporary wiring.*

**(a)(2)(ii)(A)** Feeders shall originate in a distribution center. The conductors shall be run as multiconductor cord or cable assemblies or within raceways; or, where not subject to physical damage, they may be run as open conductors on insulators not more than 10 feet (3.05 m) apart.

**(a)(2)(ii)(B)** Branch circuits shall originate in a power outlet or panelboard. Conductors shall be run as multiconductor cord or cable assemblies or open conductors,

or shall be run in raceways. All conductors shall be protected by overcurrent devices at their ampacity. Runs of open conductors shall be located where the conductors will not be subject to physical damage, and the conductors shall be fastened at intervals not exceeding 10 feet (3.05 m). No branch-circuit conductors shall be laid on the floor. Each branch circuit that supplies receptacles or fixed equipment shall contain a separate equipment grounding conductor if the branch circuit is run as open conductors.

**(a)(2)(ii)(C)** Receptacles shall be of the grounding type. Unless installed in a complete metallic raceway, each branch circuit shall contain a separate equipment grounding conductor, and all receptacles shall be electrically connected to the grounding conductor. Receptacles for uses other than temporary lighting shall not be installed on branch circuits which supply temporary lighting. Receptacles shall not be connected to the same ungrounded conductor of multiwire circuits which supply temporary lighting.

**(a)(2)(ii)(D)** Disconnecting switches or plug connectors shall be installed to permit the disconnection of all ungrounded conductors of each temporary circuit.

**(a)(2)(ii)(E)** All lamps for general illumination shall be protected from accidental contact or breakage. Metal-case sockets shall be grounded.

**(a)(2)(ii)(F)** Temporary lights shall not be suspended by their electric cords unless cords and lights are designed for this means of suspension.

**(a)(2)(ii)(G)** Portable electric lighting used in wet and/or other conductive locations, as for example, drums, tanks, and vessels, shall be operated at 12 volts or less. However, 120-volt lights may be used if protected by a ground-fault circuit interrupter.

**(a)(2)(ii)(H)** A box shall be used

wherever a change is made to a raceway system or a cable system which is metal clad or metal sheathed.

**(a)(2)(ii)(I)** Flexible cords and cables shall be protected from damage. Sharp corners and projections shall be avoided. Flexible cords and cables may pass through doorways or other pinch points, if protection is provided to avoid damage.

**(a)(2)(ii)(J)** Extension cord sets used with portable electric tools and appliances shall be of three-wire type and shall be designed for hard or extra-hard usage. Flexible cords used with temporary and portable lights shall be designed for hard or extra-hard usage.

**NOTE:** The National Electrical Code, ANSI/NFPA 70, in Article 400, Table 400-4, lists various types of flexible cords, some of which are noted as being designed for hard or extra-hard usage. Examples of these types of flexible cords include hard service cord (types S, ST, SO, STO) and junior hard service cord (types SJ, SJO, SJT, SJTO).

**(a)(2)(iii)** *Guarding.* For temporary wiring over 600 volts, nominal, fencing, barriers, or other effective means shall be provided to prevent access of other than authorized and qualified personnel.

**(b)** *Cabinets, boxes, and fittings.*

**(b)(1)** *Conductors entering boxes, cabinets, or fittings.* Conductors entering boxes, cabinets, or fittings shall be protected from abrasion, and openings through which conductors enter shall be effectively closed. Unused openings in cabinets, boxes, and fittings shall also be effectively closed.

**(b)(2)** *Covers and canopies.* All pull boxes, junction boxes, and fittings shall be provided with covers. If metal covers are used, they shall be grounded. In energized installations each outlet box shall have a cover, faceplate, or fixture canopy. Covers of

outlet boxes having holes through which flexible cord pendants pass shall be provided with bushings designed for the purpose or shall have smooth, well-rounded surfaces on which the cords may bear.

**(d)** *Switchboards and panelboards.* Switchboards that have any exposed live parts shall be located in permanently dry locations and accessible only to qualified persons. Panelboards shall be mounted in cabinets, cutout boxes, or enclosures designed for the purpose and shall be dead front. However, panelboards other than the dead front externally-operable type are permitted where accessible only to qualified persons. Exposed blades of knife switches shall be dead when open.

**(e)** *Enclosures for damp or wet locations.*

**(e)(1)** *Cabinets, fittings, and boxes.* Cabinets, cutout boxes, fittings, boxes, and panelboard enclosures in damp or wet locations shall be installed so as to prevent moisture or water from entering and accumulating within the enclosures. In wet locations the enclosures shall be weatherproof.

**(e)(2)** *Switches and circuit breakers.* Switches, circuit breakers, and switchboards installed in wet locations shall be enclosed in weatherproof enclosures.

**(f)** *Conductors for general wiring.* All conductors used for general wiring shall be insulated unless otherwise permitted in this Subpart. The conductor insulation shall be of a type that is suitable for the voltage, operating temperature, and location of use. Insulated conductors shall be distinguishable by appropriate color or other means as being grounded conductors, ungrounded conductors, or equipment grounding conductors.

(g) *Flexible cords and cables.*

(g)(1) *Use of flexible cords and cables.*

(g)(1)(i) *Permitted uses.* Flexible cords and cables shall be suitable for conditions of use and location. Flexible cords and cables shall be used only for:

(A) Pendants;

(B) Wiring of fixtures;

(C) Connection of portable lamps or appliances;

(D) Elevator cables;

(E) Wiring of cranes and hoists;

(F) Connection of stationary equipment to facilitate their frequent interchange;

(G) Prevention of the transmission of noise or vibration; or

(H) Appliances where the fastening means and mechanical connections are designed to permit removal for maintenance and repair.

(g)(1)(ii) *Attachment plugs for cords.* If used as permitted in paragraphs (g)(1)(i)(C), (g)(1)(i)(F), or (g)(1)(i)(H) of this section, the flexible cord shall be equipped with an attachment plug and shall be energized from a receptacle outlet.

(g)(1)(iii) *Prohibited uses.* Unless necessary for a use permitted in paragraph (g)(1)(i) of this section, flexible cords and cables shall not be used:

(A) As a substitute for the fixed wiring of a structure;

(B) Where run through holes in walls, ceilings, or floors;

(C) Where run through doorways, windows, or similar openings, except as permitted in paragraph (a)(2)(ii)(1) of this section;

(D) Where attached to building surfaces;  
or

(E) Where concealed behind building walls, ceilings, or floors.

(g)(2) *Identification, splices, and terminations.*

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**(g)(2)(i) Identification.** A conductor of a flexible cord or cable that is used as a grounded conductor or an equipment grounding conductor shall be distinguishable from other conductors.

**(g)(2)(ii) Marking.** Type SJ, SJO, SJT, SJTO, S, SO, ST, and STO cords shall not be used unless durably marked on the surface with the type designation, size, and number of conductors.

**(g)(2)(iii) Splices.** Flexible cords shall be used only in continuous lengths without splice or tap. Hard service flexible cords No. 12 or larger may be repaired if spliced so that the splice retains the insulation, outer sheath properties, and usage characteristics of the cord being spliced.

**(g)(2)(iv) Strain relief.** Flexible cords shall be connected to devices and fittings so that strain relief is provided which will prevent pull from being directly transmitted to joints or terminal screws.

**(g)(2)(v) Cords passing through holes.** Flexible cords and cables shall be protected by bushings or fittings where passing through holes in covers, outlet boxes, or similar enclosures.

**(i) Fixture wires.**

**(i)(1) General.** Fixture wires shall be suitable for the voltage, temperature, and location of use. A fixture wire which is used as a grounded conductor shall be identified.

**(i)(2) Uses permitted.** Fixture wires may be used:

**(i)(2)(i)** For installation in lighting, fixtures and in similar equipment where enclosed or protected and not subject to bending or twisting in use; or

**(i)(2)(ii)** For connecting lighting fixtures to the branch-circuit conductors supplying the fixtures.

**(i)(3) Uses not permitted.** Fixture wires shall not be used as branch-circuit conduc-

tors except as permitted for Class 1 power-limited circuits.

**(j) Equipment for general use.**

**(j)(1) Lighting fixtures, lampholders, lamps, and receptacles.**

**(j)(1)(i) Live parts.** Fixtures, lampholders, lamps, rosettes, and receptacles shall have no live parts normally exposed to employee contact. However, rosettes and cleat-type lampholders and receptacles located at least 8 feet (2.44 m) above the floor may have exposed parts.

**(j)(1)(ii) Support.** Fixtures, lampholders, rosettes, and receptacles shall be securely supported. A fixture that weighs more than 6 pounds (2.72 kg) or exceeds 16 inches (406 mm) in any dimension shall not be supported by the screw shell of a lampholder.

**(j)(1)(iii) Portable lamps.** Portable lamps shall be wired with flexible cord and an attachment plug of the polarized or grounding type. If the portable lamp uses an Edison-based lampholder, the grounded conductor shall be identified and attached to the screw shell and the identified blade of the attachment plug. In addition, portable handlamps shall comply with the following:

**(j)(1)(iii)(A)** Metal shell, paperlined lampholders shall not be used;

**(j)(1)(iii)(B)** Handlamps shall be equipped with a handle of molded composition or other insulating material;

**(j)(1)(iii)(C)** Handlamps shall be equipped with a substantial guard attached to the lampholder or handle;

**(j)(1)(iii)(D)** Metallic guards shall be grounded by the means of an equipment grounding conductor run within the power supply cord.

**(j)(1)(iv) Lampholders.** Lampholders of the screw-shell type shall be installed for use as lampholders only. Lampholders

installed in wet or damp locations shall be of the weatherproof type.

(j)(1)(v) *Fixtures.* Fixtures installed in wet or damp locations shall be identified for the purpose and shall be installed so that water cannot enter or accumulate in wireways, lampholders, or other electrical parts.

(j)(2) *Receptacles, cord connectors, and attachment plugs (caps).*

(j)(2)(i) *Configuration.* Receptacles, cord connectors, and attachment plugs shall be constructed so that no receptacle or cord connector will accept an attachment plug with a different voltage or current rating than that for which the device is intended. However, a 20-ampere T-slot receptacle or cord connector may accept a 15-ampere attachment plug of the same voltage rating. Receptacles connected to circuits having different voltages, frequencies, or types of current (ac or dc) on the same premises shall be of such design that the attachment plugs used on these circuits are not interchangeable.

(j)(2)(ii) *Damp and wet locations.* A receptacle installed in a wet or damp location shall be designed for the location.

(j)(3) *Appliances.*

(j)(3)(i) *Live parts.* Appliances, other than those in which the current-carrying parts at high temperatures are necessarily exposed, shall have no live parts normally exposed to employee contact.

(j)(3)(ii) *Disconnecting means.* A means shall be provided to disconnect each appliance.

(j)(3)(iii) *Rating.* Each appliance shall be marked with its rating in volts and amperes or volts and watts.

#### § 1926.416 - General requirements.

(a) *Protection of employees.*

(a)(1) No employer shall permit an

employee to work in such proximity to any part of an electric power circuit that the employee could contact the electric power circuit in the course of work, unless the employee is protected against electric shock by deenergizing the circuit and grounding it or by guarding it effectively by insulation or other means.

(a)(2) In work areas where the exact location of underground electric powerlines is unknown, employees using jack-hammers, bars, or other hand tools which may contact a line shall be provided with insulated protective gloves.

(a)(3) Before work is begun the employer shall ascertain by inquiry or direct observation, or by instruments, whether any part of an energized electric power circuit, exposed or concealed, is so located that the performance of the work may bring any person, tool, or machine into physical or electrical contact with the electric power circuit. The employer shall post and maintain proper warning signs where such a circuit exists. The employer shall advise employees of the location of such lines, the hazards involved, and the protective measures to be taken.

(b) *Passageways and open spaces.*

(b)(1) Barriers or other means of guarding shall be provided to ensure that workspace for electrical equipment will not be used as a passageway during periods when energized parts of electrical equipment are exposed.

(b)(2) Working spaces, walkways, and similar locations shall be kept clear of cords so as not to create a hazard to employees.

(c) *Load ratings.* In existing installations, no changes in circuit protection shall be made to increase the load in excess of the load rating of the circuit wiring.

(d) *Fuses.* When fuses are installed or removed with one or both terminals

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**Lockout and tagging of circuits**

energized, special tools insulated for the voltage shall be used.

(e) *Cords and cables.*

(e)(1) Worn or frayed electric cords or cables shall not be used.

(e)(2) Extension cords shall not be fastened with staples, hung from nails, or suspended by wire.

**§ 1926.417 - Lockout and tagging of circuits.**

(a) *Controls.* Controls that are to be deactivated during the course of work on energized or deenergized equipment or circuits shall be tagged.

(b) *Equipment and circuits.* Equipment or circuits that are deenergized shall be rendered inoperative and shall have tags attached at all points where such equipment or circuits can be energized.

(c) *Tags.* Tags shall be placed to identify plainly the equipment or circuits being worked on.

**§ 1926.432 - Environmental deterioration of equipment.**

(a) *Deteriorating agents.*

(a)(1) Unless identified for use in the operating environment, no conductors or equipment shall be located:

(i) In damp or wet locations;

(ii) Where exposed to gases, fumes, vapors, liquids, or other agents having a deteriorating effect on the conductors or equipment; or

(iii) Where exposed to excessive temperatures.

(a)(2) Control equipment, utilization equipment, and busways approved for use in dry locations only shall be protected against damage from the weather during building construction.

(b) *Protection against corrosion.* Metal

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raceways, cable armor, boxes, cable sheathing, cabinets, elbows, couplings, fittings, supports, and support hardware shall be of materials appropriate for the environment in which they are to be installed.

**§ 1926.449 - Definitions applicable to this subpart.**

The definitions given in this section apply to the terms used in Subpart K. The definitions given here for "approved" and "qualified person" apply, instead of the definitions given in 1926.32, to the use of these terms in Subpart K.

*Acceptable.* An installation or equipment is acceptable to the Assistant Secretary of Labor, and approved within the meaning of this Subpart K: (a) If it is accepted, or certified, or listed, or labeled, or otherwise determined to be safe by a qualified testing laboratory capable of determining the suitability of materials and equipment for installation and use in accordance with this standard; or (b) With respect to an installation or equipment of a kind which no qualified testing laboratory accepts, certifies, lists, labels, or determines to be safe, if it is inspected or tested by another Federal agency, or by a State, municipal, or other local authority responsible for enforcing occupational safety provisions of the National Electrical Code, and found in compliance with those provisions.

*Accepted.* An installation is "accepted" if it has been inspected and found to be safe by a qualified testing laboratory.

*Accessible.* (As applied to wiring methods.) Capable of being removed or exposed without damaging the building structure or finish, or not permanently closed in by the structure or finish of the building. (See "concealed" and "exposed.")

*Accessible.* (As applied to equipment.)

Admitting close approach; not guarded by locked doors, elevation, or other effective means. (See "Readily accessible.")

*Ampacity.* The current in amperes a conductor can carry continuously under the conditions of use without exceeding its temperature rating.

*Appliances.* Utilization equipment, generally other than industrial, normally built in standardized sizes or types, which is installed or connected as a unit to perform one or more functions.

*Approved.* Acceptable to the authority enforcing this Subpart. The authority enforcing this Subpart is the Assistant Secretary of Labor for Occupational Safety and Health. The definition of "acceptable" indicates what is acceptable to the Assistant Secretary of Labor, and therefore approved within the meaning of this Subpart.

*Attachment plug (Plug cap)(Cap).* A device which, by insertion in a receptacle, establishes connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle.

*Automatic.* Self-acting, operating by its own mechanism when actuated by some impersonal influence, as for example, a change in current strength, pressure, temperature, or mechanical configuration.

*Bare conductor.* See "Conductor."

*Bonding.* The permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed.

*Bonding jumper.* A reliable conductor to assure the required electrical conductivity between metal parts required to be electrically connected.

*Branch circuit.* The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s).

*Building.* A structure which stands alone or which is cut off from adjoining structures

by fire walls with all openings therein protected by approved fire doors.

*Cabinet.* An enclosure designed either for surface or flush mounting, and provided with a frame, mat, or trim in which a swinging door or doors are or may be hung.

*Certified.* Equipment is "certified" if it: (a) Has been tested and found by a qualified testing laboratory to meet applicable test standards or to be safe for use in a specified manner, and (b) Is of a kind whose production is periodically inspected by a qualified testing laboratory. Certified equipment must bear a label, tag, or other record of certification.

*Circuit breaker - (a)* (600 volts nominal, or less.) A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without injury to itself when properly applied within its rating.

(b) *Class II, Division 2.* A Class II, Division 2 location is a location in which: (1) Combustible dust will not normally be in suspension in the air in quantities sufficient to produce explosive or ignitable mixtures, and dust accumulations are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus; or (2) Dust may be in suspension in the air as a result of infrequent malfunctioning of handling or processing equipment, and dust accumulations resulting therefrom may be ignitable by abnormal operation or failure of electrical equipment or other apparatus.

**NOTE:** This classification includes locations where dangerous concentrations of suspended dust would not be likely but where dust accumulations might form on or in the vicinity of electric equipment. These areas may contain equipment from which appreciable quantities of dust would escape under abnormal operating conditions or be adjacent to a Class II Division 1 location, as

described above, into which an explosive or ignitable concentration of dust may be put

into suspension under abnormal operating conditions.

*Class III locations.* Class III locations are those that are hazardous because of the presence of easily ignitable fibers or flyings but in which such fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures. Class III locations include the following:

(a) *Class III, Division 1.* A Class III, Division 1 location is a location in which easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used.

**NOTE:** Easily ignitable fibers and flyings include rayon, cotton (including cotton linters and cotton waste), sisal or henequen, istle, jute, hemp, tow, cocoa fiber, oakum, baled waste kapok, Spanish moss, excelsior, sawdust, woodchips, and other material of similar nature.

(b) *Class III, Division 2.* A Class III, Division 2 location is a location in which easily ignitable fibers are stored or handled, except in process of manufacture.

*Collector ring.* A collector ring is an assembly of slip rings for transferring electrical energy from a stationary to a rotating member.

*Concealed.* Rendered inaccessible by the structure or finish of the building. Wires in concealed raceways are considered concealed, even though they may become accessible by withdrawing them. [See "Accessible. (As applied to wiring methods)."]

*Conductor* - (a) *Bare.* A conductor having no covering or electrical insulation whatsoever. (b) *Covered.* A conductor encased within material of composition or thickness that is not recognized as electrical insulation. (c) *Insulated.* A conductor encased within material of composition and thickness

that is recognized as electrical insulation.

*Controller.* A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

*Covered conductor.* See "Conductor."

*Cutout.* (Over 600 volts, nominal.) An assembly of a fuse support with either a fuseholder, fuse carrier, or disconnecting blade. The fuseholder or fuse carrier may include a conducting element (fuse link), or may act as the disconnecting blade by the inclusion of a nonfusible member.

*Cutout box.* An enclosure designed for surface mounting and having swinging doors or covers secured directly to and telescoping with the walls of the box proper. (See "Cabinet.")

*Damp location.* See "Location."

*Dead front.* Without live parts exposed to a person on the operating side of the equipment.

*Device.* A unit of an electrical system which is intended to carry but not utilize electric energy.

*Disconnecting means.* A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

*Disconnecting (or Isolating) switch.* (Over 600 volts, nominal.) A mechanical switching device used for isolating a circuit or equipment from a source of power.

*Dry location.* See "Location."

*Enclosed.* Surrounded by a case, housing, fence or walls which will prevent persons from accidentally contacting energized parts.

*Enclosure.* The case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts, or to protect the equipment from physical damage.

*Equipment.* A general term including

## Electrical

## Definitions applicable to this subpart

material, fittings, devices, appliances, fixtures, apparatus, and the like, used as a part of, or in connection with, an electrical installation.

*Exposed.* (As applied to wiring methods.) On or attached to the surface or behind panels designed to allow access. [See "Accessible. (As applied to wiring methods.)"]

*Exposed.* (For the purposes of 1926.408(d), Communications systems.) Where the circuit is in such a position that in case of failure of supports or insulation, contact with another circuit may result.

*Externally operable.* Capable of being operated without exposing the operator to contact with live parts.

*Feeder.* All circuit conductors between the service equipment, or the generator switchboard of an isolated plant, and the final branch-circuit overcurrent device.

*Festoon lighting.* A string of outdoor lights suspended between two points more than 15 feet (4.57 m) apart.

*Fitting.* An accessory such as a locknut, bushing, or other part of a wiring system that is intended primarily to perform a mechanical rather than an electrical function.

*Ground.* A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

*Grounded.* Connected to earth or to some conducting body that serves in place of the earth.

*Grounded conductor.* A system or circuit conductor that is intentionally grounded.

*Grounding conductor.* A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode or electrodes.

*Grounding conductor, equipment.* The conductor used to connect the

noncurrent-carrying metal parts of equipment, raceways, and other enclosures to the system grounded conductor and/or the grounding electrode conductor at the service equipment or at the source of a separately derived system.

*Grounding electrode conductor.* The conductor used to connect the grounding electrode to the equipment grounding conductor and/or to the grounded conductor of the circuit at the service equipment or at the source of a separately derived system.

*Ground-fault circuit interrupter.* A device for the protection of personnel that functions to deenergize a circuit or portion thereof within an established period of time when a current to ground exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit.

*Guarded.* Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach to a point of danger or contact by persons or objects.

*Hoistway.* Any shaftway, hatchway, well hole, or other vertical opening or space in which an elevator or dumbwaiter is designed to operate.

*Identified (conductors or terminals).* Identified, as used in reference to a conductor or its terminal, means that such conductor or terminal can be recognized as grounded.

*Identified (for the use).* Recognized as suitable for the specific purpose, function, use, environment, application, etc. where described as a requirement in this standard. Suitability of equipment for a specific purpose, environment, or application is determined by a qualified testing laboratory where such identification includes labeling or listing.

*Isolated.* Not readily accessible to persons unless special means for access are used.

*Isolated power system.* A system comprising an isolating transformer or its equivalent, a line isolation monitor, and its ungrounded circuit conductors.

*Labeled.* Equipment or materials to which has been attached a label, symbol or other identifying mark of a qualified testing laboratory which indicates compliance with appropriate standards or performance in a specified manner.

*Lighting outlet.* An outlet intended for the direct connection of a lampholder, a lighting fixture, or a pendant cord terminating in a lampholder.

*Listed.* Equipment or materials included in a list published by a qualified testing laboratory whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

*Location - (a) Damp location.* Partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements. (b) *Dry location.* A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction. (c) *Wet location.* Installations underground or in concrete slabs or masonry in direct contact with the earth, and locations subject to saturation with water or other liquids, such as locations exposed to weather and unprotected.

*Motor control center.* An assembly of one or more enclosed sections having a common power bus and principally containing motor control units.

*Outlet.* A point on the wiring system at which current is taken to supply utilization equipment.

*Overcurrent.* Any current in excess of the

rated current of equipment or the ampacity of a conductor. It may result from overload (see definition), short circuit, or ground fault. A current in excess of rating may be accommodated by certain equipment and conductors for a given set of conditions. Hence the rules for overcurrent protection are specific for particular situations.

*Overload.* Operation of equipment in excess of normal, full load rating, or of a conductor in excess of rated ampacity which, when it persists for a sufficient length of time, would cause damage or dangerous overheating. A fault, such as a short circuit or ground fault, is not an overload. (See "Overcurrent.")

*Panelboard.* A single panel or group of panel units designed for assembly in the form of a single panel; including buses, automatic overcurrent devices, and with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall or partition and accessible only from the front. (See "Switchboard.")

*Power outlet.* An enclosed assembly which may include receptacles, circuit breakers, fuseholders, fused switches, buses and watt-hour meter mounting means; intended to serve as a means for distributing power required to operate mobile or temporarily installed equipment.

*Premises wiring system.* That interior and exterior wiring, including power, lighting, control, and signal circuit wiring together with all of its associated hardware, fittings, and wiring devices, both permanently and temporarily installed, which extends from the load end of the service drop, or load end of the service lateral conductors to the outlet(s). Such wiring does not include wiring internal to appliances, fixtures, motors, controllers, motor control centers, and similar equipment. Qualified person. One familiar with the

construction and operation of the equipment and the hazards involved.

*Raceway.* A channel designed expressly for holding wires, cables, or busbars, with additional functions as permitted in this subpart. Raceways may be of metal or insulating material, and the term includes rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible metal conduit, flexible metallic tubing, flexible metal conduit, electrical metallic tubing, underfloor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, wireways, and busways.

*Readily accessible.* Capable of being reached quickly for operation, renewal, or inspections, without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, chairs, etc. (See "Accessible.")

*Receptacle.* A receptacle is a contact device installed at the outlet for the connection of a single attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is a single device containing two or more receptacles.

*Receptacle outlet.* An outlet where one or more receptacles are installed.

*Remote-control circuit.* Any electric circuit that controls any other circuit through a relay or an equivalent device.

*Sealable equipment.* Equipment enclosed in a case or cabinet that is provided with a means of sealing or locking so that live parts cannot be made accessible without opening the enclosure. The equipment may or may not be operable without opening the enclosure.

*Separately derived system.* A premises wiring system whose power is derived from generator, transformer, or converter windings and has no direct electrical connection,

including a solidly connected grounded circuit conductor, to supply conductors originating in another system.

*Service.* The conductors and equipment for delivering energy from the electricity supply system to the wiring system of the premises served.

*Service conductors.* The supply conductors that extend from the street main or from transformers to the service equipment of the premises supplied.

*Service drop.* The overhead service conductors from the last pole or other aerial support to and including the splices, if any, connecting to the service-entrance conductors at the building or other structure.

*Service-entrance conductors, overhead system.* The service conductors between the terminals of the service equipment and a point usually outside the building, clear of building walls, where joined by tap or splice to the service drop.

*Service-entrance conductors, underground system.* The service conductors between the terminals of the service equipment and the point of connection to the service lateral. Where service equipment is located outside the building walls, there may be no service-entrance conductors, or they may be entirely outside the building.

*Service equipment.* The necessary equipment, usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the point of entrance of supply conductors to a building or other structure, or an otherwise defined area, and intended to constitute the main control and means of cutoff of the supply.

*Service raceway.* The raceway that encloses the service-entrance conductors.

*Signaling circuit.* Any electric circuit that energizes signaling equipment.

*Switchboard.* A large single panel, frame,

or assembly of panels which have switches, buses, instruments, overcurrent

**Scope, application and definitions applicable to this subpart**

**Scaffolds**

and other protective devices mounted on the face or back or both. Switchboards are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets. (See "Panelboard.")

*Switches* - (a) *General-use switch*. A switch intended for use in general distribution and branch circuits. It is rated in amperes, and it is capable of interrupting its rated current at its rated voltage. (b) *General-use snap switch*. A form of general-use switch so constructed that it can be installed in flush device boxes or on outlet box covers, or otherwise used in conjunction with wiring systems recognized by this subpart. (c) *Isolating switch*. A switch intended for isolating an electric circuit from the source of power. It has no interrupting rating, and it is intended to be operated only after the circuit has been opened by some other means. (d) *Motor-circuit switch*. A switch, rated in horsepower, capable of interrupting the maximum operating overload current of a motor of the same horsepower rating as the switch at the rated voltage.

*Transportable X-ray*. X-ray equipment installed in a vehicle or that may readily be disassembled for transport in a vehicle.

*Utilization equipment*. Utilization equipment means equipment which utilizes electric energy for mechanical, chemical, heating, lighting, or similar useful purpose.

*Utilization system*. A utilization system is a system which provides electric power and light for employee workplaces, and includes the premises wiring system and utilization equipment.

*Ventilated*. Provided with a means to permit circulation of air sufficient to remove an excess of heat, fumes, or vapors.

*Voltage*. (Of a circuit.) The greatest root-mean-square (effective) difference of potential between any two conductors of the

circuit concerned.

*Voltage, nominal*. A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (as 120/240, 480Y/277, 600, etc.). The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment.

*Voltage to ground*. For grounded circuits, the voltage between the given conductor and that point or conductor of the circuit that is grounded; for ungrounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit.

*Watertight*. So constructed that moisture will not enter the enclosure.

*Weatherproof*. So constructed or protected that exposure to the weather will not interfere with successful operation. Rainproof, raintight, or watertight equipment can fulfill the requirements for weatherproof where varying weather conditions other than wetness, such as snow, ice, dust, or temperature extremes, are not a factor.

*Wet location*. See "Location."

**Subpart L - Scaffolds**

**§ 1926.450 - Scope, application and definitions applicable to this subpart.**

(a) *Scope and application*. This subpart applies to all scaffolds used in workplaces covered by this part. It does not apply to crane or derrick suspended personnel platforms, which are covered by 1926.550(g). The criteria for aerial lifts are set out exclusively in 1926.453.

(b) *Definitions*.

*Bearer (putlog)* means a horizontal transverse scaffold member (which may be supported by ledgers or runners) upon which

the scaffold platform rests and which joins scaffold uprights, posts, poles, and similar members.

*Body belt (safety belt)* means a strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device.

*Body harness* means a design of straps which may be secured about the employee in a manner to 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.

*Brace* means a rigid connection that holds one scaffold member in a fixed position with respect to another member, or to a building or structure.

*Bricklayers' square scaffold* means a supported scaffold composed of framed squares which support a platform.

*Carpenters' bracket scaffold* means a supported scaffold consisting of a platform supported by brackets attached to building or structural walls.

*Cleat* means a structural block used at the end of a platform to prevent the platform from slipping off its supports. Cleats are also used to provide footing on sloped surfaces such as crawling boards.

*Competent person* means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

*Coupler* means a device for locking together the tubes of a tube and coupler scaffold.

*Crawling board (chicken ladder)* means a supported scaffold consisting of a plank with cleats spaced and secured to provide

footing, for use on sloped surfaces such as roofs.

*Deceleration device* means any mechanism, such as a rope grab, rip-stitch lanyard, specially-woven lanyard, tearing or deforming lanyard, or automatic self-retracting lifeline lanyard, which dissipates a substantial amount of energy during a fall arrest or limits the energy imposed on an employee during fall arrest.

*Double pole (independent pole) scaffold* means a supported scaffold consisting of a platform(s) resting on cross beams (bearers) supported by ledgers and a double row of uprights independent of support (except ties, guys, braces) from any structure.

*Equivalent* means alternative designs, materials or methods to protect against a hazard which the employer can demonstrate will provide an equal or greater degree of safety for employees than the methods, materials or designs specified in the standard.

*Exposed power lines* means electrical power lines which are accessible to employees and which are not shielded from contact. Such lines do not include extension cords or power tool cords.

*Eye or Eye splice* means a loop with or without a thimble at the end of a wire rope.

*Fabricated decking and planking* means manufactured platforms made of wood (including laminated wood, and solid sawn wood planks), metal or other materials.

*Fabricated frame scaffold (tubular welded frame scaffold)* means a scaffold consisting of a platform(s) supported on fabricated end frames with integral posts, horizontal bearers, and intermediate members.

*Failure* means load refusal, breakage, or separation of component parts. Load refusal is the point where the ultimate strength is exceeded.

**Scope, application and definitions applicable to this subpart****Scaffolds**

*Form scaffold* means a supported scaffold consisting of a platform supported by brackets attached to formwork.

*Guardrail system* means a vertical barrier, consisting of, but not limited to, toprails, midrails, and posts, erected to prevent employees from falling off a scaffold platform or walkway to lower levels.

*Hoist* means a manual or power-operated mechanical device to raise or lower a suspended scaffold.

*Horse scaffold* means a supported scaffold consisting of a platform supported by construction horses (saw horses). Horse scaffolds constructed of metal are sometimes known as trestle scaffolds.

*Independent pole scaffold* (see "Double pole scaffold").

*Ladder jack scaffold* means a supported scaffold consisting of a platform resting on brackets attached to ladders.

*Ladder stand* means a mobile, fixed-size, self-supporting ladder consisting of a wide flat tread ladder in the form of stairs.

*Landing* means a platform at the end of a flight of stairs.

*Large area scaffold* means a pole scaffold, tube and coupler scaffold, systems scaffold, or fabricated frame scaffold erected over substantially the entire work area. For example: a scaffold erected over the entire floor area of a room.

*Lean-to scaffold* means a supported scaffold which is kept erect by tilting it toward and resting it against a building or structure.

*Lifeline* means a component consisting of a flexible line that connects to an anchorage at one end to hang vertically (vertical lifeline), or that connects 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.

*Lower levels* means areas below the level where the employee is located and to which an employee can fall. Such areas include, but are not limited to, ground levels, floors, roofs, ramps, runways, excavations, pits, tanks, materials, water, and equipment.

*Maximum intended load* means the total load of all persons, equipment, tools, materials, transmitted loads, and other loads reasonably anticipated to be applied to a scaffold or scaffold component at any one time.

*Mobile scaffold* means a powered or unpowered, portable, caster or wheel-mounted supported scaffold.

*Multi-level suspended scaffold* means a two-point or multi-point adjustable suspension scaffold with a series of platforms at various levels resting on common stirrups.

*Multi-point adjustable suspension scaffold* means a suspension scaffold consisting of a platform(s) which is suspended by more than two ropes from overhead supports and equipped with means to raise and lower the platform to desired work levels. Such scaffolds include chimney hoists.

*Needle beam scaffold* means a platform suspended from needle beams.

*Open sides and ends* means the edges of a platform that are more than 14 inches (36 cm) away horizontally from a sturdy, continuous, vertical surface (such as a building wall) or a sturdy, continuous horizontal surface (such as a floor), or a point of access. Exception: For plastering and lathing operations the horizontal threshold distance is 18 inches (46 cm).

*Outrigger* means the structural member of a supported scaffold used to increase the base width of a scaffold in order to provide support for and increased stability of the scaffold.

*Overhand bricklaying* means the process of laying bricks and masonry units such that the surface of the wall to be jointed is on the opposite side of the wall from the mason, requiring the mason to lean over the wall to complete the work. It includes mason tending and electrical installation incorporated into the brick wall during the overhand bricklaying process.

*Personal fall arrest system* means a system used to arrest an employee's fall. It consists of an anchorage, connectors, a body belt or body harness and may include a lanyard, deceleration device, lifeline, or combinations of these.

*Platform* means a work surface elevated above lower levels. Platforms can be constructed using individual wood planks, fabricated planks, fabricated decks, and fabricated platforms.

*Pole scaffold* (see definitions for "Single-pole scaffold" and "Double (independent) pole scaffold").

*Power operated hoist* means a hoist which is powered by other than human energy.

*Pump jack scaffold* means a supported scaffold consisting of a platform supported by vertical poles and movable support brackets.

*Qualified* means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve or resolve problems related to the subject matter, the work, or the project.

*Rated load* means the manufacturer's specified maximum load to be lifted by a hoist or to be applied to a scaffold or scaffold component.

*Repair bracket scaffold* means a supported scaffold consisting of a platform supported by brackets which are secured in place around the circumference or perimeter

of a chimney, stack, tank or other supporting structure by one or more wire ropes placed around the supporting structure.

*Roof bracket scaffold* means a rooftop supported scaffold consisting of a platform resting on angular-shaped supports.

*Runner (ledger or ribbon)* means the lengthwise horizontal spacing or bracing member which may support the bearers.

*Scaffold* means any temporary elevated platform (supported or suspended) and its supporting structure (including points of anchorage), used for supporting employees or materials or both.

*Self-contained adjustable scaffold* means a combination supported and suspension scaffold consisting of an adjustable platform(s) mounted on an independent supporting frame(s) not a part of the object being worked on, and which is equipped with a means to permit the raising and lowering of the platform(s). Such systems include rolling roof rigs, rolling outrigger systems, and some masons' adjustable supported scaffolds.

*Shore scaffold* means a supported scaffold which is placed against a building or structure and held in place with props.

*Single-point adjustable suspension scaffold* means a suspension scaffold consisting of a platform suspended by one rope from an overhead support and equipped with means to permit the movement of the platform to desired work levels.

*Single-pole scaffold* means a supported scaffold consisting of a platform(s) resting on bearers, the outside ends of which are supported on runners secured to a single row of posts or uprights, and the inner ends of which are supported on or in a structure or building wall.

*Stair tower (Scaffold stairway/tower)* means a tower comprised of scaffold components and which contains internal

stairway units and rest platforms. These towers are used to provide access to scaffold platforms and other elevated points such as floors and roofs.

*Stall load* means the load at which the prime-mover of a power-operated hoist stalls or the power to the prime-mover is automatically disconnected.

*Step, platform, and trestle ladder scaffold* means a platform resting directly on the rungs of step ladders or trestle ladders.

*Stilts* means a pair of poles or similar supports with raised footrests, used to permit walking above the ground or working surface.

*Stonesetters' multi-point adjustable suspension scaffold* means a continuous run suspension scaffold designed and used for stonesetters' operations.

*Supported scaffold* means one or more platforms supported by outrigger beams, brackets, poles, legs, uprights, posts, frames, or similar rigid support.

*System scaffold* means a scaffold consisting of posts with fixed connection points that accept runners, bearers, and diagonals that can be interconnected at predetermined levels.

*Top plate bracket scaffold* means a scaffold supported by brackets that hook over or are attached to the top of a wall. This type of scaffold is similar to carpenters' bracket scaffolds and form scaffolds and is used in residential construction for setting trusses.

*Tube and coupler scaffold* means a supported or suspended scaffold consisting of a platform(s) supported by tubing, erected with coupling devices connecting uprights, braces, bearers, and runners.

*Tubular welded frame scaffold* (see "Fabricated frame scaffold").

*Unstable objects* means items whose strength, configuration, or lack of stability may allow them to become dislocated and

shift and therefore may not properly support the loads imposed on them. Unstable objects do not constitute a safe base support for scaffolds, platforms, or employees. Examples include, but are not limited to, barrels, boxes, loose brick, and concrete blocks.

*Vertical pickup* means a rope used to support the horizontal rope in catenary scaffolds.

*Walkway* means a portion of a scaffold platform used only for access and not as a work level.

*Window jack scaffold* means a platform resting on a bracket or jack which projects through a window opening.

**§ 1926.451 - General requirements.**

This section does not apply to aerial lifts, the criteria for which are set out exclusively in 1926.453.

**(a) Capacity**

**(a)(1)** Except as provided in paragraphs (a)(2), (a)(3), (a)(4), (a)(5) and (g) of this section, each scaffold and scaffold component shall be capable of supporting, without failure, its own weight and at least 4 times the maximum intended load applied or transmitted to it.

**(a)(2)** Direct connections to roofs and floors, and counterweights used to balance adjustable suspension scaffolds, shall be capable of resisting at least 4 times the tipping moment imposed by the scaffold \*operating at the rated load of the hoist, or 1.5 (minimum) times the tipping moment imposed by the scaffold operating at the stall load of the hoist, whichever is greater.

**(a)(5)** The stall load of any scaffold hoist shall not exceed 3 times its rated load.

**(a)(6)** Scaffolds shall be designed by a qualified person and shall be constructed and loaded in accordance with that design. Non-mandatory Appendix A to this subpart

contains examples of criteria that will enable an employer to comply with paragraph (a) of this section.

**(b)** *Scaffold platform construction.*

**(b)(1)** Each platform on all working levels of scaffolds shall be fully planked or decked between the front uprights and the guardrail supports as follows:

**(b)(1)(i)** Each platform unit (e.g., scaffold plank, fabricated plank, fabricated deck, or fabricated platform) shall be installed so that the space between adjacent units and the space between the platform and the uprights is no more than 1 inch (2.5 cm) wide, except where the employer can demonstrate that a wider space is necessary (for example, to fit around uprights when side brackets are used to extend the width of the platform).

**(b)(1)(ii)** Where the employer makes the demonstration provided for in paragraph (b)(1)(i) of this section, the platform shall be planked or decked as fully as possible and the remaining open space between the platform and the uprights shall not exceed 9 1/2 inches (24.1 cm).

Exception to paragraph (b)(1): The requirement in paragraph (b)(1) to provide full planking or decking does not apply to platforms used solely as walkways or solely by employees performing scaffold erection or dismantling. In these situations, only the planking that the employer establishes is necessary to provide safe working conditions is required.

**(b)(2)** Except as provided in paragraphs (b)(2)(i) and (b)(2)(ii) of this section, each scaffold platform and walkway shall be at least 18 inches (46 cm) wide.

**(b)(2)(i)** Each ladder jack scaffold, top plate bracket scaffold, roof bracket scaffold, and pump jack scaffold shall be at least 12 inches (30 cm) wide. There is no minimum width requirement for boatswains' chairs.

\* **Note** to paragraph (b)(2)(i): Pursuant to an administrative stay effective November 29, 1996 and published in the Federal Register on November 25, 1996, the requirement in paragraph (b)(2)(i) that roof bracket scaffolds be at least 12 inches wide is stayed until November 25, 1997 or until rulemaking regarding the minimum width of roof bracket scaffolds has been completed, whichever is later.

**(b)(2)(ii)** Where scaffolds must be used in areas that the employer can demonstrate are so narrow that platforms and walkways cannot be at least 18 inches (46 cm) wide, such platforms and walkways shall be as wide as feasible, and employees on those platforms and walkways shall be protected from fall hazards by the use of guardrails and/or personal fall arrest systems.

**(b)(3)** Except as provided in paragraphs (b)(3)(i) and (ii) of this section, the front edge of all platforms shall not be more than 14 inches (36 cm) from the face of the work, unless guardrail systems are erected along the front edge and/or personal fall arrest systems are used in accordance with paragraph (g) of this section to protect employees from falling.

**(b)(3)(i)** The maximum distance from the face for outrigger scaffolds shall be 3 inches (8 cm);

**(b)(3)(ii)** The maximum distance from the face for plastering and lathing operations shall be 18 inches (46 cm).

**(b)(4)** Each end of a platform, unless cleated or otherwise restrained by hooks or equivalent means, shall extend over the centerline of its support at least 6 inches (15 cm).

**(b)(5)(i)** Each end of a platform 10 feet or less in length shall not extend over its support more than 12 inches (30 cm) unless the platform is designed and installed so that the cantilevered portion of the platform is able to

support employees and/or materials without tipping, or has guardrails which block employee access to the cantilevered end.

**(b)(5)(ii)** Each platform greater than 10 feet in length shall not extend over its support more than 18 inches (46 cm), unless it is designed and installed so that the cantilevered portion of the platform is able to support employees without tipping, or has guardrails which block employee access to the cantilevered end.

**(b)(6)** On scaffolds where scaffold planks are abutted to create a long platform, each abutted end shall rest on a separate support surface. This provision does not preclude the use of common support members, such as "T" sections, to support abutting planks, or hook on platforms designed to rest on common supports.

**(b)(7)** On scaffolds where platforms are overlapped to create a long platform, the overlap shall occur only over supports, and shall not be less than 12 inches (30 cm) unless the platforms are nailed together or otherwise restrained to prevent movement.

**(b)(8)** At all points of a scaffold where the platform changes direction, such as turning a corner, any platform that rests on a bearer at an angle other than a right angle shall be laid first, and platforms which rest at right angles over the same bearer shall be laid second, on top of the first platform.

**(b)(9)** Wood platforms shall not be covered with opaque finishes, except that platform edges may be covered or marked for identification. Platforms may be coated periodically with wood preservatives, fire-retardant finishes, and slip-resistant finishes; however, the coating may not obscure the top or bottom wood surfaces.

**(b)(10)** Scaffold components manufactured by different manufacturers shall not be intermixed unless the components fit together without force and the scaffold's structural integrity is maintained by the user. Scaffold components manufactured by

different manufacturers shall not be modified in order to intermix them unless a competent person determines the resulting scaffold is structurally sound.

(b)(11) Scaffold components made of dissimilar metals shall not be used together unless a competent person has determined that galvanic action will not reduce the strength of any component to a level below that required by paragraph (a)(1) of this section.

(c) *Criteria for supported scaffolds.*

(c)(1) Supported scaffolds with a height to base width (including outrigger supports, if used) ratio of more than four to one (4:1) shall be restrained from tipping by guying, tying, bracing, or equivalent means, as follows:

(c)(1)(i) Guys, ties, and braces shall be installed at locations where horizontal members support both inner and outer legs.

(c)(1)(ii) Guys, ties, and braces shall be installed according to the scaffold manufacturer's recommendations or at the closest horizontal member to the 4:1 height and be repeated vertically at locations of horizontal members every 20 feet (6.1 m) or less thereafter for scaffolds 3 feet (0.91 m) wide or less, and every 26 feet (7.9 m) or less thereafter for scaffolds greater than 3 feet (0.91 m) wide. The top guy, tie or brace of completed scaffolds shall be placed no further than the 4:1 height from the top. Such guys, ties and braces shall be installed at each end of the scaffold and at horizontal intervals not to exceed 30 feet (9.1 m) (measured from one end [not both] towards the other).

(c)(1)(iii) Ties, guys, braces, or outriggers shall be used to prevent the tipping of supported scaffolds in all circumstances where an eccentric load, such as a cantilevered work platform, is applied or is transmitted to the scaffold.

(c)(2) \* Supported scaffold poles, legs,

posts, frames, and uprights shall bear on base plates and mud sills or other adequate firm foundation.

(c)(2)(i) Footings shall be level, sound, rigid, and capable of supporting the loaded scaffold without settling or displacement.

(c)(2)(ii) Unstable objects shall not be used to support scaffolds or platform units.

(c)(2)(iii) Unstable objects shall not be used as working platforms.

(c)(2)(iv) Front-end loaders and similar pieces of equipment shall not be used to support scaffold platforms unless they have been specifically designed by the manufacturer for such use.

(c)(2)(v) Fork-lifts shall not be used to support scaffold platforms unless the entire platform is attached to the fork and the fork-lift is not moved horizontally while the platform is occupied.

(c)(3) Supported scaffold poles, legs, posts, frames, and uprights shall be plumb and braced to prevent swaying and displacement.

(e) *Access.* This paragraph applies to scaffold access for all employees. Access requirements for employees erecting or dismantling supported scaffolds are specifically addressed in paragraph (e)(9) of this section.

(e)(1) When scaffold platforms are more than 2 feet (0.6 m) above or below a point of access, portable ladders, hook-on ladders, attachable ladders, stair towers (scaffold stairways/towers), stairway-type ladders (such as ladder stands), ramps, walkways, integral prefabricated scaffold access, or direct access from another scaffold, structure, personnel hoist, or similar surface shall be used. Crossbraces shall not be used as a means of access.

(e)(2) Portable, hook-on, and attachable ladders (Additional requirements for the

proper construction and use of portable ladders are contained in subpart X of this part -- Stairways and Ladders):

**(e)(2)(i)** Portable, hook-on, and attachable ladders shall be positioned so as not to tip the scaffold;

**(e)(2)(ii)** Hook-on and attachable ladders shall be positioned so that their bottom rung is not more than 24 inches (61 cm) above the scaffold supporting level;

**(e)(2)(iii)** When hook-on and attachable ladders are used on a supported scaffold more than 35 feet (10.7 m) high, they shall have rest platforms at 35-foot (10.7 m) maximum vertical intervals.

**(e)(2)(iv)** Hook-on and attachable ladders shall be specifically designed for use with the type of scaffold used;

**(e)(2)(v)** Hook-on and attachable ladders shall have a minimum rung length of 11 1/2 inches (29 cm); and

**(e)(2)(vi)** Hook-on and attachable ladders shall have uniformly spaced rungs with a maximum spacing between rungs of 16 3/4 inches.

**(e)(3)** Stairway-type ladders shall:

**(e)(3)(i)** Be positioned such that their bottom step is not more than 24 inches (61 cm) above the scaffold supporting level;

**(e)(3)(ii)** Be provided with rest platforms at 12 foot (3.7 m) maximum vertical intervals;

**(e)(3)(iii)** Have a minimum step width of 16 inches (41 cm), except that mobile scaffold stairway-type ladders shall have a minimum step width of 11 1/2 inches (30 cm); and

**(e)(3)(iv)** Have slip-resistant treads on all steps and landings.

**(e)(4)** Stairtowers (scaffold stairway/towers) shall be positioned such that their bottom step is not more than 24 inches (61 cm.) above the scaffold supporting level.

**(e)(4)(i)** A stairrail consisting of a toprail and a midrail shall be provided on each side of each scaffold stairway.

(e)(4)(ii) The top rail of each stairrail system shall also be capable of serving as a handrail, unless a separate handrail is provided.

(e)(4)(iii) Handrails, and top rails that serve as handrails, shall provide an adequate handhold for employees grasping them to avoid falling.

(e)(4)(iv) Stairrail systems and handrails shall be surfaced to prevent injury to employees from punctures or lacerations, and to prevent snagging of clothing.

(e)(4)(v) The ends of stairrail systems and handrails shall be constructed so that they do not constitute a projection hazard.

(e)(4)(vi) Handrails, and top rails that are used as handrails, shall be at least 3 inches (7.6 cm) from other objects.

(e)(4)(vii) Stairrails shall be not less than 28 inches (71 cm) nor more than 37 inches (94 cm) from the upper surface of the stairrail to the surface of the tread, in line with the face of the riser at the forward edge of the tread.

(e)(4)(viii) A landing platform at least 18 inches (45.7 cm) wide by at least 18 inches (45.7 cm) long shall be provided at each level.

(e)(4)(ix) Each scaffold stairway shall be at least 18 inches (45.7 cm) wide between stairrails.

(e)(4)(x) Treads and landings shall have slip-resistant surfaces.

(e)(4)(xi) Stairways shall be installed between 40 degrees and 60 degrees from the horizontal.

(e)(4)(xii) Guardrails meeting the requirements of paragraph (g)(4) of this section shall be provided on the open sides and ends of each landing.

(e)(4)(xiii) Riser height shall be uniform, within 1/4 inch, (0.6 cm) for each flight of stairs. Greater variations in riser height are allowed for the top and bottom steps of the

entire system, not for each flight of stairs.

(e)(4)(xiv) Tread depth shall be uniform, within 1/4 inch, for each flight of stairs.

(e)(5) Ramps and walkways.

(e)(5)(i) Ramps and walkways 6 feet (1.8 m) or more above lower levels shall have guardrail systems which comply with subpart M of this part -- Fall Protection;

(e)(5)(ii) No ramp or walkway shall be inclined more than a slope of one (1) vertical to three (3) horizontal (20 degrees above the horizontal).

(e)(5)(iii) If the slope of a ramp or a walkway is steeper than one (1) vertical in eight (8) horizontal, the ramp or walkway shall have cleats not more than fourteen (14) inches (35 cm) apart which are securely fastened to the planks to provide footing.

(e)(6) Integral prefabricated scaffold access frames shall:

(e)(6)(i) Be specifically designed and constructed for use as ladder rungs;

(e)(6)(ii) Have a rung length of at least 8 inches (20 cm);

(e)(6)(iii) Not be used as work platforms when rungs are less than 11 1/2 inches in length, unless each affected employee uses fall protection, or a positioning device, which complies with 1926.502;

(e)(6)(iv) Be uniformly spaced within each frame section;

(e)(6)(v) Be provided with rest platforms at 35-foot (10.7 m) maximum vertical intervals on all supported scaffolds more than 35 feet (10.7 m) high; and

(e)(6)(vi) Have a maximum spacing between rungs of 16 3/4 inches (43 cm). Non-uniform rung spacing caused by joining end frames together is allowed, provided the resulting spacing does not exceed 16 3/4 inches (43 cm).

(e)(7) Steps and rungs of ladder and stairway type access shall line up vertically

with each other between rest platforms.

(e)(8) Direct access to or from another surface shall be used only when the scaffold is not more than 14 inches (36 cm) horizontally and not more than 24 inches (61 cm) vertically from the other surface.

(e)(9) Effective September 2, 1997, access for employees erecting or dismantling supported scaffolds shall be in accordance with the following:

(e)(9)(i) The employer shall provide safe means of access for each employee erecting or dismantling a scaffold where the provision of safe access is feasible and does not create a greater hazard. The employer shall have a competent person determine whether it is feasible or would pose a greater hazard to provide, and have employees use a safe means of access. This determination shall be based on site conditions and the type of scaffold being erected or dismantled.

(e)(9)(ii) Hook-on or attachable ladders shall be installed as soon as scaffold erection has progressed to a point that permits safe installation and use.

(e)(9)(iii) When erecting or dismantling tubular welded frame scaffolds, (end) frames, with horizontal members that are parallel, level and are not more than 22 inches apart vertically may be used as climbing devices for access, provided they are erected in a manner that creates a usable ladder and provides good hand hold and foot space.

(e)(9)(iv) Cross braces on tubular welded frame scaffolds shall not be used as a means of access or egress.

(f) *Use.*

(f)(1) Scaffolds and scaffold components shall not be loaded in excess of their maximum intended loads or rated capacities, whichever is less.

(f)(2) The use of shore or lean-to scaffolds is prohibited.

(f)(3) Scaffolds and scaffold components shall be inspected for visible defects by a competent person before each work shift,

and after any occurrence which could affect a scaffold's structural integrity.

**(f)(4)** Any part of a scaffold damaged or weakened such that its strength is less than that required by paragraph (a) of this section shall be immediately repaired or replaced, braced to meet those provisions, or removed from service until repaired.

**(f)(5)** Scaffolds shall not be moved horizontally while employees are on them, unless they have been designed by a registered professional engineer specifically for such movement or, for mobile scaffolds, where the provisions of 1926.452(w) are followed.

**(f)(6)** The clearance between scaffolds and power lines shall be as follows: Scaffolds shall not be erected, used, dismantled, altered, or moved such that they or any conductive material handled on them might come closer to exposed and energized power lines than as follows:

**(f)(7)** Scaffolds shall be erected, moved, dismantled, or altered only under the supervision and direction of a competent person qualified in scaffold erection, moving, dismantling or alteration. Such activities shall be performed only by experienced and trained employees selected for such work by the competent person.

**(f)(8)** Employees shall be prohibited from working on scaffolds covered with snow, ice, or other slippery material except as necessary for removal of such materials.

**(f)(12)** Work on or from scaffolds is prohibited during storms or high winds unless a competent person has determined that it is safe for employees to be on the scaffold and those employees are protected by a personal fall arrest system or wind screens. Wind screens shall not be used unless the scaffold is secured against the anticipated wind forces imposed.

*Insulated Lines			*Uninsulated lines		
Voltage	Minimum distance	Alternatives	Voltage	Minimum distance	Alternatives
Less than 300 volts	3 feet (0.9 m)				
*300 volts to 50 kv	10 feet (3.1 m)		Less than 50 kv	10 feet (3.1 m)	
More than 50 kv	10 feet (3.1 m) plus 0.4 inches (1.0 cm) for each 1 kv over 50 kv.	2 times the length of the line insulator, but never less than 10 ft (3.1 m).	More than 50 kv	10 feet (3.1 m) plus 0.4 inches (1.0 cm) for each 1 kv over 50 kv.	2 times the length of the line insulator, but never less than 10 ft (3.1 m).

\*Exception to paragraph (f)(6): Scaffolds and materials may be closer to power lines than specified above where such clearance is necessary for performance of work, and only after the utility company, or electrical system operator, has been notified of the need to work closer and the utility company, or electrical system operator, has deenergized the lines, relocated the lines, or installed protective coverings to prevent accidental contact with the lines.

(f)(13) Debris shall not be allowed to accumulate on platforms.

(f)(14) Makeshift devices, such as but not limited to boxes and barrels, shall not be used on top of scaffold platforms to increase the working level height of employees.

(f)(15) Ladders shall not be used on scaffolds to increase the working level height of employees, except on large area scaffolds where employers have satisfied the following criteria:

(f)(15)(i) When the ladder is placed against a structure which is not a part of the scaffold, the scaffold shall be secured against the sideways thrust exerted by the ladder;

(f)(15)(ii) The platform units shall be secured to the scaffold to prevent their movement;

(f)(15)(iii) The ladder legs shall be on the same platform or other means shall be provided to stabilize the ladder against unequal platform deflection, and

(f)(15)(iv) The ladder legs shall be secured to prevent them from slipping or being pushed off the platform.

(f)(16) Platforms shall not deflect more than 1/60 of the span when loaded.

(f)(17) To reduce the possibility of welding current arcing through the suspension wire rope when performing welding from suspended scaffolds, the following precautions shall be taken, as applicable:

(f)(17)(iv) In addition to a work lead attachment required by the welding process, a grounding conductor shall be connected from the scaffold to the structure. The size of this conductor shall be at least the size of the welding process work lead, and this conductor shall not be in series with the welding process or the work piece;

(f)(17)(v) If the scaffold grounding lead is disconnected at any time, the welding machine shall be shut off; and

(f)(17)(vi) An active welding rod or uninsulated welding lead shall not be allowed to contact the scaffold or its suspension system.

(g) Fall protection.

(g)(1) Each employee on a scaffold more than 10 feet (3.1 m) above a lower level shall be protected from falling to that lower

level. Paragraphs (g)(1)(i) through (vii) of this section establish the types of fall protection to be provided to the employees on each type of scaffold. Paragraph (g)(2) of this section addresses fall protection for scaffold erectors and dismantlers.

Note to paragraph (g)(1): The fall protection requirements for employees installing suspension scaffold support systems on floors, roofs, and other elevated surfaces are set forth in subpart M of this part.

**(g)(1)(i)** Each employee on a boatswains' chair, catenary scaffold, float scaffold, needle beam scaffold, or ladder jack scaffold shall be protected by a personal fall arrest system;

**(g)(1)(iii)** Each employee on a crawling board (chicken ladder) shall be protected by a personal fall arrest system, a guardrail system (with minimum 200 pound toprail capacity), or by a three-fourth inch (1.9 cm) diameter grabline or equivalent handhold securely fastened beside each crawling board;

**(g)(1)(iv)** Each employee on a self-contained adjustable scaffold shall be protected by a guardrail system (with minimum 200 pound toprail capacity) when the platform is supported by the frame structure, and by both a personal fall arrest system and a guardrail system (with minimum 200 pound toprail capacity) when the platform is supported by ropes;

**(g)(1)(v)** Each employee on a walkway located within a scaffold shall be protected by a guardrail system (with minimum 200 pound toprail capacity) installed within 9 1/2 inches (24.1 cm) of and along at least one side of the walkway.

**(g)(1)(vi)** Each employee performing overhand bricklaying operations from a supported scaffold shall be protected from falling from all open sides and ends of the scaffold (except at the side next to the wall being laid) by the use of a personal fall arrest system or guardrail system (with

minimum 200 pound toprail capacity).

**(g)(1)(vii)** For all scaffolds not otherwise specified in paragraphs (g)(1)(i) through (g)(1)(vi) of this section, each employee shall be protected by the use of personal fall arrest systems or guardrail systems meeting the requirements of paragraph (g)(4) of this section.

**(g)(2)** Effective September 2, 1997, the employer shall have a competent person determine the feasibility and safety of providing fall protection for employees erecting or dismantling supported scaffolds. Employers are required to provide fall protection for employees erecting or dismantling supported scaffolds where the installation and use of such protection is feasible and does not create a greater hazard.

**(g)(3)** In addition to meeting the requirements of 1926.502(d), personal fall arrest systems used on scaffolds shall be attached by lanyard to a vertical lifeline, horizontal lifeline, or scaffold structural member. Vertical lifelines shall not be used when overhead components, such as overhead protection or additional platform levels, are part of a single-point or two-point adjustable suspension scaffold.

**(g)(3)(i)** When vertical lifelines are used, they shall be fastened to a fixed safe point of anchorage, shall be independent of the scaffold, and shall be protected from sharp edges and abrasion. Safe points of anchorage include structural members of buildings, but do not include standpipes, vents, other piping systems, electrical conduit, outrigger beams, or counterweights.

**(g)(3)(ii)** When horizontal lifelines are used, they shall be secured to two or more structural members of the scaffold, or they may be looped around both suspension and independent suspension lines (on scaffolds so equipped) above the hoist and brake attached to the end of the scaffold. Horizon-

tal lifelines shall not be attached only to the suspension ropes.

**(g)(3)(iii)** When lanyards are connected to horizontal lifelines or structural members on a single-point or two-point adjustable suspension scaffold, the scaffold shall be equipped with additional independent support lines and automatic locking devices capable of stopping the fall of the scaffold in the event one or both of the suspension ropes fail. The independent support lines shall be equal in number and strength to the suspension ropes.

**(g)(3)(iv)** Vertical lifelines, independent support lines, and suspension ropes shall not be attached to each other, nor shall they be attached to or use the same point of anchorage, nor shall they be attached to the same point on the scaffold or personal fall arrest system.

**(g)(4)** Guardrail systems installed to meet the requirements of this section shall comply with the following provisions (guardrail systems built in accordance with Appendix A to this subpart will be deemed to meet the requirements of paragraphs (g)(4)(vii), (viii), and (ix) of this section):

**(g)(4)(i)** Guardrail systems shall be installed along all open sides and ends of platforms. Guardrail systems shall be installed before the scaffold is released for use by employees other than erection/dismantling crews.

**(g)(4)(ii)** The top edge height of top rails or equivalent member on supported scaffolds manufactured or placed in service after January 1, 2000 shall be installed between 38 inches (0.97 m) and 45 inches (1.2 m) above the platform surface. The top edge height on supported scaffolds manufactured and placed in service before January 1, 2000, and on all suspended scaffolds where both a guardrail and a personal fall arrest system are required shall be between 36 inches (0.9 m) and 45 inches (1.2 m). When conditions warrant, the

height of the top edge may exceed the 45-inch height, provided the guardrail system meets all other criteria of paragraph (g)(4).

**(g)(4)(iii)** When midrails, screens, mesh, intermediate vertical members, solid panels, or equivalent structural members are used, they shall be installed between the top edge of the guardrail system and the scaffold platform.

**(g)(4)(iv)** When midrails are used, they shall be installed at a height approximately midway between the top edge of the guardrail system and the platform surface.

**(g)(4)(v)** When screens and mesh are used, they shall extend from the top edge of the guardrail system to the scaffold platform, and along the entire opening between the supports.

**(g)(4)(vi)** When intermediate members (such as balusters or additional rails) are used, they shall not be more than 19 inches (48 cm) apart.

**(g)(4)(vii)** Each top rail or equivalent member of a guardrail system shall be capable of withstanding, without failure, a force applied in any downward or horizontal direction at any point along its top edge of at least 100 pounds (445 n) for guardrail systems installed on single-point adjustable suspension scaffolds or two-point adjustable suspension scaffolds, and at least 200 pounds (890 n) for guardrail systems installed on all other scaffolds.

**(g)(4)(viii)** When the loads specified in paragraph (g)(4)(vii) of this section are applied in a downward direction, the top edge shall not drop below the height above the platform surface that is prescribed in paragraph (g)(4)(ii) of this section.

**(g)(4)(ix)** Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members of a guardrail system shall be capable of withstanding, without failure, a force applied

in any down-ward or horizontal direction at any point along the midrail or other member of at least 75 pounds (333 n) for guardrail systems with a minimum 100 pound toprail capacity, and at least 150 pounds (666 n) for guardrail systems with a minimum 200 pound toprail capacity.

**(g)(4)(xi)** Guardrails shall be surfaced to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing.

**(g)(4)(xii)** The ends of all rails shall not overhang the terminal posts except when such overhang does not constitute a projection hazard to employees.

**(g)(4)(xiii)** Steel or plastic banding shall not be used as a toprail or midrail.

**(g)(4)(xiv)** Manila or plastic (or other synthetic) rope being used for toprails or midrails shall be inspected by a competent person as frequently as necessary to ensure that it continues to meet the strength requirements of paragraph (g) of this section.

**(g)(4)(xv)** Crossbracing is acceptable in place of a midrail when the crossing point of two braces is between 20 inches (0.5 m) and 30 inches (0.8 m) above the work platform or as a toprail when the crossing point of two braces is between 38 inches (0.97 m) and 48 inches (1.3 m) above the work platform. The end points at each upright shall be no more than 48 inches (1.3 m) apart.

**(h)** *Falling object protection.*

**(h)(1)** In addition to wearing hardhats each employee on a scaffold shall be provided with 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. When the falling 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.

**(h)(2)** Where there is a danger of tools, materials, or equipment falling from a scaffold and striking employees below, the following provisions apply:

**(h)(2)(i)** The area below the scaffold to which objects can fall shall be barricaded, and employees shall not be permitted to enter the hazard area; or

**(h)(2)(ii)** A toeboard shall be erected along the edge of platforms more than 10 feet (3.1 m) above lower levels for a distance sufficient to protect employees below, except on float (ship) scaffolds where an edging of 3/4 x 1 1/2 inch (2 x 4 cm) wood or equivalent may be used in lieu of toeboards;

**(h)(2)(iii)** Where tools, materials, or equipment are piled to a height higher than the top edge of the toeboard, paneling or screening extending from the toeboard or platform to the top of the guardrail shall be erected for a distance sufficient to protect employees below; or

**(h)(2)(iv)** A guardrail system shall be installed with openings small enough to prevent passage of potential falling objects; or

**(h)(2)(v)** A canopy structure, debris net, or catch platform strong enough to withstand the impact forces of the potential falling objects shall be erected over the employees below.

**(h)(3)** Canopies, when used for falling object protection, shall comply with the following criteria:

**(h)(3)(i)** Canopies shall be installed between the falling object hazard and the employees.

**(h)(3)(ii)** When canopies are used on

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suspension scaffolds for falling object protection, the scaffold shall be equipped with additional independent support lines equal in number to the number of points supported, and equivalent in strength to the strength of the suspension ropes.

receiving the new platforms.

**(h)(3)(iii)** Independent support lines and suspension ropes shall not be attached to the same points of anchorage.

**(h)(4)** Where used, toeboards shall be:

**(h)(4)(i)** Capable of withstanding, without failure, a force of at least 50 pounds (222 n) applied in any downward or horizontal direction at any point along the toeboard (toeboards built in accordance with Appendix A to this subpart will be deemed to meet this requirement); and

**(h)(4)(ii)** At least three and one-half inches (9 cm) high from the top edge of the toeboard to the level of the walking/working surface. Toeboards shall be securely fastened in place at the outermost edge of the platform and have not more than 1/4 inch (0.7 cm) clearance above the walking/working surface. Toeboards shall be solid or with openings not over one inch (2.5 cm) in the greatest dimension.

**§ 1926.452 - Additional requirements applicable to specific types of scaffolds.**

In addition to the applicable requirements of 1926.451, the following requirements apply to the specific types of scaffolds indicated. Scaffolds not specifically addressed by 1926.452, such as but not limited to systems scaffolds, must meet the requirements of 1926.451.

**(a)** *Pole scaffolds.*

**(a)(1)** When platforms are being moved to the next level, the existing platform shall be left undisturbed until the new bearers have been set in place and braced, prior to

(a)(2) Crossbracing shall be installed between the inner and outer sets of poles on double pole scaffolds.

(a)(3) Diagonal bracing in both directions shall be installed across the entire inside face of double-pole scaffolds used to support loads equivalent to a uniformly distributed load of 50 pounds (222 kg) or more per square foot (929 square cm).

(a)(4) Diagonal bracing in both directions shall be installed across the entire outside face of all double- and single-pole scaffolds.

(a)(5) Runners and bearers shall be installed on edge.

(a)(6) Bearers shall extend a minimum of 3 inches (7.6 cm) over the outside edges of runners.

(a)(7) Runners shall extend over a minimum of two poles, and shall be supported by bearing blocks securely attached to the poles.

(a)(8) Braces, bearers, and runners shall not be spliced between poles.

(a)(9) Where wooden 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 at least two adjacent sides, and shall extend at least 2 feet (0.6 m) on either side of the splice, overlap the abutted ends equally, and have at least the same cross-sectional areas as the pole. Splice plates of other materials of equivalent strength may be used.

(a)(10) Pole scaffolds over 60 feet in height shall be designed by a registered professional engineer, and shall be constructed and loaded in accordance with that design. Non-mandatory Appendix A to this subpart contains examples of criteria that will enable an employer to comply with design and loading requirements for pole scaffolds under 60 feet in height.

(b) *Tube and coupler scaffolds.*

(b)(2) Transverse bracing forming an "X" across the width of the scaffold shall be installed at the scaffold ends and at least at every third set of posts horizontally (measured from only one end) and every fourth runner vertically. Bracing shall extend diagonally from the inner or outer posts or runners upward to the next outer or inner posts or runners. Building ties shall be installed at the bearer levels between the transverse bracing and shall conform to the requirements of 1926.451(c)(1).

(b)(3) On straight run scaffolds, longitudinal bracing across the inner and outer rows of posts shall be installed diagonally in both directions, and shall extend from the base of the end posts upward to the top of the scaffold at approximately a 45 degree angle. On scaffolds whose length is greater than their height, such bracing shall be repeated beginning at least at every fifth post. On scaffolds whose length is less than their height, such bracing shall be installed from the base of the end posts upward to the opposite end posts, and then in alternating directions until reaching the top of the scaffold. Bracing shall be installed as close as possible to the intersection of the bearer and post or runner and post.

(b)(4) Where conditions preclude the attachment of bracing to posts, bracing shall be attached to the runners as close to the post as possible.

(b)(5) Bearers shall be installed transversely between posts, and when coupled to the posts, shall have the inboard coupler bear directly on the runner coupler. When the bearers are coupled to the runners, the couplers shall be as close to the posts as possible.

(b)(6) Bearers shall extend beyond the posts and runners, and shall provide full contact with the coupler.

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(b)(7) Runners shall be installed along the length of the scaffold, located on both the inside and outside posts at level heights (when tube and coupler guardrails and midrails are used on outside posts, they may be used in lieu of outside runners).

(b)(8) Runners shall be interlocked on straight runs to form continuous lengths, and shall be coupled to each post. The bottom runners and bearers shall be located as close to the base as possible.

(b)(9) Couplers shall be of a structural metal, such as drop-forged steel, malleable iron, or structural grade aluminum. The use of gray cast iron is prohibited.

(b)(10) Tube and coupler scaffolds over 125 feet in height shall be designed by a registered professional engineer, and shall be constructed and loaded in accordance with such design. Non-mandatory Appendix A to this subpart contains examples of criteria that will enable an employer to comply with design and loading requirements for tube and coupler scaffolds under 125 feet in height.

(c) *Fabricated frame scaffolds* (tubular welded frame scaffolds).

(c)(1) When moving platforms to the next level, the existing platform shall be left undisturbed until the new end frames have been set in place and braced prior to receiving the new platforms.

(c)(2) Frames and panels shall be braced by cross, horizontal, or diagonal braces, or combination thereof, which secure vertical members together laterally. The cross braces shall be of such length as will automatically square and align vertical members so that the erected scaffold is always plumb, level, and square. All brace connections shall be secured.

(c)(3) Frames and panels shall be joined together vertically by coupling or stacking pins or equivalent means.

(c)(4) Where uplift can occur which would displace scaffold end frames or panels, the frames or panels shall be locked together vertically by pins or equivalent means.

(c)(5) Brackets used to support cantilevered loads shall:

(c)(5)(i) Be seated with side-brackets parallel to the frames and end-brackets at 90 degrees to the frames;

(c)(5)(ii) Not be bent or twisted from these positions; and

(c)(5)(iii) Be used only to support personnel, unless the scaffold has been designed for other loads by a qualified engineer and built to withstand the tipping forces caused by those other loads being placed on the bracket-supported section of the scaffold.

(c)(6) Scaffolds over 125 feet (38.0 m) in height above their base plates shall be designed by a registered professional engineer, and shall be constructed and loaded in accordance with such design.

(d) *Plasterers', decorators', and large area scaffolds.* Scaffolds shall be constructed in accordance with paragraphs (a), (b), or (c) of this section, as appropriate.

(e) *Bricklayers' square scaffolds (squares).*

(e)(1) Scaffolds made of wood shall be reinforced with gussets on both sides of each corner.

(e)(2) Diagonal braces shall be installed on all sides of each square.

(e)(3) Diagonal braces shall be installed between squares on the rear and front sides of the scaffold, and shall extend from the bottom of each square to the top of the next square.

(e)(4) Scaffolds shall not exceed three tiers in height, and shall be so constructed

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

**(f)** *Horse scaffolds.*

**(f)(1)** Scaffolds shall not be constructed or arranged more than two tiers or 10 feet (3.0 m) in height, whichever is less.

**(f)(2)** When horses are arranged in tiers, each horse shall be placed directly over the horse in the tier below.

**(f)(3)** When horses are arranged in tiers, the legs of each horse shall be nailed down or otherwise secured to prevent displacement.

**(f)(4)** When horses are arranged in tiers, each tier shall be crossbraced.

**(g)** *Form scaffolds and carpenters' bracket scaffolds.*

**(g)(1)** Each bracket, except those for wooden bracket-form scaffolds, shall be attached to the supporting formwork or structure by means of one or more of the following: nails; a metal stud attachment device; welding; hooking over a secured structural supporting member, with the form wales either bolted to the form or secured by snap ties or tie bolts extending through the form and securely anchored; or, for carpenters' bracket scaffolds only, by a bolt extending through to the opposite side of the structure's wall.

**(g)(2)** Wooden bracket-form scaffolds shall be an integral part of the form panel.

**(g)(3)** Folding type metal brackets, when extended for use, shall be either bolted or secured with a locking-type pin.

**(h)** *Roof bracket scaffolds.*

**(h)(1)** Scaffold brackets shall be constructed to fit the pitch of the roof and shall provide a level support for the platform.

**(h)(2)** Brackets (including those provided with pointed metal projections) shall be anchored in place by nails unless it is impractical to use nails. When nails are not used, brackets shall be secured in place with first-grade manila rope of at least three-fourth inch (1.9 cm) diameter, or equivalent.

**(j)** *Pump jack scaffolds.*

**(j)(1)** Pump jack brackets, braces, and accessories shall be fabricated from metal plates and angles. Each pump jack bracket shall have two positive gripping mechanisms to prevent any failure or slippage.

**(j)(2)** Poles shall be secured to the structure by rigid triangular bracing or equivalent at the bottom, top, and other points as

necessary. When the pump jack has to pass bracing already installed, an additional brace shall be installed approximately 4 feet (1.2 m) above the brace to be passed, and shall be left in place until the pump jack has been moved and the original brace reinstalled.

**(j)(3)** When guardrails are used for fall protection, a workbench may be used as the toprail only if it meets all the requirements in paragraphs (g)(4)(ii), (vii), (viii), and (xiii) of 1926.451.

**(j)(4)** Work benches shall not be used as scaffold platforms.

**(j)(5)** When poles are made of wood, the pole lumber shall be straight-grained, free of shakes, large loose or dead knots, and other defects which might impair strength.

**(j)(6)** When wood poles are constructed of two continuous lengths, they shall be joined together with the seam parallel to the bracket.

**(j)(7)** When two by fours are spliced to make a pole, mending plates shall be installed at all splices to develop the full strength of the member.

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(k) *Ladder jack scaffolds.*

(k)(1) Platforms shall not exceed a height of 20 feet (6.1 m).

(k)(2) All ladders used to support ladder jack scaffolds shall meet the requirements of subpart X of this part -- Stairways and Ladders, except that job-made ladders shall not be used to support ladder jack scaffolds.

(k)(3) The ladder jack shall be so designed and constructed that it will bear on the side rails and ladder rungs or on the ladder rungs alone. If bearing on rungs only, the bearing area shall include a length of at least 10 inches (25.4 cm) on each rung.

(k)(4) Ladders used to support ladder jacks shall be placed, fastened, or equipped with devices to prevent slipping.

(k)(5) Scaffold platforms shall not be bridged one to another.

(l) *Window jack scaffolds.*

(l)(1) Scaffolds shall be securely attached to the window opening.

(l)(2) Scaffolds shall be used only for the purpose of working at the window opening through which the jack is placed.

(l)(3) Window jacks shall not be used to support planks placed between one window jack and another, or for other elements of scaffolding.

(m) *Crawling boards (chicken ladders).*

(m)(1) Crawling boards shall extend from the roof peak to the eaves when used in connection with roof construction, repair, or maintenance.

(m)(2) Crawling boards shall be secured to the roof by ridge hooks or by means that meet equivalent criteria (e.g., strength and durability).

(n) *Step, platform, and trestle ladder scaffolds.*

(n)(1) Scaffold platforms shall not be placed any higher than the second highest

rung or step of the ladder supporting the platform.

(n)(2) All ladders used in conjunction with step, platform and trestle ladder scaffolds shall meet the pertinent requirements of subpart X of this part -- Stairways and Ladders, except that job-made ladders shall not be used to support such scaffolds.

(n)(3) Ladders used to support step, platform, and trestle ladder scaffolds shall be placed, fastened, or equipped with devices to prevent slipping.

(n)(4) Scaffolds shall not be bridged one to another.

(w) *Mobile scaffolds.*

(w)(1) Scaffolds shall be braced by cross, horizontal, or diagonal braces, or combination thereof, to prevent racking or collapse of the scaffold and to secure vertical members together laterally so as to automatically square and align the vertical members. Scaffolds shall be plumb, level, and squared. All brace connections shall be secured.

(w)(1)(i) Scaffolds constructed of tube and coupler components shall also comply with the requirements of paragraph (b) of this section;

(w)(1)(ii) Scaffolds constructed of fabricated frame components shall also comply with the requirements of paragraph (c) of this section.

(w)(2) Scaffold casters and wheels shall be locked with positive wheel and/or wheel and swivel locks, or equivalent means, to prevent movement of the scaffold while the scaffold is used in a stationary manner.

(w)(3) Manual force used to move the scaffold shall be applied as close to the base as practicable, but not more than 5 feet (1.5 m) above the supporting surface.

(w)(4) Power systems used to propel mobile scaffolds shall be designed for such

use. Forklifts, trucks, similar motor vehicles or add-on motors shall not be used to propel scaffolds unless the scaffold is designed for such propulsion systems.

(w)(5) Scaffolds shall be stabilized to prevent tipping during movement.

(w)(6) Employees shall not be allowed to ride on scaffolds unless the following conditions exist:

(w)(6)(i) The surface on which the scaffold is being moved is within 3 degrees of level, and free of pits, holes, and obstructions;

(w)(6)(ii) The height to base width ratio of the scaffold during movement is two to one or less, unless the scaffold is designed and constructed to meet or exceed nationally recognized stability test requirements such as those listed in paragraph (x) of Appendix A to this subpart (ANSI/SIA A92.5 and A92.6);

(w)(6)(iii) Outrigger frames, when used, are installed on both sides of the scaffold;

(w)(6)(iv) When power systems are used, the propelling force is applied directly to the wheels, and does not produce a speed in excess of 1 foot per second (.3 mps); and

(w)(6)(v) No employee is on any part of the scaffold which extends outward beyond the wheels, casters, or other supports.

(w)(7) Platforms shall not extend outward beyond the base supports of the scaffold unless outrigger frames or equivalent devices are used to ensure stability.

(w)(8) Where leveling of the scaffold is necessary, screw jacks or equivalent means shall be used.

(w)(9) Caster stems and wheel stems shall be pinned or otherwise secured in scaffold legs or adjustment screws.

(w)(10) Before a scaffold is moved, each employee on the scaffold shall be made aware of the move.

(y) *Stilts*. Stilts, when used, shall be used in accordance with the following requirements:

(y)(1) An employee may wear stilts on a scaffold only if it is a large area scaffold.

(y)(2) When an employee is using stilts on a large area scaffold where a guardrail system is used to provide fall protection, the guardrail system shall be increased in height by an amount equal to the height of the stilts being used by the employee.

(y)(3) Surfaces on which stilts are used shall be flat and free of pits, holes and obstructions, such as debris, as well as other tripping and falling hazards.

(y)(4) Stilts shall be properly maintained. Any alteration of the original equipment shall be approved by the manufacturer.

#### **§ 1926.454 - Training requirements.**

This section supplements and clarifies the requirements of 1926.21(b)(2) as these relate to the hazards of work on scaffolds.

(a) The employer shall have each employee who performs work while on a scaffold trained by a person qualified in the subject matter to recognize the hazards associated with the type of scaffold being used and to understand the procedures to control or minimize those hazards. The training shall include the following areas, as applicable:

(a)(1) The nature of any electrical hazards, fall hazards and falling object hazards in the work area;

(a)(2) The correct procedures for dealing with electrical hazards and for erecting, maintaining, and disassembling the fall protection systems and falling object protection systems being used;

(a)(3) The proper use of the scaffold, and the proper handling of materials on the scaffold;

(a)(4) The maximum intended load and the load-carrying capacities of the scaffolds used; and

(a)(5) Any other pertinent requirements of this subpart.

(b) The employer shall have each employee who is involved in erecting, disassembling, moving, operating, repairing, maintaining, or inspecting a scaffold trained by a competent person to recognize any hazards associated with the work in question. The training shall include the following topics, as applicable:

(b)(1) The nature of scaffold hazards;

(b)(2) The correct procedures for erecting, disassembling, moving, operating, repairing, inspecting, and maintaining the type of scaffold in question;

(b)(3) The design criteria, maximum intended load-carrying capacity and intended use of the scaffold;

(b)(4) Any other pertinent requirements of this subpart.

(c) When the employer has reason to believe that an employee lacks the skill or understanding needed for safe work involving the erection, use or dismantling of scaffolds, the employer shall retrain each such employee so that the requisite proficiency is regained. Retraining is required in at least the following situations:

(c)(1) Where changes at the worksite present a hazard about which an employee has not been previously trained; or

(c)(2) Where changes in the types of scaffolds, fall protection, falling object protection, or other equipment present a hazard about which an employee has not been previously trained; or

(c)(3) Where inadequacies in an affected employee's work involving scaffolds indicate that the employee has not retained the requisite proficiency.

**Subpart L Appendix A - Scaffold Specifications**

This Appendix provides non-mandatory guidelines to assist employers in complying with the requirements of subpart L of this part. An employer may use these guidelines and tables as a starting point for designing scaffold systems. However, the guidelines do not provide all the information necessary to build a complete system, and the employer is still responsible for designing and assembling these components in such a way that the completed system will meet the requirements of 1926.451(a). Scaffold components which are not selected and loaded in accordance with this Appendix, and components for which no specific guidelines or tables are given in this Appendix (e.g., joints, ties, components for wood pole scaffolds more than 60 feet in height, components for heavy-duty horse scaffolds, components made with other materials, and components with other dimensions, etc.) must be designed and constructed in accordance with the capacity requirements of 1926.451(a), and loaded in accordance with 1926.451(d)(1).

**1. General Guidelines and Tables**

(a) The following tables, and the tables in Part 2 -- Specific guidelines and tables, assume that all load-carrying timber members (except planks) of the scaffold are a minimum of 1,500 lb-f/in(2) (stress grade) construction grade lumber. All dimensions are nominal sizes as provided in the American Softwood Lumber Standards, dated January 1970, except that, where rough sizes are noted, only rough or undressed lumber of the size specified will satisfy minimum requirements.

(b) Solid sawn wood used as scaffold planks shall be selected for such use following the grading rules established by a recog-

nized lumber grading association or by an independent lumber grading inspection agency. Such planks shall be identified by the grade stamp of such association or agency. The association or agency and the grading rules under which the wood is graded shall be certified by the Board of Review, American Lumber Standard Committee, as set forth in the American Softwood Lumber Standard of the U.S. Department of Commerce.

(b)(i) Allowable spans shall be determined in compliance with the National Design Specification for Wood Construction published by the National Forest Products Association; paragraph 5 of ANSI A10.8-1988 Scaffolding-Safety Requirements published by the American National Standards Institute; or for 2 x 10 inch (nominal) or 2 x 9 inch (rough) solid sawn wood planks, as shown in the following table:

Maximum intended nominal load (lb/ft(2))	Maximum permissible span using nominal thickness lumber (ft)	Maximum permissible span using nominal thickness lumber (ft)
25	10	8
50	8	6
75	6	

(b)(ii) The maximum permissible span for 1 1/4 x 9-inch or wider wood plank of full thickness with a maximum intended load of 50 lb/ft.(2) shall be 4 feet.

(c) Fabricated planks and platforms may be used in lieu of solid sawn wood planks. Maximum spans for such units shall be as recommended by the manufacturer based on the maximum intended load being calculated as follows:

Rated load capacity	Intended load
Light-duty	* 25 lbs. per square foot applied uniformly over the entire span area.
Medium-duty	* 50 lbs. per square foot applied uniformly over the entire span area.
Heavy-duty	* 75 lbs. per square foot applied uniformly over the entire span area.
One-person	* 250 lbs. placed at the center of the span (total 250 lbs.).
Two-person	* 250 lbs. placed 18 inches to the left and right of the center of the span (total 500 lbs.).
Three-person	* 250 lbs. placed at the center of the span and 250 lbs. placed 18 inches to the left and right of the center of the span (total 750 lbs.).

Note: Platform units used to make scaffold platforms intended for light-duty use shall be capable of supporting at least 25 pounds per square foot applied uniformly over the entire unit-span area, or a 250-pound point load placed on the unit at the center of the span, whichever load produces the greater shear force.

**(d)** Guardrails shall be as follows:

**(d)(i)** Toprails shall be equivalent in strength to 2 inch by 4 inch lumber; or 1 1/4 inch x 1/8 inch structural angle iron; or 1 inch x .070 inch wall steel tubing; or 1.990 inch x .058 inch wall aluminum tubing.

**(d)(ii)** Midrails shall be equivalent in strength to 1 inch by 6 inch lumber; or 1 1/4 inch x 1 1/4 inch x 1/8 inch structural angle iron; or 1 inch x .070 inch wall steel tubing; or 1.990 inch x .058 inch wall aluminum tubing.

**(d)(iii)** Toeboards shall be equivalent in strength to 1 inch by 4 inch lumber; or 1 1/4 inch x 1 1/4 inch structural angle iron; or 1 inch x .070 inch wall steel tubing; or 1.990 inch x .058 inch wall aluminum tubing.

**(d)(iv)** Posts shall be equivalent in strength to 2 inch by 4 inch lumber; or 1 1/4 inch x 1 1/4 inch x 1/8 structural angle iron; or 1 inch x .070 inch wall steel tubing; or

1.990 inch x .058 inch wall aluminum tubing.

**(d)(v)** Distance between posts shall not exceed 8 feet.

**(e)** Overhead protection shall consist of 2 inch nominal planking laid tight, or 3/4-inch plywood.

**(f)** Screen installed between toeboards and midrails or top rails shall consist of No. 18 gauge U.S. Standard wire one inch mesh.

**2. Specific guidelines and tables.**

**(a)** Pole Scaffolds.

**(b)** Tube and coupler scaffolds.

**(c)** Fabricated frame scaffolds. Because of their prefabricated nature, no additional guidelines or tables for these scaffolds are being adopted in this Appendix.

**(d)** Plasterers', decorators', and large area scaffolds. The guidelines for pole scaffolds or tube and coupler scaffolds (Appendix A (a) and (b)) may be applied.

**Appendix A**  
**Scaffold Specifications**

**Subpart L**  
**Scaffolds**

(e) *Bricklayers' square scaffolds.*

Maximum intended load: 50 lb/ft.<sup>2</sup>\*

Maximum width: 5 ft.

Maximum height: 5 ft.

Gussets: 1 x 6 in.

Braces: 1 x 8 in.

Legs: 2 x 6 in.

Bearers (horizontal members): 2 x 6 in.

\* The squares shall be set not more than 8 feet apart for light duty scaffolds and not more than 5 feet apart for medium duty scaffolds.

(f) *Horse scaffolds.*

Maximum intended load (light duty): 25 lb/ft.<sup>2</sup>\*\*

Maximum intended load (medium duty): 50 lb/ft.<sup>2</sup>\*\*

\*\* Horses shall be spaced not more than 8 feet apart for light duty loads, and not more than 5 feet apart for medium duty loads.

*Horizontal members or bearers:*

Light duty: 2 x 4 in.

Medium duty: 3 x 4 in.

Legs: 2 x 4 in.

Longitudinal brace between legs: 1x6 in.

Gusset brace at top of legs: 1 x 8 in.

Half diagonal braces: 2 x 4 in.

(g) *Form scaffolds and carpenters' bracket scaffolds.*

(g)(1) Brackets shall consist of a triangular-shaped frame made of wood with a cross-section not less than 2 inches by 3 inches, or of 1 1/4 inch x 1 1/4 inch x 1/8 inch structural angle iron.

(g)(2) Bolts used to attach brackets to structures shall not be less than 5/8 inches in diameter.

(g)(3) Maximum bracket spacing shall be 8 feet on centers.

(g)(4) No more than two employees shall occupy any given 8 feet of a bracket or form scaffold at any one time. Tools and materi-

als shall not exceed 75 pounds in addition to the occupancy.

(g)(5) *Wooden figure-four scaffolds:*

Maximum intended load: 25 lb/ft.<sup>2</sup>

Uprights: 2 x 4 in. or 2 x 6 in.

Bearers (two): 1 x 6 in.

Braces: 1 x 6 in.

Maximum length of bearers (unsupported): 3 ft. 6 in.

(g)(5)(i) Outrigger bearers shall consist of two pieces of 1 x 6 inch lumber nailed on opposite sides of the vertical support.

(g)(5)(ii) Bearers for wood figure-four brackets shall project not more than 3 feet 6 inches from the outside of the form support, and shall be braced and secured to prevent tipping or turning. The knee or angle brace shall intersect the bearer at least 3 feet from the form at an angle of approximately 45 degrees, and the lower end shall be nailed to a vertical support.

(g)(6) *Metal bracket scaffolds:*

Maximum intended load: 25 lb/ft.<sup>2</sup>

Uprights: 2 x 4 inch

Bearers: As designed.

Braces: As designed.

(g)(7) *Wood bracket scaffolds:*

Maximum intended load: 25 lb/ft.<sup>2</sup>

Uprights: 2 x 4 in or 2 x 6 in

Bearers: 2 x 6 in

Maximum scaffold width: 3 ft 6 in

Braces: 1 x 6 in

(h) *Roof bracket scaffolds.* No specific guidelines or tables are given.

(i) *Outrigger scaffolds (single level).* No specific guidelines tables are given.

(j) *Pump jack scaffolds.* Wood poles shall not exceed 30 feet in height. Maximum intended load -- 500 lbs between poles; applied at the center of the span. Not more than two employees shall be on a pump jack scaffold at one time between any two supports. When 2 x 4's are spliced together to

make a 4 x 4 inch wood pole, they shall be

### Single Pole Wood Pole Scaffolds

	Light duty up to 20 ft. high	Light duty up to 60 ft. high	Medium duty up to 60 ft. high	Heavy duty up to 60 ft. high
Maximum intended load (lbs/ft(2))	25	25	50	75
Poles or uprights	2x4 in.	4x4 in.	4x4 in.	4x6 in.
Maximum pole spacing (longitudinal)	6 feet	10 feet	8 feet	6 feet
Maximum pole spacing (transverse)	5 feet	5 feet	5 feet	5 feet
Runners	1x4 in.	1 1/4x9 in.	2x10 in.	2x10 in.
Bearers and maximum spacing of bearers: 3 feet	2 x 4 in.	2 x 4 in.	2 x 10 in.	2 x 10 in. (rough)
6 feet	2x6 in. or 3 x 4 in.	2x10 in (rough) or 3x8 in	2x10 in.	2x10 in. (rough)
8 feet	2x6 in. or 3x4 in.	2x10 in. (rough) or 3x8 in.	2x10 in.	
10 feet	2x6 in. or 3 x 4 in.	2x10 (rough) or 3x3 in		
Planking	1 1/4x9 in.	2x10 in.	2x10 in.	2x10 in.
Maximum vertical spacing of horizontal members.	7 feet	9 feet	7 feet	6 ft. 6 in.
Bracing horizontal	1x4 in.	1x4 in.	1x6 in or 1 1/4x4 in	2x4 in.
Bracing diagonal	1x4 in.	1x4 in.	1x4 in.	2x4 in.
Tie-ins	1x4 in.	1x4 in.	1x4 in.	1x4 in.

Note: All members except planking are used on edge. All wood bearers shall be reinforced with 3/16 x 2 inch steel strip, or the equivalent, secured to the lower edges for the entire length of the bearer.

### Independent Wood Pole Scaffolds

	Light duty up to 20 ft. high	Light duty up to 60 ft. high	Medium duty up to 60 ft. high	Heavy duty up to 60 ft. high
Maximum load	25	25 lbs/ft <sup>2</sup>	50 lbs/ft <sup>2</sup>	75 lbs/ft <sup>2</sup>
Poles or uprights	2x4 in.	4x4 in.	4x4 in.	4x4 in.
Maximum pole spacing (longitudinal)	6 feet	10 feet	8 feet	6 feet
Maximum pole spacing (transverse)	6 feet	10 feet	8 feet	8 feet
Runners	1x4 in.	1 1/4x9 in.	2x10 in.	2x10 in.
Bearers and maximum spacing of bearers: 3 feet	2x4 in.	2x4 in.	2x10 in.	2x10 in. (rough)
6 feet	2x 6 in. or 3x4 in.	2x10 in (rough) or 3x8 in	2x10 in.	2x10 in. (rough)
8 feet	2x 6 in. or 3x4 in.	2x10 in. (rough) or 3x8 in.	2x10 in.	
10 feet	2x 6 in. or 3x4 in.	2x10 in. (rough) or 3x3 in.		
Planking	1 1/4x9 in.	2x10 in.	2x10 in.	2x10 in.
Maximum vertical spacing of horizontal members.	7 feet	7 feet	6 feet	6 ft.
Bracing horizontal	1x4 in.	1x4 in.	1x6 in. or 1 1/4x4 in	2x4 in.
Bracing diagonal	1x4 in.	1x4 in.	1x4 in.	2x4 in.
Tie-ins	1x4 in.	1x4 in.	1x4 in.	1x4 in.

Note: All members except planking are used on edge. All wood bearers shall be reinforced with 3/16 x 2 inch steel strip, or the equivalent, secured to the lower edges for the entire length of the bearer.

### Minimum Size of Members

	Light duty	Medium duty	Heavy duty
Maximum intended load	25 lbs/ft <sup>2</sup>	50 lbs/ft <sup>2</sup>	75 lbs/ft <sup>2</sup>
Posts, runners and braces	Nominal 2 in. (1.90 inches) OD steel tube or pipe	Nominal 2 in. (1.90 inches) OD steel tube or pipe	Nominal 2 in. (1.90 inches) OD steel tube or pipe
Bearers	Nominal 2 (1.90 inches)  OD steel tube or pipe and a maximum post spacing of 4 ft. x 10 ft.	Nominal 2 in. (1.90 inches)  OD steel tube or pipe and a maximum post spacing of 4 ft. x 7 ft. or Nominal 2 1/2 in. (2.375 in.) OD steel tube or pipe and a maximum post spacing of 6 ft. x 8 ft.*	Nominal 2 1/2 in. (2.375 in.)  OD steel tube or pipe and a maximum post spacing of 6 ft. x 6 ft.
Maximum runner spacing vertically	6 ft. 6 in.	6 ft. 6 in.	6 ft. 6 in.

\*Bearers shall be installed in the direction of the shorter dimension.

Note: Longitudinal diagonal bracing shall be installed at an angle of 45 deg. (+/- 5 deg.).

### Maximum Number of Planked Levels

Number of Working Levels	Maximum number of additional planked levels			Maximum height of scaffold (in feet)
	Light Duty	Medium Duty	Heavy Duty	
1	16	11	6	125
2	11	1	0	125
3	6	0	0	125
4	1	0	0	125

spliced with "10 penny" common nails no more than 12 inches center to center, staggered uniformly from the opposite outside edges.

(k) *Ladder jack scaffolds.* Maximum intended load -- 25 lb/ft<sup>2</sup>. However, not more than two employees shall occupy any platform at any one time. Maximum span between supports shall be 8 feet.

(l) *Window jack scaffolds.* Not more than one employee shall occupy a window jack scaffold at any one time.

(m) *Crawling boards (chicken ladders).* Crawling boards shall be not less than 10 inches wide and 1 inch thick, with cleats having a minimum 1 x 1 1/2 inch cross-sectional area. The cleats shall be equal in length to the width of the board and spaced at equal intervals not to exceed 24 inches.

(n) *Step, platform, and trestle ladder scaffolds.* No additional guidelines or tables are given.

(o) *Single-point adjustable suspension scaffolds.* Maximum intended load -- 250 lbs. Wood seats for boatswains' chairs shall be not less than 1 inch thick if made of non-laminated wood, or 5/8 inches thick if made of marine quality plywood.

(p) *Two-point adjustable suspension scaffolds.*

(p)(1) In addition to direct connections to buildings (except window cleaners' anchors) acceptable ways to prevent scaffold sway include angulated roping and static lines. Angulated roping is a system of platform suspension in which the upper wire rope sheaves or suspension points are closer to the plane of the building face than the corresponding attachment points on the platform, thus causing the platform to press against the face of the building. Static lines are separate ropes secured at their top and bottom ends closer to the plane of the building

face than the outermost edge of the platform. By drawing the static line taut, the platform is drawn against the face of the building.

(p)(2) On suspension scaffolds designed for a working load of 500 pounds, no more than two employees shall be permitted on the scaffold at one time. On suspension scaffolds with a working load of 750 pounds, no more than three employees shall be permitted on the scaffold at one time.

(p)(3) *Ladder-type platforms.* The side stringer shall be of clear straight-grained spruce. The rungs shall be of straight-grained oak, ash, or hickory, at least 1 1/8 inches in diameter, with 7/8 inch tenons mortised into the side stringers at least 7/8 inch. The stringers shall be tied together with tie rods not less than 1/4 inch in diameter, passing through the stringers and riveted up tight against washers on both ends. The flooring strips shall be spaced not more than 5/8 inch apart, except at the side rails where the space may be 1 inch. Ladder-type platforms shall be constructed in accordance with the following table:

(p)(4) *Plank-Type Platforms.* Plank-type platforms shall be composed of not less than nominal 2 x 8 inch unspliced planks, connected together on the underside with cleats at intervals not exceeding 4 feet, starting 6 inches from each end. A bar or other effective means shall be securely fastened to the platform at each end to prevent the platform from slipping off the hanger. The span between hangers for plank-type platforms shall not exceed 10 feet.

(p)(5) *Beam-Type Platforms.* Beam platforms shall have side stringers of lumber not less than 2 x 6 inches set on edge. The span between hangers shall not exceed 12 feet when beam platforms are used. The flooring shall be supported on 2 x 6 inch cross beams, laid flat and set into the upper edge of the stringers with a snug fit, at intervals of not

more than 4 feet, securely

**Schedule for Ladder - Type Platforms**

Length of Platform	12 ft.	14 & 16 ft.	18 & 20 ft.	22 & 24 ft	28 & 30 ft.
Side stringers, minimum cross section (finished sizes): At ends At middle	1 3/4x2 3/4 in. 1 3/4x3 3/4 in.	1 3/4x2 3/4 in. 1 3/4x3 3/4 in.	1 3/4x3 in. 1 3/4x4 in.	1 3/4x3 in. 1 3/4x4 1/4 in	1 3/4x3 1/2 in. 1 3/4x5 in.
Reinforcing strip (minimum)	A 1/8 x 7/8 inch steel reinforcing strip shall be attached to the side or underside, full length.				
Rungs	Rungs shall be 1 1/8 inch minimum diameter with at least 7/8 inch in diameter tenons, and the maximum spacing shall be 12 inches to center.				
Tie rods: Number (minimum) Diameter (minimum)	3 1/4 inch	4 1/4 inch	4 1/4 inch	5 1/4 inch	6 1/4 inch
Flooring, minimum finished size	1/2x2 3/4 in.	1/2x2 3/4 in.	1/2x2 3/4 in.	1/2x2 3/4 in.	1/2x2 3/4 in.

nailed to the cross beams. Floor-boards shall not be spaced more than 1/2 inch apart.

**(q)(1)** *Multi-point adjustable suspension scaffolds and stonemasons' multi-point adjustable suspension scaffolds.* No specific guidelines or tables are given for these scaffolds.

**(q)(2)** *Masons' multi-point adjustable suspension scaffolds.* Maximum intended load -- 50 lb/ft<sup>2</sup>. Each outrigger beam shall be at least a standard 7 inch, 15.3 pound steel I-beam, at least 15 feet long. Such beams shall not project more than 6 feet 6 inches beyond the bearing point. Where the overhang exceeds 6 feet 6 inches, outrigger beams shall be composed of stronger beams or multiple beams.

**(r)** *Catenary scaffolds.*

**(r)(1)** Maximum intended load -- 500 lbs.

**(r)(2)** Not more than two employees shall be permitted on the scaffold at one time.

**(r)(3)** Maximum capacity of come-along shall be 2,000 lbs.

**(r)(4)** Vertical pickups shall be spaced not more than 50 feet apart.

**(r)(5)** Ropes shall be equivalent in strength to at least 1/2 inch (1.3 cm) diameter improved plow steel wire rope.

**(t)** *Interior hung scaffolds.*

Bearers (use on edge): 2 x 10 in.

Maximum intended load: Maximum span  
25 lb/ft.<sup>2</sup>: 10 ft.

50 lb/ft.<sup>2</sup>: 10 ft.

75 lb/ft.<sup>2</sup>: 7 ft.

**(u)** *Needle beam scaffolds.*

Maximum intended load: 25 lb/ft.<sup>2</sup>

Beams: 4 x 6 in.

Maximum platform span: 8 ft.

Maximum beam span: 10 ft.

**(u)(1)** Ropes shall be attached to the needle beams by a scaffold hitch or an eye splice. The loose end of the rope shall be tied

by a bowline knot or by a round turn and a half hitch.

(u)(2) Ropes shall be equivalent in strength to at least 1 inch (2.5 cm) diameter first grade manila rope.

(v) *Multi-level suspension scaffolds.* No additional guidelines or tables are being given for these scaffolds.

(w) *Mobile Scaffolds.* Stability test as described in the ANSI A92 series documents, as appropriate for the type of scaffold, can be used to establish stability for the purpose of 1926.452(w)(6).

(x) *Repair bracket scaffolds.* No additional guidelines or tables are being given for these scaffolds.

(y) *Stilts.* No specific guidelines or tables are given.

(z) *Tank builder's scaffold.*

(z)(1) The maximum distance between brackets to which scaffolding and guardrail supports are attached shall be no more than 10 feet 6 inches.

(z)(2) Not more than three employees shall occupy a 10 feet 6 inch span of scaffold planking at any time.

(z)(3) A taut wire or synthetic rope supported on the scaffold brackets shall be installed at the scaffold plank level between the innermost edge of the scaffold platform and the curved plate structure of the tank shell to serve as a safety line in lieu of an inner guardrail assembly where the space between the scaffold platform and the tank exceeds 12 inches (30.48 cm). In the event the open space on either side of the rope exceeds 12 inches (30.48 cm), a second wire or synthetic rope appropriately placed, or guardrails in accordance with 1926.451(e)(4), shall be installed in order to reduce that open space to less than 12 inches (30.48 cm).

(z)(4) Scaffold planks of rough full-dimensioned 2-inch (5.1 cm) x 12-inch

(30.5 cm) Douglas Fir or Southern Yellow Pine of Select Structural Grade shall be used. Douglas Fir planks shall have a fiber stress of at least 1900 lb/in<sup>2</sup> (130,929 n/cm<sup>2</sup>) and a modulus of elasticity of at least

**Fall Protection****Scope, application, and definitions applicable to this subpart**

1,900,000 lb/in<sup>2</sup> (130,929,000 n/cm<sup>2</sup>), while Yellow Pine planks shall have a fiber stress of at least 2500 lb/in<sup>2</sup> (172,275 n/cm<sup>2</sup>) and a modulus of elasticity of at least 2,000,000 lb/in<sup>2</sup> (137,820,000 n/cm<sup>2</sup>).

(z)(5) Guardrails shall be constructed of a taut wire or synthetic rope, and shall be supported by angle irons attached to brackets welded to the steel plates. These guardrails shall comply with 1926.451(e)(4). Guardrail supports shall be located at no greater than 10 feet 6 inch intervals.

**Subpart L Appendix C - List of National Consensus Standards.**

ANSI/SIA A92.2-1990 Vehicle-Mounted Elevating and Rotating Aerial Devices

ANSI/SIA A92.3-1990 Manually Propelled Elevating Aerial Platforms

ANSI/SIA A92.5-1990 Boom Supported Elevating Work Platforms

ANSI/SIA A92.6-1990 Self-Propelled Elevating Work Platforms

ANSI/SIA A92.7-1990 Airline Ground Support Vehicle-Mounted Vertical Lift Devices

ANSI/SIA A92.8-1993 Vehicle-Mounted Bridge Inspection and Maintenance Devices

ANSI/SIA A92.9-1993 Mast-Climbing Work Platforms

**Subpart L Appendix D - List of Training Topics for Scaffold Erectors and Dismantlers.**

This Appendix D is provided to serve as a guide to assist employers when evaluating the training needs of employees erecting or dismantling supported scaffolds.

The Agency believes that employees erecting or dismantling scaffolds should be trained in the following topics:

*General Overview of Scaffolding*

- regulations and standards
- erection/dismantling planning
- PPE and proper procedures
- fall protection
- materials handling
- access
- working platforms
- foundations
- guys, ties and braces

*Tubular Welded Frame Scaffolds*

- specific regulations and standards
- components
- parts inspection
- erection/dismantling planning
- guys, ties and braces
- fall protection
- general safety
- access and platforms
- erection/dismantling procedures
- rolling scaffold assembly
- putlogs

*Tube and Clamp Scaffolds*

- specific regulations and standards
- components
- parts inspection
- erection/dismantling planning
- guys, ties and braces
- fall protection
- general safety
- access and platforms
- erection/dismantling procedures
- buttresses, cantilevers, and bridges

*System Scaffolds*

- specific regulations and standards
- components
- parts inspection
- erection/dismantling planning
- guys, ties and braces
- fall protection
- general safety
- access and platforms
- erection/dismantling procedures

**Scope, application, and definitions applicable to this subpart**

**Fall Protection**

- buttresses, cantilevers, and bridges

Scaffold erectors and dismantlers should all receive the general overview, and, in addition, specific training for the type of supported scaffold being erected or dismantled.

**Subpart M - Fall Protection**

**§ 1926.500 - Scope, application, and definitions applicable to this subpart.**

*(a) Scope and application.*

**(a)(1)** This subpart sets forth requirements and criteria for fall protection in construction workplaces covered under 29 CFR part 1926. Exception: The provisions of this subpart do not apply when employees are making an inspection, investigation, or assessment of workplace conditions prior to the actual start of construction work or after all construction work has been completed.

**(a)(2)** Section 1926.501 sets forth those workplaces, conditions, operations, and circumstances for which fall protection shall be provided except as follows:

**(a)(2)(i)** Requirements relating to fall protection for employees working on scaffolds are provided in subpart L of this part.

**(a)(2)(ii)** Requirements relating to fall protection for employees working on certain cranes and derricks are provided in subpart N of this part.

**(a)(2)(iii)** Requirements relating to fall protection for employees performing steel erection work are provided in 1926.105 and in subpart R of this part.

**(a)(2)(iv)** Requirements relating to fall protection for employees working on certain types of equipment used in tunneling operations are provided in subpart S of this

part.

**(a)(2)(v)** Requirements relating to fall protection for employees engaged in the construction of electric transmission and distribution lines and equipment are provided in subpart V of this part.

**(a)(2)(vi)** Requirements relating to fall protection for employees working on stairways and ladders are provided in subpart X of this part.

**(a)(3)** Section 1926.502 sets forth the requirements for the installation, construction, and proper use of fall protection required by part 1926, except as follows:

**(a)(3)(i)** Performance requirements for guardrail systems used on scaffolds and performance requirements for falling object protection used on scaffolds are provided in subpart L of this part.

**(a)(3)(ii)** Performance requirements for stairways, stairrail systems, and handrails are provided in subpart X of this part.

**(a)(3)(iii)** Additional performance requirements for personal climbing equipment, lineman's body belts, safety straps, and lanyards are provided in Subpart V of this part.

**(a)(3)(iv)** Section 1926.502 does not apply to steel erection activities. (Note: Section 1926.104 sets the criteria for body belts, lanyards and lifelines used for fall protection in steel erection activities. Paragraphs (b), (c) and (f) of 1926.107 provide definitions for the pertinent terms).

**(a)(4)** Section 1926.503 sets forth requirements for training in the installation and use of fall protection systems, except in relation to steel erection activities.

**(b) Definitions.**

*Anchorage* means a secure point of attachment for lifelines, lanyards or deceleration devices.

*Body belt (safety belt)* means a strap with

Scope, application, and definitions  
applicable to this subpart

Fall Protection

means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device.

*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.

*Buckle* means any device for holding the body belt or body harness closed around the employee's body.

*Connector* means a device which is used to couple (connect) parts of the personal fall arrest system and positioning device systems together. It may be an independent component of the system, such as a carabiner, or it may be an integral component of part of the system (such as a buckle or dee-ring sewn into a body belt or body harness, or a snap-hook spliced or sewn to a lanyard or self-retracting lanyard).

*Controlled access zone (CAZ)* means an area in which certain work (e.g., overhand bricklaying) may take place without the use of guardrail systems, personal fall arrest systems, or safety net systems and access to the zone is controlled.

*Dangerous equipment* means equipment (such as pickling or galvanizing tanks, degreasing units, machinery, electrical equipment, and other units) which, as a result of form or function, may be hazardous to employees who fall onto or into such equipment.

*Deceleration device* means any mechanism, such as a rope grab, rip-stitch lanyard, specially-woven lanyard, tearing or deforming lanyards, automatic self-retracting lifelines/lanyards, etc., which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limit the energy imposed on an employee during fall arrest.

*Deceleration distance* means the additional vertical distance a falling employee

travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which the deceleration device begins to operate. It is measured as the distance between the location of an employee's body belt or body harness attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall, and the location of that attachment point after the employee comes to a full stop.

*Equivalent* means alternative designs, materials, or methods to protect against a hazard which the employer can demonstrate will provide an equal or greater degree of safety for employees than the methods, materials or designs specified in the standard.

*Failure* means load refusal, breakage, or separation of component parts. Load refusal is the point where the ultimate strength is exceeded.

*Free fall* means the act of falling before a personal fall arrest system begins to apply force to arrest the fall.

*Free fall distance* means the vertical displacement of the fall arrest attachment point on the employee's body belt or body harness between onset of the fall and just before the system begins to apply force to arrest the fall. This distance excludes deceleration distance, and lifeline/lanyard elongation, but includes any deceleration device slide distance or self-retracting lifeline/lanyard extension before they operate and fall arrest forces occur.

*Guardrail system* means a barrier erected to prevent employees from falling to lower levels.

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

*Infeasible* means that it is impossible to perform the construction work using a conventional fall protection system (i.e., guardrail system, safety net system, or personal fall arrest system) or that it is technologically impossible to use any one of these systems to provide fall protection.

*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 to a deceleration device, lifeline, or anchorage.

*Leading edge* means the edge of a floor, roof, or formwork for a floor or other walking/working surface (such as the deck) which changes location as additional floor, roof, decking, or formwork sections are placed, formed, or constructed. A leading edge is considered to be an "unprotected side and edge" during periods when it is not actively and continuously under construction.

*Lifeline* means a 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.

*Low-slope roof* means a roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

*Lower levels* means those areas or surfaces to which an employee can fall. Such areas or surfaces include, but are not limited to, ground levels, floors, platforms, ramps, runways, excavations, pits, tanks, material, water, equipment, structures, or portions thereof.

*Mechanical equipment* means all motor or human propelled wheeled equipment

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applicable to this subpart****Fall Protection**

used for roofing work, except wheelbarrows and mopcars.

*Opening* means a gap or void 30 inches (76 cm) or more high and 18 inches (48 cm) or more wide, in a wall or partition, through which employees can fall to a lower level.

*Overhand bricklaying and related work* means the process of laying bricks and masonry units such that the surface of the wall to be jointed is on the opposite side of the wall from the mason, requiring the mason to lean over the wall to complete the work. Related work includes mason tending and electrical installation incorporated into the brick wall during the overhand bricklaying process.

*Personal fall arrest system* means a system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, a body belt or body harness and may include a lanyard, deceleration device, lifeline, or suitable combinations of these. As of January 1, 1998, the use of a body belt for fall arrest is prohibited.

*Positioning device system* means a body belt or body harness system rigged to allow an employee to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning.

*Rope grab* means a deceleration device which travels on a lifeline and automatically, by friction, engages the lifeline and locks so as to arrest the fall of an employee. A rope grab usually employs the principle of inertial locking, cam/level locking, or both.

*Roof* means the exterior surface on the top of a building. This does not include floors or formwork which, because a building has not been completed, temporarily become the top surface of a building.

*Roofing work* means the hoisting, storage, application, and removal of roofing materials

and equipment, including related insulation, sheet metal, and vapor barrier work, but not including the construction of the roof deck.

*Safety-monitoring system* means a safety system in which a competent person is responsible for recognizing and warning employees of fall hazards.

*Self-retracting lifeline/lanyard* means a deceleration device containing a drum-wound line which can be slowly extracted from, or retracted onto, the drum under slight tension during normal employee movement, and which, after onset of a fall, automatically locks the drum and arrests the fall.

*Snaphook* means a connector comprised of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released, automatically closes to retain the object. Snaphooks are generally one of two types:

(1) The locking type with a self-closing, self-locking keeper which remains closed and locked until unlocked and pressed open for connection or disconnection; or

(2) The non-locking type with a self-closing keeper which remains closed until pressed open for connection or disconnection. As of January 1, 1998, the use of a non-locking snaphook as part of personal fall arrest systems and positioning device systems is prohibited.

*Steep roof* means a roof having a slope greater than 4 in 12 (vertical to horizontal).

*Toeboard* means a low protective barrier that will prevent the fall of materials and equipment to lower levels and provide protection from falls for personnel.

*Unprotected sides and edges* means any side or edge (except at entrances to points of access) of a walking/working surface, e.g., floor, roof, ramp, or runway where there is no wall or guardrail system at least 39 inches

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(1.0 m) high.

*Walking/working surface* means any surface, whether horizontal or vertical on which an employee walks or works, including, but not limited to, floors, roofs, ramps, bridges, runways, formwork and concrete reinforcing steel but not including ladders, vehicles, or trailers, on which employees must be located in order to perform their job duties.

*Warning line system* means a barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge, and which designates an area in which roofing work may take place without the use of guardrail, body belt, or safety net systems to protect employees in the area.

*Work area* means that portion of a walking/working surface where job duties are being performed.

**§ 1926.501 - Duty to have fall protection.**

**(a) General.**

**(a)(1)** This section sets forth requirements for employers to provide fall protection systems. All fall protection required by this section shall conform to the criteria set forth in 1926.502 of this subpart.

**(a)(2)** The employer shall determine if the walking/working surfaces on which its employees are to work have the strength and structural integrity to support employees safely. Employees shall be allowed to work on those surfaces only when the surfaces have the requisite strength and structural integrity.

**(b)(1) Unprotected sides and edges.** Each employee on a walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet (1.8 m) or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall

arrest systems.

**(b)(2) Leading edges.**

**(b)(2)(i)** Each employee who is constructing a leading edge 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, or personal fall arrest systems. Exception: When the employer can demonstrate that it is infeasible or creates a greater hazard to use these systems, the employer shall develop and implement a fall protection plan which meets the requirements of paragraph (k) of 1926.502.

**Note:** There is a presumption that it is feasible and will not create a greater hazard to implement at least one of the above-listed fall protection systems. Accordingly, the employer has the burden of establishing that it is appropriate to implement a fall protection plan which complies with 1926.502(k) for a particular workplace situation, in lieu of implementing any of those systems.

**(b)(2)(ii)** Each employee on a walking/working surface 6 feet (1.8 m) or more above a lower level where leading edges are under construction, but who is not engaged in the leading edge work, shall be protected from falling by a guardrail system, safety net system, or personal fall arrest system. If a guardrail system is chosen to provide the fall protection, and a controlled access zone has already been established for leading edge work, the control line may be used in lieu of a guardrail along the edge that parallels the leading edge.

**(b)(3) Hoist areas.** Each employee in a hoist area shall be protected from falling 6 feet (1.8 m) or more to lower levels by guardrail systems or personal fall arrest systems. If guardrail systems, [or chain, gate, or guardrail] or portions thereof, are removed to facilitate the hoisting operation (e.g., during landing of materials), and an

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employee must lean through the access opening or out over the edge of the access opening (to receive or guide equipment and materials, for example), that employee shall be protected from fall hazards by a personal fall arrest system.

**(b)(4) Holes.**

**(b)(4)(i)** Each employee on walking/working surfaces shall be protected from falling through holes (including skylights) more than 6 feet (1.8 m) above lower levels, by personal fall arrest systems, covers, or guardrail systems erected around such holes.

**(b)(4)(ii)** Each employee on a walking/working surface shall be protected from tripping in or stepping into or through holes (including skylights) by covers.

**(b)(4)(iii)** Each employee on a walking/working surface shall be protected from objects falling through holes (including skylights) by covers.

**(b)(5) Formwork and reinforcing steel.** Each employee on the face of formwork or reinforcing steel shall be protected from falling 6 feet (1.8 m) or more to lower levels by personal fall arrest systems, safety net systems, or positioning device systems.

**(b)(6) Ramps, runways, and other walkways.** Each employee on ramps, runways, and other walkways shall be protected from falling 6 feet (1.8 m) or more to lower levels by guardrail systems.

**(b)(7) Excavations.**

**(b)(7)(i)** Each employee at the edge of an excavation 6 feet (1.8 m) or more in depth shall be protected from falling by guardrail systems, fences, or barricades when the excavations are not readily seen because of plant growth or other visual barrier;

**(b)(7)(ii)** Each employee at the edge of a well, pit, shaft, and similar excavation 6 feet (1.8 m) or more in depth shall be pro-

ected from falling by guardrail systems, fences, barricades, or covers.

**(b)(8) Dangerous equipment.**

**(b)(8)(i)** Each employee less than 6 feet (1.8 m) above dangerous equipment shall be protected from falling into or onto the dangerous equipment by guardrail systems or by equipment guards.

**(b)(8)(ii)** Each employee 6 feet (1.8 m) or more above dangerous equipment shall be protected from fall hazards by guardrail systems, personal fall arrest systems, or safety net systems.

**(b)(9) Overhand bricklaying and related work.**

**(b)(9)(i)** Except as otherwise provided in paragraph (b) of this section, each employee performing overhand bricklaying and related work 6 feet (1.8 m) or more above lower levels, shall be protected from falling by guardrail systems, safety net systems, personal fall arrest systems, or shall work in a controlled access zone.

**(b)(9)(ii)** Each employee reaching more than 10 inches (25 cm) below the level of the walking/working surface on which they are working, shall be protected from falling by a guardrail system, safety net system, or personal fall arrest system.

**Note:** Bricklaying operations performed on scaffolds are regulated by subpart L - Scaffolds of this part.

**(b)(10) Roofing work on Low-slope roofs.** Except as otherwise provided in paragraph (b) of this section, each employee engaged in roofing activities on low-slope roofs, with unprotected sides and edges 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, personal fall arrest systems, or a combination of warning line system and guardrail system, warning line system and safety net system, or warning line

system and personal fall arrest

system, or warning line system and safety monitoring system. Or, on roofs 50-feet (15.25 m) or less in width (see Appendix A to subpart M of this part), the use of a safety monitoring system alone [i.e. without the warning line system] is permitted.

**(b)(11) Steep roofs.** Each employee on a steep roof with unprotected sides and edges 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems with toeboards, safety net systems, or personal fall arrest systems.

**(b)(13) Residential construction.** Each employee engaged in residential construction activities 6 feet (1.8 m) or more above lower levels shall be protected by guardrail systems, safety net system, or personal fall arrest system unless another provision in paragraph (b) of this section provides for an alternative fall protection measure. Exception: When the employer can demonstrate that it is infeasible or creates a greater hazard to use these systems, the employer shall develop and implement a fall protection plan which meets the requirements of paragraph (k) of 1926.502.

Note: There is a presumption that it is feasible and will not create a greater hazard to implement at least one of the above-listed fall protection systems. Accordingly, the employer has the burden of establishing that it is appropriate to implement a fall protection plan which complies with 1926.502(k) for a particular workplace situation, in lieu of implementing any of those systems.

**(b)(14) Wall openings.** Each employee working on, at, above, or near wall openings (including those with chutes attached) where the outside bottom edge of the wall opening is 6 feet (1.8 m) or more above lower levels and the inside bottom edge of the wall opening is less than 39 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.

(b)(15) *Walking/working surfaces not otherwise addressed.* Except as provided in 1926.500(a)(2) or in 1926.501 (b)(1) through (b)(14), each employee on a walking/working surface 6 feet (1.8 m) or more above lower levels shall be protected from falling by a guardrail system, safety net system, or personal fall arrest system.

(c) *Protection from falling objects.* When an employee is exposed to falling objects, the employer shall have each employee wear a hard hat and shall implement one of the following measures:

(c)(1) Erect toeboards, screens, or guardrail systems to prevent objects from falling from higher levels; or,

(c)(2) Erect a canopy structure and keep potential fall objects far enough from the edge of the higher level so that those objects would not go over the edge if they were accidentally displaced; or,

(c)(3) Barricade the area to which objects could fall, prohibit employees from entering the barricaded area, and keep objects that may fall far enough away from the edge of a higher level so that those objects would not go over the edge if they were accidentally displaced.

**§ 1926.502 - Fall protection systems criteria and practices.**

(a) *General.*

(a)(1) Fall protection systems required by this part shall comply with the applicable provisions of this section.

(a)(2) Employers shall provide and install all fall protection systems required by this subpart for an employee, and shall comply with all other pertinent requirements of this subpart before that employee begins the work that necessitates the fall protection.

(b) *Guardrail systems.* Guardrail systems and their use shall comply with the following provisions:

(b)(1) Top edge height of top rails, or equivalent guardrail system members, shall be 42 inches (1.1 m) plus or minus 3 inches (8 cm) above the walking/working level. When conditions warrant, the height of the top edge may exceed the 45-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.

(b)(2) Midrails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members shall be installed between the top edge of the guardrail system and the walking/working surface when there is no wall or parapet wall at least 21 inches (53 cm) high.

(b)(2)(i) Midrails, when used, shall be installed at a height midway between the top edge of the guardrail system and the walking/working level.

(b)(2)(ii) Screens and mesh, when used, shall extend from the top rail to the walking/working level and along the entire opening between top rail supports.

(b)(2)(iii) Intermediate members (such as balusters), when used between posts, shall be not more than 19 inches (48 cm) apart.

(b)(2)(iv) Other structural members (such as additional midrails and architectural panels) shall be installed such that there are no openings in the guardrail system that are more than 19 inches (.5 m) wide.

(b)(3) Guardrail systems shall be capable of withstanding, without failure, a force of at least 200 pounds (890 N) applied within

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2 inches (5.1 cm) of the top edge, in any outward or downward direction, at any point along the top edge.

(b)(4) When the 200 pound (890 N) test load specified in paragraph (b)(3) of this section is applied in a downward direction, the top edge of the guardrail shall not deflect to a height less than 39 inches (1.0 m) above the walking/working level. Guardrail system components selected and constructed in accordance with the Appendix B to subpart M of this part will be deemed to meet this requirement.

(b)(5) Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members shall be capable of withstanding, without failure, a force of at least 150 pounds (666 N) applied in any downward or outward direction at any point along the midrail or other member.

(b)(6) Guardrail systems shall be so surfaced as to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing.

(b)(7) The ends of all top rails and midrails shall not overhang the terminal posts, except where such overhang does not constitute a projection hazard.

(b)(8) Steel banding and plastic banding shall not be used as top rails or midrails.

(b)(9) Top rails and midrails shall be at least one-quarter inch (0.6 cm) nominal diameter or thickness to prevent cuts and lacerations. If wire rope is used for top rails, it shall be flagged at not more than 6-foot intervals with high-visibility material.

(b)(10) When guardrail systems are used at hoisting areas, a chain, gate or removable guardrail section shall be placed across the access opening between guardrail sections when hoisting operations are not taking place.

(b)(11) When guardrail systems are used at holes, they shall be erected on all unprotected sides or edges of the hole.

(b)(12) When guardrail systems are used around holes used for the passage of materials, the hole shall have not more than two sides provided with removable guardrail sections to allow the passage of materials. When the hole is not in use, it shall be closed over with a cover, or a guardrail system shall be provided along all unprotected sides or edges.

(b)(13) When guardrail systems are used around holes which are used as points of access (such as ladderways), they shall be provided with a gate, or be so offset that a person cannot walk directly into the hole.

(b)(14) Guardrail systems used on ramps and runways shall be erected along each unprotected side or edge.

(b)(15) Manila, plastic or synthetic rope being used for top rails or midrails shall be inspected as frequently as necessary to ensure that it continues to meet the strength requirements of paragraph (b)(3) of this section.

(d) *Personal fall arrest systems.* Personal fall arrest systems and their use shall comply with the provisions set forth below. Effective January 1, 1998, body belts are not acceptable as part of a personal fall arrest system.

Note: The use of a body belt in a positioning device system is acceptable and is regulated under paragraph (e) of this section.

(d)(1) Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.

(d)(2) Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of the system.

(d)(3) Dee-rings and snaphooks shall have a minimum tensile strength of 5,000 pounds (22.2 kN).

(d)(4) Dee-rings and snaphooks shall be proof-tested to a minimum tensile load of 3,600 pounds (16 kN) without cracking, breaking, or taking permanent deformation.

(d)(5) Snaphooks shall be sized to be compatible with the member to which they are connected to prevent unintentional disengagement of the snaphook by depression of the snaphook keeper by the connected member, or shall be a locking type snaphook designed and used to prevent disengagement of the snaphook by the contact of the snaphook keeper by the connected member. Effective January 1, 1998, only locking type snaphooks shall be used.

(d)(6) Unless the snaphook is a locking type and designed for the following connections, snaphooks shall not be engaged:

(d)(6)(i) directly to webbing, rope or wire rope;

(d)(6)(ii) to each other;

(d)(6)(iii) to a dee-ring to which another snaphook or other connector is attached;

(d)(6)(iv) to a horizontal lifeline; or

(d)(6)(v) to any object which is incompatibly shaped or dimensioned in relation to the snaphook such that unintentional disengagement could occur by the connected object being able to depress the snaphook keeper and release itself.

(d)(9) Lanyards and vertical lifelines shall have a minimum breaking strength of 5,000 pounds (22.2 kN).

(d)(11) Lifelines shall be protected against being cut or abraded.

(d)(12) Self-retracting lifelines and lanyards which automatically limit free fall distance to 2 feet (0.61 m) or less shall be capable of sustaining a minimum tensile load of 3,000 pounds (13.3 kN) applied to

the device with the lifeline or lanyard in the fully extended position.

(d)(13) Self-retracting lifelines and lanyards which do not limit free fall distance to 2 feet (0.61 m) or less, ripstitch lanyards, and tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,000 pounds (22.2 kN) applied to the device with the lifeline or lanyard in the fully extended position.

(d)(14) Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses shall be made from synthetic fibers.

(d)(15) Anchorages used for attachment of personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 5,000 pounds (22.2 kN) per employee attached, or shall be designed, installed, and used as follows:

(d)(15)(i) as part of a complete personal fall arrest system which maintains a safety factor of at least two; and

(d)(15)(ii) under the supervision of a qualified person.

(d)(16) Personal fall arrest systems, when stopping a fall, shall:

(d)(16)(i) limit maximum arresting force on an employee to 900 pounds (4 kN) when used with a body belt;

(d)(16)(ii) limit maximum arresting force on an employee to 1,800 pounds (8 kN) when used with a body harness;

(d)(16)(iii) be rigged such that an employee can neither free fall more than 6 feet (1.8 m), nor contact any lower level;

(d)(16)(iv) bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet (1.07 m); and,

(d)(16)(v) have sufficient strength to withstand twice the potential impact energy of

an employee free falling a distance of

6 feet (1.8 m), or the free fall distance permitted by the system, whichever is less.

Note: If the personal fall arrest system meets the criteria and protocols contained in Appendix C to subpart M, and if the system is being used by an employee having a combined person and tool weight of less than 310 pounds (140 kg), the system will be considered to be in compliance with the provisions of paragraph (d)(16) of this section. If the system is used by an employee having a combined tool and body weight of 310 pounds (140 kg) or more, then the employer must appropriately modify the criteria and protocols of the Appendix to provide proper protection for such heavier weights, or the system will not be deemed to be in compliance with the requirements of paragraph (d)(16) of this section.

**(d)(17)** The attachment point of the body belt shall be located in the center of the wearer's back. The attachment point of the body harness shall be located in the center of the wearer's back near shoulder level, or above the wearer's head.

**(d)(18)** Body belts, harnesses, and components shall be used only for employee protection (as part of a personal fall arrest system or positioning device system) and not to hoist materials.

**(d)(19)** Personal fall arrest systems and components subjected to impact loading shall be immediately removed from service and shall not be used again for employee protection until inspected and determined by a competent person to be undamaged and suitable for reuse.

**(d)(20)** The employer shall provide for prompt rescue of employees in the event of a fall or shall assure that employees are able to rescue themselves.

**(d)(21)** Personal fall arrest systems shall be inspected prior to each use for wear,

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damage and other deterioration, and defective components shall be removed from service.

**(d)(22)** Body belts shall be at least one and five-eighths (1 5/8) inches (4.1 cm) wide.

**(d)(23)** Personal fall arrest systems shall not be attached to guardrail systems, nor shall they be attached to hoists except as specified in other subparts of this Part.

**(e)** *Positioning device systems.* Positioning device systems and their use shall conform to the following provisions:

**(e)(1)** Positioning devices shall be rigged such that an employee cannot free fall more than 2 feet (.9 m).

**(e)(2)** Positioning devices shall be secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds (13.3 kN), whichever is greater.

**(e)(3)** Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.

**(e)(4)** Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of this system.

**(e)(5)** Connecting assemblies shall have a minimum tensile strength of 5,000 pounds (22.2 kN)

**(e)(6)** Dee-rings and snaphooks shall be proof-tested to a minimum tensile load of 3,600 pounds (16 kN) without cracking, breaking, or taking permanent deformation.

**(e)(7)** Snaphooks shall be sized to be compatible with the member to which they are connected to prevent unintentional disengagement of the snaphook by depression of the snaphook keeper by the connected member, or shall be a locking type snaphook designed and used to prevent disengagement of the snaphook by the contact of the snaphook keeper by the con-

nected member. As of January 1, 1998, only locking type snaphooks shall be used.

**(e)(8)** Unless the snaphook is a locking type and designed for the following connections, snaphooks shall not be engaged:

**(e)(8)(i)** directly to webbing, rope or wire rope;

**(e)(8)(ii)** to each other;

**(e)(8)(iii)** to a dee-ring to which another snaphook or other connector is attached;

**(e)(8)(iv)** to a horizontal lifeline; or

**(e)(8)(v)** to any object which is incompatibly shaped or dimensioned in relation to the snaphook such that unintentional disengagement could occur by the connected object being able to depress the snaphook keeper and release itself.

**(e)(9)** Positioning device systems shall be inspected prior to each use for wear, damage, and other deterioration, and defective components shall be removed from service.

**(e)(10)** Body belts, harnesses, and components shall be used only for employee protection (as part of a personal fall arrest system or positioning device system) and not to hoist materials.

**(g)** *Controlled access zones.* Controlled access zones [See 1926.501(b)(9) and 1926.502(k)] and their use shall conform to the following provisions.

**(g)(1)** When used to control access to areas where leading edge and other operations are taking place the controlled access zone shall be defined by a control line or by any other means that restricts access.

**(g)(1)(i)** When control lines are used, they shall be erected not less than 6 feet (1.8 m) nor more than 25 feet (7.7 m) from the unprotected or leading edge, except when erecting precast concrete members.

**(g)(1)(ii)** When erecting precast concrete members, the control line shall be erected not less than 6 feet (1.8 m) nor more than

60 feet (18 m) or half the length of the member being erected, whichever is less, from the leading edge.

from the walking/working surface.

(g)(1)(iii) The control line shall extend along the entire length of the unprotected or leading edge and shall be approximately parallel to the unprotected or leading edge.

(g)(1)(iv) The control line shall be connected on each side to a guardrail system or wall.

(g)(2) When used to control access to areas where overhand bricklaying and related work are taking place:

(g)(2)(i) The controlled access zone shall be defined by a control line erected not less than 10 feet (3.1 m) nor more than 15 feet (4.5 m) from the working edge.

(g)(2)(ii) The control line shall extend for a distance sufficient for the controlled access zone to enclose all employees performing overhand bricklaying and related work at the working edge and shall be approximately parallel to the working edge.

(g)(2)(iii) Additional control lines shall be erected at each end to enclose the controlled access zone.

(g)(2)(iv) Only employees engaged in overhand bricklaying or related work shall be permitted in the controlled access zone.

(g)(3) Control lines shall consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions as follows:

(g)(3)(i) Each line shall be flagged or otherwise clearly marked at not more than 6-foot (1.8 m) intervals with high-visibility material.

(g)(3)(ii) Each line shall be rigged and supported in such a way that its lowest point (including sag) is not less than 39 inches (1 m) from the walking/working surface and its highest point is not more than 45 inches (1.3 m) [50 inches (1.3 m) when overhand bricklaying operations are being performed]

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(g)(3)(iii) Each line shall have a minimum breaking strength of 200 pounds (.88 kN).

(g)(4) On floors and roofs where guardrail systems are not in place prior to the beginning of overhand bricklaying operations, controlled access zones shall be enlarged, as necessary, to enclose all points of access, material handling areas, and storage areas.

(g)(5) On floors and roofs where guardrail systems are in place, but need to be removed to allow overhand bricklaying work or leading edge work to take place, only that portion of the guardrail necessary to accomplish that day's work shall be removed.

(j) *Protection from falling objects.* Falling object protection shall comply with the following provisions:

(j)(1) Toeboards, when used as falling object protection, shall be erected along the edge of the overhead walking/working surface for a distance sufficient to protect employees below.

(j)(2) Toeboards shall be capable of withstanding, without failure, a force of at least 50 pounds (222 N) applied in any downward or outward direction at any point along the toeboard.

(j)(3) Toeboards shall be a minimum of 3 1/2 inches (9 cm) in vertical height from their top edge to the level of the walking/working surface. They shall have not more than 1/4 inch (0.6 cm) clearance above the walking/working surface. They shall be solid or have openings not over 1 inch (2.5 cm) in greatest dimension.

(j)(4) Where tools, equipment, or materials are piled higher than the top edge of a toeboard, paneling or screening shall be erected from the walking/working surface or toeboard to the top of a guardrail system's top rail or midrail, for a distance sufficient to protect employees below.

(j)(5) Guardrail systems, when used as

falling object protection, shall have all openings small enough to prevent passage of potential falling objects.

(j)(6) During the performance of overhand bricklaying and related work:

(j)(6)(i) No materials or equipment except masonry and mortar shall be stored within 4 feet (1.2 m) of the working edge.

(j)(6)(ii) Excess mortar, broken or scattered masonry units, and all other materials and debris shall be kept clear from the work area by removal at regular intervals.

(j)(7) During the performance of roofing work:

(j)(7)(i) Materials and equipment shall not be stored within 6 feet (1.8 m) of a roof edge unless guardrails are erected at the edge.

(j)(7)(ii) Materials which are piled, grouped, or stacked near a roof edge shall be stable and self-supporting.

(j)(8) Canopies, when used as falling object protection, shall be strong enough to prevent collapse and to prevent penetration by any objects which may fall onto the canopy.

(k) *Fall protection plan.* This option is available only to employees engaged in leading edge work, precast concrete erection work, or residential construction work (See 1926.501(b)(2), (b)(12), and (b)(13)) who can demonstrate that it is infeasible or it creates a greater hazard to use conventional fall protection equipment. The fall protection plan must conform to the following provisions.

(k)(1) The fall protection plan shall be prepared by a qualified person and developed specifically for the site where the leading edge work, precast concrete work, or residential construction work is being performed and the plan must be maintained up to date.

(k)(2) Any changes to the fall protection plan shall be approved by a qualified person.

(k)(3) A copy of the fall protection plan with all approved changes shall be maintained at the job site.

(k)(4) The implementation of the fall protection plan shall be under the supervision of a competent person.

(k)(5) The fall protection plan shall document the reasons why the use of conventional fall protection systems (guardrail systems, personal fall arrest systems, or safety nets systems) are infeasible or why their use would create a greater hazard.

(k)(6) The fall protection plan shall include a written discussion of other measures that will be taken to reduce or eliminate the fall hazard for workers who cannot be provided with protection from the conventional fall protection systems. For example, the employer shall discuss the extent to which scaffolds, ladders, or vehicle mounted work platforms can be used to provide a safer working surface and thereby reduce the hazard of falling.

(k)(7) The fall protection plan shall identify each location where conventional fall protection methods cannot be used. These locations shall then be classified as controlled access zones and the employer must comply with the criteria in paragraph (g) of this section.

(k)(8) Where no other alternative measure has been implemented, the employer shall implement a safety monitoring system in conformance with 1926.502(h).

(k)(9) The fall protection plan must include a statement which provides the name or other method of identification for each employee who is designated to work in controlled access zones. No other employees may enter controlled access zones.

(k)(10) In the event an employee falls, or some other related, serious incident occurs, (e.g., a near miss) the employer shall investigate the circumstances of the fall or other incident to determine if the fall protection plan needs to be changed (e.g. new practices, procedures, or training) and shall implement those changes to prevent similar types of falls or incidents.

**§ 1926.503 - Training requirements.**

The following training provisions supplement and clarify the requirements of 1926.21 regarding the hazards addressed in subpart M of this part.

*(a) Training Program.*

(a)(1) The employer shall provide a training program for each employee who might be exposed to fall hazards. The program shall enable each employee to recognize the hazards of falling and shall train each employee in the procedures to be followed in order to minimize these hazards.

(a)(2) The employer shall assure that each employee has been trained, as necessary, by a competent person qualified in the following areas:

(a)(2)(i) The nature of fall hazards in the work area;

(a)(2)(ii) The correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection systems to be used;

(a)(2)(iii) The use and operation of guardrail systems, personal fall arrest systems, safety net systems, warning line systems, safety monitoring systems, controlled access zones, and other protection to be used;

(a)(2)(iv) The role of each employee in the safety monitoring system when this system is used;

(a)(2)(v) The limitations on the use of mechanical equipment during the

performance of roofing work on low-sloped roofs;

(a)(2)(vi) The correct procedures for the handling and storage of equipment and materials and the erection of overhead protection; and

(a)(2)(vii) The role of employees in fall protection plans;

(a)(2)(viii) The standards contained in this subpart.

*(b) Certification of training.*

(b)(1) The employer shall verify compliance with paragraph (a) of this section by preparing a written certification record. The written certification record shall contain the name or other identity of the employee trained, the date(s) of the training, and the signature of the person who conducted the training or the signature of the employer. If the employer relies on training conducted by another employer or completed prior to the effective date of this section, the certification record shall indicate the date the employer determined the prior training was adequate rather than the date of actual training.

(b)(2) The latest training certification shall be maintained.

*(c) Retraining.* When the employer has reason to believe that any affected employee who has already been trained does not have the understanding and skill required by paragraph (a) of this section, the employer shall retrain each such employee. Circumstances where retraining is required include, but are not limited to, situations where:

(c)(1) Changes in the workplace render previous training obsolete; or

(c)(2) Changes in the types of fall protection systems or equipment to be used render previous training obsolete; or

(c)(3) Inadequacies in an affected employee's knowledge or use of fall

protection systems or equipment indicate that the employee has not retained the requisite understanding or skill.

Note: The following appendices to subpart M of this part serve as non-mandatory guidelines to assist employers in complying with the appropriate requirements of subpart M of this part.

**Subpart M Appendix A - Determining Roof Widths - Non-mandatory Guidelines for Complying with 1926.501(b)(10)**

(1) This Appendix serves as a guideline to assist employers complying with the requirements of 1926.501(b)(10). Section 1910.501(b)(10) allows the use of a safety monitoring system alone as a means of providing fall protection during the performance of roofing operations on low-sloped roofs 50 feet (15.25 m) or less in width. Each example in the appendix shows a roof plan or plans and indicates where each roof or roof area is to be measured to determine its width. Section views or elevation views are shown where appropriate. Some examples show "correct" and "incorrect" subdivisions of irregularly shaped roofs divided into smaller, regularly shaped areas. In all examples, the dimension selected to be the width of an area is the lesser of the two primary dimensions of the area, as viewed

from above. Example A shows that on a simple rectangular roof, width is the lesser of the two primary overall dimensions. This is also the case with roofs which are sloped toward or away from the roof center, as shown in Example B.

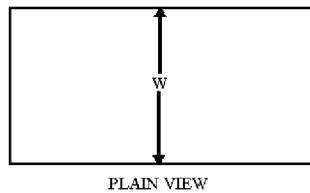
(2) Many roofs are not simple rectangles. Such roofs may be broken down into subareas as shown in Example C. The process of dividing a roof area can produce many different configurations. Example C gives the

general rule of using dividing lines of minimum length to minimize the size and number of the areas which are potentially less than 50 feet (15.25 m) wide. The intent is to minimize the number of roof areas where safety monitoring systems alone are sufficient protection.

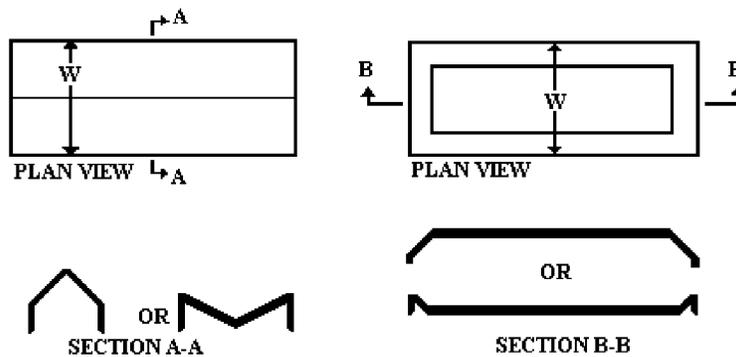
(3) Roofs which are comprised of several separate, non-contiguous roof areas, as in Example D, may be considered as a series of individual roofs. Some roofs have penthouses,

additional floors, courtyard openings, or similar architectural features; Example E shows how the rule for dividing roofs into subareas is applied to such configurations. Irregular, non-rectangular roofs must be considered on an individual basis, as shown in Example F.

**Example A - Rectangular Shaped Roofs**



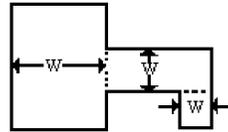
**Example B - Sloped Rectangular Shaped Roofs**



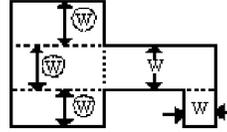
**Example C - Irregularly Shaped Roofs With Rectangular Shaped Sections**

Such roofs are to be divided into sub-areas by using dividing lines of minimum length to minimize the size and number of the areas which are potentially less than or equal to 50 feet (15.25 meters) in width, in order to limit the size of roof areas where the safety monitoring system alone can be used [1926.502(b)(10)].

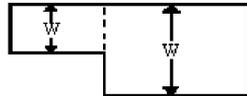
Dotted lines are used in the examples to show the location of dividing lines. W denotes incorrect measurements of width.



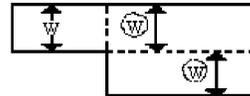
CORRECT



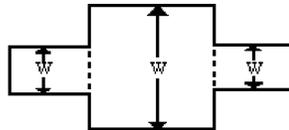
INCORRECT



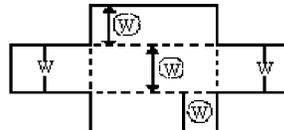
CORRECT



INCORRECT

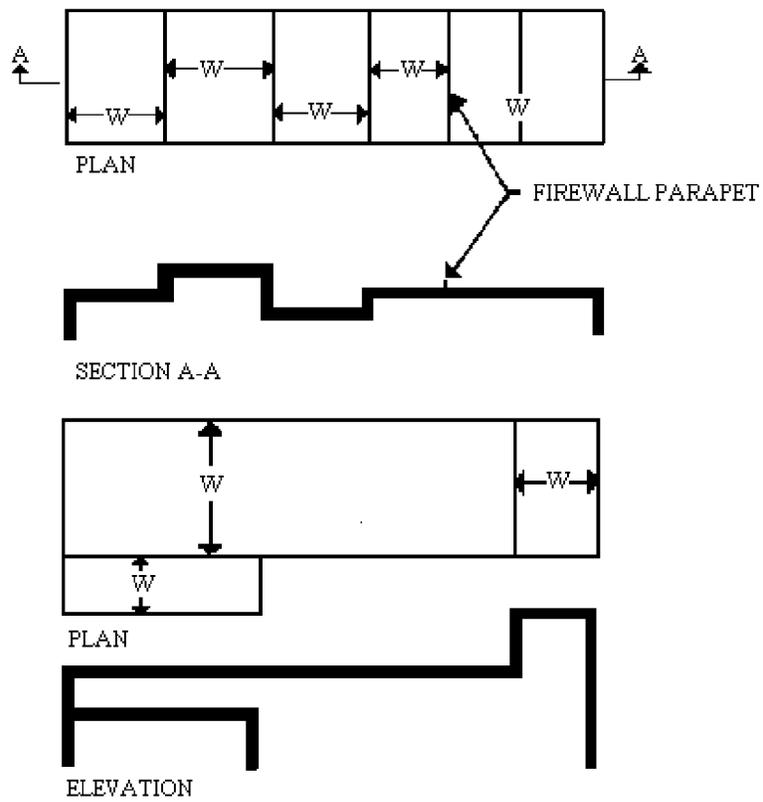


CORRECT



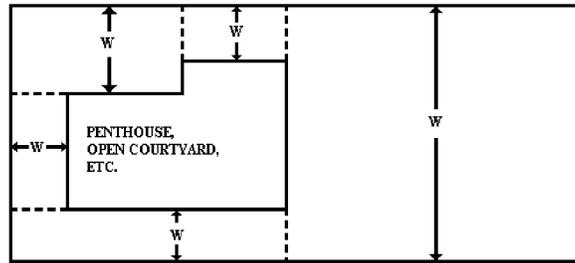
INCORRECT

**Example D**  
**Separate, Non-Contiguous Roof Areas**

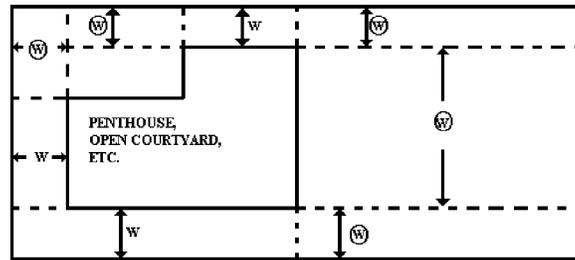


**Example E - Roofs With Penthouses, Open Courtyards, Additional Floors, etc.**

Such roofs are to be divided into sub-areas by using dividing lines of minimum length to minimize the size and number of the areas which are potentially less than or equal to 50 feet (15.25 meters) in width, in order to limit the size of roof areas where the safety monitoring system alone can be used [1926.502(b)(10)]. Dotted lines are used in the examples to show the location of dividing lines. W denotes incorrect measurements of width.

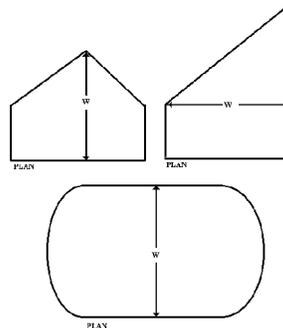


Correct



Incorrect

**Example F - Irregular, Non-Rectangular Shaped Roofs**



**Subpart M Appendix B - Guardrail**  
**Systems - Non-Mandatory Guidelines**  
**for Complying with 1926.502(b)**

The standard requires guardrail systems and components to be designed and built to meet the requirements of 1926.502(b)(3), (4), and (5). This Appendix serves as a non-mandatory guideline to assist employers in complying with these requirements. An employer may use these guidelines as a starting point for designing guardrail systems. However, the guidelines do not provide all the information necessary to build a complete system, and the employer is still responsible for designing and assembling these components in such a way that the completed system will meet the requirements of 1926.502(b)(3), (4), and (5). Components for which no specific guidelines are given in this Appendix (e.g., joints, base connections, components made with other materials, and components with other dimensions) must also be designed and constructed in such a way that the completed system meets the requirements of 1926.502.

(1) For wood railings: Wood components shall be minimum 1500 lb-ft/in<sup>2</sup> fiber (stress grade) construction grade lumber; the posts shall be at least 2-inch by 4-inch (5 cm x 10 cm) lumber spaced not more than 8 feet (2.4 m) apart on centers; the top rail shall be at least 2-inch by 4-inch (5 cm x 10 cm) lumber, the intermediate rail shall be at least 1-inch by 6-inch (2.5 cm x 15 cm) lumber. All lumber dimensions are nominal sizes as provided by the American Softwood Lumber Standards, dated January 1970.

(2) For pipe railings: posts, top rails, and intermediate railings shall be at least one and one-half inches nominal diameter (schedule 40 pipe) with posts spaced not more than 8 feet (2.4 m) apart on centers.

(3) For structural steel railings: posts, top rails, and intermediate rails shall be at least 2-inch by 2-inch (5 cm x 10 cm) by 3/8-inch (1.1 cm) angles, with posts spaced not more than 8 feet (2.4 m) apart on centers.

**Subpart M Appendix C - Personal Fall Arrest Systems - Non-Mandatory Guidelines for Complying with 1926.502(d)**

(c) *Component compatibility considerations.* Ideally, a personal fall arrest system is designed, tested, and supplied as a complete system. However, it is common practice for lanyards, connectors, lifelines, deceleration devices, body belts and body harnesses to be interchanged since some components wear out before others. The employer and employee should realize that not all components are interchangeable. For instance, a lanyard should not be connected between a body belt (or harness) and a deceleration device of the self-retracting type since this can result in additional free fall for which the system was not designed. Any substitution or change to a personal fall arrest system should be fully evaluated or tested by a competent person to determine that it meets the standard, before the modified system is put in use.

(d) *Employee training considerations.* Thorough employee training in the selection and use of personal fall arrest systems is imperative. Employees must be trained in the safe use of the system. This should include the following: application limits; proper anchoring and tie-off techniques; estimation of free fall distance, including determination of deceleration distance, and total fall distance to prevent striking a lower level; methods of use; and inspection and storage of the system. Careless or improper use of the equipment

can result in serious injury or death. Employers and employees should become familiar with the material in this Appendix, as well as manufacturer's recommendations, before a system is used. Of uppermost importance is the reduction in strength caused by certain tie-offs (such as using knots, tying around sharp edges, etc.) and maximum permitted free fall distance. Also, to be stressed are the importance of inspections prior to use, the limitations of the equipment, and unique conditions at the worksite which may be important in determining the type of system to use.

(e) *Instruction considerations.* Employers should obtain comprehensive instructions from the supplier as to the system's proper use and application, including, where applicable:

(e)(1) The force measured during the sample force test;

(e)(2) The maximum elongation measured for lanyards during the force test;

(e)(3) The deceleration distance measured for deceleration devices during the force test;

(e)(4) Caution statements on critical use limitations;

(e)(5) Application limits;

(e)(6) Proper hook-up, anchoring and tie-off techniques, including the proper dee-ring or other attachment point to use on the body belt and harness for fall arrest;

(e)(7) Proper climbing techniques;

(e)(8) Methods of inspection, use, cleaning, and storage; and

(e)(9) Specific lifelines which may be used.

This information should be provided to employees during training.

(f) *Rescue considerations.* As required by 1926.502(d)(20), when personal fall arrest systems are used, the employer must assure that employees can be promptly rescued or can rescue themselves should a fall occur.

The availability of rescue personnel, ladders or other rescue equipment should be evaluated. In some situations, equipment which allows employees to rescue themselves after the fall has been arrested may be desirable, such as devices which have descent capability.

**(g)** *Inspection considerations.* As required by 1926.502(d)(21), personal fall arrest systems must be regularly inspected. Any component with any significant defect, such as cuts, tears, abrasions, mold, or undue stretching; alterations or additions which might affect its efficiency; damage due to deterioration; contact with fire, acids, or other corrosives; distorted hooks or faulty hook springs; tongues unfitted to the shoulder of buckles; loose or damaged mountings; non-functioning parts; or wearing or internal deterioration in the ropes must be withdrawn from service immediately, and should be tagged or marked as unusable, or destroyed.

**(h)** *Tie-off considerations.*

**(h)(1)** One of the most important aspects of personal fall protection systems is fully planning the system before it is put into use. Probably the most overlooked component is planning for suitable anchorage points. Such planning should ideally be done before the structure or building is constructed so that anchorage points can be incorporated during construction for use later for window cleaning or other building maintenance. If properly planned, these anchorage points may be used during construction, as well as afterwards.

**(h)(1)(i)** Properly planned anchorages should be used if they are available. In some cases, anchorages must be installed immediately prior to use. In such cases, a registered professional engineer with experience in designing fall protection systems, or another qualified person with appropriate education

and experience should design an anchor point to be installed.

**(h)(1)(ii)** In other cases, the Agency recognizes that there will be a need to devise an anchor point from existing structures. Examples of what might be appropriate anchor points are steel members or I-beams if an acceptable strap is available for the connection (do not use a lanyard with a snaphook clipped onto itself); large eye-bolts made of an appropriate grade steel; guardrails or railings if they have been designed for use as an anchor point; or masonry or wood members only if the attachment point is substantial and precautions have been taken to assure that bolts or other connectors will not pull through. A qualified person should be used to evaluate the suitability of these "make shift" anchorages with a focus on proper strength.

**(h)(2)** Employers and employees should at all times be aware that the strength of a personal fall arrest system is based on its being attached to an anchoring system which does not reduce the strength of the system (such as a properly dimensioned eye-bolt/snap-hook anchorage). Therefore, if a means of attachment is used that will reduce the strength of the system, that component should be replaced by a stronger one, but one that will also maintain the appropriate maximum arrest force characteristics.

**(h)(3)** Tie-off using a knot in a rope lanyard or lifeline (at any location) can reduce the lifeline or lanyard strength by 50 percent or more. Therefore, a stronger lanyard or lifeline should be used to compensate for the weakening effect of the knot, or the lanyard length should be reduced (or the tie-off location raised) to minimize free fall distance, or the lanyard or lifeline should be replaced by one which has an appropriately

incorporated connector to eliminate the need for a knot.

**(h)(4)** Tie-off of a rope lanyard or lifeline around an "H" or "I" beam or similar support can reduce its strength as much as 70 percent due to the cutting action of the beam edges. Therefore, use should be made of a webbing lanyard or wire core lifeline around the beam; or the lanyard or lifeline should be protected from the edge; or free fall distance should be greatly minimized.

**(h)(5)** Tie-off where the line passes over or around rough or sharp surfaces reduces strength drastically. Such a tie-off should be avoided or an alternative tie-off rigging should be used. Such alternatives may include use of a snap-hook/dee ring connection, wire rope tie-off, an effective padding of the surfaces, or an abrasion-resistance strap around or over the problem surface.

**(h)(6)** Horizontal lifelines may, depending on their geometry and angle of sag, be subjected to greater loads than the impact load imposed by an attached component. When the angle of horizontal lifeline sag is less than 30 degrees, the impact force imparted to the lifeline by an attached lanyard is greatly amplified. For example, with a sag angle of 15 degrees, the force amplification is about 2:1 and at 5 degrees sag, it is about 6:1. Depending on the angle of sag, and the line's elasticity, the strength of the horizontal lifeline and the anchorages to which it is attached should be increased a number of times over that of the lanyard. Extreme care should be taken in considering a horizontal lifeline for multiple tie-offs. The reason for this is that in multiple tie-offs to a horizontal lifeline, if one employee falls, the movement of the falling employee and the horizontal lifeline during arrest of the fall may cause other employees to fall also. Horizontal lifeline and anchorage strength should be

increased for each additional employee to be tied off. For these and other reasons, the design of systems using horizontal lifelines must only be done by qualified persons. Testing of installed lifelines and anchors prior to use is recommended.

**(h)(7)** The strength of an eye-bolt is rated along the axis of the bolt and its strength is greatly reduced if the force is applied at an angle to this axis (in the direction of shear). Also, care should be exercised in selecting the proper diameter of the eye to avoid accidental disengagement of snap-hooks not designed to be compatible for the connection.

**(h)(8)** Due to the significant reduction in the strength of the lifeline/lanyard (in some cases, as much as a 70 percent reduction), the sliding hitch knot (prusik) should not be used for lifeline/lanyard connections except in emergency situations where no other available system is practical. The "one-and-one" sliding hitch knot should never be used because it is unreliable in stopping a fall. The "two-and-two," or "three-and-three" knot (preferable) may be used in emergency situations; however, care should be taken to limit free fall distance to a minimum because of reduced lifeline/lanyard strength.

**(j)** *Snap-hook considerations.*

**(j)(1)** Although not required by this standard for all connections until January 1, 1998, locking snaphooks designed for connection to suitable objects (of sufficient strength) are highly recommended in lieu of the nonlocking type. Locking snaphooks incorporate a positive locking mechanism in addition to the spring loaded keeper, which will not allow the keeper to open under moderate pressure without someone first releasing the mechanism. Such a feature, properly designed, effectively prevents roll-out from occurring.

**(j)(2)** As required by 1926.502(d)(6), the

following connections must be avoided (unless properly designed locking snaphooks are used) because they are conditions which can result in roll-out when a nonlocking snaphook is used:

(j)(2)(i) Direct connection of a snaphook to a horizontal lifeline.

(j)(2)(ii) Two (or more) snaphooks connected to one dee-ring.

(j)(2)(iii) Two snaphooks connected to each other.

(j)(2)(iv) A snaphook connected back on its integral lanyard.

(j)(2)(v) A snaphook connected to a webbing loop or webbing lanyard.

(j)(2)(vi) Improper dimensions of the dee-ring, rebar, or other connection point in relation to the snaphook dimensions which would allow the snaphook keeper to be depressed by a turning motion of the snaphook.

(k) *Free fall considerations.* The employer and employee should at all times be aware that a system's maximum arresting force is evaluated under normal use conditions established by the manufacturer, and in no case using a free fall distance in excess of 6 feet (1.8 m). A few extra feet of free fall can significantly increase the arresting force on the employee, possibly to the point of causing injury. Because of this, the free fall distance should be kept at a minimum, and, as required by the standard, in no case greater than 6 feet (1.8 m). To help assure this, the tie-off attachment point to the lifeline or anchor should be located at or above the connection point of the fall arrest equipment to belt or harness. (Since otherwise additional free fall distance is added to the length of the connecting means (i.e. lanyard)). Attaching to the working surface will often result in a free fall greater than 6 feet (1.8 m). For instance, if a 6 foot (1.8 m)

lanyard is used, the total free fall distance will be the distance from the working level to the body belt (or harness) attachment point plus the 6 feet (1.8 m) of lanyard length. Another important consideration is that the arresting force which the fall system must withstand also goes up with greater distances of free fall, possibly exceeding the strength of the system.

(l) *Elongation and deceleration distance considerations.* Other factors involved in a proper tie-off are elongation and deceleration distance. During the arresting of a fall, a lanyard will experience a length of stretching or elongation, whereas activation of a deceleration device will result in a certain stopping distance. These distances should be available with the lanyard or device's instructions and must be added to the free fall distance to arrive at the total fall distance before an employee is fully stopped. The additional stopping distance may be very significant if the lanyard or deceleration device is attached near or at the end of a long lifeline, which may itself add considerable distance due to its own elongation. As required by the standard, sufficient distance to allow for all of these factors must also be maintained between the employee and obstructions below, to prevent an injury due to impact before the system fully arrests the fall. In addition, a minimum of 12 feet (3.7 m) of lifeline should be allowed below the securing point of a rope grab type deceleration device, and the end terminated to prevent the device from sliding off the lifeline. Alternatively, the lifeline should extend to the ground or the next working level below. These measures are suggested to prevent the worker from inadvertently moving past the end of the lifeline and having the rope grab become disengaged from the lifeline.

(m) *Obstruction considerations.* The location of the tie-off should also consider the hazard of obstructions in the potential fall path of the employee. Tie-offs which minimize the possibilities of exaggerated swinging should be considered. In addition, when a body belt is used, the employee's body will go through a horizontal position to a jack-knifed position during the arrest of all falls. Thus, obstructions which might interfere with this motion should be avoided or a severe injury could occur.

(n) *Other considerations.* Because of the design of some personal fall arrest systems, additional considerations may be required for proper tie-off. For example, heavy deceleration devices of the self-retracting type should be secured overhead in order to avoid the weight of the device having to be supported by the employee. Also, if self-retracting equipment is connected to a horizontal lifeline, the sag in the lifeline should be minimized to prevent the device from sliding down the lifeline to a position which creates a swing hazard during fall arrest. In all cases, manufacturer's instructions should be followed.

**Subpart M Appendix D - Positioning Device Systems - Non-Mandatory Guidelines for Complying with 1926.502(e)**

***I. Testing Methods For Positioning Device Systems.***

This appendix serves as a non-mandatory guideline to assist employers comply with the requirements for positioning device systems in 1926.502(e). Paragraphs (b), (c), (d) and (e) of Appendix C of subpart M relating to 1926.502(d) - Personal Fall Arrest Systems - set forth test procedures which may be used, along with

the procedures listed below, to determine compliance with the requirements for positioning device systems in 1926.502(e)(3) and (4) of Subpart M.

**(a) General.**

**(a)(1)** Single strap positioning devices shall have one end attached to a fixed anchorage and the other end connected to a body belt or harness in the same manner as they would be used to protect employees. Double strap positioning devices, similar to window cleaner's belts, shall have one end of the strap attached to a fixed anchorage and the other end shall hang free. The body belt or harness shall be attached to the strap in the same manner as it would be used to protect employees. The two strap ends shall be adjusted to their maximum span.

**(a)(2)** The fixed anchorage shall be rigid, and shall not have a deflection greater than .04 inches (1 mm) when a force of 2,250 pounds (10 kN) is applied.

**(a)(3)** During the testing of all systems, a test weight of 250 pounds plus or minus 3 pounds (113 kg plus or minus 1.6 kg) shall be used. The weight shall be a rigid object with a girth of 38 inches plus or minus 4 inches (96 cm plus or minus 10 cm).

**(a)(4)** Each test shall consist of dropping the specified weight one time without failure of the system being tested. A new system shall be used for each test.

**(a)(5)** The test weight for each test shall be hoisted exactly 4 feet (1.2 m above its "at rest" position), and shall be dropped so as to permit a vertical free fall of 4 feet (1.2 m).

**(a)(6)** The test is failed whenever any breakage or slippage occurs which permits the weight to fall free of the system.

**(a)(7)** Following the test, the system need not be capable of further operation; however, all such incapacities shall be readily apparent.

**II. Inspection Considerations.**

As required in 1926.502 (e)(5), positioning device systems must be regularly inspected. Any component with any significant defect, such as cuts, tears, abrasions, mold, or undue stretching; alterations or additions which might affect its efficiency; damage due to deterioration; contact with fire, acids, or other corrosives; distorted hooks or faulty hook springs; tongues unfitted to the shoulder of buckles; loose or damaged mountings; non-functioning parts; or wearing or internal deterioration in the ropes must be withdrawn from service immediately, and should be tagged or marked as unusable, or destroyed.

**Subpart M Appendix E - Sample Fall Protection Plan - Non-Mandatory Guidelines for Complying with 1926.502(k)**

Employers engaged in leading edge work, precast concrete construction work and residential construction work who can demonstrate that it is infeasible or creates a greater hazard to use conventional fall protection systems must develop and follow a fall protection plan. Below are sample fall protection plans developed for precast concrete construction and residential work that could be tailored to be site specific for other precast concrete or residential jobsite. This sample plan can be modified to be used for other work involving leading edge work. The sample plan outlines the elements that must be addressed in any fall protection plan. The reasons outlined in this sample fall protection plan are for illustrative purposes only and are not necessarily a valid, acceptable rationale (unless the conditions at the job site are the same as those covered by these sample plans) for not using

conventional fall protection systems for a particular precast concrete or residential construction worksite. However, the sample plans provide guidance to employers on the type of information that is required to be discussed in fall protection plans.

*Sample Fall Protection Plan  
for Residential Construction  
(Insert Company Name)*

This Fall Protection Plan Is Specific For  
The Following Project:

- Location of Job
- Date Plan Prepared or Modified
- Plan Prepared By
- Plan Approved By
- Plan Supervised By

The following Fall Protection Plan is a sample program prepared for the prevention of injuries associated with falls. A Fall Protection Plan must be developed and evaluated on a site by site basis. It is recommended that builders discuss the written Fall Protection Plan with their OSHA Area Office prior to going on a jobsite.

**I. Statement of Company Policy**

(Your company name here) is dedicated to the protection of its employees from on-the-job injuries. All employees of (Your company name here) have the responsibility to work safely on the job. The purpose of the plan is to supplement our existing safety and health program and to ensure that every employee who works for (Your company name here) recognizes workplace fall hazards and takes the appropriate measures to address those hazards.

This Fall Protection Plan addresses the use of conventional fall protection at a number of areas on the project, as well as identifies

specific activities that require non-conventional means of fall protection. During the construction of residential buildings under 48 feet in height, it is sometimes infeasible or it creates a greater hazard to use conventional fall protection systems at specific areas or for specific tasks. The areas or tasks may include, but are not limited to:

- a. Setting and bracing of roof trusses and rafters;
- b. Installation of floor sheathing and joists;
- c. Roof sheathing operations; and
- d. Erecting exterior walls.

In these cases, conventional fall protection systems may not be the safest choice for builders. This plan is designed to enable employers and employees to recognize the fall hazards associated with this job and to establish the safest procedures that are to be followed in order to prevent falls to lower levels or through holes and openings in walking/working surfaces.

Each employee will be trained in these procedures and will strictly adhere to them except when doing so would expose the employee to a greater hazard. If, in the employee's opinion, this is the case, the employee is to notify the competent person of their concern and have the concern addressed before proceeding.

It is the responsibility of (name of competent person) to implement this Fall Protection Plan. Continual observational safety checks of work operations and the enforcement of the safety policy and procedures shall be regularly enforced. The crew supervisor or foreman (insert name) is responsible for correcting any unsafe practices or conditions immediately.

It is the responsibility of the employer to ensure that all employees understand and

adhere to the procedures of this plan and to follow the instructions of the crew supervisor. It is also the responsibility of the employee to bring to management's attention any unsafe or hazardous conditions or practices that may cause injury to either themselves or any other employees. Any changes to the Fall Protection Plan must be approved by (name of qualified person).

#### **II. Fall Protection Systems to Be Used on This Job**

Installation of roof trusses/rafters, exterior wall erection, roof sheathing, floor sheathing and joist/truss activities will be conducted by employees who are specifically trained to do this type of work and are trained to recognize the fall hazards. The nature of such work normally exposes the employee to the fall hazard for a short period of time. This Plan details how (Your company name here) will minimize these hazards.

##### *Controlled Access Zones*

When using the Plan to implement the fall protection options available, workers must be protected through limited access to high hazard locations. Before any non-conventional fall protection systems are used as part of the work plan, a controlled access zone (CAZ) shall be clearly defined by the competent person as an area where a recognized hazard exists. The demarcation of the CAZ shall be communicated by the competent person in a recognized manner, either through signs, wires, tapes, ropes or chains.

(Your company name here) shall take the following steps to ensure that the CAZ is clearly marked or controlled by the competent person:

All access to the CAZ must be restricted to authorized entrants;

All workers who are permitted in the CAZ shall be listed in the appropriate sections of

the Plan (or be visibly identifiable by the competent person) prior to implementation;

The competent person shall ensure that all protective elements of the CAZ be implemented prior to the beginning of work.

*Installation Procedures for Roof Truss and Rafter Erection*

During the erection and bracing of roof trusses/rafters, conventional fall protection may present a greater hazard to workers. On this job, safety nets, guardrails and personal fall arrest systems will not provide adequate fall protection because the nets will cause the walls to collapse, while there are no suitable attachment or anchorage points for guardrails or personal fall arrest systems.

On this job, requiring workers to use a ladder for the entire installation process will cause a greater hazard because the worker must stand on the ladder with his back or side to the front of the ladder. While erecting the truss or rafter the worker will need both hands to maneuver the truss and therefore cannot hold onto the ladder. In addition, ladders cannot be adequately protected from movement while trusses are being maneuvered into place. Many workers may experience additional fatigue because of the increase in overhead work with heavy materials, which can also lead to a greater hazard.

Exterior scaffolds cannot be utilized on this job because the ground, after recent backfilling, cannot support the scaffolding. In most cases, the erection and dismantling of the scaffold would expose workers to a greater fall hazard than erection of the trusses/rafters.

On all walls eight feet or less, workers will install interior scaffolds along the interior wall below the location where the trusses/rafters will be erected. "Sawhorse" scaffolds constructed of 46 inch sawhorses and 2x10 planks will often allow workers to be elevated high enough to allow for the

erection of trusses and rafters without working on the top plate of the wall.

In structures that have walls higher than eight feet and where the use of scaffolds and ladders would create a greater hazard, safe working procedures will be utilized when working on the top plate and will be monitored by the crew supervisor. During all stages of truss/rafter erection the stability of the trusses/rafters will be ensured at all times.

(Your company name here) shall take the following steps to protect workers who are exposed to fall hazards while working from the top plate installing trusses/rafters:

Only the following trained workers will be allowed to work on the top plate during roof truss or rafter installation:

Workers shall have no other duties to perform during truss/rafter erection procedures;

All trusses/rafters will be adequately braced before any worker can use the truss/rafter as a support;

Workers will remain on the top plate using the previously stabilized truss/rafter as a support while other trusses/rafters are being erected;

Workers will leave the area of the secured trusses only when it is necessary to secure another truss/rafter;

The first two trusses/rafters will be set from ladders leaning on side walls at points where the walls can support the weight of the ladder; and

A worker will climb onto the interior top plate via a ladder to secure the peaks of the first two trusses/rafters being set.

The workers responsible for detaching trusses from cranes and/or securing trusses at the peaks traditionally are positioned at the peak of the trusses/rafters. There are also situations where workers securing rafters to

ridge beams will be positioned on top of the ridge beam.

(Your company name here) shall take the following steps to protect workers who are exposed to fall hazards while securing trusses/rafters at the peak of the trusses/ridge beam:

Only the following trained workers will be allowed to work at the peak during roof truss or rafter installation:

Once truss or rafter installation begins, workers not involved in that activity shall not stand or walk below or adjacent to the roof opening or exterior walls in any area where they could be struck by falling objects;

Workers shall have no other duties than securing/bracing the trusses/ridge beam;

Workers positioned at the peaks or in the webs of trusses or on top of the ridge beam shall work from a stable position, either by sitting on a "ridge seat" or other equivalent surface that provides additional stability or by positioning themselves in previously stabilized trusses/rafters and leaning into and reaching through the trusses/rafters;

Workers shall not remain on or in the peak/ridge any longer than necessary to safely complete the task.

*Roof Sheathing Operations*

Workers typically install roof sheathing after all trusses/rafters and any permanent truss bracing is in place. Roof structures are unstable until some sheathing is installed, so workers installing roof sheathing cannot be protected from fall hazards by conventional fall protection systems until it is determined that the roofing system can be used as an anchorage point. At that point, employees shall be protected by a personal fall arrest system.

Trusses/rafters are subject to collapse if a worker falls while attached to a single

truss with a belt/harness. Nets could also cause collapse, and there is no place to attach guardrails.

All workers will ensure that they have secure footing before they attempt to walk on the sheathing, including cleaning shoes/boots of mud or other slip hazards.

To minimize the time workers must be exposed to a fall hazard, materials will be staged to allow for the quickest installation of sheathing.

(Your company name here) shall take the following steps to protect workers who are exposed to fall hazards while installing roof sheathing:

Once roof sheathing installation begins, workers not involved in that activity shall not stand or walk below or adjacent to the roof opening or exterior walls in any area where they could be struck by falling objects;

The competent person shall determine the limits of this area, which shall be clearly communicated to workers prior to placement of the first piece of roof sheathing;

The competent person may order work on the roof to be suspended for brief periods as necessary to allow other workers to pass through such areas when this would not create a greater hazard;

Only qualified workers shall install roof sheathing;

The bottom row of roof sheathing may be installed by workers standing in truss webs;

After the bottom row of roof sheathing is installed, a slide guard extending the width of the roof shall be securely attached to the roof. Slide guards are to be constructed of no less than nominal 4" height capable of limiting the uncontrolled slide of workers. Workers should install the slide guard while standing in truss webs and leaning over the sheathing;

Additional rows of roof sheathing may be installed by workers positioned on previously

installed rows of sheathing. A slide guard can be used to assist workers in retaining their footing during successive sheathing operations; and

Additional slide guards shall be securely attached to the roof at intervals not to exceed 13 feet as successive rows of sheathing are installed. For roofs with pitches in excess of 9-in-12, slide guards will be installed at four-foot intervals.

When wet weather (rain, snow, or sleet) are present, roof sheathing operations shall be suspended unless safe footing can be assured for those workers installing sheathing.

When strong winds (above 40 miles per hour) are present, roof sheathing operations are to be suspended unless wind breakers are erected.

*Installation of Floor Joists and Sheathing*

During the installation of floor sheathing/joists (leading edge construction), the following steps shall be taken to protect workers:

Only the following trained workers will be allowed to install floor joists or sheathing:

Materials for the operations shall be conveniently staged to allow for easy access to workers;

The first floor joists or trusses will be rolled into position and secured either from the ground, ladders or sawhorse scaffolds;

Each successive floor joist or truss will be rolled into place and secured from a platform created from a sheet of plywood laid over the previously secured floor joists or trusses;

Except for the first row of sheathing which will be installed from ladders or the

ground, workers shall work from the established deck; and is some other related, serious incident

Any workers not assisting in the leading edge construction while leading edges still exist (e.g. cutting the decking for the installers) shall not be permitted within six feet of the leading edge under construction.

*Erection of Exterior Walls*

During the construction and erection of exterior walls, employers shall take the following steps to protect workers:

Only the following trained workers will be allowed to erect exterior walls:

A painted line six feet from the perimeter will be clearly marked prior to any wall erection activities to warn of the approaching unprotected edge;

Materials for operations shall be conveniently staged to minimize fall hazards; and

Workers constructing exterior walls shall complete as much cutting of materials and other preparation as possible away from the edge of the deck.

**III. Enforcement**

Constant awareness of and respect for fall hazards, and compliance with all safety rules are considered conditions of employment. The crew supervisor or foreman, as well as individuals in the Safety and Personnel Department, reserve the right to issue disciplinary warnings to employees, up to and including termination, for failure to follow the guidelines of this program.

**IV. Accident Investigations**

All accidents that result in injury to workers, regardless of their nature, shall be investigated and reported. It is an integral part of any safety program that documentation take place as soon as possible so that the cause and means of prevention can be identified to prevent a reoccurrence.

In the event that an employee falls or there

occurring, this plan shall be reviewed to determine if additional practices, procedures, or training need to be implemented to prevent similar types of falls or incidents from occurring.

**V. Changes to Plan**

Any changes to the plan will be approved by (name of the qualified person). This plan shall be reviewed by a qualified person as the job progresses to determine if additional practices, procedures or training needs to be implemented by the competent person to improve or provide additional fall protection. Workers shall be notified and trained, if necessary, in the new procedures. A copy of this plan and all approved changes shall be maintained at the jobsite.

**Subpart N - Cranes,  
Derricks, Hoists, Elevators,  
and Conveyors**

**§ 1926.550 - Cranes and derricks.**

**(a) General requirements.**

**(a)(1)** The employer shall comply with the manufacturer's specifications and limitations applicable to the operation of any and all cranes and derricks. Where manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a qualified engineer competent in this field and such determinations will be appropriately documented and recorded. Attachments used with cranes shall not exceed the capacity, rating, or scope recommended by the manufacturer.

**(a)(2)** Rated load capacities, and recommended operating speeds, special hazard warnings, or instruction, shall be

conspicuously posted on all equipment. Instructions or warnings shall be visible to the operator while he is at his control station.

**(a)(4)** Hand signals to crane and derrick operators shall be those prescribed by the applicable ANSI standard for the type of crane in use. An illustration of the signals shall be posted at the job site.

**(a)(5)** The employer shall designate a competent person who shall inspect all machinery and equipment prior to each use, and during use, to make sure it is in safe operating condition. Any deficiencies shall be repaired, or defective parts replaced, before continued use.

**(a)(6)** A thorough, annual inspection of the hoisting machinery shall be made by a competent person, or by a government or private agency recognized by the U.S. Department of Labor. The employer shall maintain a record of the dates and results of inspections for each hoisting machine and piece of equipment.

**(a)(7)** Wire rope shall be taken out of service when any of the following conditions exist:

**(a)(7)(i)** In running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay;

**(a)(7)(ii)** 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;

**(a)(7)(iii)** Evidence of any heat damage from any cause;

**(a)(7)(iv)** Reductions from nominal diameter of more than one-sixty-fourth inch for diameters up to and including five-sixteenths inch, one-thirty-second inch for diameters three-eighths inch to and including one-half inch, three-sixty-fourths inch for diameters nine-sixteenths inch to and including three-fourths inch,

one-sixteenth inch for diameters seven-eighths inch to 1 1/8 inches inclusive, three-thirty-seconds inch for diameters 1 1/4 to 1 1/2 inches inclusive;

(a)(7)(v) 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.

(a)(7)(vi) Wire rope safety factors shall be in accordance with American National Standards Institute B 30.5-1968 or SAE J959-1966.

(a)(8) Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or other moving parts or equipment shall be guarded if such parts are exposed to contact by employees, or otherwise create a hazard. Guarding shall meet the requirements of the American National Standards Institute B 15.1-1958 Rev., Safety Code for Mechanical Power Transmission Apparatus.

(a)(9) Accessible areas within the swing radius of the rear of the rotating superstructure of the crane, either permanently or temporarily mounted, shall be barricaded in such a manner as to prevent an employee from being struck or crushed by the crane.

(a)(10) All exhaust pipes shall be guarded or insulated in areas where contact by employees is possible in the performance of normal duties.

(a)(11) Whenever internal combustion engine powered equipment exhausts in enclosed spaces, tests shall be made and recorded to see that employees are not exposed to unsafe concentrations of toxic gases or oxygen deficient atmospheres.

(a)(12) All windows in cabs shall be of safety glass, or equivalent, that introduces no visible distortion that will interfere with the safe operation of the machine.

**Cranes, Derricks, Hoists,  
Elevators, and Conveyors****Cranes and derricks**

(a)(13)(i) Where necessary for rigging or service requirements, a ladder, or steps, shall be provided to give access to a cab roof.

(a)(13)(ii) Guardrails, handholds, and steps shall be provided on cranes for easy access to the car and cab, conforming to American National Standards Institute B30.5.

(a)(13)(iii) Platforms and walkways shall have anti-skid surfaces.

(a)(14) Fuel tank filler pipe shall be located in such a position, or protected in such manner, as to not allow spill or overflow to run onto the engine, exhaust, or electrical equipment of any machine being fueled.

(a)(14)(i) An accessible fire extinguisher of 5BC rating, or higher, shall be available at all operator stations or cabs of equipment.

(a)(14)(ii) All fuels shall be transported, stored, and handled to meet the rules of Subpart F of this part. When fuel is transported by vehicles on public highways, Department of Transportation rules contained in 49 CFR Parts 177 and 393 concerning such vehicular transportation are considered applicable.

(a)(15) Except where electrical distribution and transmission lines have been deenergized and visibly grounded at point of work or where insulating barriers, not a part of or an attachment to the equipment or machinery, have been erected to prevent physical contact with the lines, equipment or machines shall be operated proximate to power lines only in accordance with the following:

(a)(15)(i) For lines rated 50 kV. or below, minimum clearance between the lines and any part of the crane or load shall be 10 feet;

(a)(15)(ii) For lines rated over 50 kV., minimum clearance between the lines and any part of the crane or load shall be 10 feet plus 0.4 inch for each 1 kV. over 50 kV., or twice the length of the line insulator, but never less

than 10 feet;

(a)(15)(iii) In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltages less than 50 kV., and 10 feet for voltages over 50 kV., up to and including 345 kV., and 16 feet for voltages up to and including 750 kV.

(a)(15)(iv) A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means;

(a)(15)(v) Cage-type boom guards, insulating links, or proximity warning devices may be used on cranes, but the use of such devices shall not alter the requirements of any other regulation of this part even if such device is required by law or regulation;

(a)(15)(vi) Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded;

(a)(16) No modifications or additions which affect the capacity or safe operation of the equipment shall be made by the employer without the manufacturer's written approval. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals, shall be changed accordingly. In no case shall the original safety factor of the equipment be reduced.

(a)(17) The employer shall comply with Power Crane and Shovel Association Mobile Hydraulic Crane Standard No. 2.

(a)(18) Sideboom cranes mounted on wheel or crawler tractors shall meet the requirements of SAE J743a-1964.

(a)(19) All employees shall be kept clear of loads about to be lifted and of suspended loads.

**§ 1926.601**

**Motor vehicles**

(b) *Crawler, locomotive, and truck cranes.*

(b)(1) All jibs shall have positive stops to prevent their movement of more than 5 deg above the straight line of the jib and boom on conventional type crane booms. The use of cable type belly slings does not constitute compliance with this rule.

(b)(2) All crawler, truck, or locomotive cranes in use shall meet the applicable requirements for design, inspection, construction, testing, maintenance and operation as prescribed in the ANSI B30.5-1968, Safety Code for Crawler, Locomotive and Truck Cranes. However, the written, dated, and signed inspection reports and records of the monthly inspection of critical items prescribed in section 5-2.1.5 of the ANSI B30.5-1968 standard are not required. Instead, the employer shall prepare a certification record which includes the date the crane items were inspected; the signature of the person who inspected the crane items; and a serial number, or other identifier, for the crane inspected. The most recent certification record shall be maintained on file until a new one is prepared.

**Subpart O - Motor Vehicles,  
Mechanized Equipment,  
and Marine Operations**

**§ 1926.601 - Motor vehicles.**

(a) *Coverage.* Motor vehicles as covered by this part are those vehicles that operate within an off-highway jobsite, not open to public traffic. The requirements of this

**Subpart O**

**Motor Vehicles, Mechanized  
Equipment, and Marine Operations**

section do not apply to equipment for which rules are prescribed in 1926.602.

(b) *General requirements.*

(b)(1) All vehicles shall have a service brake system, an emergency brake system, and a parking brake system. These systems may use common components, and shall be maintained in operable condition.

(b)(2)(i) Whenever visibility conditions warrant additional light, all vehicles, or combinations of vehicles, in use shall be equipped with at least two headlights and two taillights in operable condition.

(b)(2)(ii) All vehicles, or combination of vehicles, shall have brake lights in operable condition regardless of light conditions.

(b)(3) All vehicles shall be equipped with an adequate audible warning device at the operator's station and in an operable condition.

(b)(4) No employer shall use any motor vehicle equipment having an obstructed view to the rear unless:

(b)(4)(i) The vehicle has a reverse signal alarm audible above the surrounding noise level or:

(b)(4)(ii) The vehicle is backed up only when an observer signals that it is safe to do so.

(b)(5) All vehicles with cabs shall be equipped with windshields and powered wipers. Cracked and broken glass shall be replaced. Vehicles operating in areas or under conditions that cause fogging or frosting of the windshields shall be equipped with operable defogging or defrosting devices.

(b)(6) All haulage vehicles, whose pay load is loaded by means of cranes, power shovels, loaders, or similar equipment, shall have a cab shield and/or canopy adequate to protect the operator from shifting or falling materials.

**Motor Vehicles, Mechanized Equipment, and Marine Operations****Material handling equipment**

(b)(7) Tools and material shall be secured to prevent movement when transported in the same compartment with employees.

(b)(8) Vehicles used to transport employees shall have seats firmly secured and adequate for the number of employees to be carried.

(b)(9) 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.

(b)(10) Trucks with dump bodies shall be 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.

(b)(11) Operating levers controlling hoisting or dumping devices on haulage bodies shall be equipped with a latch or other device which will prevent accidental starting or tripping of the mechanism.

(b)(12) Trip handles for tailgates of dump trucks shall be so arranged that, in dumping, the operator will be in the clear.

(b)(13)(i) All rubber-tired motor vehicle equipment manufactured on or after May 1, 1972, shall be equipped with fenders. All rubber-tired motor vehicle equipment manufactured before May 1, 1972, shall be equipped with fenders not later than May 1, 1973.

(b)(13)(ii) Mud flaps may be used in lieu of fenders whenever motor vehicle equipment is not designed for fenders.

(b)(14) All vehicles in use shall be checked at the beginning of each shift to assure that the following parts, equipment, and accessories are in safe operating condition and free of apparent damage that could cause failure while in use: service brakes,

including trailer brake connections; parking system (hand brake); emergency stopping system (brakes); tires; horn; steering mechanism; coupling devices; seat belts; operating controls; and safety devices. All defects shall be corrected before the vehicle is placed in service. These requirements also apply to equipment such as lights, reflectors, windshield wipers, defrosters, fire extinguishers, etc., where such equipment is necessary.

**§ 1926.602 - Material handling equipment.**

(a) *Earthmoving equipment; General.*

(a)(1) These rules apply to the following types of earthmoving equipment: scrapers, loaders, crawler or wheel tractors, bulldozers, off-highway trucks, graders, agricultural and industrial tractors, and similar equipment. The promulgation of specific rules for compactors and rubber-tired "skid-steer" equipment is reserved pending consideration of standards currently being developed.

(a)(2) *Seat belts.*

(a)(2)(i) Seat belts shall be provided on all equipment covered by this section and shall meet the requirements of the Society of Automotive Engineers, J386-1969, Seat Belts for Construction Equipment. Seat belts for agricultural and light industrial tractors shall meet the seat belt requirements of Society of Automotive Engineers J333a-1970, Operator Protection for Agricultural and Light Industrial Tractors.

(a)(2)(ii) Seat belts need not be provided for equipment which is designed only for standup operation.

(a)(2)(iii) Seat belts need not be provided for equipment which does not have roll-over protective structure (ROPS) or adequate canopy protection.

(a)(3) *Access roadways and grades.*

(a)(3)(i) No employer shall move or cause to be moved construction equipment or vehicles upon any access roadway or grade unless the access roadway or grade is constructed and maintained to accommodate safely the movement of the equipment and vehicles involved.

(a)(3)(ii) Every emergency access ramp and berm used by an employer shall be constructed to restrain and control runaway vehicles.

(a)(4) *Brakes.* All earthmoving equipment mentioned in this 1926.602(a) shall have a service braking system capable of stopping and holding the equipment fully loaded, as specified in Society of Automotive Engineers SAE-J237, Loader Dozer-1971, J236, Graders-1971, and J319b, Scrapers-1971. Brake systems for self-propelled rubber-tired off-highway equipment manufactured after January 1, 1972 shall meet the applicable minimum performance criteria set forth in the following Society of Automotive Engineers Recommended Practices:

Self-Propelled Scrapers.....SAE J319b-1971.  
Self-Propelled Graders.....SAE J236-1971.  
Trucks and Wagons.....SAE J166-1971.  
Front End Loaders and Dozers...SAE J237-1971.

(a)(5) *Fenders.* Pneumatic-tired earth-moving haulage equipment (trucks, scrapers, tractors, and trailing units) whose maximum speed exceeds 15 miles per hour, shall be equipped with fenders on all wheels to meet the requirements of Society of Automotive Engineers SAE J321a-1970, Fenders for Pneumatic-Tired Earthmoving Haulage Equipment. An employer may, of course, at any time seek to show under 1926.2, that the uncovered wheels present no hazard to personnel from flying materials.

(a)(6) *Rollover protective structures*

(ROPS). See Subpart W of this part for requirements for rollover protective structures and overhead protection.

(a)(7) Rollover protective structures for off-highway trucks. The promulgation of standards for rollover protective structures for off-highway trucks is reserved pending further study and development.

(a)(8) *Specific effective dates-brakes and fenders.*

(a)(8)(i) Equipment mentioned in paragraph (a)(4) and (5) of this section, and manufactured after January 1, 1972, which is used by any employer after that date, shall comply with the applicable rules prescribed therein concerning brakes and fenders. Equipment mentioned in paragraphs (a) (4) and (5) of this section, and manufactured before January 1, 1972, which is used by any employer after that date, shall meet the applicable rules prescribed herein not later than June 30, 1973. It should be noted that, as permitted under 1926.2, employers may request variations from the applicable brakes and fender standards required by this subpart. Employers wishing to seek variations from the applicable brakes and fenders rules may submit any requests for variations after the publication of this document in the Federal Register. Any statements intending to meet the requirements of 1926.2(b)(4), should specify how the variation would protect the safety of the employees by providing for any compensating restrictions on the operation of equipment.

(a)(8)(ii) Notwithstanding the provisions of paragraphs (a)(5) and (a)(8)(i) of this section, the requirement that fenders be installed on pneumatic-tired earthmoving haulage equipment, is suspended pending reconsideration of the requirement.

(a)(9) *Audible alarms.*

(a)(9)(i) All bidirectional machines, such as rollers, compacters, front-end loaders, bulldozers, and similar equipment, shall be equipped with a horn, distinguishable from the surrounding noise level, which shall be operated as needed when the machine is moving in either direction. The horn shall be maintained in an operative condition.

(a)(9)(ii) No employer shall permit earthmoving or compacting equipment which has an obstructed view to the rear to be used in reverse gear unless the equipment has in operation a reverse signal alarm distinguishable from the surrounding noise level or an employee signals that it is safe to do so.

(a)(10) *Scissor points.* Scissor points on all front-end loaders, which constitute a hazard to the operator during normal operation, shall be guarded.

### **§ 1926.604 - Mechanized equipment, and marine operations.**

(a) *General requirements.*

(a)(1) Employees engaged in site clearing shall be protected from hazards of irritant and toxic plants and suitably instructed in the first aid treatment available.

(a)(2) All equipment used in site clearing operations shall be equipped with rollover guards meeting the requirements of this subpart. In addition, rider-operated equipment shall be equipped with an overhead and rear canopy guard meeting the following requirements:

(a)(2)(i) The overhead covering on this canopy structure shall be of not less than 1/8-inch steel plate or 1/4-inch woven wire mesh with openings no greater than 1 inch, or equivalent.

(a)(2)(ii) The opening in the rear of the

canopy structure shall be covered with not

less than 1/4-inch woven wire mesh with openings no greater than 1 inch.

## Subpart P - Excavations

### **§ 1926.650 - Scope, application, and definitions applicable to this subpart.**

(a) *Scope and application.* This subpart applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

(b) *Definitions applicable to this subpart.*

*Accepted engineering practices* means those requirements which are compatible with standards of practice required by a registered professional engineer.

*Aluminum Hydraulic Shoring* means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (wales). Such system is designed specifically to support the sidewalls of an excavation and prevent cave-ins.

*Bell-bottom pier hole* means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

*Benching (Benching system)* means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

*Cave-in* means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient

**Scope, application, and definitions applicable to this subpart****Excavations**

quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

*Competent person* means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

*Cross braces* mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

*Excavation* means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

*Faces or sides* means the vertical or inclined earth surfaces formed as a result of excavation work.

*Failure* means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

*Hazardous atmosphere* means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

*Kickout* means the accidental release or failure of a cross brace.

*Protective system* means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

*Ramp* means an inclined walking or working surface that is used to gain access to

one point from another, and is constructed from earth or from structural materials such as steel or wood.

*Registered Professional Engineer* means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

*Sheeting* means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

*Shield (Shield system)* means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

*Shoring (Shoring system)* means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

*Sides.* See "Faces."

*Sloping (Sloping system)* means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

**Excavations****Specific excavation requirements**

*Stable rock* means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

*Structural ramp* means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

*Support system* means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

*Tabulated data* means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

*Trench (Trench excavation)* means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

*Trench box.* See "Shield."

*Trench shield.* See "Shield."

*Uprights* means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with

or interconnected to each other, are often called "sheeting."

*Wales* means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

**§ 1926.651 - Specific excavation requirements.**

(a) *Surface encumbrances.* All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

(b) *Underground installations.*

(b)(1) The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

(b)(2) Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used.

(b)(3) When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe

and acceptable means.

**(b)(4)** While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

**(c)(2)** *Means of egress from trench excavations.* A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

**(d)** *Exposure to vehicular traffic.* Employees exposed to public vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

**(e)** *Exposure to falling loads.* No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with 1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.

**(f)** *Warning system for mobile equipment.* When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

**(h)** *Protection from hazards associated with water accumulation.*

**(h)(1)** Employees shall not work in

excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

**(h)(2)** If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

**(h)(3)** If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person and compliance with paragraphs (h)(1) and (h)(2) of this section.

**(i)** *Stability of adjacent structures.*

**(i)(1)** Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

**(i)(2)** Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:

**(i)(2)(i)** A support system, such as underpinning, is provided to ensure the safety

**Excavations****Requirements for protective systems**

of employees and the stability of the structure;  
or

(i)(2)(ii) The excavation is in stable rock;  
or

(i)(2)(iii) A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or

(i)(2)(iv) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

(i)(3) Sidewalks, pavements and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

(j) *Protection of employees from loose rock or soil.*

(j)(1) Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

(j)(2) Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

(k) *Inspections.*

(k)(1) Daily inspections of excavations,

the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

(k)(2) Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

(l) Walkways shall be provided where employees or equipment are required or permitted to cross over excavations. Guardrails which comply with 1926.502(b) shall be provided where walkways are 6 feet (1.8 m) or more above lower levels.

**§ 1926.652 - Requirements for protective systems.**

(a) *Protection of employees in excavations.*

(a)(1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when:

(a)(1)(i) Excavations are made entirely in stable rock; or

(a)(1)(ii) Excavations are less than 5 feet (1.52 m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

(a)(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

(b) *Design of sloping and benching systems.* The slopes and configurations of sloping and benching systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (b)(1); or, in the alternative, paragraph (b)(2); or, in the alternative, paragraph (b)(3); or, in the alternative, paragraph (b)(4), as follows:

(b)(1) Option (1) - Allowable configurations and slopes.

(b)(1)(i) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

(b)(1)(ii) Slopes specified in paragraph (b)(1)(i) of this section, shall be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this subpart.

(b)(2) Option (2) - Determination of slopes and configurations using Appendices A and B. Maximum allowable slopes, and allowable configurations for sloping and benching systems, shall be determined in accordance with the conditions and requirements set forth in appendices A and B to this subpart.

(b)(4) Option (4) - Design by a registered professional engineer.

(b)(4)(i) Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under paragraph (b) of this section shall be approved by a registered professional engineer.

(b)(4)(ii) Designs shall be in written form and shall include at least the following:

(b)(4)(ii)(A) The magnitude of the slopes that were determined to be safe for the particular project;

(b)(4)(ii)(B) The configurations that were determined to be safe for the particular project;

(b)(4)(ii)(C) The identity of the registered professional engineer approving the design.

(b)(4)(iii) At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available to the Secretary upon request.

(c) *Design of support systems, shield systems, and other protective systems.* Designs of support systems, shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (c)(2) as follows:

(c)(2) Option (2) - Designs Using Manufacturer's Tabulated Data.

(c)(2)(i) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(c)(2)(ii) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(c)(2)(iii) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall be made available to the Secretary upon request.

(e) *Installation and removal of support-*  
(e)(1) *General.*

(e)(1)(i) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(e)(1)(ii) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(e)(1)(iii) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(e)(1)(iv) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(e)(1)(v) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(e)(1)(vi) Backfilling shall progress together with the removal of support systems from excavations.

(e)(2) *Additional requirements for support systems for trench excavations.*

(e)(2)(i) Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(e)(2)(ii) Installation of a support system

shall be closely coordinated with the excavation of trenches.

(f) *Sloping and benching systems.* Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) *Shield systems.*

(g)(1) *General.*

(g)(1)(i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(g)(1)(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(g)(1)(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(g)(1)(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(g)(2) *Additional requirement for shield systems used in trench excavations.* Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

**Subpart P Appendix A - Soil Classification**

(a) *Scope and application.*

(a)(1) *Scope.* This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains

definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

**(a)(2) Application.** This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in 1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in 1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

**(b) Definitions.** The definitions and examples given below are based on, in whole or in part, the following; American Society for Testing Materials (ASTM) Standards D653-85 and D2488; The Unified Soils Classification System; The U.S. Department of Agriculture (USDA) Textural Classification Scheme; and The National Bureau of Standards Report BSS-121.

*Cemented soil* means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

*Cohesive soil* means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt,

sandy clay, silty clay, clay and organic clay.

*Dry soil* means soil that does not exhibit visible signs of moisture content.

*Fissured* means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

*Granular soil* means gravel, sand, or silt (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

*Layered system* means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

*Moist soil* means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

*Plastic* means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

*Saturated soil* means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or shear vane.

*Soil classification system* means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

*Stable rock* means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

*Submerged soil* means soil which is underwater or is free seeping.

*Type A* means cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if: (i) The soil is fissured; or (ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or (iii) The soil has been previously disturbed; or (iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or (v) The material is subject to other factors that would require it to be classified as a less stable material.

*Type B* means: (i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or (ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam. (iii) Previously disturbed soils except those which would otherwise be classed as Type C soil. (iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or (v) Dry rock that is not stable; or (vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

*Type C* means: (i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48kPa) or less; or (ii) Granular soils including gravel, sand, and loamy sand; or (iii) Submerged soil or soil from which water is freely seeping; or (iv) Submerged rock that

is not stable, or (v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

*Unconfined compressive strength* means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

*Wet soil* means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

**(c) Requirements**

**(c)(1) Classification of soil and rock deposits.** Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

**(c)(2) Basis of classification.** The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the American Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

**(c)(3) Visual and manual analyses.** The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the

classification of the deposits.

(c)(4) *Layered systems.* In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(c)(5) *Reclassification.* If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) *Acceptable visual and manual tests.-*

(d)(1) *Visual tests.* Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(d)(1)(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(d)(1)(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(d)(1)(iii) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(d)(1)(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(d)(1)(v) Observed the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(d)(1)(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(d)(1)(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(d)(2) *Manual tests.* Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(d)(2)(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as 1/8-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of 1/8-inch thread can be held on one end without tearing, the soil is cohesive.

(d)(2)(ii) *Dry strength.* If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or

silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

**(d)(2)(iii) Thumb penetration.** The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488 - "Standard Recommended Practice for Description of Soils (Visual - Manual Procedure).") Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

**(d)(2)(iv) Other strength tests.** Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

**(d)(2)(v) Drying test.** The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately

one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

**(d)(2)(v)(A)** If the sample develops cracks as it dries, significant fissures are indicated.

**(d)(2)(v)(B)** Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as an unfissured cohesive material and the unconfined compressive strength should be determined.

**(d)(2)(v)(C)** If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

**Subpart P Appendix B - Sloping and Benching**

**(a) Scope and application.** This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in 1926.652(b)(2).

**(b) Definitions.**

*Actual slope* means the slope to which an excavation face is excavated.

*Distress* means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such

phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

*Maximum allowable slope* means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

*Short term exposure* means a period of time less than or equal to 24 hours that an excavation is open.

(c) *Requirements -*

(c)(1) *Soil classification.* Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(c)(2) *Maximum allowable slope.* The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.

(c)(3) *Actual slope.*

(c)(3)(i) The actual slope shall not be steeper than the maximum allowable slope.

(c)(3)(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least 1/2 horizontal to one vertical (1/2H:1V) less steep than the maximum allowable slope.

(c)(3)(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with 1926.651(i).

(c)(4) *Configurations.* Configurations of sloping and benching systems shall be in accordance with Figure B-1.

**TABLE B-1.**  
**Maximum Allowable Slopes**

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V) <sup>1</sup> FOR EXCAVATIONS LESS THAN 20 FEET DEEP <sup>3</sup>
STABLE ROCK	VERTICAL (90 Deg.)
TYPE A <sup>2</sup>	3/4:1 (53 Deg.)
TYPE B	1:1 (45 Deg.)
TYPE C	1 1/2:1 (34 Deg.)

<sup>1</sup> Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.

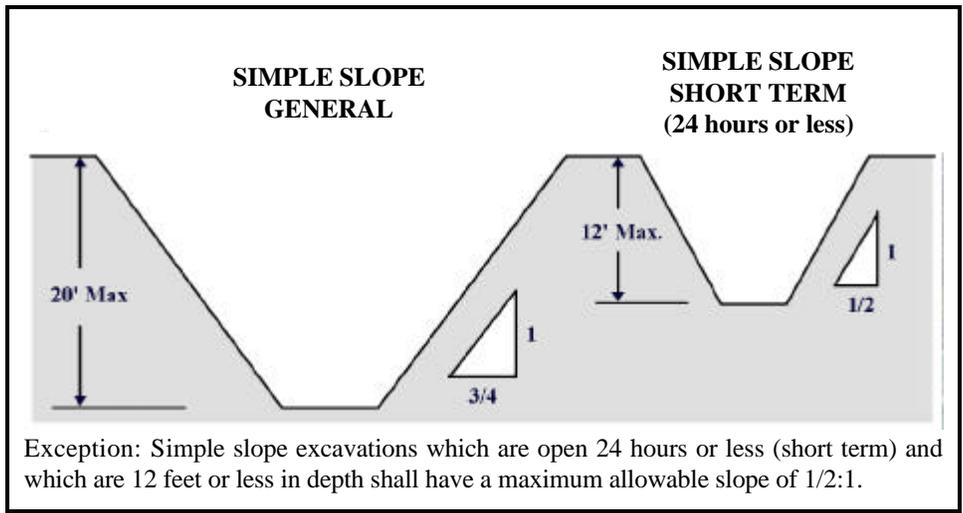
<sup>2</sup> A short-term maximum allowable slope of 1/2H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53 degrees).

<sup>3</sup> Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

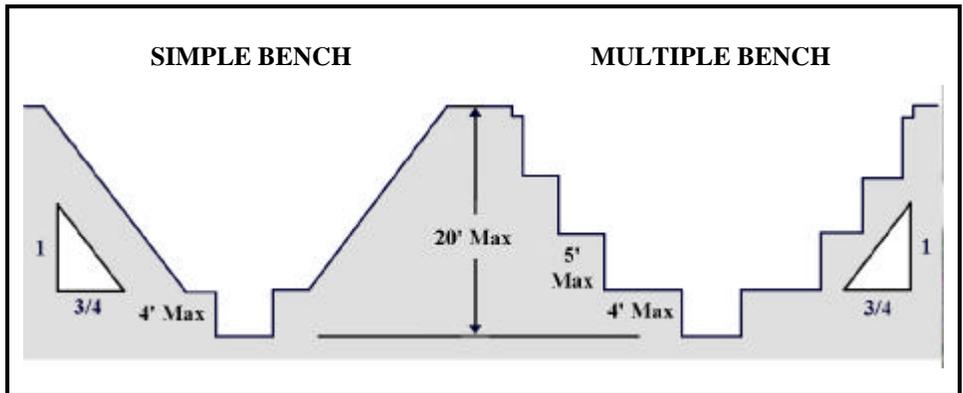
**Figure B-1 - Slope Configurations**  
 (All slopes stated below are in the horizontal to vertical ratio)

**B - 1.1 Excavations made in Type A soil.**

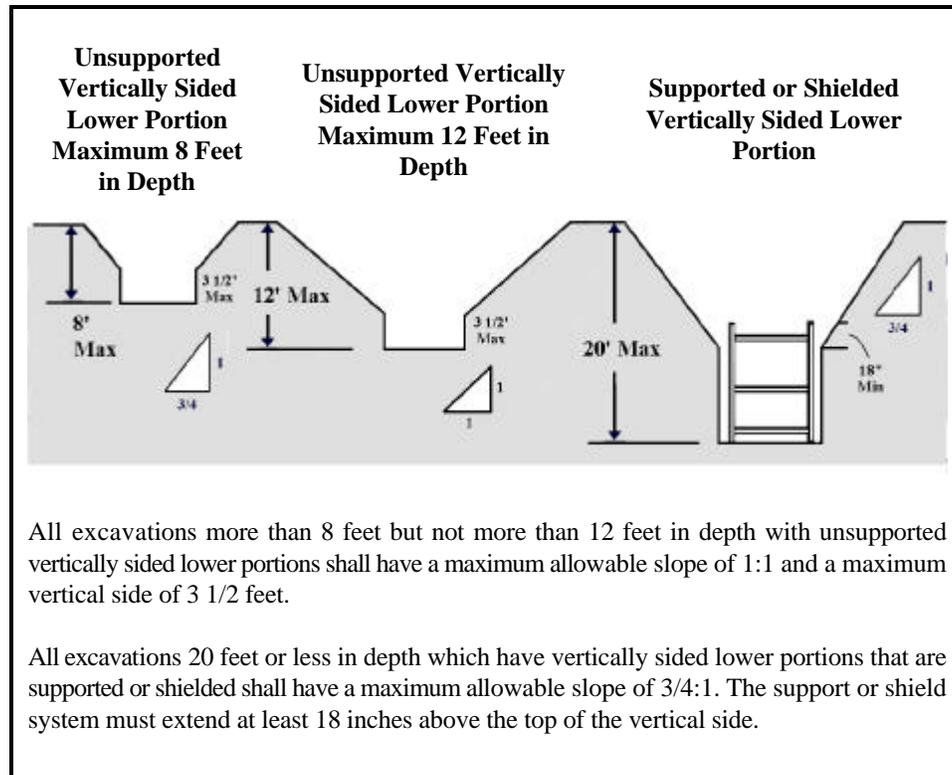
1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of 3/4:1.



2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 3/4 to 1 and maximum bench dimensions as follows:



3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3 1/2 feet.

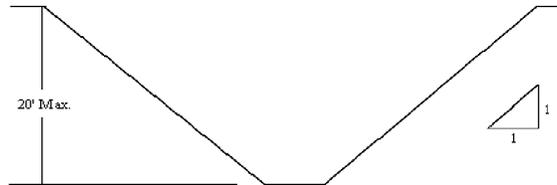


4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under 1926.652(b).

**B - 1.2 Excavations made in Type B soil.**

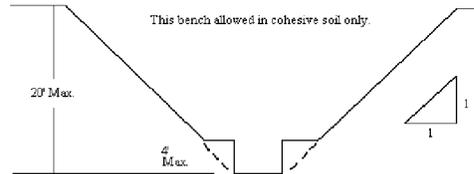
1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

**SIMPLE SLOPE**

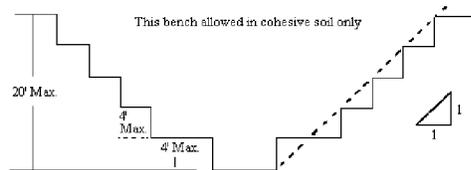


2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

**SINGLE BENCH**

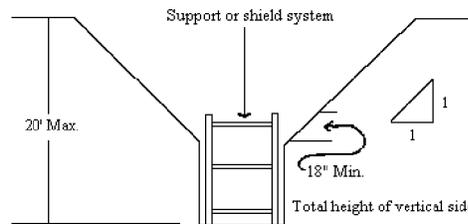


**MULTIPLE BENCH**



3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

**VERTICALLY SIDE LOWER PORTION**

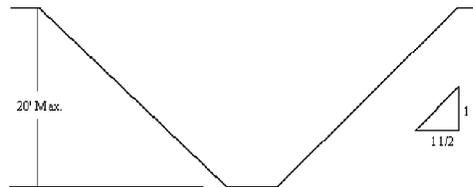


4. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b).

***B - 1.3 Excavations made in Type C soil.***

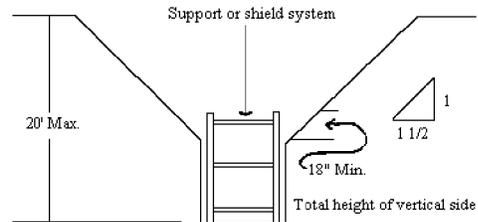
1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1 1/2:1.

**SIMPLE SLOPE**



2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1 1/2:1.

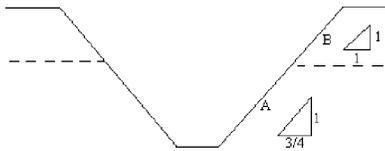
**VERTICAL SIDED LOWER PORTION**



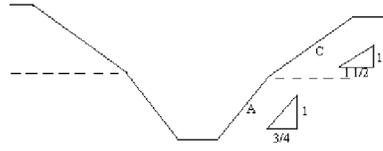
3. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b).

**B - 1.4 Excavations made in Layered Soils**

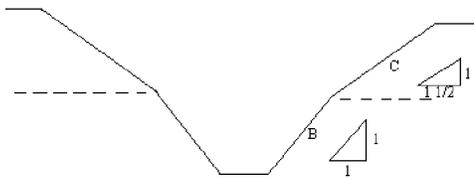
1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.



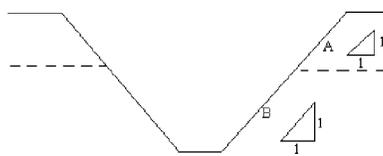
**B OVER A**



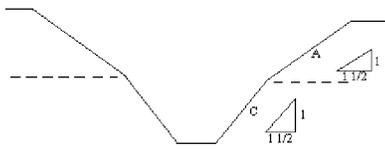
**C OVER A**



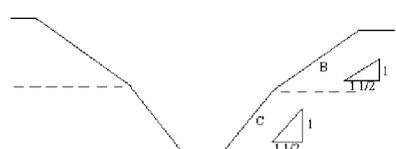
**C OVER B**



**A OVER B**



**A OVER C**



**B OVER C**

2. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b).

**Subpart Q - Concrete and Masonry Construction**

**§ 1926.700 - Scope, application, and definitions applicable to this subpart.**

(a) *Scope and application.* This subpart sets forth requirements to protect all construction employees from the hazards associated with concrete and masonry construction operations performed in workplaces covered under 29 CFR Part 1926. In addition to the requirements in Subpart Q, other relevant provisions in Parts 1910 and 1926 apply to concrete and masonry construction operations.

(b) *Definitions applicable to this subpart.* In addition to the definitions set forth in 1926.32, the following definitions apply to this subpart.

(b)(1) *Bull float* means a tool used to spread out and smooth concrete.

(b)(2) *Formwork* means the total system of support for freshly placed or partially cured concrete, including the mold or sheeting (form) that is in contact with the concrete as well as all supporting members including shores, reshores, hardware, braces, and related hardware.

(b)(4) *Limited access zone* means an area alongside a masonry wall, which is under construction, and which is clearly demarcated to limit access by employees.

(b)(5) *Precast concrete* means concrete members (such as walls, panels, slabs, columns, and beams) which have been formed, cast, and cured prior to final placement in a structure.

(b)(6) *Reshoring* means the construction operation in which shoring equipment (also called reshores or reshoring equipment) is placed, as the original forms and shores are removed, in order to support partially cured

concrete and construction loads.

(b)(7) *Shore* means a supporting member that resists a compressive force imposed by a load.

**§ 1926.701 - General requirements.**

(a) *Construction loads.* No construction loads shall be placed on a concrete structure or portion of a concrete structure unless the employer determines, based on information received from a person who is qualified in structural design, that the structure or portion of the structure is capable of supporting the loads.

(b) *Reinforcing steel.* All protruding reinforcing steel, onto and into which employees could fall, shall be guarded to eliminate the hazard of impalement.

(c) *Post-tensioning operations.*

(c)(1) No employee (except those essential to the post-tensioning operations) shall be permitted to be behind the jack during tensioning operations.

(c)(2) Signs and barriers shall be erected to limit employee access to the post-tensioning area during tensioning operations.

(d) *Riding concrete buckets.* No employee shall be permitted to ride concrete buckets.

(e) *Working under loads.*

(e)(1) No employee shall be permitted to work under concrete buckets while buckets are being elevated or lowered into position.

(e)(2) To the extent practical, elevated concrete buckets shall be routed so that no employee, or the fewest number of employees, are exposed to the hazards associated with falling concrete buckets.

(f) *Personal protective equipment.* No employee shall be permitted to apply a cement, sand, and water mixture through a pneumatic hose unless the employee is

wearing protective head and face equipment. connections.

**§ 1926.702 - Requirements for equipment and tools.**

(b) *Concrete mixers.* Concrete mixers with one cubic yard (-8 m(3)) or larger loading skips shall be equipped with the following:

(b)(1) A mechanical device to clear the skip of materials; and

(b)(2) Guardrails installed on each side of the skip.

(c) *Power concrete trowels.* Powered and rotating type concrete troweling machines that are manually guided shall be equipped with a control switch that will automatically shut off the power whenever the hands of the operator are removed from the equipment handles.

(d) *Concrete buggies.* Concrete buggy handles shall not extend beyond the wheels on either side of the buggy.

(e) *Concrete pumping systems.*

(e)(1) Concrete pumping systems using discharge pipes shall be provided with pipe supports designed for 100 percent overload.

(e)(2) Compressed air hoses used on concrete pumping system shall be provided with positive fail-safe joint connectors to prevent separation of sections when pressurized.

(f) *Concrete buckets.*

(f)(1) Concrete buckets equipped with hydraulic or pneumatic gates shall have positive safety latches or similar safety devices installed to prevent premature or accidental dumping.

(f)(2) Concrete buckets shall be designed to prevent concrete from hanging up on top and the sides.

(g) *Tremies.* Sections of tremies and similar concrete conveyances shall be secured with wire rope (or equivalent materials) in addition to the regular couplings or

**Requirements for masonry construction**

**Concrete and Masonry Construction**

(h) *Bull floats.* Bull float handles used where they might contact energized electrical conductors, shall be constructed of nonconductive material or insulated with a nonconductive sheath whose electrical and mechanical characteristics provide the equivalent protection of a handle constructed of nonconductive material.

(i) *Masonry saws.*

(i)(1) Masonry saw shall be guarded with a semicircular enclosure over the blade.

(i)(2) A method for retaining blade fragments shall be incorporated in the design of the semicircular enclosure.

(j) *Lockout/Tagout procedures.*

(j)(1) No employee shall be permitted to perform maintenance or repair activity on equipment (such as compressors mixers, screens or pumps used for concrete and masonry construction activities) where the inadvertent operation of the equipment could occur and cause injury, unless all potentially hazardous energy sources have been locked out and tagged.

(j)(2) Tags shall read Do Not Start or similar language to indicate that the equipment is not to be operated.

**§ 1926.703 - Requirements for cast-in-place concrete.**

(a) *General requirements for formwork.*

(a)(1) Formwork shall be designed, fabricated, erected, supported, braced and maintained so that it will be capable of supporting without failure all vertical and lateral loads that may reasonably be anticipated to be applied to the formwork. Formwork which is designed, fabricated, erected, supported, braced and maintained in conformance with the Appendix to this section will be deemed to meet the requirements of this paragraph.

(a)(2) Drawings or plans, including all revisions, for the jack layout, formwork (including shoring equipment), working decks, and scaffolds, shall be available at the jobsite.

(b) *Shoring and reshoring.*

(b)(1) All Shoring equipment (including equipment used in reshoring operations) shall be inspected prior to erection to determine that the equipment meets the requirements specified in the formwork drawings.

(b)(2) Shoring equipment found to be damaged such that its strength is reduced to less than that required by 1926.703(a)(1) shall not be used for shoring.

(b)(3) Erected shoring equipment shall be inspected immediately prior to, during, and immediately after concrete placement.

(b)(4) Shoring equipment that is found to be damaged or weakened after erection, such that its strength is reduced to less than that required by 1926.703(a)(1), shall be immediately reinforced.

(b)(5) The sills for shoring shall be sound, rigid, and capable of carrying the maximum intended load.

(b)(6) All base plates, shore heads, extension devices, and adjustment screws shall be in firm contact, and secured when necessary, with the foundation and the form.

(b)(7) Eccentric loads on shore heads and similar members shall be prohibited unless these members have been designed for such loading.

(d) *Reinforcing steel.*

(d)(1) Reinforcing steel for walls, piers, columns, and similar vertical structures shall be adequately supported to prevent overturning and to prevent collapse.

(d)(2) Employers shall take measures to prevent unrolled wire mesh from recoiling. Such measures may include, but are not limited to, securing each end of the roll or

turning over the roll.

(e) *Removal of formwork.*

(e)(1) Forms and shores (except those used for slabs on grade and slip forms) shall not be removed until the employer determines that the concrete has gained sufficient strength to support its weight and superimposed loads. Such determination shall be based on compliance with one of the following:

(e)(1)(i) The plans and specifications stipulate conditions for removal of forms and shores, and such conditions have been followed, or

(e)(1)(ii) The concrete has been properly tested with an appropriate ASTM standard test method designed to indicate the concrete compressive strength, and the test results indicate that the concrete has gained sufficient strength to support its weight and superimposed loads.

(e)(2) Reshoring shall not be removed until the concrete being supported has attained adequate strength to support its weight and all loads in place upon it.

**§ 1926.706 - Requirements for masonry construction.**

(a) A limited access zone shall be established whenever a masonry wall is being constructed. The limited access zone shall conform to the following.

(a)(1) The limited access zone shall be established prior to the start of construction of the wall.

(a)(2) The limited access zone shall be equal to the height of the wall to reconstructed plus four feet, and shall run the entire length of the wall.

(a)(3) The limited access zone shall be established on the side of the wall which will be unscaffolded.

(a)(4) The limited access zone shall be restricted to entry by employees actively engaged in constructing the wall. No other

**Subpart T**

**§ 1926.850**

**Demolition**

**Preparatory operations**

employees shall be permitted to enter the zone.

(a)(5) The limited access zone shall remain in place until the wall is adequately supported to prevent overturning and to prevent collapse unless the height of wall is over eight feet, in which case, the limited access zone shall remain in place until the requirements of paragraph (b) of this section have been met.

(b) All masonry walls over eight feet in height shall be adequately braced to prevent overturning and to prevent collapse unless the wall is adequately supported so that it will not overturn or collapse. The bracing shall remain in place until permanent supporting elements of the structure are in place.

**Subpart T - Demolition**

**§ 1926.850 - Preparatory operations.**

(a) Prior to permitting employees to start demolition operations, an engineering survey shall be made, by a competent person, of the structure to determine the condition of the framing, floors, and walls, and possibility of unplanned collapse of any portion of the structure. Any adjacent structure where employees may be exposed shall also be similarly checked. The employer shall have in writing evidence that such a survey has been performed.

(b) 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.

(c) All electric, gas, water, steam, sewer, and other service lines shall be shut off, capped, or otherwise controlled, outside the building line before demolition work is started. In each case, any utility company

which is involved shall be notified in advance.

(d) If it is necessary to maintain any power, water or other utilities during demolition, such lines shall be temporarily relocated, as necessary, and protected.

(e) It shall also be determined if any type of hazardous chemicals, gases, explosives, flammable materials, or similarly dangerous substances have been used in any pipes, tanks, or other equipment on the property. When the presence of any such substances is apparent or suspected, testing and purging shall be performed and the hazard eliminated before demolition is started.

(f) Where a hazard exists from fragmentation of glass, such hazards shall be removed.

(g) Where a hazard exists to employees falling through wall openings, the opening shall be protected to a height of approximately 42 inches.

(h) When debris is dropped through holes in the floor without the use of chutes, the area onto which the material is dropped shall be completely enclosed with barricades not less than 42 inches high and not less than 6 feet back from the projected edge of the opening above. Signs, warning of the hazard of falling materials, shall be posted at each level. Removal shall not be permitted in this lower area until debris handling ceases above.

(i) All floor openings, not used as material drops, shall be covered over with material substantial enough to support the weight of any load which may be imposed. Such material shall be properly secured to prevent its accidental movement.

(j) Except for the cutting of holes in floors for chutes, holes through which to drop materials, preparation of storage space, and similar necessary preparatory work, the demolition of exterior walls and floor construction shall begin at the top of the

**Rollover protective structures (ROPS) for material handling equipment**

**Rollover Protective Structures; Overhead Protection**

structure and proceed downward. Each story of exterior wall and floor construction shall be removed and dropped into the storage space before commencing the removal of exterior walls and floors in the story next below.

(k) Employee entrances to multistory structures being demolished shall be completely protected by sidewalk sheds or canopies, or both, providing protection from the face of the building for a minimum of 8 feet. All such canopies shall be at least 2 feet wider than the building entrances or openings (1 foot wider on each side thereof), and shall be capable of sustaining a load of 150 pounds per square foot.

**Subpart W - Rollover Protective Structures; Overhead Protection**

**§ 1926.1000 - Rollover protective structures (ROPS) for material handling equipment.**

(a) *Coverage.*

(a)(1) This section applies to the following types of material handling equipment: To all rubber-tired, self-propelled scrapers, rubber-tired front-end loaders, rubber-tired dozers, wheel-type agricultural and industrial tractors, crawler tractors, crawler-type loaders, and motor graders, with or without attachments, that are used in construction work. This requirement does not apply to sideboom pipe laying tractors.

(a)(2) The promulgation of specific standards for rollover protective structures for compactors and rubber-tired skid-steer equipment is reserved pending consideration of standards currently being developed.

(b) *Equipment manufactured on or after September 1, 1972.* Material handling machinery described in paragraph (a) of this section and manufactured on or after September 1, 1972, shall be equipped with rollover protective structures which meet the minimum performance standards prescribed in 1926.1001 and 1926.1002, as applicable.

(c) *Equipment manufactured before September 1, 1972.*

(c)(1) All material handling equipment described in paragraph (a) of this section and manufactured or placed in service (owned or operated by the employer) prior to September 1, 1972, shall be fitted with rollover protective structures no later than the dates listed below:

(c)(1)(i) Machines manufactured on or after January 1, 1972, shall be fitted no later than April 1, 1973.

(c)(1)(ii) Machines manufactured between July 1, 1971, and December 31, 1971, shall be fitted no later than July 1, 1973.

(c)(1)(iii) Machines manufactured between July 1, 1970, and June 30, 1971, shall be fitted no later than January 1, 1974.

(c)(1)(iv) Machines manufactured between July 1, 1969, and June 30, 1970, shall be fitted no later than July 1, 1974.

(c)(1)(v) Machines manufactured before July 1, 1969: Reserved pending further study, development, and review.

(c)(2) Rollover protective structures and supporting attachment shall meet the minimum performance criteria detailed in 1926.1001 and 1926.1002, as applicable or shall be designed, fabricated, and installed in a manner which will support, based on the ultimate strength of the metal, at least two times the weight of the prime mover applied at the point of impact.

(c)(2)(i) The design objective shall be to minimize the likelihood of a complete overturn and thereby minimize the possibility of the operator being crushed as a result of a rollover or upset.

(c)(2)(ii) The design shall provide a vertical clearance of at least 52 inches from the work deck to the ROPS at the point of ingress or egress.

(d) Remounting. ROPS removed for any reason, shall be remounted with equal quality, or better, bolts or welding as required for the original mounting.

(e) Labeling. Each ROPS shall have the following information permanently affixed to the structure:

(e)(1) Manufacturer or fabricator's name and address;

(e)(2) ROPS model number, if any;

(e)(3) Machine make, model, or series number that the structure is designed to fit.

(f) Machines meeting certain existing governmental requirements. Any machine in use, equipped with rollover protective structures, shall be deemed in compliance with this section if it meets the rollover protective structure requirements of the State of California, the U.S. Army Corps of Engineers, or the Bureau of Reclamation of the U.S. Department of the Interior in effect on April 5, 1972. The requirements in effect are:

(f)(1) State of California: Construction Safety Orders, issued by the Department of Industrial Relations pursuant to Division 5, Labor Code, 6312, State of California.

(f)(2) U.S. Army Corps of Engineers: General Safety Requirements, EM-385-1-1 (March 1967).

(f)(3) Bureau of Reclamation, U.S. Department of the Interior: Safety and Health Regulations for Construction. Part II (September 1971).

## **Subpart X - Stairways and Ladders**

### **§ 1926.1050 - Scope, application, and definitions applicable to this subpart.**

(a) *Scope and application.* This subpart applies to all stairways and ladders used in construction, alteration repair (including painting and decorating), and demolition workplaces covered under 29 CFR part 1926, and also sets forth, in specified circumstances, when ladders and stairways are required to be provided. Additional requirements for ladders used on or with scaffolds are contained in Subpart L - Scaffolds.

(b) *Definitions.*

*Cleat* means a ladder crosspiece of rectangular cross section placed on edge upon which a person may step while ascending or descending a ladder.

*Double-cleat ladder* means a ladder similar in construction to a single-cleat ladder, but with a center rail to allow simultaneous two-way traffic for employees ascending or descending.

*Equivalent* means alternative designs, materials, or methods that the employer can demonstrate will provide an equal or greater degree of safety for employees than the method or item specified in the standard.

*Extension trestle ladder* means a self-supporting portable ladder, adjustable in length consisting of a trestle ladder base and a vertically adjustable extension section, with a suitable means for locking the ladders together.

*Failure* means load refusal, breakage or separation of component parts. Load refusal is the point where the structural members lose their ability to carry the loads.

**Scope, application, and definitions  
applicable to this subpart**

**Stairways and Ladders**

*Fixed-ladder* means a ladder that cannot be readily moved or carried because it is an integral part of a building or structure. A side-step fixed ladder is a fixed ladder that requires a person getting off at the top to step to the side of the ladder side rails to reach the landing. A through fixed ladder is a fixed ladder that requires a person getting off at the top to step between the side rails of the ladder to reach the landing.

*Handrail* means a rail used to provide employees with a handhold for support.

*Individual-rung/step ladders* means ladders without a side rail or center rail support. Such ladders are made by mounting individual steps or rungs directly to the side or wall of the structure.

*Job-made ladder* means a ladder that is fabricated by employees, typically at the construction site, and is not commercially manufactured. This definition does not apply to any individual-rung/step ladders.

*Ladder stand.* A mobile fixed size self-supporting ladder consisting of a wide flat tread ladder in the form of stairs. The assembly may include handrails.

*Lower levels* means those areas to which an employee can fall from a stairway or ladder. Such areas include ground levels, floors, roofs, ramps, runways, excavations, pits, tanks, material, water, equipment, and similar surfaces. It does not include the surface from which the employee falls.

*Maximum intended load* means the total load of all employees, equipment, tools, materials, transmitted loads, and other loads anticipated to be applied to a ladder component at any one time.

*Nosing* means that portion of a tread projecting beyond the face of the riser immediately below.

*Point of access* means all areas used by employees for work related passage from one

area or level to another. Such open areas include doorways, passageways, stairway openings, studded walls, and various other permanent or temporary openings used for such travel.

*Portable ladder* means a ladder that can be readily moved or carried.

*Riser height* means 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.

*Side-step fixed ladder.* See "Fixed ladder."

*Single-cleat ladder* means a ladder consisting of a pair of side rails, connected together by cleats, rungs, or steps.

*Single-rail ladder* means a portable ladder with rungs, cleats, or steps mounted on a single rail instead of the normal two rails used on most other ladders.

*Spiral stairway* means a series of steps attached to a vertical pole and progressing upward in a winding fashion within a cylindrical space.

*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."

*Step stool (ladder type)* means a self-supporting, foldable, portable ladder, nonadjustable in length, 32 inches or less in overall size, with flat steps and without a pail shelf, designed to be climbed on the ladder top cap as well as all steps. The side rails may continue above the top cap.

*Through fixed ladder.* See "Fixed ladder."

*Tread depth* means the horizontal distance from front to back of a tread (excluding nosing, if any).

*Unprotected sides and edges* means any side or edge (except at entrances to points of access) of a stairway where there is no stairrail system or wall 36 inches (.9 m) or more in height, and any side or edge (except at entrances to points of access) of a stairway landing, or ladder platform where there is no wall or guardrail system 39 inches (1 m) or more in height.

**§ 1926.1051 - General requirements.**

(a) A stairway or ladder shall be provided at all personnel points of access where there is a break in elevation of 19 inches (48 cm) or more, and no ramp, runway, sloped embankment, or personnel hoist is provided.

(a)(1) Employees shall not use any spiral stairways that will not be a permanent part of the structure on which construction work is being performed.

(a)(2) A double-cleated ladder or two or more separate ladders shall be provided when ladders are the only mean of access or exit from a working area for 25 or more employees, or when a ladder is to serve simultaneous two-way traffic.

(a)(3) When a building or structure has only one point of access between levels, that point of access shall be kept clear to permit free passage of employees. When work must be performed or equipment must be used such that free passage at that point of access is restricted, a second point of access shall be provided and used.

(a)(4) When a building or structure has two or more points of access between levels, at least one point of access shall be kept clear to permit free passage of employees.

(b) Employers shall provide and install all stairway and ladder fall protection systems required by this subpart and shall comply with all other pertinent requirements of this

subpart before employees begin the work that necessitates the installation and use of stairways, ladders, and their respective fall protection systems.

**§ 1926.1052 - Stairways.**

(a) *General.* The following requirements apply to all stairways as indicated:

(a)(1) Stairways that will not be a permanent part of the structure on which construction work is being performed shall have landings of not less than 30 inches (76 cm) in the direction of travel and extend at least 22 inches (56 cm) in width at every 12 feet (3.7 m) or less of vertical rise.

(a)(2) Stairs shall be installed between 30 deg. and 50 deg. from horizontal.

(a)(3) Riser height and tread depth shall be uniform within each 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.

(a)(4) Where doors or gates open directly on 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 20 inches (51 cm).

(a)(5) Metal pan landings and metal pan treads, when used, shall be secured in place before filling with concrete or other material.

(a)(6) All parts of stairways shall be free of hazardous projections, such as protruding nails.

(a)(7) Slippery conditions on stairways shall be eliminated before the stairways are used to reach other levels.

(b) *Temporary service.* The following requirements apply to all stairways as indicated:

(b)(1) 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.

(b)(2) Except during stairway construction, foot traffic is prohibited on skeleton metal stairs where permanent treads and/or landings are to be installed at a later date, unless the stairs are fitted with secured temporary treads and landings long enough to cover the entire tread and/or landing area.

(b)(3) 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.

(c) *Stairrails and handrails.* The following requirements apply to all stairways as indicated:

(c)(1) Stairways having four or more risers or rising more than 30 inches (76 cm), whichever is less, shall be equipped with:

(c)(1)(i) At least one handrail; and

(c)(1)(ii) One stairrail system along each unprotected side or edge.

Note: When the top edge of a stairrail system also serves as a handrail, paragraph (c)(7) of this section applies.

(c)(2) 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 6 inches (15 cm).

(c)(3) The height of stairrails shall be as follows:

(c)(3)(i) Stairrails installed after March 15, 1991, shall be not less than 36 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.

(c)(3)(ii) Stairrails installed before March 15, 1991, shall be not less than 30 inches (76 cm) nor more than 34 inches (86 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.

(c)(4) Midrails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members, shall be provided between the top rail of the stairrail system and the stairway steps.

(c)(4)(i) Midrails, when used, shall be located at a height midway between the top edge of the stairrail system and the stairway steps.

(c)(4)(ii) Screens or mesh, when used, shall extend from the top rail to the stairway step, and along the entire opening between top rail supports.

(c)(4)(iii) When intermediate vertical members, such as balusters, are used between posts, they shall be not more than 19 inches (48 cm) apart.

(c)(4)(iv) Other structural members, when used, shall be installed such that there are no openings in the stairrail system that are more than 19 inches (48 cm) wide.

(c)(5) Handrails and the top rails of stairrail systems shall be capable of withstanding, without failure, a force of at least 200 pounds (890 n) applied within 2 inches (5 cm) of the top edge, in any downward or outward direction, at any point along the top edge.

(c)(6) The height of handrails shall be not more than 37 inches (94 cm) nor less than 30 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.

(c)(7) When the top edge of a stairrail system also serves as a handrail, the height of the top edge shall be not more than 37 inches

(94 cm) nor less than 36 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.

(c)(8) Stairrail systems and handrails shall be so surfaced as to prevent injury to employees from punctures or lacerations, and to prevent snagging of clothing.

(c)(9) Handrails shall provide an adequate handhold for employees grasping them to avoid falling.

(c)(10) The ends of stairrail systems and handrails shall be constructed so as not to constitute a projection hazard.

(c)(11) Handrails that will not be a permanent part of the structure being built shall have a minimum clearance of 3 inches (8 cm) between the handrail and walls, stairrail systems, and other objects.

(c)(12) Unprotected sides and edges of stairway landings shall be provided with guardrail systems. Guardrail system criteria are contained in subpart M of this part.

#### **§ 1926.1053 - Ladders.**

(a) *General.* The following requirements apply to all ladders as indicated, including job-made ladders.

(a)(1) Ladders shall be capable of supporting the following loads without failure:

(a)(1)(i) Each self-supporting portable ladder: At least four times the maximum intended load, except that each extra-heavy-duty type 1A metal or plastic ladder shall sustain at least 3.3 time the maximum intended load. The ability of a ladder to sustain the loads indicated in this paragraph shall be determined by applying or transmitting the requisite load to the ladder in a downward vertical direction. Ladders built and tested in conformance with the applicable provisions of appendix A of this subpart will

be deemed to meet this requirement.

(a)(1)(ii) Each portable ladder that is not self-supporting: At least four times the maximum intended load, except that each extra-heavy-duty type 1A metal or plastic ladders shall sustain at least 3.3 times the maximum intended load. The ability of a ladder to sustain the loads indicated in this paragraph shall be determined by applying or transmitting the requisite load to the ladder in a downward vertical direction when the ladder is placed at an angle of 75 1/2 degrees from the horizontal. Ladders built and tested in conformance with the applicable provisions of appendix A will be deemed to meet this requirement.

(a)(1)(iii) Each Fixed ladder: At least two loads of 250 pounds (114 kg) each, concentrated between any two consecutive attachments (the number and position of additional concentrated loads of 250 pounds (114 kg) each, determined from anticipated usage of the ladder, shall also be included), plus anticipated loads caused by ice buildup, winds, rigging, and impact loads resulting from the use of ladder safety devices. Each step or rung shall be capable of supporting a single concentrated load of a least 250 pounds (114 kg) applied in the middle of the step or rung. Ladders built in conformance with the applicable provisions of appendix A will be deemed to meet this requirement.

(a)(2) Ladder rungs, cleats, and steps shall be parallel, level, and uniformly spaced when the ladder is in position for use.

(a)(3)(i) Rungs, cleats, and steps of portable ladders (except as provided below) and fixed ladders (including individual-rung/step ladders) shall be spaced not less than 10 inches (25 cm) apart, nor more than 14 inches (36 cm) apart, as measured between center lines of the rungs, cleats and steps.

(a)(3)(ii) Rungs, cleats, and steps of step

stools shall be not less than 8 inches (20 cm) apart, nor more than 12 inches (31 cm) apart, as measured between center lines of the rungs, cleats, and steps.

(a)(3)(iii) Rungs, cleats, and steps of the base section of extension trestle ladders shall be not less than 8 inches (20 cm) nor more than 18 inches (46 cm) apart, as measured between center lines of the rungs, cleats, and steps. The rung spacing on the extension section of the extension trestle ladder shall be not less than 6 inches (15 cm) nor more than 12 inches (31 cm), as measured between center lines of the rungs, cleats, and steps.

(a)(4)(i) The minimum clear distance between the sides of individual-rung/step ladders and the minimum clear distance between the side rails of other fixed ladders shall be 16 inches (41 cm).

(a)(4)(ii) The minimum clear distance between side rails for all portable ladders shall be 11 1/2 inches (29 cm).

(a)(5) The rungs of individual-rung/step ladders shall be shaped such that employees' feet cannot slide off the end of the rungs.

(a)(6)(i) The rungs and steps of fixed metal ladders manufactured after March 15, 1991, shall be corrugated, knurled, dimpled, coated with skid-resistant material, or otherwise treated to minimize slipping.

(a)(6)(ii) The rungs and steps of portable metal ladders shall be corrugated, knurled, dimpled, coated with skid-resistant material, or otherwise treated to minimize slipping.

(a)(7) Ladders shall not be tied or fastened together to provide longer sections unless they are specifically designed for such use.

(a)(8) A metal spreader or locking device shall be provided on each stepladder to hold the front and back sections in an open position when the ladder is being used.

(a)(9) When splicing is required to obtain a given length of side rail, the resulting side

rail must be at least equivalent in strength to a one-piece side rail made of the same material.

(a)(10) Except when portable ladders are used to gain access to fixed ladders (such as

those on utility towers, billboards, and other structures where the bottom of the fixed ladder is elevated to limit access), when two or more separate ladders are used to reach an elevated work area, the ladders shall be offset with a platform or landing between the ladders. (The requirements to have guardrail systems with toeboards for falling object and overhead protection on platforms and landings are set forth in subpart M of this part.)

**(a)(11)** Ladder components shall be surfaced so as to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing.

**(a)(12)** Wood ladders shall not be coated with any opaque covering, except for identification or warning labels which may be placed on one face only of a side rail.

**(a)(13)** The minimum perpendicular clearance between fixed ladder rungs, cleats, and steps, and any obstruction behind the ladder shall be 7 inches (18 cm), except in the case of an elevator pit ladder for which a minimum perpendicular clearance of 4 1/2 inches (11 cm) is required.

**(a)(14)** The minimum perpendicular clearance between the center line of fixed ladder rungs, cleats, and steps, and any obstruction on the climbing side of the ladder shall be 30 inches (76 cm), except as provided in paragraph (a)(15) of this section.

**(a)(15)** When unavoidable obstructions are encountered, the minimum perpendicular clearance between the centerline of fixed ladder rungs, cleats, and steps, and the obstruction on the climbing side of the ladder may be reduced to 24 inches (61 cm), provided that a deflection device is installed to guide employees around the obstruction.

**(b)** *Use.* The following requirements apply to the use of all ladders, including job-made ladders, except as otherwise

indicated:

**(b)(1)** When portable ladders are used for access to an upper landing surface, the ladder side rails shall extend at least 3 feet (.9 m) above the upper landing surface to which the ladder is used to gain access; or, when such an extension is not possible because of the ladder's length, then the ladder shall be secured at its top to a rigid support that will not deflect, and a grasping device, such as a grabrail, shall be provided to assist employees in mounting and dismounting the ladder. In no case shall the extension be such that ladder deflection under a load would, by itself, cause the ladder to slip off its support.

**(b)(2)** Ladders shall be maintained free of oil, grease, and other slipping hazards.

**(b)(3)** Ladders shall not be loaded beyond the maximum intended load for which they were built, nor beyond their manufacturer's rated capacity.

**(b)(4)** Ladders shall be used only for the purpose for which they were designed.

**(b)(5)(i)** Non-self-supporting ladders shall be used at an angle such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder (the distance along the ladder between the foot and the top support).

**(b)(5)(ii)** Wood job-made ladders with spliced side rails shall be used at an angle such that the horizontal distance is one-eighth the working length of the ladder.

**(b)(6)** Ladders shall be used only on stable and level surfaces unless secured to prevent accidental displacement.

**(b)(7)** Ladders shall not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental displacement. Slip-resistant feet shall not be used as a substitute for care in placing, lashing, or holding a ladder that is used upon

slippery surfaces including, but not limited to, flat metal or concrete surfaces that are constructed so they cannot be prevented from becoming slippery.

**(b)(8)** Ladders placed in any location where they can be displaced by workplace activities or traffic, such as in passageways, doorways, or driveways, shall be secured to prevent accidental displacement, or a barricade shall be used to keep the activities or traffic away from the ladder.

**(b)(9)** The area around the top and bottom of ladders shall be kept clear.

**(b)(10)** The top of a non-self-supporting ladder shall be placed with the two rails supported equally unless it is equipped with a single support attachment.

**(b)(11)** Ladders shall not be moved, shifted, or extended while occupied.

**(b)(12)** Ladders shall have nonconductive siderails if they are used where the employee or the ladder could contact exposed energized electrical equipment, except as provided in 1926.951(c)(1) of this part.

**(b)(13)** The top or top step of a stepladder shall not be used as a step.

**(b)(14)** Cross-bracing on the rear section of stepladders shall not be used for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections.

**(b)(15)** Ladders shall be inspected by a competent person for visible defects on a periodic basis and after any occurrence that could affect their safe use.

**(b)(16)** Portable ladders with structural defects, such as, but not limited to, broken or missing rungs, cleats, or steps, broken or split rails, corroded components, or other faulty or defective components, shall either be immediately marked in a manner that readily identifies them as defective, or be tagged with "Do Not Use" or similar language, and shall

be withdrawn from service until repaired.

**§ 1926.1060**

**Training Requirements**

(b)(18) Ladder repairs shall restore the ladder to a condition meeting its original design criteria, before the ladder is returned to use.

(b)(19) Single-rail ladders shall not be used.

(b)(20) When ascending or descending a ladder, the user shall face the ladder.

(b)(21) Each employee shall use at least one hand to grasp the ladder when progressing up and/or down the ladder.

(b)(22) An employee shall not carry any object or load that could cause the employee to lose balance and fall.

**§ 1926.1060 - Training requirements.**

(a) The employer shall provide a training program for each employee using ladders and stairways, as necessary. The program shall enable each employee to recognize hazards related to ladders and stairways, and shall train each employee in the procedures to be followed to minimize these hazards.

(a)(1) The employer shall ensure that each employee has been trained by a competent person in the following areas, as applicable:

(a)(1)(i) The nature of fall hazards in the work area;

(a)(1)(ii) The correct procedures for erecting, maintaining, and disassembling the fall protection systems to be used;

(a)(1)(iii) The proper construction, use, placement, and care in handling of all stairways and ladders;

**Subpart Z**

**Toxic and Hazardous Substances**

(a)(1)(iv) The maximum intended load-carrying capacities of ladders and

(a)(1)(v) The standards contained in this subpart.

(b) Retaining shall be provided for each employee as necessary so that the employee maintains the understanding and knowledge acquired through compliance with this section.

**Subpart Z - Toxic and Hazardous Substances**

**§ 1926.1101 - Asbestos.**

Note: The requirement applicable to residential construction activities involving exposure to Asbestos are found in the full text of the standard, 29 CFR 1926.1101 (Asbestos).

**§ 1926.1148 - Formaldehyde.**

Note: The requirements applicable to construction work under this section are identical to those set forth at 1910.1048 of this chapter.

**§ 1926.1152 - Methylene chloride.**

Note: The requirements applicable to construction employment under this section are identical to those set forth at 29 CFR 1910.1052.