

gress shall be of substantial, reliable construction and shall be built or installed in a workmanlike manner.

(2) Means of egress shall be continuously maintained free of all obstructions or impediments to full instant use in the case of fire or other emergency.

(3) Any device or alarm installed to restrict the improper use of an exit shall be so designed and installed that it cannot, even in cases of failure, impede or prevent emergency use of such exit.

(l) **Furnishings and decorations.** (1) No furnishings, decorations, or other objects shall be so placed as to obstruct exits, access thereto, egress therefrom, or visibility thereof.

(2) No furnishings or decorations of an explosive or highly flammable character shall be used in any occupancy.

(m) **Automatic sprinkler systems.** All automatic sprinkler systems shall be continuously maintained in reliable operating condition at all times, and such periodic inspections and tests shall be made as are necessary to assure proper maintenance.

(n) **Alarm and fire protection systems.** (1) Systems shall be under the supervision of a responsible person who shall cause proper tests to be made at weekly intervals and have general charge of all alterations and additions.

(2) Fire alarm signaling equipment shall be restored to service as promptly as possible after each test or alarm, and shall be kept in normal condition for operation. Equipment requiring rewinding or replenishing shall be reworked or replenished as promptly as possible after each test or alarm.

(o) **Fire retardant paints.** Fire retardant paints or solutions shall be renewed at such intervals as necessary to maintain the necessary flame retardant properties.

(p) (Reserved)

(q) **Exit marking.** (1) 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.

(2) Any door, passage, or stairway which is neither an exit nor a way of exit access, and which is so located or arranged as to be likely to be mistaken for an exit, shall be identified by a sign reading "Not an Exit" or similar designation, or shall be identified by a sign indicating its actual character, such as "To Basement," "Storeroom," "Linen Closet," or the like.

(3) Every required sign designating an exit or way of exit access shall be so located and of such size, color, and design as to be readily visible. No decorations, furnishings, or equipment which impair visibility of an exit sign shall be permitted, nor shall there be any brightly illuminated sign (for other than exit purposes), display, or object in or near the line of vision to the required exit signs of such a character as to so detract attention from the exit sign that it may not be noticed.

(4) Every exit sign shall be distinctive in color and shall provide contrast with

decorations, interior finish, or other signs.

(5) A sign reading "Exit," or similar designation, with an arrow indicating the direction, shall be placed in every location where the direction of travel to reach the nearest exit is not immediately apparent.

(6) Every exit sign shall be suitably illuminated by a reliable light source giving a value of not less than 5-foot candles on the illuminated surface. Artificial lights giving illumination to exit signs other than the internally illuminated types shall have screens, discs, or lenses of not less than 25 square inches area made of translucent material to show red or other specified designating color on the side of the approach.

(7) Each internally illuminated exit sign shall be provided in all occupancies where reduction of normal illumination is permitted.

(8) Every exit sign shall have the word "Exit" in plainly legible letters not less than 6 inches high, with the principal strokes of letters not less than three-fourths-inch wide.

§ 1910.38 Specific means of egress requirements by occupancy. (Reserved)

§ 1910.39 Sources of standards.

The entire subpart is promulgated from NFPA 101-1970, Life Safety Code.

§ 1910.40 Standards organizations.

Specific standards of the following organization have been referenced in this subpart. Copies of the standards may be obtained from the issuing organization:

National Fire Protection Association, 60 Batterymarch Street, Boston, MA 02110.

Subpart F—Powered Platforms, Manlifts, and Vehicle-Mounted Work Platforms

§ 1910.66 Power platforms for exterior building maintenance.

(a) **Definitions applicable to this section.**—(1) **Angulated roping.** 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 during its vertical travel.

(2) **ANSI.** American National Standards Institute.

(3) **Babbitted fastenings.** The method of providing wire rope attachments in which the ends of the wire strands are bent back and are held in a tapered socket by means of poured molten babbitt metal.

(4) **Brake-disc type.** A brake in which the holding effect is obtained by frictional resistance between one or more faces of discs keyed to the rotating member to be held and fixed discs keyed to the stationary or holding member (pressure between the discs being applied axially).

(5) **Brake-relay energizing band type.** An essentially unidirectional brake in

which the holding effect is obtained by the snubbing action of a flexible band wrapped about a cylindrical wheel or drum affixed to the rotating member to be held, the connections and linkages being so arranged that the motion of the brake wheel or drum will act to increase the tension or holding force of the band.

(6) **Brake-shoe type.** A brake in which the holding effect is obtained by applying the direct pressure of two or more segmental friction elements held to a stationary member against a cylindrical wheel or drum affixed to the rotating member to be held.

(7) **Building face rollers.** A specialized form of guide roller designed to contact a portion of the outer face or wall structure of the building, and to assist in stabilizing the operators' platform during vertical travel.

(8) **Continuous pressure.** Operation by means of buttons or switches, any one of which may be used to control the movement of the working platform or roof car, only as long as the button or switch is manually maintained in the actuating position.

(9) **Control.** A system governing starting, stopping, direction, acceleration, speed, and retardation of moving members.

(10) **Controller.** A device or group of devices, usually contained in a single enclosure, which serves to control in some predetermined manner the apparatus to which it is connected.

(11) **Electrical ground.** A conducting connection between an electrical circuit or equipment and the earth, or some conducting body which serves in place of the earth.

(12) **Guide roller.** A rotating, bearing-mounted, generally cylindrical member, operating separately or as part of a guide shoe assembly, attached to the platform, and providing rolling contact with building guideways, or other building contact members.

(13) **Guide shoe.** An assembly of rollers, slide members, or the equivalent, attached as a unit to the operators' platform, and designed to engage with the building members provided for the vertical guidance of the operators' platform.

(14) **Interlock.** A device actuated by the operation of some other device with which it is directly associated, to govern succeeding operations of the same or allied devices.

(15) **Operating device.** A pushbutton, lever, or other manual device used to actuate a control.

(16) **Powered platform.** Equipment to provide access to the exterior of a building for maintenance, consisting of a suspended power-operated working platform, a roof car, or other suspension means, and the requisite operating and control devices.

(17) **Rated load.** The combined weight of employees, tools, equipment, and other material which the working platform is designed and installed to lift.

(18) **Relay, direction.** An electrically energized contactor responsive to an initiating control circuit, which in turn

Registered

WEDNESDAY, OCTOBER 18, 1972

WASHINGTON, D.C.

Volume 37, Number 202

PART II



DEPARTMENT OF LABOR

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

OCCUPATIONAL SAFETY AND HEALTH STANDARDS

Title 29—LABOR

Chapter XVII—Occupational Safety and Health Administration, Department of Labor

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

Pursuant to authority in sections 6 and 8(g) of the Williams-Steiger Occupational Safety and Health Act of 1970 (84 Stat. 1593, 1600; 29 U.S.C. 655, 657) and in Secretary of Labor's Order No. 12-71 (36 F.R. 8754), Part 1910 of Title 29 of the Code of Federal Regulations is hereby revised to read as set forth below. This revision includes amendments through Sept. 22, 1972. The purpose of the revision is (1) to publish fully in one place the present occupational safety and health standards contained therein in order to reflect many changes made during the current year and thereby to improve their usefulness and facilitate their enforcement; (2) to correct a number of typographical and clerical errors in the text of the standards; and (3) to publish indexes with the standards, which are intended to permit quicker access to pertinent standards.

Since this revision does not make any substantive changes in the standards, it is not necessary to provide notice of proposed rulemaking, opportunity for public participation therein, nor any delay in effective date. For the same reason, good cause is found for not following the regular procedure for rulemaking provided in 5 U.S.C. 553 and for making this revision effective immediately.

Signed at Washington, D.C. this 4 day of October 1972.

G. C. GUENTHER,
Assistant Secretary of Labor.

- Sec.
- 1910.1 Purpose and scope.
- 1910.2 Definitions.
- 1910.3 Petitions for the issuance, amendment, or repeal of a standard.
- 1910.4 Amendments to this part.
- 1910.5 Applicability of standards.
- 1910.6 Incorporation by reference.
- Subpart A—Adoption and Extension of Established Federal Standards
- 1910.11 Scope and purpose.
- 1910.12 Construction work.
- 1910.13 Ship repairing.
- 1910.14 Shipbuilding.
- 1910.15 Shipbreaking.
- 1910.16 Longshoring.
- 1910.17 Effective dates.
- 1910.18 Changes in established Federal standards.
- 1910.19 Asbestos dust.
- Subpart C—[Reserved]
- Subpart D—Walking—Working Surfaces
- 1910.21 Definitions.
- 1910.22 General requirements.
- 1910.23 Guarding floor and wall openings and holes.
- 1910.24 Fixed industrial stairs.
- 1910.25 Portable wood ladders.
- 1910.26 Portable metal ladders.

RULES AND REGULATIONS

- Sec.
- 1910.27 Fixed ladders.
- 1910.28 Safety requirements for scaffolding.
- 1910.29 Manually propelled mobile ladder stands and scaffolds (towers).
- 1910.30 Other working surfaces.
- 1910.31 Sources of standards.
- 1910.32 Standards organizations.
- Subpart E—Means of Egress
- 1910.35 Definitions.
- 1910.36 General requirements.
- 1910.37 Means of egress, general.
- 1910.38 Specific means of egress requirements by occupancy. [Reserved]
- 1910.39 Sources of standards.
- 1910.40 Standards organizations.
- Subpart F—Powered Platforms, Manlifts and Vehicle-Mounted Work Platforms
- 1910.66 Power platforms for exterior building maintenance.
- 1910.67 Vehicle-mounted elevating and rotating work platforms.
- 1910.68 Manlifts.
- 1910.69 Sources of standards.
- 1910.70 Standards organizations.
- Subpart G—Occupational Health and Environmental Control
- 1910.93 Air contaminants.
- 1910.93a Asbestos.
- 1910.94 Ventilation.
- 1910.95 Occupational noise exposure.
- 1910.96 Ionizing radiation.
- 1910.97 Nonionizing radiation.
- 1910.98 Effective dates.
- 1910.99 Sources of standards.
- 1910.100 Standards organizations.
- Subpart H—Hazardous Materials
- 1910.101 Compressed gases (general requirements).
- 1910.102 Acetylene.
- 1910.103 Hydrogen.
- 1910.104 Oxygen.
- 1910.105 Nitrous oxide.
- 1910.106 Flammable and combustible liquids.
- 1910.107 Spray finishing using flammable and combustible materials.
- 1910.108 Dip tanks containing flammable or combustible liquids.
- 1910.109 Explosives and blasting agents.
- 1910.110 Storage and handling of liquified petroleum gases.
- 1910.111 Storage and handling of anhydrous ammonia.
- 1910.112 [Reserved]
- 1910.113 [Reserved]
- 1910.114 Effective dates.
- 1910.115 Sources of standards.
- 1910.116 Standards organizations.
- Subpart I—Personal Protective Equipment
- 1910.132 General requirements.
- 1910.133 Eye and face protection.
- 1910.134 Respiratory protection.
- 1910.135 Occupational head protection.
- 1910.136 Occupational foot protection.
- 1910.137 Electrical protective devices.
- 1910.138 Effective dates.
- 1910.139 Sources of standards.
- 1910.140 Standards organizations.
- Subpart J—General Environmental Controls
- 1910.141 Sanitation.
- 1910.142 Temporary labor camps.
- 1910.143 Non-water carriage disposal systems.
- 1910.144 Safety color code for marking physical hazards.
- 1910.145 Specifications for accident prevention signs and tags.
- 1910.146 [Reserved]
- 1910.147 Sources of standards.

- Sec.
- 1910.148 Standards organizations.
- 1910.149 Effective dates.
- Subpart K—Medical and First Aid
- 1910.151 Medical services and first aid.
- 1910.152 [Reserved]
- 1910.153 Sources of standards.
- Subpart L—Fire Protection
- 1910.156 Definitions applicable to this subpart.
- PORTABLE FIRE SUPPRESSION EQUIPMENT
- 1910.157 Portable fire extinguishers.
- 1910.158 Standpipes and hose systems.
- FIXED FIRE SUPPRESSION EQUIPMENT
- 1910.159 Automatic sprinkler systems.
- 1910.160 Fixed dry chemical extinguishing systems.
- 1910.161 Carbon dioxide extinguishing systems.
- 1910.162 Other special fixed extinguishing systems. [Reserved]
- OTHER FIRE PROTECTION SYSTEMS
- 1910.163 Local fire alarm signaling systems.
- 1910.164 Fire brigades. [Reserved]
- 1910.165 Effective dates.
- 1910.166 Sources of standards.
- 1910.167 Standards organizations.
- Subpart M—Compressed Gas and Compressed Air Equipment
- 1910.168 Inspection of compressed gas cylinders.
- 1910.169 Safety relief devices for compressed gas cylinders.
- 1910.170 Safety relief devices for cargo and portable tanks storing compressed gases.
- 1910.171 Air receivers.
- 1910.172 Sources of standards.
- 1910.173 Standards organizations.
- Subpart N—Materials Handling and Storage
- 1910.174 Handling materials—general.
- 1910.177 Indoor general storage.
- 1910.178 Powered industrial trucks.
- 1910.179 Overhead and gantry cranes.
- 1910.180 Crawler, locomotive, and truck cranes.
- 1910.181 Derricks.
- 1910.182 Effective dates.
- 1910.183 Sources of standards.
- 1910.184 Standards organizations.
- Subpart O—Machinery and Machine Guarding
- 1910.211 Definitions.
- 1910.212 General requirements for all machines.
- 1910.213 Woodworking machinery requirements.
- 1910.214 Cooperage machinery.
- 1910.215 Abrasive wheel machinery.
- 1910.216 Mills and calendars in the rubber and plastics industries.
- 1910.217 Mechanical power presses.
- 1910.218 Porging machines.
- 1910.219 Mechanical power-transmission apparatus.
- 1910.220 Effective dates.
- 1910.221 Sources of standards.
- 1910.222 Standards organizations.
- Subpart P—Hand and Portable Powered Tools and Other Hand-Held Equipment
- 1910.241 Definitions.
- 1910.242 Hand and portable powered tools and equipment, general.
- 1910.243 Guarding of portable powered tools.
- 1910.244 Other portable tools and equipment.
- 1910.245 Effective dates.
- 1910.246 Sources of standards.
- 1910.247 Standards organizations.

§ 1910.37 Means of egress, general.

(a) *Permissible exit components.* An exit shall consist only of the approved components. Exit components shall be constructed as an integral part of the building or shall be permanently affixed thereto.

(b) *Protective enclosure of exits.* When an exit is protected by separation from other parts of the building the separating construction shall meet the following requirements.

(1) The separation shall have at least a 1-hour fire resistance rating when the exit connects three stories or less. This applies whether the stories connected are above or below the story at which exit discharge begins.

(2) The separation shall have at least a 2-hour fire resistance rating when the exit connects four or more stories, whether above or below the floor of discharge. It shall be constructed of non-combustible materials, and shall be supported by construction having at least a 2-hour fire resistance rating.

(3) Any opening therein shall be protected by an approved self-closing fire door.

(4) Openings in exit enclosures shall be confined to those necessary for access to the enclosure from normally occupied spaces and for egress from the enclosure.

(c) *Width and capacity of means of egress.* (1) The capacity in number of persons per unit of exit width for approved components of means of egress shall be as follows:

- (i) Level Egress Components (including Class A Ramps) 100 persons.
- (ii) Inclined Egress Components (including Class B Ramps) 60 persons.
- (iii) A ramp shall be designated as Class A or Class B in accordance with the following Table E-1:

TABLE E-1		
	Class A	Class B
Width.....	44 inches and greater.	30 to 44 inches.
Slope.....	1 to 1 1/2 inches in 12 inches.	1 1/2 to 2 inches in 12 inches.
Maximum height between landings.....	No limit.	12 feet.

(2) Means of egress shall be measured in units of exit width of 22 inches. Fractions of a unit shall not be counted, except that 12 inches added to one or more full units shall be counted as one-half a unit of exit width.

(3) Units of exit width shall be measured in the clear at the narrowest point of the means of egress except that a handrail may project inside the measured width on each side not more than 5 inches and a stringer may project inside the measured width not more than 1 1/2 inches. An exit or exit access door swinging into an aisle or passageway shall not restrict the effective width thereof at any point during its swing to less than the minimum widths hereafter specified.

(d) *Egress capacity and occupant load.* The capacity of means of egress for

RULES AND REGULATIONS

any floor, balcony, tier, or other occupied space shall be sufficient for the occupant load thereof. The occupant load shall be the maximum number of persons that may be in the space at any time.

(2) Where exits serve more than one floor, only the occupant load of each floor considered individually need be used in computing the capacity of the exits at that floor, provided that exit capacity shall not be decreased in the direction of exit travel.

(e) *Arrangement of exits.* When more than one exit is required from a story, at least two of the exits shall be remote from each other and so arranged as to minimize any possibility that both may be blocked by any one fire or other emergency condition.

(f) *Access to exits.* (1) Exits shall be so located and exit access shall be so arranged that exits are readily accessible at all times. Where exits are not immediately accessible from an open floor area, safe and continuous passageways, aisles, or corridors leading directly to every exit and so arranged as to provide convenient access for each occupant to at least two exits by separate ways of travel, except as a single exit or limited dead ends are permitted by other provisions of this subpart, shall be maintained.

(2) A door from a room to an exit or to a way of exit access shall be of the side-hinged, swinging type. It shall swing with exit travel when the room is occupied by more than 50 persons or used for a high hazard occupancy.

(3) In no case shall access to an exit be through a bathroom, or other room subject to locking, except where the exit is required to serve only the room subject to locking.

(4) Ways of exit access and the doors to exits to which they lead shall be so designed and arranged as to be clearly recognizable as such. Hangings or draperies shall not be placed over exit doors or otherwise so located as to conceal or obscure any exit. Mirrors shall not be placed on exit doors. Mirrors shall not be placed in or adjacent to any exit in such a manner as to confuse the direction of exit.

(5) Exit access shall be so arranged that it will not be necessary to travel toward any area of high hazard occupancy in order to reach the nearest exit, unless the path of travel is effectively shielded from the high hazard location by suitable partitions or other physical barriers.

(6) The minimum width of any way of exit access shall in no case be less than 28 inches. Where a single way of exit access leads to an exit, its capacity in terms of width shall be at least equal to the required capacity of the exit to which it leads. Where more than one way of exit access leads to an exit, each shall have a width adequate for the number of persons it must accommodate.

(g) *Exterior ways of exit access.* (1) Access to an exit may be by means of any exterior balcony, porch, gallery, or roof that conforms to the requirements of this section.

(2) Exterior ways of exit access shall have smooth solid floors, substantially level, and shall have guards on the unenclosed sides.

(3) Where accumulation of snow or ice is likely because of the climate, the exterior way of exit access shall be protected by a roof, unless it serves as the sole normal means of access to the rooms or spaces served, in which case it may be assumed that snow and ice will be regularly removed in the course of normal occupancy.

(4) A permanent, reasonably straight path of travel shall be maintained over the required exterior way of exit access. There shall be no obstruction by railings, barriers, or gates that divide the open space into sections appurtenant to individual rooms, apartments, or other uses. Where the Assistant Secretary of Labor or his duly authorized representative finds the required path of travel to be obstructed by furniture or other movable objects, he may require that they be fastened out of the way or he may require that railings or other permanent barriers be installed to protect the path of travel against encroachment.

(5) An exterior way of exit access shall be so arranged that there are no dead ends in excess of 20 feet. Any unenclosed exit served by an exterior way of exit access shall be so located that no part of the exit extends past a vertical plane 20 feet and one-half the required width of the exit from the end of and at right angles to the way of exit access.

(6) Any gallery, balcony, bridge, porch or other exterior exit access that projects beyond the outside wall of the building shall comply with the requirements of this section as to width and arrangement.

(h) *Discharge from exits.* (1) All exits shall discharge directly to the street, or to a yard, court, or other open space that gives safe access to a public way. The streets to which the exits discharge shall be of width adequate to accommodate all persons leaving the building. Yards, courts, or other open spaces to which exits discharge shall also be of adequate width and size to provide all persons leaving the building with ready access to the street.

(2) Stairs and other exits shall be so arranged as to make clear the direction of egress to the street. Exit stairs that continue beyond the floor of discharge shall be interrupted at the floor of discharge by partitions, doors, or other effective means.

(i) *Headroom.* Means of egress shall be so designed and maintained as to provide adequate headroom, but in no case shall the ceiling height be less than 7 feet 6 inches nor any projection from the ceiling be less than 6 feet 8 inches from the floor.

(j) *Changes in elevation.* Where a means of egress is not substantially level, such differences in elevation shall be negotiated by stairs or ramps.

(k) *Maintenance and workmanship.* (1) Doors, stairs, ramps, passages, signs, and all other components of means of

Standard	Source
§ 1910.26	ANSI A14.2-1956, Portable Metal Ladders.
§ 1910.27	ANSI A14.3-1956, Safety Code for Fixed Ladders.
§ 1910.28	ANSI A10.6-1969, Safety Requirements for Scaffolding.
§ 1910.29	ANSI A92.1-1971, Standard for Manually Propelled Mobile Ladder Stands and Scaffolds.
§ 1910.30(a)	ANSI B56.1-1969, Safety Standard for Powered Industrial Trucks.
§ 1910.30(b)	ANSI B24.1-1963, Safety Standard for Forging.
§ 1910.30(c)	ANSI O1.1-1954, Safety Code for Woodworking Machinery.

§ 1910.32 Standards organizations.

The following organizations have been referenced in this Subpart D:

American National Standards Institute, 1430 Broadway, New York, NY 10018.

Underwriters' Laboratories, Inc., 307 East Ohio Street, Chicago, IL 60611.

Factory Mutual Engineering Corp., Post Office Box 688, Norwood, MA 02062.

Subpart E—Means of Egress

§ 1910.35 Definitions.

As used in this subpart:

(a) **Means of egress.** A means of egress is a continuous and unobstructed way of exit travel from any point in a building or structure to a public way and consists of three separate and distinct parts: the way of exit access, the exit, and the way of exit discharge. A means of egress comprises the vertical and horizontal ways of travel and shall include intervening room spaces, doorways, hallways, corridors, passageways, balconies, ramps, stairs, enclosures, lobbies, escalators, horizontal exits, courts, and yards.

(b) **Exit access.** Exit access is that portion of a means of egress which leads to an entrance to an exit.

(c) **Exit.** Exit is that portion of a means of egress which is separated from all other spaces of the building or structure by construction or equipment as required in this subpart to provide a protected way of travel to the exit discharge.

(d) **Exit discharge.** Exit discharge is that portion of a means of egress between the termination of an exit and a public way.

(e) **Low hazard contents.** Low hazard contents shall be classified as those of such low combustibility that no self-propagating fire therein can occur and that consequently the only probable danger requiring the use of emergency exits will be from panic, fumes, or smoke, or fire from some external source.

(f) **High-hazard contents.** High-hazard contents shall be classified as those which are liable to burn with extreme rapidity or from which poisonous fumes or explosions are to be feared in the event of fire.

(g) **Ordinary hazard contents.** Ordinary hazard contents shall be classified as those which are liable to burn with moderate rapidity and to give off a considerable volume of smoke but from

which neither poisonous fumes nor explosions are to be feared in case of fire.

(h) **Approved.** For the purposes of this subpart approved shall mean listed or approved equipment by a nationally recognized testing laboratory.

§ 1910.36 General requirements.

(a) **Application.** This subpart contains general fundamental requirements essential to providing a safe means of egress from fire and like emergencies. Nothing in this subpart shall be construed to prohibit a better type of building construction, more exits, or otherwise safer conditions than the minimum requirements specified in this subpart. Exits from vehicles, vessels, or other mobile structures are not covered by this subpart.

(b) **Fundamental requirements.** (1) Every building or structure, new or old, designed for human occupancy shall be provided with exits sufficient to permit the prompt escape of occupants in case of fire or other emergency. The design of exits and other safeguards shall be such that reliance for safety to life in case of fire or other emergency will not depend solely on any single safeguard; additional safeguards shall be provided for life safety in case any single safeguard is ineffective due to some human or mechanical failure.

(2) Every building or structure shall be so constructed, arranged, equipped, maintained, and operated as to avoid undue danger to the lives and safety of its occupants from fire, smoke, fumes, or resulting panic during the period of time reasonably necessary for escape from the building or structure in case of fire or other emergency.

(3) Every building or structure shall be provided with exits of kinds, numbers, location, and capacity appropriate to the individual building or structure, with due regard to the character of the occupancy, the number of persons exposed, the fire protection available, and the height and type of construction of the building or structure, to afford all occupants convenient facilities for escape.

(4) 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.

(5) Every exit shall be clearly visible or the route to reach it shall be conspicuously indicated in such a manner that every occupant of every building or structure who is physically and mentally capable will readily know the direction of escape from any point, and each path of escape, in its entirety, shall be so arranged or marked that the way to a place of safety outside is unmistakable. Any doorway or passageway not constituting an exit or way to reach an exit,

but of such a character as to be subject to being mistaken for an exit, shall be so arranged or marked as to minimize its possible confusion with an exit and the resultant danger of persons endeavoring to escape from a dead-end space, such as a cellar or storeroom, from which there is no other way out.

(6) In every building or structure equipped for artificial illumination, adequate and reliable illumination shall be provided for all exit facilities.

(7) In every building or structure of such size, arrangement, or occupancy that a fire may not itself provide adequate warning to occupants, fire alarm facilities shall be provided where necessary to warn occupants of the existence of fire so that they may escape, or to facilitate the orderly conduct of fire exit drills.

(8) Every building or structure, section, or area thereof of such size, occupancy, and arrangement that the reasonable safety of numbers of occupants may be endangered by the blocking of any single means of egress due to fire or smoke, shall have at least two means of egress remote from each other, so arranged as to minimize any possibility that both may be blocked by any one fire or other emergency conditions.

(9) Compliance with this subpart shall not be construed as eliminating or reducing the necessity for other provisions for safety of persons using a structure under normal occupancy conditions, nor shall any provision of the subpart be construed as requiring or permitting any condition that may be hazardous under normal occupancy conditions.

(c) **Protection of employees exposed by construction and repair operations.** (1) No building or structure under construction shall be occupied in whole or in part until all exit facilities required for the part occupied are completed and ready for use.

(2) No existing building shall be occupied during repairs or alterations unless all existing exits and any existing fire protection are continuously maintained, or in lieu thereof other measures are taken which provide equivalent safety.

(3) No flammable or explosive substances or equipment for repairs or alterations shall be introduced in a building of normally low or ordinary hazard classification while the building is occupied, unless the condition of use and safeguards provided are such as not to create any additional danger or handicap to egress beyond the normally permissible conditions in the building.

(d) **Maintenance.** (1) Every required exit, way of approach thereto, and way of travel from the exit into the street or open space, shall be continuously maintained free of all obstructions or impediments to full instant use in the case of fire or other emergency.

(2) Every automatic sprinkler system, fire detection and alarm system, exit lighting, fire door, and other item of equipment, where provided, shall be continuously in proper operating condition.

Subpart Q—Welding, Cutting and Brazing

1910.251	Definitions.
1910.252	Welding, cutting and brazing.
1910.253	Sources of standards.
1910.254	Standards organizations.

Subpart R—Special Industries

1910.261	Pulp, paper, and paperboard mills.
1910.262	Textiles.
1910.263	Welding equipment.
1910.264	Laundry machinery and operations.
1910.265	Sawmills.
1910.266	Pulpwood logging.
1910.267	Agricultural operations.
1910.268	Sources of standards.
1910.269	Standards organizations.

Subpart S—Electrical

1910.268	Application.
1910.269	National Electrical Code.
1910.270	Subject Index for 29 CFR 1910—Occupational Safety and Health Standards.

AUTHORITY: The provisions of this Part 1910 issued under secs. 6(a), 8(g), 24 Stat. 1593, 1598; 29 U.S.C. 655, 657.

Subpart A—General

§ 1910.1 Purpose and scope.

(a) Section 6(a) of the Williams-Steiger Occupational Safety and Health Act of 1970 (84 Stat. 1593) provides that "without regard to chapter 5 of title 5, United States Code, or to the other subsections of this section, the Secretary shall, as soon as practicable during the period beginning with the effective date of this Act and ending 2 years after such date, by rule promulgate as an occupational safety or health standard any national consensus standard, and any established Federal standard, unless he determines that the promulgation of such a standard would not result in improved safety or health for specifically designated employees." The legislative purpose of this provision is to establish, as rapidly as possible and without regard to the rule-making provisions of the Administrative Procedure Act, standards with which industries are generally familiar, and on whose adoption interested and affected persons have already had an opportunity to express their views. Such standards are either (1) national consensus standards on whose adoption affected persons have reached substantial agreement, or (2) Federal standards already established by Federal statutes or regulations.

(b) This part carries out the directive to the Secretary of Labor under section 6(a) of the Act. It contains occupational safety and health standards which have been found to be national consensus standards or established Federal standards.

§ 1910.2 Definitions.

As used in this part, unless the context clearly requires otherwise:

(a) "Act" means the Williams-Steiger Occupational Safety and Health Act of 1970 (84 Stat. 1590).

(b) "Assistant Secretary of Labor" means the Assistant Secretary of Labor "or Occupational Safety and Health";

(c) "Employer" means a person engaged in a business affecting commerce

who has employees, but does not include the United States or any State or political subdivision of a State;

(d) "Employee" means an employee of an employer who is employed in a business of his employer which affects commerce;

(e) "Commerce" means trade, traffic, commerce, transportation, or communication among the several States, or between a State and any place outside thereof, or within the District of Columbia, or a possession of the United States (other than the Trust Territory of the Pacific Islands), or between points in the same State but through a point outside thereof;

(f) "Standard" means a standard which requires conditions, or the adoption or use of one or more practices, means, methods, operations, or processes, reasonably necessary or appropriate to provide safe or healthful employment and places of employment;

(g) "National consensus standard" means any standard or modification thereof which (1) has been adopted and promulgated by a nationally recognized standards-producing organization under procedures whereby it can be determined by the Secretary of Labor or by the Assistant Secretary of Labor that persons interested and affected by the scope or provisions of the standard have reached substantial agreement on its adoption, (2) was formulated in a manner which afforded an opportunity for diverse views to be considered, and (3) has been designated as such a standard by the Secretary or the Assistant Secretary, after consultation with other appropriate Federal agencies; and

(h) "Established Federal standard" means any operative standard established by any agency of the United States and in effect on April 28, 1971, or contained in any Act of Congress in force on the date of enactment of the Williams-Steiger Occupational Safety and Health Act.

§ 1910.3 Petitions for the issuance, amendment, or repeal of a standard.

(a) Any interested person may petition in writing the Assistant Secretary of Labor to promulgate, modify, or revoke a standard. The petition should set forth the terms or the substance of the rule desired, the effects thereof if promulgated, and the reasons therefor.

(b) (1) The relevant legislative history of the Act indicates congressional recognition of the American National Standards Institute and the National Fire Protection Association as the major sources of national consensus standards. National consensus standards adopted on May 29, 1971, pursuant to section 5(a) of the Act are from those two sources.

However, any organization which deems itself a producer of national consensus standards, within the meaning of section 3(9) of the Act, is invited to submit in writing to the Assistant Secretary of Labor at any time prior to February 1, 1973, all relevant information which may enable the Assistant Secretary to determine whether any of its standards

satisfy the requirements of the definition of "national consensus standard" in section 3(9) of the Act.

(2) Within a reasonable time after the receipt of a submission pursuant to subparagraph (1) of this paragraph, the Assistant Secretary of Labor shall publish or cause to be published in the *Federal Register* a notice of such submission, and shall afford interested persons a reasonable opportunity to present written data, views, or arguments with regard to the question whether any standards of the organization making the submission are national consensus standards.

§ 1910.4 Amendments to this part.

(a) The Assistant Secretary of Labor shall have all of the authority of the Secretary of Labor under §§ 3(9) and 6(a) of the Act.

(b) The Assistant Secretary of Labor may at any time before April 28, 1973, on his own motion or upon the written petition of any person, by rule promulgate as a standard any national consensus standard and any established Federal standard, pursuant to and in accordance with section 6(a) of the Act, and, in addition, may modify or revoke any standard in this Part 1910. In the event of conflict among any such standards, the Assistant Secretary of Labor shall take the action necessary to eliminate the conflict, including the revocation or modification of a standard in this part, so as to assure the greatest protection of the safety or health of the affected employees.

§ 1910.5 Applicability of standards.

(a) Except as provided in paragraph (b) of this section, 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.

(b) None of the standards in this part shall apply to working conditions of employees with respect to which Federal agencies other than the Department of Labor, or State agencies acting under section 274 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2021), exercise statutory authority to prescribe or enforce standards or regulations affecting occupational safety or health.

(c) (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. For example, § 1901.23(c) (3) of this title prescribes personal protective equipment for certain ship repairmen working in specified areas. Such a standard shall apply, and shall not be deemed modified nor superseded by any different general standard whose provisions might otherwise be applicable, to the ship re-

RULES AND REGULATIONS

palmen working in the areas specified in § 1915.23(c) (3).

(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, as in Subpart B or Subpart R of this part, to the extent that none of such particular standards applies. To illustrate, the general standard regarding noise exposure in § 1910.95 applies to employments and places of employment in pulp, paper, and paperboard mills covered by § 1910.261.

(d) 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.

(e) [Reserved]

(f) An employer who is in compliance with any standard in this part shall be deemed to be in compliance with the requirement of section 5(a) (1) of the Act, but only to the extent of the condition, practice, means, method, operation, or process covered by the standard.

§ 1910.6 Incorporation by reference.

(a) The standards of agencies of the U.S. Government and organizations which are not agencies of the U.S. Government which are legally incorporated by reference in this part, have the same force and effect as other standards in this part.

(b) Copies of the standards which are incorporated by reference may be examined at the national office of the Occupational Safety and Health Administration, U.S. Department of Labor, Washington, D.C. 20210, or at any of its regional offices. Copies of such private standards may be obtained from the issuing organizations. Their names and addresses are listed in the pertinent subparts of this part.

(c) Any changes in the standards incorporated by reference in this part and an official historic file of such changes are available for inspection at the national office of the Occupational Safety and Health Administration, U.S. Department of Labor, Washington, D.C. 20210.

Subpart B—Adoption and Extension of Established Federal Standards

§ 1910.11 Scope and purpose.

The provisions of this Subpart B adopt, and extend the applicability of, established Federal standards in effect on April 28, 1971, with respect to every employer, employee, and employment covered by the Act.

§ 1910.12 Construction work.

(a) *Standards.* The standards prescribed in Part 1926 of this chapter are adopted as occupational safety and health standards under section 6 of the Act and shall apply, according to the provisions thereof, to every employment and place of employment of every employee engaged in construction work. Each em-

ployer shall protect the employment and places of employment of each of his employees engaged in construction work by complying with the appropriate standards prescribed in this paragraph.

(b) *Definition.* For purposes of this section, "construction work" means work for construction, alteration, and/or repair, including painting and decorating. See discussion of these terms in § 1926.13 of this title.

(c) *Construction Safety Act distinguished.* This section adopts as occupational safety and health standards under section 6 of the Act the standards which are prescribed in Part 1926 of this chapter. Thus, the standards (substantive rules) published in Subpart C and the following subparts of Part 1926 of this chapter are applied. This section does not incorporate Subparts A and B of Part 1926 of this chapter. Subparts A and B have pertinence only to the application of section 107 of the Contract Work Hours and Safety Standards Act (the Construction Safety Act). For example, the interpretation of the term "subcontractor" in paragraph (c) of § 1926.13 of this chapter is significant in discerning the coverage of the Construction Safety Act and duties thereunder.

However, the term "subcontractor" has no significance in the application of the Act, which was enacted under the Commerce Clause and which establishes duties for "employers" which are not dependent for their application upon any contractual relationship with the Federal Government or upon any form of Federal financial assistance.

§ 1910.13 Ship repairing.

(a) *Adoption and extension of established safety and health standards for ship repairing.* The standards prescribed by Part 1501 of this title and in effect on April 28, 1971, are adopted as occupational safety or health standards under section 6(a) of the Act and shall apply, according to the provisions thereof, to every employment and place of employment of every employee engaged in ship repair or a related employment. Each employer shall protect the employment and places of employment of each of his employees engaged in ship repair or a related employment, by complying with the appropriate standards prescribed by this paragraph.

(b) *Definitions.* For purposes of this section:

(1) "Ship repair means any repair of a vessel, including, but not restricted to, alterations, conversions, installations, cleaning, painting, and maintenance work;

(2) "Related employment" means any employment performed as an incident to, or in conjunction with, ship repair work, including, but not restricted to, inspection, testing, and employment as a watchman; and

(3) "Vessel" includes every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water,

including special purpose floating structures not primarily designed for, or used as a means of, transportation on water. § 1910.14 Shipbuilding.

(a) *Adoption and extension of established safety and health standards for shipbuilding.* The standards prescribed by Part 1502 of this title and in effect on April 28, 1971, are adopted as occupational safety or health standards under section 6(a) of the Act and shall apply, according to the provisions thereof, to every employment and place of employment of every employee engaged in shipbuilding or a related employment. Each employer shall protect the employment and places of employment of each of his employees engaged in shipbuilding or a related employment, by complying with the appropriate standards prescribed by this paragraph.

(b) *Definitions.* For purposes of this section:

(1) "Shipbuilding" means the construction of a vessel, including the installation of machinery and equipment;

(2) "Related employment" means any employment performed as an incident to, or in conjunction with, shipbuilding work, including, but not restricted to, inspection, testing trials, and employment as a watchman; and

(3) "Vessel" includes every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water, including special purpose floating structures not primarily designed for, or used as a means of, transportation on water.

§ 1910.15 Shipbreaking.

(a) *Adoption and extension of established safety and health standards for shipbreaking.* The standards prescribed by Part 1503 of this title and in effect on April 28, 1971, are adopted as occupational safety or health standards under section 6(a) of the Act and shall apply, according to the provisions thereof, to every employment and place of employment of every employee engaged in shipbreaking or a related employment. Each employer shall protect the employment and places of employment of each of his employees engaged in shipbreaking or a related employment, by complying with the appropriate standards prescribed by this paragraph.

(b) *Definitions.* For purposes of this section:

(1) "Shipbreaking" means any breaking down of a vessel's structure for the purpose of scrapping the vessel, including the removal of gear, equipment, or any component part of a vessel;

(2) "Related employment" means any employment performed as an incident to, or in conjunction with, shipbreaking work, including, but not restricted to, inspection, survey, and employment as a watchman; and

(3) "Vessel" includes every description of watercraft or other artificial contrivance used, or capable of being used, as

together laterally. The cross braces shall be of a length that will automatically uare and align vertical members so a erected scaffold is always plumb, square, and rigid.

(3) *Spacing.* Spacing of panels or frames shall be consistent with the loads imposed. The frames shall be placed one on top of the other with coupling or stacking pins to provide proper vertical alignment of the legs.

(4) *Locking.* Where uplift may occur, panels shall be locked together vertically by pins or other equivalent means.

(5) *Erection.* Only the manufacturer of a scaffold or his qualified designated agent shall be permitted to erect or supervise the erection of scaffolds exceeding 50 feet in height above the base, unless such structure is approved in writing by a registered professional engineer, or erected in accordance with instructions furnished by the manufacturer.

(c) *Mobile tubular welded sectional folding scaffolds.* (1) *General.* Units including sectional stairway and sectional ladder scaffolds shall be designed to comply with the requirements of paragraph (a) of this section.

(2) *Stairway.* An integral stairway and work platform shall be incorporated into the structure of each sectional folding stairway scaffold.

(3) *Bracing.* An integral set of pivoting and hinged folding diagonal and horizontal braces and a detachable work platform shall be incorporated into the structure of each sectional folding ladder scaffold.

(4) *Sectional folding stairway scaffolds.* Sectional folding stairway scaffolds shall be designed as medium duty scaffolds except for high clearance. These special base sections shall be designed as light duty scaffolds. When upper sectional folding stairway scaffolds are used with a special high clearance base, the load capacity of the entire scaffold shall be reduced accordingly. The width of a sectional folding stairway scaffold shall not exceed 4½ feet. The maximum length of a sectional folding stairway scaffold shall not exceed 6 feet.

(5) *Sectional folding ladder scaffolds.* Sectional folding ladder scaffolds shall be designed as light duty scaffolds including special base (open end) sections which are designed for high clearance. For certain special applications the six-foot (6') folding ladder scaffolds, except for special high clearance base sections, shall be designed for use as medium duty scaffolds. The width of a sectional folding ladder scaffold shall not exceed 4½ feet. The maximum length of a sectional folding ladder scaffold shall not exceed 6 feet 6 inches for a six-foot (6') long unit, 8 feet 6 inches for an eight-foot (8') unit or 10 feet 6 inches for a ten-foot (10') long unit.

(6) *End frames.* The end frames of sectional ladder and stairway scaffolds shall be designed so that the horizontal bearers provide supports for multiple planking levels.

(7) *Erection.* Only the manufacturer of the scaffold or his qualified designated agent shall be permitted to erect or supervise the erection of scaffolds ex-

ceeding 50 feet in height above the base, unless such structure is approved in writing by a licensed professional engineer, or erected in accordance with instructions furnished by the manufacturer.

(d) *Mobile tube and coupler scaffolds.* (1) *Design.* Units shall be designed to comply with the applicable requirements of paragraph (a) of this section.

(2) *Material.* The material used for the couplers shall be of a structural type, such as a drop-forged steel, malleable iron or structural grade aluminum. The use of gray cast iron is prohibited.

(3) *Erection.* Only the manufacturer of the scaffold or his qualified designated agent shall be permitted to erect or supervise the erection of scaffolds exceeding 50 feet in height above the base, unless such structure is approved in writing by a licensed professional engineer, or erected in accordance with instructions furnished by the manufacturer.

(e) *Mobile work platforms.* (1) *Design.* Units shall be designed for the use intended and shall comply with the requirements of paragraph (a) of this section.

(2) *Base width.* The minimum width of the base of mobile work platforms shall not be less than 20 inches.

(3) *Bracing.* Adequate rigid diagonal bracing to vertical members shall be provided.

(f) *Mobile ladder stands.*

(1) *Design.* Units shall comply with applicable requirements of paragraph (a) of this section.

(2) *Base width.* The minimum base width shall conform to paragraph (a) (3) (i) of this section. The maximum length of the base section shall be the total length of combined steps and top assembly, measured horizontally, plus five-eighths inch per step of rise.

(3) *Steps.* Steps shall be uniformly spaced, and sloped, with a rise of not less than nine (9) inches, nor more than ten (10) inches, and a depth of not less than seven (7) inches. The slope of the steps section shall be a minimum of fifty-five (55) degrees and a maximum of sixty (60) degrees measured from the horizontal.

(4) *Handrails.* (1) Units having more than five (5) steps or 60 inches vertical height to the top step shall be equipped with handrails.

(2) Handrails shall be a minimum of 29 inches high. Measurements shall be taken vertically from the center of the step.

(3) *Loading.* The load (see paragraph (2) (ii) (a) of this section) shall be applied uniformly to a 3½ inches wide area front to back at the center of the width span with a safety factor of four (4).

§ 1910.30 Other working surfaces.

(a) *Dockboards (bridge plates).* (1) Portable and powered dockboards shall be strong enough to carry the load imposed on them.

(2) Portable dockboards shall be secured in position, either by being

anchored or equipped with devices which will prevent their slipping.

(3) *Powered dockboards shall be designed and constructed in accordance with Commercial Standard CS202-56 (1961) "Industrial Lifts and Hinged Loading Ramps" published by the U.S. Department of Commerce.*

(4) *Handholds, or other effective means, shall be provided on portable dockboards to permit safe handling.*

(5) *Positive protection shall be provided to prevent railroad cars from being moved while dockboards or bridge plates are in position.*

(b) *Forging machinery area.* (1) *Machines shall be so located as to give (i) enough clearance between machines so that the movement of one operator will not interfere with the work of another, (ii) ample room for cleaning machines and handling the work, including material and scrap. The arrangement of machines shall be such that operators will not stand in aisles.*

(2) *Aisles shall be provided of sufficient width to permit the free movement of employees bringing and removing material. This aisle space is to be independent of working and storage space and should be defined by marking.*

(3) *Wood platforms used on the floor in front of machines shall be substantially constructed.*

(c) *Veneer machinery.* (1) *Sides of steam vats shall extend to a height of not less than 36 inches above the floor, working platform, or ground.*

(2) *Large steam vats divided into sections shall be provided with substantial walkways between sections. Each walkway shall be provided with a standard handrail on each exposed side. These handrails may be removable, if necessary.*

(3) *Covers shall be removed only from that portion of steaming vats on which men are working and a portable railing shall be placed at this point to protect the operators.*

(4) *Workmen shall not ride or step on logs in steam vats.*

§ 1910.31 Sources of standards.

The standards in this Subpart D are derived from the following sources:

Standard	Source
§ 1910.22(a) -----	ANSI Z41-1968, Requirements for Cancellation in Places of Employment.
§ 1910.22(b) and (c) -----	41 CFR 50-304.3.
§ 1910.22(d) -----	ANSI A58.1-1955, Minimum Design Loads in Building and Other Structures.
§ 1910.23 -----	ANSI A12.1-1967, Safety Requirements for Floor and Wall Openings, Railings, and Toeboards.
§ 1910.24 -----	ANSI A24.1-1968, Requirements for Fixed Industrial Stairs.
§ 1910.25 -----	ANSI A14.1-1968, Safety Code for Portable Wood Ladders.

24358015

metal projections. The nails shall be driven full length into the roof. When rope supports are used, they shall consist of first-grade manilla or, at least, three-quarter-inch diameter, or equivalent.

(3) A substantial catch platform shall be installed below the working area of roofs more than 20 feet from the ground to eaves with a slope greater than 3 inches in 12 inches without a parapet. In width the platform shall extend 2 feet beyond the projection of the eaves and shall be provided with a safety rail, mid-rail, and toeboard. This provision shall not apply where employees engaged in work upon such roofs are protected by a safety belt attached to a lifeline.

(b) *Crawling boards or chicken ladders.* (1) Crawling boards shall be not less than 10 inches wide and 1 inch thick, having cleats 1 x 1 1/2 inches. The cleats shall be equal in length to the width of the board and spaced at equal intervals not to exceed 24 inches. Nails shall be driven through and clinched on the underside. The crawling board shall extend from the ridge pole to the eaves when used in connection with roof construction, repair, or maintenance.

(2) A firmly fastened lifeline of at least three-quarter-inch rope shall be strung beside each crawling board for a handhold.

(3) Crawling boards shall be secured to the roof by means of adequate ridge hooks or equivalent effective means.

(u) *Float or ship scaffolds.* (1) Float or ship scaffolds shall support not more than three men and a few light tools, such as those needed for riveting, bolting, and welding. They shall be constructed in accordance with subparagraphs (2) through (6) of this paragraph, unless substitute designs and materials provide equivalent strength, stability, and safety.

(2) The platform shall be not less than 3 feet wide and 6 feet long, made of three-quarter-inch plywood, equivalent to American Plywood Association Grade B-B, Group 1, Exterior.

(3) Under the platform, there shall be two supporting bearers made from 2- x 4-inch, or 1- x 10-inch rough, selected lumber, or better. They shall be free of knots or other flaws and project 6 inches beyond the platform on both sides. The ends of the platform shall extend about 6 inches beyond the outer edges of the bearers. Each bearer shall be securely fastened to the platform.

(4) An edging of wood not less than 3/4 x 1 1/2 inches, or equivalent, shall be placed around all sides of the platform to prevent tools from rolling off.

(5) Supporting ropes shall be 1-inch diameter manilla rope or equivalent, free from deterioration, chemical damage, flaws, or other imperfections. Rope connections shall be such that the platform cannot shift or slip. If two ropes are used with each float, they should be arranged so as to provide four ends which are to be securely fastened to an overhead support. Each of the two supporting ropes shall be hitched around one end of a bearer and pass under the platforms to

the other end of the bearer where it is hitched again, leaving sufficient rope at each end for the supporting ties.

(6) Each workman shall be protected by a safety lifeline attached to a lifeline. The lifeline shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines, which will safely suspend the workman in case of a fall.

(v) *Scope.* This section establishes safety requirements for the construction, operation, maintenance, and use of scaffolds used in the construction, alteration, demolition, and maintenance of buildings and structures.

§ 1910.29 Manually propelled mobile ladder stands and scaffolds (towers).

(a) *General requirements.*—(1) *Application.* This section is intended to prescribe rules and requirements for the design, construction, and use of mobile work platforms (including ladder stands but not including aerial ladders) and rolling (mobile) scaffolds (towers). This standard is promulgated to aid in providing for the safety of life, limb, and property, by establishing minimum standards for structural design requirements and for the use of mobile work platforms and towers.

(2) *Working loads.* (i) Work platforms and scaffolds shall be capable of carrying the design load under varying circumstances depending upon the conditions of use. Therefore, all parts and appliances necessary for their safe and efficient utilization must be integral parts of the design.

(ii) Specific design and construction requirements are not a part of this section because of the wide variety of materials and design possibilities. However, the design shall be such as to produce a mobile ladder stand or scaffold that will safely sustain the specified loads. The material selected shall be of sufficient strength to meet the test requirements and shall be protected against corrosion or deterioration.

(a) The design working load of ladder stands shall be calculated on the basis of one or more 200-pound persons together with 50 pounds of equipment each.

(b) The design load of all scaffolds shall be calculated on the basis of:

Light.—Designed and constructed to carry a working load of 25 pounds per square foot.

Medium.—Designed and constructed to carry a working load of 50 pounds per square foot.

Heavy.—Designed and constructed to carry a working load of 75 pounds per square foot.

All ladder stands and scaffolds shall be capable of supporting at least four times the design working load.

(iii) The materials used in mobile ladder stands and scaffolds shall be of standard manufacture and conform to standard specifications of strength, dimensions, and weights, and shall be selected to safely support the design working load.

(iv) Nails, bolts, or other fasteners used in the construction of ladders, scaffolds, and towers shall be of adequate size and in sufficient numbers at each connection to develop the designed

strength of the unit. Nails shall be driven full length. (All nails should be immediately withdrawn from dismantler's lumber.)

(v) All exposed surfaces shall be free from sharp edges, burrs or other safety hazards.

(3) *Work levels.* (i) The maximum work level height shall not exceed four (4) times the minimum or least base dimension of any mobile ladder stand or scaffold. Where the basic mobile unit does not meet this requirement, suitable outrigger frames shall be employed to achieve this least base dimension, or provisions shall be made to guy or brace the unit against tipping.

(ii) The minimum platform width for any work level shall not be less than 20 inches for mobile scaffolds (towers). Ladder stands shall have a minimum step width of 16 inches.

(iii) The supporting structure for the work level shall be rigidly braced, using adequate cross bracing or diagonal bracing with rigid platforms at each work level.

(iv) The steps of ladder stands shall be fabricated from slip resistant treads.

(v) The work level platform of scaffolds (towers) shall be of wood, aluminum, or plywood planking, steel or expanded metal, for the full width of the scaffold, except for necessary openings. Work platforms shall be secured in place. All planking shall be 2-inch (nominal) scaffold grade minimum 1,500 f (stress grade) construction grade lumber or equivalent.

(vi) All scaffold work levels 10 feet or higher above the ground or floor shall have a standard (4-inch nominal) toeboard.

(vii) All work levels 10 feet or higher above the ground or floor shall have a guardrail of 2- by 4-inch nominal or the equivalent installed no less than 26 inches or more than 42 inches high, with a mid-rail, when required, of 1- by 4-inch nominal lumber or equivalent.

(viii) A climbing ladder or stairway shall be provided for proper access and egress, and shall be affixed or built into the scaffold and so located that its use will not have a tendency to tip the scaffold. A landing platform shall be provided at intervals not to exceed 30 feet.

(4) *Wheels or casters.* (i) Wheels or casters shall be properly designed for strength and dimensions to support four (4) times the design working load.

(ii) All scaffold casters shall be provided with a positive wheel and/or swivel lock to prevent movement. Ladder stands shall have at least two (2) of the four (4) casters and shall be of the swivel type.

(iii) Where leveling of the elevated work platform is required, screw jacks or other suitable means for adjusting the height shall be provided in the base section of each mobile unit.

(b) *Mobile tubular welded frame scaffolds.*—(1) *General.* Units shall be designed to comply with the requirements of paragraph (a) of this section.

(2) *Bracing.* Scaffolds shall be properly braced by cross braces and/or diagonal braces for securing vertical members

a means of transportation on water, including special purpose floating structures not primarily designed for, or used as a means of, transportation on water.

§ 1910.16 Longshoring.

(a) *Adoption and extension of established safety and health standards for longshoring.* The standards prescribed by Part 1504 of this title and in effect on April 28, 1971, are adopted as occupational safety or health standards under section 6(a) of the Act and shall apply, according to the provisions thereof, to every employment and place of employment of every employee engaged in longshoring operations or a related employment. Each employer shall protect the employment and places of employment of each of his employees engaged in a longshoring operation or a related employment, by complying with the appropriate standards prescribed by this paragraph.

(b) *Definitions.* For purposes of this section:

(1) "Longshoring operation" means the loading, unloading, moving, or handling of, cargo, ship's stores, gear, etc., into, in, on, or out of any vessel;

(2) "Related employment" means any employment performed as an incident to or in conjunction with, longshoring operations including, but not restricted to, securing cargo, rigging, and employment as a porter, checker, or watchman; and

(3) "Vessel" includes every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water, including special purpose floating structures not primarily designed for, or used as a means of, transportation on water.

§ 1910.17 Effective dates.

(a) Except as provided in paragraphs (b) and (c) of this section, the standards prescribed in this Subpart B shall be effective on August 27, 1971.

(b) (1) To the extent that the standards prescribed in § 1910.12 apply to light residential construction or to other construction work, as defined in § 1910.12(b), which is not subject to the construction safety standards published in Part 1926 of this title, their application is delayed until September 27, 1971.

(2) For the purpose of subparagraph (1) of this paragraph, "light residential construction" is limited to the construction of homes and apartments which do not exceed three stories in height, and which have no elevator.

(c) Except as provided in paragraph (b) of this section, whenever any employment or place of employment is, or becomes, subject to any safety and health standard prescribed in Part 1915, 1916, 1917, 1918, or 1926 of this title on a date before August 27, 1971, by virtue of the Construction Safety Act or the Longshoremen's and Harbor Workers' Compensation Act, that occupational safety and health standard as incorporated by reference in this subpart shall also become effective under the Williams-Steiger Occupational Safety and Health Act of 1970 on that date.

§ 1910.18 Changes in established Federal standards.

Whenever an occupational safety and health standard adopted and incorporated by reference in this Subpart B is changed pursuant to section 6(b) of the Act and the statute under which the standard was originally promulgated, and in accordance with Part 1911 of this chapter, the standard shall be deemed changed for purposes of that statute and this Subpart B, and shall apply under this Subpart B. For the purposes of this section, a change in a standard includes any amendment, addition, or repeal, in whole or in part, of any standard.

§ 1910.19 Asbestos dust.

Section 1910.93a shall apply to the exposure of every employee to asbestos dust in every employment and place of employment covered by § 1910.12, § 1910.13, § 1910.14, § 1910.15, or § 1910.16, in lieu of any different standard on exposure to asbestos dust which would otherwise be applicable by virtue of any of those sections.

Support C—[Reserved]

Support D—Walking-Working Surfaces

§ 1910.21 Definitions.

(a) As used in § 1910.23, unless the context requires otherwise, floor and wall opening, railing and toe board terms shall have the meanings ascribed in this paragraph.

(1) *Floor hole.* An opening measuring less than 12 inches but more than 1 inch in its least dimension, in any floor, platform, pavement, or yard, through which materials but not persons may fall; such as a belt hole, pipe opening, or slot opening.

(2) *Floor opening.* An opening measuring 12 inches or more in its least dimension, in any floor, platform, pavement, or yard, through which persons may fall; such as a hatchway, stair or ladder opening, pit, or large manhole. Floor openings occupied by elevators, dumb waiters, conveyors, machinery, or containers are excluded from this subpart.

(3) *Handrail.* A single bar or pipe supported on brackets from a wall or partition, as on a stairway or ramp, to furnish persons with a handhold in case of tripping.

(4) *Platform.* A working space for persons, elevated above the surrounding floor or ground, such as a balcony or platform for the operation of machinery and equipment.

(5) *Runway.* A passageway for persons, elevated above the surrounding floor or ground level, such as a footwalk along shafting or a walkway between buildings.

(6) *Standard railing.* A vertical barrier erected along exposed edges of a floor opening, wall opening, ramp, platform, or runway to prevent falls of persons.

(7) *Standard strength and construction.* Any construction of railings, covers,

or other guards that meets the requirements of § 1910.23.

(8) *Stair railing.* A vertical barrier erected along exposed edges of a stairway to prevent falls of persons.

(9) *Toeboard.* A vertical barrier at floor level erected along exposed edges of a floor opening, wall opening, platform, runway, or ramp to prevent falls of materials.

(10) *Wall hole.* An opening less than 30 inches but more than 1 inch high, of unrestricted width, in any wall or partition; such as a ventilation hole or drainage scupper.

(11) *Wall opening.* An opening at least 30 inches high and 18 inches wide, in any wall or partition, through which persons may fall; such as a yard-arm doorway or chute opening.

(b) As used in § 1910.24, unless the context requires otherwise, fixed industrial stair terms shall have the meaning ascribed in this paragraph.

(1) *Handrail.* A single bar or pipe supported on brackets from a wall or partition to provide a continuous handhold for persons using a stair.

(2) *Nose, nosing.* That portion of a tread projecting beyond the face of the riser immediately below.

(3) *Open riser.* The air space between the treads of stairways without upright members (risers).

(4) *Platform.* An extended step or landing breaking a continuous run of stairs.

(5) *Railing.* A vertical barrier erected along exposed sides of stairways and platforms to prevent falls of persons. The top member of railing usually serves as a handrail.

(6) *Rise.* The vertical distance from the top of a tread to the top of the next higher tread.

(7) *Riser.* The upright member of a step situated at the back of a lower tread and near the leading edge of the next higher tread.

(8) *Stairs, stairway.* A series of steps leading from one level or floor to another, or leading to platforms, pits, boiler rooms, crossovers, or around machinery, tanks, and other equipment that are used more or less continuously or routinely by employees, or only occasionally by specific individuals. A series of steps and landings having three or more risers constitutes stairs or stairway.

(9) *Tread.* The horizontal member of a step.

(10) *Tread run.* The horizontal distance from the leading edge of a tread to the leading edge of an adjacent tread.

(11) *Tread width.* The horizontal distance from front to back of tread including nosing when used.

(c) As used in § 1910.25, unless the context requires otherwise, portable wood ladders terms shall have the meanings ascribed in this paragraph.

(1) *Ladders.* A ladder is an appliance usually consisting of two side rails joined at regular intervals by crosspieces called steps, rungs, or cleats, on which a person may step in ascending or descending.

(2) **Stepladder.** A stepladder is a self-supporting portable ladder, nonadjustable in length, having flat steps and a hinged back. Its size is designated by the overall length of the ladder measured along the front edge of the side rails.

(3) **Single ladder.** A single ladder is a non-self-supporting portable ladder, nonadjustable in length, consisting of but one section. Its size is designated by the overall length of the side rail.

(4) **Extension ladder.** An extension ladder is a non-self-supporting portable ladder adjustable in length. It consists of two or more sections traveling in guides or brackets so arranged as to permit length adjustment. Its size is designated by the sum of the lengths of the sections measured along the side rails.

(5) **Sectional ladder.** A sectional ladder is a non-self-supporting portable ladder, nonadjustable in length, consisting of two or more sections of ladder so constructed that the sections may be combined to function as a single ladder. Its size is designated by the overall length of the assembled sections.

(6) **Trestle ladder.** A trestle ladder is a self-supporting portable ladder, nonadjustable in length, consisting of two sections hinged at the top to form equal angles with the base. The size is designated by the length of the side rails measured along the front edge.

(7) **Extension trestle ladder.** An extension trestle ladder is a self-supporting portable ladder, adjustable in length, consisting of a trestle ladder base and a vertically adjustable single ladder, with suitable means for locking the ladders together. The size is designated by the length of the trestle ladder base.

(8) **Special-purpose ladder.** A special-purpose ladder is a portable ladder which represents either a modification or a combination of design or construction features in one of the general-purpose types of ladders previously defined, in order to adapt the ladder to special or specific uses.

(9) **Trolley ladder.** A trolley ladder is a semifixed ladder, nonadjustable in length, supported by attachments to an overhead track, the plane of the ladder being at right angles to the plane of motion.

(10) **Side-rolling ladder.** A side-rolling ladder is a semifixed ladder, nonadjustable in length, supported by attachments to a guide rail, which is generally fastened to shelving, the plane of the ladder being also its plane of motion.

(11) **Wood characteristics.** Wood characteristics are distinguishing features which by their extent and number determine the quality of a piece of wood.

(12) **Wood irregularities.** Wood irregularities are natural characteristics in or on wood that may lower its durability, strength, or utility.

(13) **Cross grain.** Cross grain (slope of grain) is a deviation of the fiber direction from a line parallel to the sides of the piece.

(14) **Knot.** A knot is a branch or limb, imbedded in the tree and cut through in the process of lumber manufacture, classified according to size, quality, and occurrence.

The size of the knot is determined as the average diameter on the surface of the piece.

(15) **Pitch and bark pockets.** A pitch pocket is an opening extending parallel to the annual growth rings containing, or that has contained, pitch, either solid or liquid. A bark pocket is an opening between annual growth rings that contains bark.

(16) **Shake.** A shake is a separation along the grain, most of which occurs between the rings of annual growth.

(17) **Check.** A check is a lengthwise separation of the wood, most of which occurs across the rings of annual growth.

(18) **Wane.** Wane is bark, or the lack of wood from any cause, on the corner of a piece.

(19) **Decay.** Decay is disintegration of wood substance due to action of wood-destroying fungi. It is also known as rot.

(20) **Compression failure.** A compression failure is a deformation (buckling) of the fibers due to excessive compression along the grain.

(21) **Compression wood.** Compression wood is an aberrant (abnormal) and highly variable type of wood structure occurring in softwood species. The wood commonly has density somewhat higher than does normal wood, but somewhat lower stiffness and tensile strength for its weight in addition to high longitudinal shrinkage.

(22) **Low density.** Low-density wood is that which is exceptionally light in weight and usually deficient in strength properties for the species.

(d) As used in § 1910.26, unless the context requires otherwise, portable metal ladder terms shall have the meanings ascribed in this paragraph.

(1) **Ladder.** A ladder is an appliance usually consisting of two side rails joined at regular intervals by crosspieces called steps, rungs, or cleats, on which a person may step in ascending or descending.

(2) **Step ladder.** A step ladder is a self-supporting portable ladder, nonadjustable in length, having flat steps and a hinged back. Its size is designated by the overall length of the ladder measured along the front edge of the side rails.

(3) **Single ladder.** A single ladder is a non-self-supporting portable ladder, nonadjustable in length, consisting of but one section. Its size is designated by the overall length of the side rail.

(4) **Extension ladder.** An extension ladder is a non-self-supporting portable ladder adjustable in length. It consists of two or more sections traveling in guides or brackets so arranged as to permit length adjustment. Its size is designated by the sum of the lengths of the sections measured along the side rails.

(5) **Platform ladder.** A self-supporting ladder of fixed size with a platform provided at the working level. The size is determined by the distance along the front rail from the platform to the base of the ladder.

(6) **Sectional ladder.** A sectional ladder is a non-self-supporting portable ladder, nonadjustable in length, consisting of two or more sections so constructed that the sections may be combined to function as a single ladder. Its size is designated by the overall length of the assembled sections.

(7) **Trestle ladder.** A trestle ladder is a self-supporting portable ladder, nonadjustable in length, consisting of two sections, hinged at the top to form equal angles with the base. The size is designated by the length of the side rails measured along the front edge.

(8) **Extension trestle ladder.** An extension trestle ladder is a self-supporting portable ladder, adjustable in length, consisting of a trestle ladder base and a vertically adjustable single ladder, with suitable means for locking the ladders together. The size is designated by the length of the trestle ladder base.

(9) **Special-purpose ladder.** A special-purpose ladder is a portable ladder which represents either a modification or a combination of design or construction features in one of the general-purpose types of ladders previously defined, in order to adapt the ladder to special or specific uses.

(e) As used in § 1910.27, unless the context requires otherwise, fixed ladder terms shall have the meanings ascribed in this paragraph.

(1) **Ladder.** A ladder is an appliance usually consisting of two side rails joined at regular intervals by crosspieces called steps, rungs, or cleats, on which a person may step in ascending or descending.

(2) **Fixed ladder.** A fixed ladder is a ladder permanently attached to a structure, building, or equipment.

(3) **Individual-rung ladder.** An individual-rung ladder is a fixed ladder each rung of which is individually attached to a structure, building, or equipment.

(4) **Rail ladder.** A rail ladder is a fixed ladder consisting of side rails joined at regular intervals by rungs or cleats and fastened in full length or in sections to a building, structure, or equipment.

(5) **Railings.** A railing is any one or a combination of those railings constructed in accordance with § 1910.23. A standard railing is a vertical barrier erected along exposed edges of floor openings, wall openings, ramps, platforms, and runways to prevent falls of persons.

(6) **Pitch.** Pitch is the included angle between the horizontal and the ladder, measured on the opposite side of the ladder from the climbing side.

(7) **Fastenings.** A fastening is a device to attach a ladder to a structure, building, or equipment.

(8) **Rungs.** Rungs are ladder crosspieces of circular or oval cross-section on which a person may step in ascending or descending.

(9) **Cleats.** Cleats are ladder crosspieces of rectangular cross-section placed on edge on which a person may step in ascending or descending.

(10) **Steps.** Steps are the flat crosspieces of a ladder on which a person may step in ascending or descending.

(11) **Cage.** A cage is a guard that may be referred to as a cage or basket guard which is an enclosure that is fastened to the side rails of the fixed ladder or to the structure to encircle the climbing

(5) Platform planks shall be at least 2-by 9-inch nominal size. The ends of the planks shall overlap the bearers of the ladders and each plank shall be supported by not less than three squares.

(6) Bricklayers' square scaffolds shall not exceed three tiers in height and shall be so constructed and arranged that one square shall rest directly above the other. The upper tiers shall stand on a continuous row of planks laid across the next lower tier and be nailed down or otherwise secured to prevent displacement.

(7) Scaffolds shall be level and set upon a firm foundation.

(m) **Horse scaffolds.**

(1) Horse scaffolds shall not be constructed or arranged more than two tiers or 10 feet in height.

(2) The members of the horses shall be not less than those specified in Table D-19.

(3) Horses shall be spaced not more than 5 feet for medium duty and not more than 8 feet for light duty.

(4) When arranged in tiers, each horse shall be placed directly over the horse in the tier below.

(5) On all scaffolds arranged in tiers, the legs shall be nailed down to the planks to prevent displacement or thrust and each tier shall be substantially cross braced.

TABLE D-19—MINIMUM DIMENSIONS FOR HORSE SCAFFOLD MEMBERS

Members:	Dimensions (inches)
Horizontal members or bearers	3 by 4.
Legs	1½ by 4½.
Longitudinal brace between legs	1 by 6.
Gusset brace at top of legs	1 by 8.
Half diagonal braces	1½ by 4½.

(6) Horses or parts which have become weak or defective shall not be used.

(7) Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches high with a mid-rail, when required, of 1-by 4-inch lumber or equivalent and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a) (17) of this section.

(n) **Needle beam scaffold.** (1) Wood needle beams shall be in accordance with paragraph (a) (5) and (9) of this section, and shall be not less than 4 by 6 inches in size, with the greater dimension placed in a vertical direction. Metal beams or the equivalent conforming to paragraph (a) (4) and (8) of this section may be used.

(2) Ropes or hangers shall be provided for supports. The span between supports on the needle beam shall not exceed 10 feet for 4-by 6-inch timbers. Rope supports shall be equivalent in strength to 1-inch diameter first-grade manila rope.

(3) The ropes shall be attached to the needle beams by a scaffold hitch or a properly made eye splice. The loose end of the rope shall be tied by a bowline

knot or by a round turn and one-half hitch.

(4) The platform span between the needle beams shall not exceed 8 feet when using 2-inch scaffold plank. For spans greater than 8 feet, platforms shall be designed based on design requirements for the special span. The overhang of each end of the platform planks shall be not less than 1 foot and not more than 18 inches.

(5) When one needle beam is higher than the other or when the platform is not level the platform shall be secured against slipping.

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

(7) One end of a needle beam scaffold may be supported by a permanent structural member conforming to paragraph (a) (4) and (8) of this section.

(8) Each man working on a needle beam scaffold 20 feet or more above the ground or floor and working with both hands, shall be protected by a safety life belt attached to a lifeline. The lifeline shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines, which will safely suspend the workman in case of a fall.

(o) **Plasterers', decorators', and large area scaffolds.** (1) Plasterers', decorators', lathers', and ceiling workers' inside scaffolds shall be constructed in accordance with the general requirements set forth for independent wood pole scaffolds.

(2) Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1-by 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a) (17) of this section.

(3) All platform planks shall be laid with the edges close together.

(4) When independent pole scaffold platforms are erected in sections, such sections shall be provided with connecting runways equipped with substantial guardrails.

(p) **Interior hung scaffolds.** (1) An interior hung scaffold should be hung or suspended from the roof structure or substantial ceiling beams.

(2) The suspended steel wire rope shall conform to paragraph (a) (22) of this section. Wire may be used providing the strength requirements of paragraph (a) (22) of this section are met.

(3) For hanging wood scaffolds, the following minimum nominal size material is recommended:

(i) Supporting bearers 2 by 9 inches on edge.

(ii) Planking 2 by 9 inches or 2 by 10 inches, with maximum span 7 feet for heavy duty and 10 feet for light duty or medium duty.

(4) Steel tube and coupler members may be used for hanging scaffolds with

both types of scaffold designed to sustain a uniform distributed working load up to heavy duty scaffold loads with a safety factor of four.

(5) When a hanging scaffold is supported by means of wire rope, such wire rope shall be wrapped at least twice around the supporting members and twice around the bearers of the scaffold, with each end of the wire rope secured by at least three standard wire-rope clips.

(6) All overhead supporting members shall be inspected and checked for strength before the scaffold is erected.

(7) Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1-by 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a) (17) of this section.

(q) **Ladder-jack scaffolds.** (1) All ladder-jack scaffolds shall be limited to light duty and shall not exceed a height of 20 feet above the floor or ground.

(2) All ladders used in connection with ladder-jack scaffolds shall be heavy-duty ladders and shall be designed and constructed in accordance with § 1910.25 and § 1910.26.

(3) The ladder jack shall be so designed and constructed that it will bear on the side rails in addition to the ladder rungs, or if bearing on rungs only, the bearing area shall be at least 10 inches on each rung.

(4) Ladders used in conjunction with ladder jacks shall be so placed, fastened, held, or equipped with devices so as to prevent slipping.

(5) The wood platform planks shall be not less than 2 inches nominal in thickness. Both metal and wood platform planks shall overlap the bearing surface not less than 12 inches. The span between supports for wood shall not exceed 8 feet. Platform width shall be not less than 18 inches.

(6) Not more than two persons shall occupy any given 8 feet of any ladder-jack scaffold at any one time.

(r) **Window-jack scaffolds.** (1) Window-jack scaffolds shall be used only for the purpose of working at the window opening through which the jack is placed.

(2) Window jacks shall not be used to support planks placed between one window jack and another or for other elements of scaffolding.

(3) Window-jack scaffolds shall be provided with suitable guardrails unless safety belts with lifelines are attached and provided for the workman. Window-jack scaffolds shall be used by one man only.

(4) **Roofing brackets.** (1) Roofing brackets shall be constructed to fit the pitch of the roof.

(2) Brackets shall be secured in place by nailing in addition to the pointed

RULES AND REGULATIONS

TABLE D-17—SCHEDULE FOR LADDER-TYPE PLATFORMS

	Length of platform (feet)				
	12	14 & 16	18 & 20	22 & 24	26 & 30
Side stringers, minimum cross section (finished size):					
At ends (in.)	1 3/4 x 2 1/2	1 3/4 x 2 1/2	1 3/4 x 3	1 3/4 x 3	1 3/4 x 3 1/2
At middle (in.)	1 3/4 x 2 1/2	1 3/4 x 2 1/2	1 3/4 x 3	1 3/4 x 3	1 3/4 x 3 1/2
Reinforcing strip (minimum)	A 1/2 x 3/4-in. steel reinforcing strip or its equivalent shall be attached to the side or underside full length.				
Rungs	Rungs shall be 1 1/2-in. minimum diameter with at least 1/2-in. diameter toeboards, and the maximum spacing shall be 12 in. center to center.				
Tie rods:					
Number (minimum)	3	4	4	5	6
Diameter (minimum)	3/4 in.	3/4 in.	3/4 in.	3/4 in.	3/4 in.
Flooring, minimum finished size (in.)	1 1/2 x 2 1/2	1 1/2 x 2 1/2	1 1/2 x 2 1/2	1 1/2 x 2 1/2	1 1/2 x 2 1/2

(b) *Stone setters' adjustable multiple-point suspension scaffolds.* (1) The scaffold shall be capable of sustaining a working load of 25 pounds per square foot and shall not be overloaded. Scaffolds shall not be used for storage of stone or other heavy materials.

(2) The hoisting machine and its supports shall be of a type tested and listed by Underwriters' Laboratories or Factory Mutual Engineering Corp.

(3) The platform shall be securely fastened to the hangers by U-bolts or other equivalent means.

(4) The scaffold unit shall be suspended from metal outriggers, iron brackets, wire rope slings, or iron hooks which will safely support the maximum intended load.

(5) Outriggers when used shall be set with their webs in a vertical position, securely anchored to the building or structure and provided with stop bolts at each end.

(6) The scaffold shall be supported by wire rope conforming with paragraph (a) (22) of this section, suspended from overhead supports.

(7) The free ends of the suspension wire ropes shall be equipped with proper size thimbles, secured by splicing or other equivalent means. The running ends shall be securely attached to the hoisting drum and at least four turns of rope shall remain on the drum at all times.

(8) Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1- by 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a) (17) of this section.

(9) When two or more scaffolds are used on a building or structure they shall not be bridged one to the other but shall be maintained at even height with platforms butting closely.

(10) Each scaffold shall be installed or relocated in accordance with designs and instructions of a registered professional engineer, and such installation or relocation shall be supervised by a competent designated person.

(11) *Single-point adjustable suspension scaffolds.* (1) The scaffolding, including power units or manually operated winches, shall be of a type tested and

listed by Underwriters' Laboratories or Factory Mutual Engineering Corp.

(2) The power units may be either electrically or air motor driven.

(3) All power-operated gears and brakes shall be enclosed.

(4) In addition to the normal operating brake, all-power driven units must have an emergency brake which engages automatically when the normal speed of descent is exceeded.

(5) Guards, mid-rails, and toeboards shall completely enclose the cage or basket. Guardrails shall be no less than 2 by 4 inches or the equivalent installed not less than 36 inches nor more than 42 inches above the platform. Mid-rails shall be 1 by 6 inches or the equivalent, installed equidistant between the guardrail and the platform. Toeboards shall be a minimum of 4 inches in height.

(6) The hoisting machines, cables, and equipment shall be regularly serviced and inspected after each installation and every 30 days thereafter.

(7) The units may be combined to form a two-point suspension scaffold. Such scaffold shall comply with paragraph (g) of this section.

(8) The supporting cable shall be straight for its entire length, and the operator shall not sway the basket and fix the cable to any intermediate points to change his original path of travel.

(9) Equipment shall be maintained and used in accordance with the manufacturers' instructions.

(10) Suspension methods shall conform to applicable provisions of paragraphs (f) and (g) of this section.

(11) *Boatswain's chairs.* (1) The chair seat shall be not less than 12 by 24 inches, and of 1-inch thickness. The seat shall be reinforced on the underside to prevent the board from splitting.

(2) The two fiber rope seat slings shall be of 3/4-inch diameter, reeved through the four seat holes so as to cross each other on the underside of the seat.

(3) Seat slings shall be of at least 3/4-inch wire rope when a workman is conducting a heat producing process such as gas or arc welding.

(4) The workman shall be protected by a safety life belt attached to a lifeline. The lifeline shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines, which will safely suspend the worker in case of a fall.

(5) The tackle shall consist of correct size ball bearing or bushed blocks and

properly spliced 3/4-inch diameter first-grade manila rope.

(6) The roof irons, hooks, or the object to which the tackle is anchored shall be securely installed. Tiebacks when used shall be installed at right angles to the face of the building and securely fastened to a chimney.

(k) *Carpenters' bracket scaffolds.* (1) The brackets shall consist of a triangular wood frame not less than 2 by 3 inches in cross section, or of metal of equivalent strength. Each member shall be properly fitted and securely joined.

(2) Each bracket shall be attached to the structure by means of one of the following:

(i) A bolt no less than five-eighths inch in diameter which shall extend through the inside of the building wall.

(ii) A metal stud attachment device.

(iii) Welding to steel tanks.

(iv) Hooking over a well-secured and adequately strong supporting member.

The brackets shall be spaced no more than 10 feet apart.

(3) No more than two persons shall occupy any given 10 feet of a bracket scaffold at any one time. Tools and materials shall not exceed 75 pounds in addition to the occupancy.

(4) The platform shall consist of not less than two 2- by 9-inch nominal size planks extending not more than 18 inches or less than 6 inches beyond each end support.

(5) Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1- by 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a) (17) of this section.

(1) *Bricklayers' square scaffolds.* (1) The squares shall not exceed 5 feet in width and 5 feet in height.

(2) Members shall be not less than those specified in Table D-18.

(3) The squares shall be reinforced on both sides of each corner with 1- by 6-inch gusset pieces. They shall also have braces 1 by 8 inches on both sides running from center to center of each member, or other means to secure equivalent strength and rigidity.

(4) The squares shall be set not more than 5 feet apart for medium duty scaffolds, and not more than 8 feet apart for light duty scaffolds. Bracing 1 x 8 inches, extending from the bottom of each square to the top of the next square, shall be provided on both front and rear sides of the scaffold.

TABLE D-18—MINIMUM DIMENSIONS FOR BRICKLAYERS' SQUARE SCAFFOLD MEMBERS	
Members	Dimensions (inches)
Beams or horizontal members	2 by 6
Legs	2 by 6
Braces at corners	1 by 6
Braces diagonally from center frame	1 by 8

space of the ladder for the safety of the person who must climb the ladder.

(12) *Well.* A well is a permanent complete enclosure around a fixed ladder, which is attached to the walls of the well. Proper clearances for a well will give the person who must climb the ladder the same protection as a cage.

(13) *Ladder safety device.* A ladder safety device is any device, other than a cage or well, designed to eliminate or reduce the possibility of accidental falls and which may incorporate such features as life belts, friction brakes, and sliding attachments.

(14) *Grab bars.* Grab bars are individual handholds placed adjacent to or as an extension above ladders for the purpose of providing access beyond the limits of the ladder.

(15) *Through ladder.* A through ladder is one from which a man getting off at the top must step sideways from the ladder in order to reach the landing.

(16) *Side-step ladder.* A side-step ladder is one from which a man getting off at the top must step sideways from the ladder in order to reach the landing.

(f) As used in § 1910.28, unless the context requires otherwise, scaffolding terms shall have the meaning ascribed in this paragraph.

(1) *Bearer.* A horizontal member of a scaffold upon which the platform rests and which may be supported by ledgers.

(2) *Boatswain's chair.* A seat supported by slings attached to a suspended rope, designed to accommodate one workman in a sitting position.

(3) *Brace.* A tie that holds one scaffold member in a fixed position with respect to another member.

(4) *Bricklayers' square scaffold.* A scaffold composed of framed wood squares which support a platform limited to light and medium duty.

(5) *Carpenters' bracket scaffold.* A scaffold consisting of wood or metal brackets supporting a platform.

(6) *Coupler.* A device for locking together the component parts of a tubular metal scaffold. The material used for the couplers shall be of a structural type, such as a drop-forged steel, malleable iron, or structural grade aluminum. The use of gray cast iron is prohibited.

(7) *Crawling board or chicken ladder.* A plank with cleats spaced and secured at equal intervals, for use by a worker on roofs, not designed to carry any material.

(8) *Double pole or independent pole scaffold.* A scaffold supported from the base by a double row of uprights, independent of support from the walls and constructed of uprights, ledgers, horizontal platform bearers, and diagonal bracing.

(9) *Float or ship scaffold.* A scaffold hung from overhead supports by means of ropes and consisting of a substantial platform having diagonal bracing underneath, resting upon and securely fastened to two parallel plank bearers at right angles to the span.

(10) *Guardrail.* A rail secured to uprights and erected along the exposed sides and ends of platforms.

RULES AND REGULATIONS

22107

(11) *Heavy duty scaffold.* A scaffold designed and constructed to carry a working load not to exceed 75 pounds per square foot.

(12) *Horse scaffold.* A scaffold for light or medium duty, composed of horses supporting a work platform.

(13) *Interior hung scaffold.* A scaffold suspended from the ceiling or roof structure.

(14) *Ladder jack scaffold.* A light duty scaffold supported by brackets attached to ledgers.

(15) *Ledger (stringer).* A horizontal scaffold member which extends from post to post and which supports the putlogs or bearers forming a tie between the posts.

(16) *Light duty scaffold.* A scaffold designed and constructed to carry a working load not to exceed 25 pounds per square foot.

(17) *Manually propelled mobile scaffold.* A portable rolling scaffold supported by casters.

(18) *Masons' adjustable multiple-point suspension scaffold.* A scaffold having a continuous platform supported by bearers suspended by wire rope from overhead supports, so arranged and operated as to permit the raising or lowering of the platform to desired working positions.

(19) *Maximum intended load.* The total of all loads including the working load, the weight of the scaffold, and such other loads as may be reasonably anticipated.

(20) *Medium duty scaffold.* A scaffold designed and constructed to carry a working load not to exceed 50 pounds per square foot.

(21) *Mid-rail.* A rail approximately midway between the guardrail and platform, used when required, and secured to the uprights erected along the exposed sides and ends of platforms.

(22) *Needle beam scaffold.* A light duty scaffold consisting of needle beams supporting a platform.

(23) *Outrigger scaffold.* A scaffold supported by outriggers or thrustouts projecting beyond the wall or face of the building or structure, the inboard ends of which are secured inside of such a building or structure.

(24) *Putlog.* A scaffold member upon which the platform rests.

(25) *Roofing bracket.* A bracket used in sloped roof construction, having provisions for fastening to the roof or supported by ropes fastened over the ridge and secured to some suitable object.

(26) *Runner.* The lengthwise horizontal bracing or bearing members or both.

(27) *Scaffold.* Any temporary elevated platform and its supporting structure used for supporting workmen or materials or both.

(28) *Single-point adjustable suspension scaffold.* A manually or power-operated unit designed for light duty use, supported by a single wire rope from an overhead support so arranged and operated as to permit the raising or lowering of the platform to desired working positions.

(29) *Single pole scaffold.* Platforms resting on putlogs or crossbeams, the outside ends of which are supported on ledgers secured to a single row of posts or uprights and the inner ends of which are supported on or in a wall.

(30) *Stone setters' adjustable multiple-point suspension scaffold.* A swinging-type scaffold having a platform supported by hangers suspended at four points so as to permit the raising or lowering of the platform to the desired working position by the use of hoisting machines.

(31) *Toe board.* A barrier secured along the sides and ends of a platform, to guard against the falling of material.

(32) *Tube and coupler scaffold.* An assembly consisting of tubing which serves as posts, bearers, braces, ties, and runners, a base supporting the posts; and special couplers which serve to connect the uprights and to join the various members.

(33) *Tubular welded frame scaffold.* A sectional, panel, or frame metal scaffold substantially built up of prefabricated welded sections which consist of posts and horizontal bearer with intermediate members. Panels or frames shall be braced with diagonal or cross braces.

(34) *Two-point suspension scaffold (swinging scaffold).* A scaffold, the platform of which is supported by hangers (stirrups) at two points, suspended from overhead supports so as to permit the raising or lowering of the platform to the desired working position by tackle or hoisting machines.

(35) *Window jack scaffold.* A scaffold, the platform of which is supported by a bracket or jack which projects through a window opening.

(36) *Working load.* Load imposed by men, materials, and equipment.

(g) As used in § 1910.29, unless the context requires otherwise, manually propelled mobile ladder, stair, and scaffold (tower) terms shall have the meaning ascribed in this paragraph.

(1) *Bearer.* A horizontal member of a scaffold upon which the platform rests and which may be supported by ledgers.

(2) *Brace.* A tie that holds one scaffold member in a fixed position with respect to another member.

(3) *Climbing ladder.* A separate ladder with equally spaced rungs usually attached to the scaffold structure for climbing and descending.

(4) *Coupler.* A device for locking together the components of a tubular metal scaffold which shall be designed and used to safely support the maximum intended loads.

(5) *Design working load.* The maximum intended load, being the total of all loads including the weight of the men, materials, equipment, and platform.

(6) *Equivalent.* Alternative design or features, which will provide an equal degree or factor of safety.

(7) *Guardrail.* A barrier secured to uprights and erected along the exposed sides and ends of platforms to prevent falls of persons.

(8) **Handrail.** A rail connected to a ladder stand running parallel to the slope and/or top step.

(9) **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.

(10) **Ledger (stringer).** A horizontal scaffold member which extends from post to post and which supports the bearer forming a tie between the posts.

(11) **Mobile scaffold (tower).** A light, medium, or heavy duty scaffold mounted on casters or wheels.

(12) **Mobile.** "Manually propelled." (13) **Mobile work platform.** Generally a fixed work level one frame high on casters or wheels, with bracing diagonally from platform to vertical frame.

(14) **Runner.** The lengthwise horizontal bracing and/or bearing members. (15) **Scaffold.** Any temporary elevated platform and its necessary vertical, diagonal, and horizontal members used for supporting workmen and materials. (Also known as a scaffold tower.)

(16) **Toe board.** A barrier at platform level erected along the exposed sides and ends of a scaffold platform to prevent falls of materials.

(17) **Tube and coupler scaffold.** An assembly consisting of tubing which serves as posts, bearers, braces, ties, and runners, a base supporting the posts, and uprights, and serves to join the various members, usually used in fixed locations.

(18) **Tubular welded frame scaffold.** A sectional, panel, or frame metal scaffold substantially built up of prefabricated welded sections, which consist of posts and bearers with intermediate connecting members and braced with diagonal or cross braces.

(19) **Tubular welded sectional folding scaffold.** A sectional, folding metal scaffold either of ladder frame or inside stairway design, substantially built of prefabricated welded sections, which consist of end frames, platform frame, inside inclined stairway frame and braces, or hinged connected diagonal and horizontal braces, capable of being folded into a flat package when the scaffold is not in use.

(20) **Work level.** The elevated platform, used for supporting workmen and their materials, comprising the necessary vertical, horizontal, and diagonal braces, guardrails, and ladder for access to the work platform.

§ 1910.22. General requirements.

This section applies to all permanent places of employment, except where domestic, mining, or agricultural work only is performed. Measures for the control of toxic materials are considered to be outside the scope of this section.

(a) **Housekeeping.** (1) All places of employment, passageways, storerooms, and service rooms shall be kept clean and orderly and in a sanitary condition.

(2) The floor of every workroom shall be maintained in a clean and, so far as possible, a dry condition. Where wet processes are used, drainage shall be maintained, and false floors, platforms, mats,

or other dry standing places should be provided where practicable.

(3) To facilitate cleaning, every floor, working place, and passageway shall be kept free from protruding nails, splinters, holes, or loose boards.

(b) **Aisles and passageways.** (1) Where mechanical handling equipment is used, sufficient safe clearances shall be allowed for aisles, at loading docks, through doorways and wherever turns or passage must be made. Aisles and passageways shall be kept clear and in good repair, with no obstruction across or in aisles that could create a hazard.

(2) Permanent aisles and passageways shall be appropriately marked.

(c) **Covers and guardrails.** Covers and/or guardrails shall be provided to protect personnel from the hazards of open pits, tanks, vats, ditches, etc.

(d) **Floor loading protection.** (1) In every building or other structure, or part thereof, used for mercantile, business, industrial, or storage purposes, the loads approved by the building official shall be marked on plates of approved design which shall be supplied and securely affixed by the owner of the building, or his duly authorized agent, in a conspicuous place in each space to which they relate. Such plates shall not be removed or defaced but, if lost, removed, or defaced, shall be replaced by the owner or his agent.

(2) It shall be unlawful to place, or cause or permit to be placed, on any floor or roof of a building or other structure a load greater than that for which such floor or roof is approved by the building official.

§ 1910.23. Guarding floor and wall openings and holes.

(a) **Protection for floor openings.** (1) Every stairway floor opening shall be guarded by a standard railing constructed in accordance with paragraph (e) of this section. The railing shall be provided on all exposed sides (except at entrance to stairway). For infrequently used stairways where traffic across the opening prevents the use of fixed standard railing (as when located in aisle spaces, etc.), the guard shall consist of a hinged floor opening cover of standard strength and construction and removable standard railings on all exposed sides (except at entrance to stairway).

(2) Every ladderway floor opening or platform shall be guarded by a standard railing with standard toeboard on all exposed sides (except at entrance to opening), with the passage through the railing either provided with a swinging gate or so offset that a person cannot walk directly into the opening.

(3) Every hatchway and chute floor opening shall be guarded by one of the following:

(i) Hinged floor opening cover of standard strength and construction equipped with standard railings or permanently attached thereto so as to leave only one exposed side. When the opening is not in use, the cover shall be closed or the exposed side shall be guarded at both top and intermediate positions by removable standard railings.

(ii) A removable railing with toeboard on not more than two sides of the opening and fixed standard railings with toeboards on all other exposed sides. The removable railings shall be kept in place when the opening is not in use and should preferably be hinged or otherwise mounted so as to be conveniently replaceable.

Where operating conditions necessitate the feeding of material into any hatchway or chute opening, protection shall be provided to prevent a person from falling through the opening.

(4) Every skylight floor opening and hole shall be guarded by a standard skylight screen or a fixed standard railing on all exposed sides.

(5) Every pit and trapdoor floor opening, infrequently used, shall be guarded by a floor opening cover of standard strength and construction which should be hinged in place. While the cover is not in place, the pit or trap opening shall be constantly attended by someone or shall be protected on all exposed sides by removable standard railings.

(6) Every manhole floor opening shall be guarded by a standard manhole cover which need not be hinged in place. While the cover is not in place, the manhole opening shall be constantly attended by someone or shall be protected by removable standard railings.

(7) Every temporary floor opening shall have standard railings, or shall be constantly attended by someone.

(8) Every floor hole into which persons can accidentally walk shall be guarded by either:

(i) A standard railing with standard toeboard on all exposed sides, or

(ii) A floor hole cover of standard strength and construction that should be hinged in place. While the cover is not in place, the floor hole shall be constantly attended by someone or shall be protected by a removable standard railing.

(9) Every floor hole into which persons cannot accidentally walk (on account of fixed machinery, equipment, or walls) shall be protected by a cover that leaves no openings more than 1 inch wide. The cover shall be securely held in place to prevent tools or materials from falling through.

(10) 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 to less than 20 inches.

(b) **Protection for wall openings and holes.** (1) Every wall opening from which there is a drop of more than 4 feet shall be guarded by one of the following:

(i) Rail, roller, picket fence, half door, or equivalent barrier.

The guard may be removable but should preferably be hinged or otherwise mounted so as to be conveniently replaceable. Where there is exposure below to falling materials, a removable toe board or the equivalent shall also be provided. When the opening is not in use for handling materials, the guard shall be kept in position regardless of a door on the opening. In addition, a grab handle shall

TABLE D-16—MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF OUTRIGGER SCAFFOLDS

	Light duty	Medium duty
Maximum scaffold load.....	25 p.s.f.	50 p.s.f.
Outrigger size.....	2 x 10 in.	2 x 10 in.
Maximum overhang.....	40 ft 0 in.	6 ft 0 in.
Spacing.....		
Planking.....	2 x 9 in.	2 x 9 in.
Guardrail.....	2 x 4 in.	2 x 4 in.
Guardrail uprights.....	2 x 4 in.	2 x 4 in.
Toeboards.....	4 in. (min. max.)	4 in. (min. max.)

(f) **Masons' adjustable multiple-point suspension scaffolds.** (1) The scaffold shall be capable of sustaining a working load of 50 pounds per square foot and shall not be loaded in excess of that figure.

(2) The scaffold shall be provided with hoisting machines that meet the requirements of Underwriters' Laboratories or Factory Mutual Engineering Corp.

(3) The platform shall be supported by wire ropes in conformity with paragraph (a) (22) of this section, suspended from overhead outrigger beams.

(4) The scaffold outrigger beams shall consist of structural metal securely fastened or anchored to the frame or floor system of the building or structure.

(5) Each outrigger beam shall be equivalent in strength to at least a standard 7-inch, 15.3-pound steel I-beam, be at least 15 feet long, and shall not project more than 6 feet 6 inches beyond the bearing point.

(6) Where the overhang exceeds 6 feet 6 inches, outrigger beams shall be composed of stronger beams or multiple beams and be installed in accordance with approved designs and instructions.

(7) If channel iron outrigger beams are used in place of I-beams, they shall be securely fastened together with the flanges turned out.

(8) All outrigger beams shall be set and maintained with their webs into vertical position.

(9) A stop bolt shall be placed at each end of every outrigger beam.

(10) The outrigger beam shall rest on suitable wood-bearing blocks.

(11) All parts of the scaffold such as bolts, nuts, fittings, clamps, wire rope, and outrigger beams and their fastenings, shall be maintained in sound and good working condition and shall be inspected before each installation and periodically thereafter.

(12) The free end of the suspension wire ropes shall be equipped with proper size thimbles and be secured by splicing or other equivalent means. The running ends shall be securely attached to the hoisting drum and at least four turns of rope shall at all times remain on the drum.

(13) Where a single outrigger beam is used, the steel shackles or clevises with which the wire ropes are attached to the outrigger beams shall be placed directly over the hoisting drums.

(14) The scaffold platform shall be equivalent in strength to at least 2-inch

planking. (For maximum planking spans see paragraph (a) (9) of this section.)

(15) Guardrails, not less than 2 x 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1 x 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a) (17) of this section.

(16) Overhead protection shall be provided on the scaffold, not more than 9 feet above the platform, consisting of 2-inch planking or material of equivalent strength laid tight, when men are at work on the scaffold and an overhead hazard exists.

(17) Each scaffold shall be installed or relocated in accordance with designs and instructions, of a registered professional engineer, and supervised by a competent, designated person.

(g) **Two-point suspension scaffolds (swing scaffolds).** (1) Two-point suspension scaffold platforms shall be not less than 20 inches nor more than 36 inches wide overall. The platform shall be securely fastened to the hangers by U-bolts or by other equivalent means.

(2) The hangers of two-point suspension scaffolds shall be made of wrought iron, mild steel, or other equivalent material having a cross-sectional area capable of sustaining four times the maximum intended load, and shall be designed with a support for guardrail, intermediate rail, and toeboard.

(3) When hoisting machines are used on two-point suspension scaffolds, such machines shall be of a design tested and approved by Underwriters' Laboratories or Factory Mutual Engineering Corp.

(4) The roof irons or hooks shall be of wrought iron, mild steel, or other equivalent material of proper size and design, securely installed and anchored. Tiebacks of three-fourth inch manila rope or the equivalent shall serve as a secondary means of anchorage, installed at right angles to the face of the building whenever possible and secured to a structurally sound portion of the building.

(5) Guardrails not less than 2 x 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1 x 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a) (17) of this section.

(6) Two-point suspension scaffolds shall be suspended by wire or fiber ropes. Wire and fiber ropes shall conform to paragraph (a) (22) of this section.

(7) The blocks for fiber ropes shall be of standard 6-inch size, consisting of at least one double and one single block. The sheaves of all blocks shall fit the size of rope used.

(8) All wire ropes, fiber ropes, slings, hangers, platforms, and other supporting parts shall be inspected before every installation. Periodic inspections shall be made while the scaffold is in use.

(9) On suspension scaffolds designed for a working load of 500 pounds no more than two men shall be permitted to work at one time. On suspension scaffolds with a working load of 750 pounds, no more than three men shall be permitted to work at one time. Each workman shall be protected by a safety lifeline attached to a lifeline. The lifeline shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines, which will safely suspend the workman in case of a fall.

(10) Where acid solutions are used, fiber ropes are not permitted unless acid-proof.

(11) Two-point suspension scaffolds shall be securely lashed to the building or structure to prevent them from swaying. Window cleaners' anchors shall not be used for this purpose.

(12) The platform of every two-point suspension scaffold shall be one of the following types:

(i) The side stringer of ladder-type platforms shall be clear straight-grained spruce or materials of equivalent strength and durability. The rungs shall be of straight-grained oak, ash, or hickory, at least 1½ inch in diameter, with seven-eighth inch tenons mortised into the side stringers at least seven-eighth inch. The stringers shall be tied together with the tie rods not less than one-quarter 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 five-eighth inch apart except at the side rails where the space may be 1 inch. Ladder-type platforms shall be constructed in accordance with table D-17.

(ii) Plank-type platforms shall be composed of not less than nominal 2 x 8-inch unplinked planks, properly cleated together on the underside starting 6 inches from each end; intervals in between shall not exceed 4 feet. The plank-type platform shall not extend beyond the hangers more than 18 inches. A bar or other effective means shall be securely fastened to the platform at each end to prevent its slipping off the hanger. The span between hangers for plank-type platforms shall not exceed 10 feet.

(iii) 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- and 6-inch crossbeams, laid flat and set into the upper edge of the stringers with a snug fit, at intervals of not more than 4 feet, securely nailed in place. The flooring shall be of 1- x 6-inch material properly nailed. Floorboards shall not be spaced more than one-half inch apart.

(2) A medium-duty tube and coupler scaffold shall have all posts, runners, and bracing of nominal 2-inch O.D. steel tubing. Posts spaced not more than 6 feet apart by 8 feet along the length of the scaffold shall have bearers of nominal 2½-inch O.D. steel tubing. Posts spaced not more than 5 feet apart by 8 feet along the length of the scaffold shall have bearers of nominal 2-inch O.D. steel tubing. Other structural metals when used must be designed to carry an equivalent load.

(3) A heavy-duty tube and coupler scaffold shall have all posts, runners, and bracing of nominal 2-inch O.D. steel tubing, with the posts spaced not more than 6 feet apart by 8 feet along the length of the scaffold. Other structural metals when used must be designed to carry an equivalent load.

(4) Tube and coupler scaffolds shall be limited in heights and working levels to those permitted in tables D-13, 14, and 15, of this section. Drawings and specifications of all tube and coupler scaffolds above the limitations in tables D-13, 14, and 15 of this section shall be designed by a registered professional engineer and copies made available to the employer and for inspection purposes.

(5) All tube and coupler scaffolds shall be constructed and erected to support four times the maximum intended loads as set forth in tables D-13, 14, and 15 of this section, or as set forth in the specifications by a registered professional engineer, copies which shall be made available to the employer and for inspection purposes.

(6) All tube and coupler scaffolds shall be erected by competent and experienced personnel.

(7) Posts shall be accurately spaced, erected on suitable bases, and maintained plumb.

(8) Runners shall be erected along the length of the scaffold located on both the inside and the outside posts at even height. Runners shall be interlocked to form continuous lengths and coupled to each post. The bottom runners shall be located as close to the base as possible. Runners shall be placed not more than 6 feet 6 inches on centers.

(9) Bearers shall be installed transversely between posts and shall be securely coupled to the posts bearing on the runner coupler. When coupled directly to the runners, the coupler must be kept as close to the posts as possible.

(10) Bearers shall be at least 4 inches but not more than 12 inches longer than the post spacing or runner spacing. Bearers may be cantilevered for use as brackets to carry not more than two planks.

(11) Cross bracing shall be installed across the width of the scaffold at least every third set of posts horizontally and every fourth runner vertically. Such bracing shall extend diagonally from the inner and outer runners upward to the next outer and inner runners.

(12) Longitudinal diagonal bracing shall be installed at approximately a 45-

degree angle from near the base of the first outer post upward to the extreme top of the scaffold. Where the longitudinal length of the scaffold permits, such bracing shall be duplicated beginning at every fifth post. In a similar manner, longitudinal diagonal bracing shall also be installed from the last post extending back and upward toward the first post. Where conditions preclude the attachment of this bracing to the posts, it may be attached to the runners.

(13) The entire scaffold shall be tied to and securely braced against the building at intervals not to exceed 30 feet horizontally and 26 feet vertically.

(14) Guardrails not less than 2 x 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1 x 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a) (17) of this section.

(d) *Tubular welded frame scaffolds.* (1) Metal tubular frame scaffolds, including accessories such as braces, brackets, trusses, screw legs, ladders, etc., shall be designed and proved to safely support four times the maximum intended load.

(2) Spacing of panels or frames shall be consistent with the loads imposed.

(3) Scaffolds shall be properly braced by cross bracing or diagonal braces, or both, for securing vertical members to each other laterally, and the cross braces shall be of such length as will automatically square and align vertical members so that the erected scaffold is always plumb, square, and rigid. All brace connections shall be made secure.

(4) Scaffold legs shall be set on adjustable bases or plain bases placed on mud sills or other foundations adequate to support the maximum intended load.

(5) The frames shall be placed one on top of the other with coupling or stacking pins to provide proper vertical alignment of the legs.

(6) Where uplift may occur, panels shall be locked together vertically by pins or other equivalent suitable means.

(7) Guardrails not less than 2 x 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1 x 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a) (17) of this section.

(8) All tubular metal scaffolds shall be constructed and erected to support four times the maximum intended loads.

(9) To prevent movement, the scaffold shall be secured to the building or structure at intervals not to exceed 30 feet horizontally and 26 feet vertically.

(10) Maximum permissible spans of planking shall be in conformity with paragraph (a) (9) of this section.

(11) Drawings and specifications for all frame scaffolds over 125 feet in height above the base plates shall be designed by a registered professional engineer and copies made available to the employer and for inspection purposes.

(12) All tubular welded frame scaffolds shall be erected by competent and experienced personnel.

(13) Frames and accessories for scaffold shall be maintained in good repair and every defect, unsafe condition, or non-compliance with this section shall be immediately corrected before further use of the scaffold. Any broken, bent, excessively rusted, altered, or otherwise structurally damaged frames or accessories shall not be used.

(14) Periodic inspections shall be made of all welded frames and accessories, and any maintenance, including painting, or minor corrections authorized by the manufacturer, shall be made before further use.

(e) *Outrigger scaffolds.* (1) Outrigger beams shall extend not more than 6 feet beyond the face of the building. The inboard end of outrigger beams, measured from the fulcrum point to the extreme point of support, shall be not less than one and one-half times the outboard end in length. The beams shall rest on edge, the sides shall be plumb, and the edges shall be horizontal. The fulcrum point of the beam shall rest on a secure bearing at least 8 inches in each horizontal dimension. The beam shall be secured in place against movement and shall be securely braced at the fulcrum point against tipping.

(2) The inboard ends of outrigger beams shall be securely supported either by means of struts bearing against sills in contact with the overhead beams or ceiling, or by means of tension members secured to the floor joists underneath, or by both if necessary. The inboard ends of outrigger beams shall be secured against tipping and the entire supporting structure shall be securely braced in both directions to prevent any horizontal movement.

(3) Unless outrigger scaffolds are designed by a licensed professional engineer, they shall be constructed and erected in accordance with Table D-18. Outrigger scaffolds designed by a registered professional engineer shall be constructed and erected in accordance with such design. A copy of the detailed drawings and specifications showing the sizes and spacing of members shall be kept on the job.

(4) Planking shall be laid tight and shall extend to within 3 inches of the building wall. Planking shall be nailed or bolted to outriggers.

(5) Where there is danger of material falling from the scaffold, a wire mesh or other enclosure shall be provided between the guardrail and the toeboard.

(6) Where additional working levels are required to be supported by the outrigger method, the plans and specifications of the outrigger and scaffolding structure shall be designed by a registered professional engineer.

be provided on each side of the opening with its center approximately 4 feet above floor level and of standard strength and mounting.

(d) *Extension platform onto which materials can be hoisted for handling, and which shall have side rails or equivalent guards of standard specifications.*

(2) Every chute wall opening from which there is a drop of more than 4 feet shall be guarded by one or more of the barriers specified in subparagraph (1) of this paragraph, or as required by the conditions.

(3) Every window wall opening at a stairway landing, floor, platform, or balcony, from which there is a drop of more than 4 feet, and where the bottom of the opening is less than 5 feet above the platform or landing, shall be guarded by standard slats, standard grill work (as specified in paragraph (e) (11) of this section), or standard railing.

Where the window opening is below the landing, or platform, a standard toe board shall be provided.

(4) Every temporary wall opening shall have adequate guards but these need not be of standard construction.

(5) Where there is a hazard of materials falling through a wall hole, and the lower edge of the near side of the hole is less than 4 inches above the floor, and the far side of the hole more than 5 feet above the next lower level, the hole shall be protected by a standard toeboard, or an enclosing screen either of solid construction, or as specified in paragraph (e) (11) of this section.

(c) *Protection of open-sided floors, platforms, and runways.* (1) Every open-sided floor or platform 4 feet or more above adjacent floor or ground level shall be guarded by a standard railing (or the equivalent as specified in paragraph (e) (3) of this section) on all open sides, except where there is entrance to a ramp, stairway, or fixed ladder. The railing shall be provided with a toeboard wherever, beneath the open sides,

(i) Persons can pass,

(ii) There is moving machinery, or

(iii) There is equipment with which falling materials could create a hazard.

(2) Every runway shall be guarded by a standard railing (or the equivalent as specified in paragraph (e) (3) of this section) on all open sides 4 feet or more above floor or ground level. Wherever tools, machine parts, or materials are likely to be used on the runway, a toeboard shall also be provided on each exposed side.

Runways used exclusively for special purposes (such as oiling, shafting, or filling tank cars) may have the railing on one side omitted where operating conditions necessitate such omission, providing the falling hazard is minimized by using a runway of not less than 18 inches wide. Where persons entering upon runways become thereby exposed to machinery, electrical equipment, or other danger not a falling hazard, additional guarding as here specified may be essential for safety.

(3) Regardless of height, open-sided floors, walkways, platforms, or runways above or adjacent to dangerous equipment, picking or galvanizing tanks, degreasing units, and similar hazards shall be guarded with a standard railing and toe board.

(d) *Stairway railings and guards.* (1) Every flight of stairs having four or more risers shall be equipped with standard stair railings or standard handrails as specified in subdivisions (i) through (v) of this subparagraph, the width of the stair to be measured clear of all obstructions except handrails:

(i) On stairways less than 44 inches wide having both sides enclosed, at least one handrail, preferably on the right side descending.

(ii) On stairways less than 44 inches wide having one side open, at least one stair railing on open side.

(iii) On stairways less than 44 inches wide having both sides open, one stair railing on each side.

(iv) On stairways more than 44 inches wide but less than 88 inches wide, one handrail on each enclosed side and one stair railing on each open side.

(v) On stairways 88 or more inches wide, one handrail on each enclosed side, one stair railing on each open side, and one intermediate stair railing located approximately midway of the width.

(2) Winding stairs shall be equipped with a handrail offset to prevent walking on all portions of the treads having width less than 8 inches.

(e) *Railings, toe boards, and cover specifications.* (1) A standard railing shall consist of top rail, intermediate rail, and posts, and shall have a vertical height of 42 inches nominal from upper surface of top rail to floor, platform, runway, or ramp level. The top rail shall be smooth-surfaced throughout the length of the railing. The intermediate rail shall be approximately halfway between the top rail and the floor, platform, runway, or ramp. The ends of the rails shall not overhang the terminal posts except where such overhang does not constitute a projection hazard.

(2) A stair railing shall be of construction similar to a standard railing but the vertical height shall be not more than 34 inches nor less than 30 inches from upper surface of top rail to surface of tread in line with face of riser at forward edge of tread.

(3) Minimum requirements for standard railings under various types of construction are specified in the following subdivisions. Dimensions specified are based on the U.S. Department of Agriculture Wood Handbook, No. 72, 1955 (No. 1 [S45] Southern Yellow Pine [Modulus of Rupture 7,400 p.s.i.] for wood; ANSI G41.5-1970, American National Standard Specifications for Structural Steel, for structural steel; and ANSI B125.1-1970, American National Standard Specifications for Welded and Stainless Steel Pipe, for pipe).

(i) For wood railings, the posts shall be of at least 2-inch by 4-inch stock spaced not to exceed 5 feet; the top and

intermediate rails shall be of at least 2-inch by 4-inch stock. If top rail is made of two right-angle pieces of 1-inch by 4-inch stock, posts may be spaced on 8-foot centers, with 2-inch by 4-inch intermediate rail.

(ii) For pipe railings, posts and top and intermediate railings shall be at least 1½ inches nominal diameter with posts spaced not more than 8 feet on centers.

(iii) For structural steel railings, posts and top and intermediate rails shall be of 2-inch by 2-inch by ¾-inch angles or other metal shapes of equivalent bending strength with posts spaced not more than 8 feet on centers.

(iv) The anchoring of posts and framing of members for railings of all types shall be of such construction that the completed structure shall be capable of withstanding a load of at least 200 pounds applied in any direction at any point on the top rail.

(v) Other types, sizes, and arrangements of railing construction are acceptable provided they meet the following conditions:

(a) A smooth-surfaced top rail at a height above floor, platform, runway, or ramp level of 42 inches nominal;

(b) A strength to withstand at least the minimum requirement of 200 pounds top rail pressure;

(c) Protection between top rail and floor, platform, runway, ramp, or stair treads, equivalent at least to that afforded by a standard intermediate rail;

(d) Elimination of overhang of rail ends unless such overhang does not constitute a hazard; such as baluster railings, scrollwork railings, paneled railings.

(4) A standard toeboard shall be 4 inches nominal in vertical height from its top edge to the level of the floor, platform, runway, or ramp. It shall be securely fastened in place and with not more than ¼-inch clearance above floor level. It may be made of any substantial material either solid or with openings not over 1 inch in greatest dimension.

Where material is piled to such height that a standard toeboard does not provide protection, paneling from floor to intermediate rail, or to top rail shall be provided.

(5) (i) A handrail shall consist of a lengthwise member mounted directly on a wall or partition by means of brackets attached to the lower side of the handrail so as to offer no obstruction to a smooth surface along the top and both sides of the handrail. The handrail shall be of rounded or other section that will furnish an adequate handhold for anyone grasping it to avoid falling. The ends of the handrail should be turned in to the supporting wall or otherwise arranged so as not to constitute a projection hazard.

(ii) The height of handrails shall be not more than 34 inches nor less than 30 inches from upper surface of handrail to surface of tread in line with face of riser or to surface of ramp.

(iii) The size of handrails shall be: When of hardwood, at least 2 inches in diameter; when of metal pipe, at least

1½ inches in diameter. The length of brackets shall be such as will give a clearance between handrail and wall or any projection thereon of at least 3 inches. The spacing of brackets shall not exceed 8 feet.

(iv) The mounting of handrails shall be such that the completed structure is capable of withstanding a load of at least 200 pounds applied in any direction at any point on the rail.

(v) All handrails and railings shall be provided with a clearance of not less than 3 inches between the handrail or railing and any other object.

(vi) Floor opening covers may be of any material that meets the following strength requirements:

(i) Trench or conduit covers and their supports, when located in plant roadways, shall be designed to carry a truck rear-axle load of at least 20,000 pounds.

(ii) Manhole covers and their supports, when located in plant roadways, shall comply with local standard highway requirements if any; otherwise, they shall be designed to carry a truck rear-axle load of at least 20,000 pounds.

(iii) The construction of floor opening covers may be of any material that meets the strength requirements. Covers projecting not more than 1 inch above the floor level may be used providing all edges are chamfered to an angle with the horizontal of not over 30 degrees. All hinges, handles, bolts, or other parts shall set flush with the floor or cover surface.

(b) Skylight screens shall be of such construction and mounting that they are capable of withstanding a load of at least 200 pounds applied perpendicularly at any one area on the screen. They shall also be of such construction and mounting that under ordinary loads or impacts, they will not deflect downward sufficiently to break the glass below them. The construction shall be of grillwork with openings not more than 4 inches long or of slatwork with openings not more than 2 inches wide with length unrestricted.

(9) Wall opening barriers (rails, rollers, picket fences, and half doors) shall be of such construction and mounting that, when in place at the opening, the barrier is capable of withstanding a load of at least 200 pounds applied in any direction (except upward) at any point on the top rail or corresponding member.

(10) Wall opening grab handles shall be not less than 12 inches in length and shall be so mounted as to give 3 inches clearance from the side framing of the wall opening. The size, material, and anchoring of the grab handle shall be such that the completed structure is capable of withstanding a load of at least 200 pounds applied in any direction at any point of the handle.

(11) Wall opening screens shall be of such construction and mounting that they are capable of withstanding a load of at least 200 pounds applied horizontally at any point on the near side of the screen. They may be of solid construction, of grillwork with openings not

more than 8 inches long, or of slatwork with openings not more than 4 inches wide with length unrestricted.

§ 1910.24 Fixed industrial stairs.

(a) *Application of requirements.* This section contains specifications for the safe design and construction of fixed general industrial stairs. This classification includes interior and exterior stairs around machinery, tanks, and other equipment, and stairs leading to or from floors, platforms, or pits. This section does not apply to stairs used for fire exit purposes, to construction operations to private residences, or to articulated stairs, such as may be installed on floating roof tanks or on dock facilities, the angle of which changes with the rise and fall of the base support.

(b) *Where fixed stairs are required.* Fixed stairs shall be provided for access from one structure level to another where operations necessitate regular travel between levels, and for access to operating platforms at any equipment which requires attention routinely during operations. Fixed stairs shall also be provided where access to elevations is daily or at each shift for such purposes as gauging, inspection, regular maintenance, etc., where such work may expose employees to acids, caustics, gases, or other harmful substances, or for which purposes the carrying of tools or equipment by hand is normally required. (It is not the intent of this section to preclude the use of fixed ladders for access to elevated tanks, towers, and similar structures, overhead traveling cranes, etc., where the use of fixed ladders is common practice.) Spiral stairways shall not be permitted except for special limited usage and secondary access situations where it is not practical to provide a conventional stairway. Windmill stairways may be installed on tanks and similar round structures where the diameter of the structure is not less than five (5) feet.

(c) *Stair strength.* Fixed stairways shall be designed and constructed to carry a load of five times the normal live load anticipated but never of less strength than to carry safely a moving concentrated load of 1,000 pounds.

(d) *Stair width.* Fixed stairways shall have a minimum width of 22 inches.

(e) *Angle of stairway rise.* Fixed stairs shall be installed at angles to the horizontal of between 30° and 50°. Any uniform combination of rise/tread dimensions may be used that will result in a stairway at an angle to the horizontal within the permissible range. Table D-1 gives rise/tread dimensions which will produce a stairway within the permissible range, stating the angle to the horizontal produced by each combination. However, the rise/tread combinations are not limited to those given in Table D-1.

(f) *Stair treads.* Each tread and the top landing of a stairway, where risers are used, should have a nose which extends one-half inch to 1 inch beyond the face of the lower riser. Noses should have an even leading edge. All treads shall be

reasonably slip-resistant and the nosings shall be of nonslip finish. Welded bar grating treads without nosings are acceptable providing the leading edge can be readily identified by personnel descending the stairway and provided the tread is serrated or is of definite nonslip design. Rise height and tread width shall be uniform throughout any flight of

TABLE D-1

Angle to horizontal	Rise (in inches)	Tread run (in inches)
30°	6 1/4	11
32°	6 3/4	10 1/2
34°	7	10 1/4
36°	7 1/4	10
38°	7 1/2	9 3/4
40°	7 3/4	9 1/2
42°	8	9
44°	8 1/4	8 3/4
46°	8 1/2	8 1/2
48°	8 3/4	8
50°	9	7 1/2

stairs including any foundation structure used as one or more treads of the stairs.

(g) *Length of stairways.* Long flights of stairs, unbroken by landings or intermediate platforms, should be avoided. Consideration should be given to providing intermediate platforms where practical and where such stairways are in frequent use. Stairway platforms shall be no less than the width of a stairway and a minimum of 30 inches in length measured in the direction of travel.

(h) *Railings and handrails.* Standard railings shall be provided on the open sides of all exposed stairways and stair platforms. Handrails shall be provided on at least one side of closed stairways, preferably on the right side descending. Stair railings and handrails shall be installed in accordance with the provisions of § 1910.23.

(i) *Vertical clearance.* Vertical clearance above any stair tread to an overhead obstruction shall be at least 7 feet measured from the leading edge of the tread.

(j) *Open risers.* Stairs having treads of less than 9-inch width should have open risers.

(k) *General.* Open grating type treads are desirable for outside stairs.

§ 1910.25 Portable wood ladders.

(a) *Application of requirements.* This section is intended to prescribe rules and establish minimum requirements for the construction, care, and use of the common types of portable wood ladders, in order to insure safety under normal conditions of usage. Other types of special ladders, fruitpicker's ladders, combination step and extension ladders, stockroom step ladders, aisle-way step ladders, shelf ladders, and library ladders are not specifically covered by this section.

(b) *Materials.* (1) *Requirements applicable to all wood parts.* (i) All wood parts shall be of the species specified in Table D-5, seasoned to a moisture content of not more than 15 percent; smoothly machined and dressed on all sides; free from sharp edges and splinters; sound and free by accepted visual inspection from shake, wane, compression

TABLE D-7—MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF SINGLE POLE SCAFFOLDS LIGHT DUTY

	Maximum height of scaffold	
	20 feet	60 feet
Uniformly distributed load.....	Not to exceed 25 pounds per square foot.	
Poles or uprights.....	2 by 4 in.	4 by 4 in.
Pole spacing (longitudinal).....	6 ft. 0 in.	10 ft. 0 in.
Maximum width of scaffold.....	5 ft. 0 in.	5 ft. 0 in.
Bearers or putlogs to 3 ft. 0 in. width.....	2 by 4 in.	2 by 4 in.
Bearers or putlogs to 3 ft. 0 in. width.....	2 by 6 in. or 3 by 4 in.	2 by 6 in. or 3 by 4 in.
Ladders.....	1 by 4 in.	1 by 4 in.
Planking.....	1½ by 9 in. (rough).	2 by 9 in.
Vertical spacing of horizontal members.....	7 ft. 0 in.	7 ft. 0 in.
Bracing, horizontal and diagonal.....	1 by 4 in.	1 by 4 in.
Tie-ins.....	1 by 4 in.	1 by 4 in.
Toeboards.....	4 in. high (minimum).	4 in. high (minimum).
Guardrail.....	2 by 4 in.	2 by 4 in.

All members except planking are used on edge.

(17) Wood-pole scaffolds shall not be erected beyond the reach of effective firefighting apparatus.

TABLE D-8—MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF SINGLE POLE SCAFFOLDS

MEDIUM DUTY	
Uniformly distributed load.....	Not to exceed 50 pounds per square foot.
Maximum height of scaffold.....	60 ft.
Poles or uprights.....	4 by 4 in.
Pole spacing (longitudinal).....	8 ft. 0 in.
Maximum width of scaffold.....	5 ft. 0 in.
Bearers or putlogs.....	2 by 9 in. or 3 by 4 in.
Spacing of bearers or putlogs.....	8 ft. 0 in.
Ladders.....	2 by 9 in.
Vertical spacing of horizontal members.....	9 ft. 0 in.
Bracing, horizontal.....	1 by 6 in. or 1½ by 4 in.
Bracing, diagonal.....	1 by 4 in.
Tie-ins.....	1 by 4 in.
Planking.....	2 by 9 in.
Toeboards.....	4 in. high (minimum).
Guardrail.....	2 by 4 in.

All members except planking are used on edge.

TABLE D-9—MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF INDEPENDENT POLE SCAFFOLDS

MEDIUM DUTY	
Uniformly distributed load.....	Not to exceed 25 pounds per square foot.
Poles or uprights.....	2 by 4 in.
Pole spacing (longitudinal).....	4 ft. 0 in.
Pole spacing (transverse).....	4 ft. 0 in.
Ladders.....	1½ by 4 in.
Bearers to 3 ft. 0 in. span.....	2 by 4 in.
Bearers to 10 ft. 0 in. span.....	2 by 6 in. or 3 by 4 in.
Planking.....	1½ by 9 in.
Vertical spacing of horizontal members.....	7 ft. 0 in.
Bracing, horizontal and diagonal.....	1 by 4 in.
Tie-ins.....	1 by 4 in.
Toeboards.....	4 in. high (minimum).
Guardrail.....	2 by 4 in.

All members except planking are used on edge.

TABLE D-11—MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF INDEPENDENT POLE SCAFFOLDS

MEDIUM DUTY	
Uniformly distributed load.....	Not to exceed 50 pounds per square foot.
Maximum height of scaffold.....	60 ft.
Poles or uprights.....	4 by 4 in.
Pole spacing (longitudinal).....	8 ft. 0 in.
Pole spacing (transverse).....	8 ft. 0 in.
Spacing of bearers.....	8 ft. 0 in.
Bearers.....	2 by 9 in. (rough) or 3 by 10 in.
Bracing, horizontal.....	1 by 6 in. or 1½ by 4 in.
Bracing, diagonal.....	1 by 4 in.
Tie-ins.....	1 by 4 in.

All members except planking are used on edge.

TABLE D-12—MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF INDEPENDENT POLE SCAFFOLDS

HEAVY DUTY	
Uniformly distributed load.....	Not to exceed 75 pounds per square foot.
Maximum height of scaffold.....	60 ft.
Poles or uprights.....	4 by 4 in.
Pole spacing (longitudinal).....	6 ft. 0 in.
Pole spacing (transverse).....	6 ft. 0 in.
Spacing of bearers.....	6 ft. 0 in.
Bearers.....	2 by 9 in. (rough) or 3 by 10 in.
Bracing, horizontal.....	1 by 6 in. or 1½ by 4 in.
Bracing, diagonal.....	1 by 4 in.
Tie-ins.....	1 by 4 in.

All members except planking are used on edge.

TABLE D-11—Continued

MEDIUM DUTY—continued	
Planking.....	2 by 9 in.
Toeboards.....	4 in. high (minimum).
Guardrail.....	2 by 4 in.

All members except planking are used on edge.

TABLE D-12—MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF INDEPENDENT POLE SCAFFOLDS

HEAVY DUTY	
Uniformly distributed load.....	Not to exceed 75 pounds per square foot.
Maximum height of scaffold.....	60 ft.
Poles or uprights.....	4 by 4 in.
Pole spacing (longitudinal).....	6 ft. 0 in.
Pole spacing (transverse).....	6 ft. 0 in.
Spacing of bearers.....	6 ft. 0 in.
Bearers.....	2 by 9 in. (rough) or 3 by 10 in.
Bracing, horizontal and diagonal.....	1 by 6 in. or 1½ by 4 in.
Tie-ins.....	1 by 4 in.
Toeboards.....	4 in. high (minimum).
Guardrail.....	2 by 4 in.

All members except planking are used on edge.

TABLE D-13—TUBE AND COUPLER SCAFFOLDS LIGHT DUTY

Uniformly distributed load.....	Not to exceed 25 p.s.f.
Post spacing (longitudinal).....	19 ft. 0 in.
Post spacing (transverse).....	6 ft. 0 in.
Working levels.....	Additional planned levels..... Maximum height.....
1.....	5..... 125 ft.
2.....	4..... 125 ft.
3.....	0..... 91 ft. 0 in.

All members except planking are used on edge.

TABLE D-14—TUBE AND COUPLER SCAFFOLDS MEDIUM DUTY

Uniformly distributed load.....	Not to exceed 50 p.s.f.
Post spacing (longitudinal).....	8 ft. 0 in.
Post spacing (transverse).....	6 ft. 0 in.
Working levels.....	Additional planned levels..... Maximum height.....
1.....	6..... 125 ft.
2.....	0..... 78 ft. 9 in.

All members except planking are used on edge.

TABLE D-15—TUBE AND COUPLER SCAFFOLDS HEAVY DUTY

Uniformly distributed load.....	Not to exceed 75 p.s.f.
Post spacing (longitudinal).....	8 ft. 0 in.
Post spacing (transverse).....	6 ft. 0 in.
Working levels.....	Additional planned levels..... Maximum height.....
1.....	6..... 125 ft.

All members except planking are used on edge.

(c) *Tube and coupler scaffolds.* (1) A light-duty tube and coupler scaffold shall have all posts, bearers, runners, and bracing of nominal 2-inch O.D. steel tubing. The posts shall be spaced no more than 8 feet apart by 10 feet along the length of the scaffold. Other structural metals when used must be designed to carry an equivalent load.

(5) Scaffolds and other devices mentioned or described in this section shall be maintained in safe condition. Scaffolds shall not be altered or moved horizontally while they are in use or occupied.

(6) Any scaffold damaged or weakened from any cause shall be immediately repaired and shall not be used until repairs have been completed.

(7) Scaffolds shall not be loaded in excess of the working load for which they are intended.

(8) All load-carrying timber members of scaffold framing shall be a minimum of 1,500 f. (Stress Grade) construction grade lumber. All dimensions are nominal sizes as provided in the American Lumber Standards, except that where rough sizes are noted, only rough or undressed lumber of the size specified will satisfy minimum requirements. (Note: Where nominal sizes of lumber are used in place of rough sizes, the nominal size lumber shall be such as to provide equivalent strength to that specified in tables D-7 through D-12 and D-16.)

(9) All planking shall be Scaffold Grade as recognized by grading rules for the species of wood used. The maximum permissible spans for 2- x 9-inch or wider planks are shown in the following table:

	Material				
	Full thickness un-dressed lumber	Nominal thickness lumber			
Working load (p.s.f.)	25	50	75	25	50
Permissible span (ft.)	10	8	6	8	6

The maximum permissible span for 1½ x 9-inch or wider plank of full thickness is 4 feet with medium loading of 50 p.s.f.

(10) Nails or bolts used in the construction of scaffolds shall be of adequate size and in sufficient numbers at each connection to develop the designed strength of the scaffold. Nails shall not be subjected to a straight pull and shall be driven full length.

(11) All planking or platforms shall be overlapped (minimum 12 inches) or secured from movement.

(12) An access ladder or equivalent safe access shall be provided.

(13) Scaffold planks shall extend over their end supports not less than 6 inches nor more than 18 inches.

(14) The poles, legs, or uprights of scaffolds shall be plumb, and securely and rigidly braced to prevent swaying and displacement.

(15) Materials being hoisted onto a scaffold shall have a tag line.

(16) Overhead protection shall be provided for men on a scaffold exposed to overhead hazards.

(17) Scaffolds shall be provided with a screen between the toeboard and the guardrail, extending along the entire opening, consisting of No. 18 gauge U.S. Standard Wire one-half-inch mesh or the equivalent, where persons are re-

quired to work or pass under the scaffolds.

(18) Employees shall not work on scaffolds during storms or high winds.

(19) Employees shall not work on scaffolds which are covered with ice or snow, unless all ice or snow is removed and planking sanded to prevent slipping.

(20) Tools, materials, and debris shall not be allowed to accumulate in quantities to cause a hazard.

(21) Only treated or protected fiber rope shall be used for or near any work involving the use of corrosive substances or chemicals.

(22) Wire or fiber rope used for scaffold suspension shall be capable of supporting at least six times the intended load.

(23) When acid solutions are used for cleaning buildings over 50 feet in height, wire rope supported scaffolds shall be used.

(24) The use of shore scaffolds or lean-to scaffolds is prohibited.

(25) Lumber sizes, when used in this section, refer to nominal sizes except where otherwise stated.

(26) Scaffolds shall be secured to permanent structures, through use of anchor bolts, reveal bolts, or other equivalent means. Window cleaners' anchor bolts shall not be used.

(27) Special precautions shall be taken to protect scaffold members, including any wire or fiber ropes, when using a heat-producing process.

(b) General requirements for wood pole scaffolds. (1) Scaffold poles shall bear on a foundation of sufficient size and strength to spread the load from the poles over a sufficient area to prevent settlement. All poles shall be set plumb.

(2) Where wood 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 not be less than 4 feet 0 inches in length, overlapping the abutted ends equally, and have the same width and not less than the cross-sectional area of the pole. Splice plates of other materials of equivalent strength may be used.

(3) Independent pole scaffolds shall be set as near to the wall of the building as practicable.

(4) All pole scaffolds shall be securely guyed or tied to the building or structure. Where the height or length exceeds 25 feet, the scaffold shall be secured at intervals not greater than 25 feet vertically and horizontally.

(5) Putlogs or bearers shall be set with their greater dimensions vertical, long enough to project over the ledgers of the inner and outer rows of poles at least 3 inches for proper support.

(6) Every wooden putlog on single pole scaffolds shall be reinforced with a ½ x 2-inch steel strip or equivalent secured to its lower edge throughout its entire length.

(7) Ledgers shall be long enough to extend over two pole spaces. Ledgers

shall not be spliced between the poles. Ledgers shall be reinforced by bearing blocks securely nailed to the side of the pole to form a support for the ledger.

(8) Diagonal bracing shall be provided to prevent the poles from moving in a direction parallel with the wall of the building, or from buckling.

(9) Cross bracing shall be provided between the inner and outer sets of poles in independent pole scaffolds. The free ends of pole scaffolds shall be cross braced.

(10) Full diagonal face bracing shall be erected across the entire face of pole scaffolds in both directions. The braces shall be spliced at the poles.

(11) Platform planks shall be laid with their edges close together so the platform will be tight with no spaces through which tools or fragments of material can fall.

(12) Where planking is lapped, each plank shall lap its end supports at least 12 inches. Where the ends of planks abut each other to form a flush floor, the butt joint shall be at the centerline of a pole. The abutted ends shall rest on separate bearers. Intermediate beams shall be provided where necessary to prevent dislodgment of planks due to deflection, and the ends shall be nailed or cleated to prevent their dislodgment.

(13) When a scaffold turns a corner, the platform planks shall be laid to prevent tipping. The planks that meet the corner putlog at an angle shall be laid first, extending over the diagonally placed putlog far enough to have a good safe bearing, but not far enough to involve any danger from tipping. The planking running in the opposite direction at right angles shall be laid so as to extend over and rest on the first layer of planking.

(14) When moving platforms to the next level, the old platform shall be left undisturbed until the new putlogs or bearers have been set in place, ready to receive the platform planks.

(15) Guardrails not less than 2 x 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1 x 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with paragraph (a)(17) of this section.

(16) All wood pole scaffolds 60 feet or less in height shall be constructed and erected in accordance with tables D-7 through D-12 of this section. If they are over 60 feet in height they shall be designed by a registered professional engineer and constructed and erected in accordance with such design. A copy of the typical drawings and specifications shall be made available to the employer and for inspection purposes.

sion failures, decay, or other irregularities except as hereinafter provided. Low-stress wood shall not be used.

(ii) Black streaks in western hemlock shall not be considered an irregularity, except that chambers associated with black streaks, when present in the part, shall be limited as specified for pitch and bark pockets.

(2) Permissible irregularities in side rails and back rails. (i) The general slope of grain in side rails of minimum dimension shall not be steeper than 1 in 12, except that for ladders under 10 feet in length and having flat steps for treads, the general slope of grain shall not be steeper than 1 in 10. The slope of grain in areas of local grain deviation shall not be steeper than 1 in 12 or 1 in 10 as specified above when occurring on the edges or in the outer one-fourth of the width of the wide face. Local areas of grain deviation within the center half of the width of the wide face may contain grain slope as steep as 1 in 8. Local deviations of grain associated with otherwise permissible irregularities are permitted.

(ii) Knots shall not appear in narrow faces of side rails. Knots, if tight and sound and less than one-half inch in diameter, are permitted on the wide face provided they are at least one-half inch back from either edge and not more frequent than 1 to any 3 feet of ladder length.

(iii) Pitch and bark pockets are permitted provided they are not more than eight inch in width, or more than 2 inches in length, or more than one-half inch in depth, and then only if they are not more frequent than 1 to any 3 feet of ladder length.

(iv) Checks are permitted on side rails provided they are not more than 6 inches in length or more than one-half inch in depth.

(v) Occurrences of compression wood in relatively small amounts and positively identified by competent and conscientious visual inspection of side rails are permitted provided no single streak shall exceed one-half inch in width nor shall the aggregate of streaks exceed one-fourth of the face of the side rail. Borderline forms of compression wood not positively identified by competent and conscientious visual inspection are permitted. Ladder parts containing bow or crook which would interfere with the operation of the ladder shall not be used.

(3) Permissible irregularities in flat steps, rungs, and cleats. (i) The general slope of grain in flat steps of minimum dimension shall not be steeper than 1 in 12, except that for ladders under 10 feet in length the slope of grain shall not be steeper than 1 in 10. The slope of grain in areas of local deviation shall not be steeper than 1 in 12 or 1 in 10 as specified above. For all ladders, cross grain not steeper than 1 in 10 are permitted in lieu of 1 in 12, provided the size is increased to afford at least 15 percent calculated strength than for ladders built to minimum dimensions. Local deviations of grain associated with otherwise permissible irregularities are permitted.

(ii) The general slope of grain and that in areas of local deviations of grain shall not be steeper than 1 in 12 in rungs and cleats. For all ladders cross grain not steeper than 1 in 12 are permitted in lieu of 1 in 10, provided the size is increased to afford at least 15 percent calculated strength for ladders built to minimum dimensions. Local deviations of grain associated with otherwise permissible irregularities are permitted.

(iii) Knots over one-eighth inch in diameter shall not appear in rungs. Knots shall not appear in the narrow faces of flat steps and cleats. Knots appearing in the wide faces of flat steps and cleats shall not exceed a diameter of one-fourth inch.

(4) Classification of species of wood. Table D-5 gives a list of native woods, divided into four groups on the basis of mechanical properties considered from the standpoint of use for ladder construction. (i) All minimum dimensions and specifications set forth hereinafter for side rails and flat steps are based on the species of wood listed in Group 3 in Table D-5 except where otherwise provided. The species of all other groups may be substituted for those of Group 3 when used in sizes that provide at least equivalent strength. (See Table D-5 for suggested methods of size adjustment.) (ii) All minimum dimensions and specifications set forth hereinafter for rungs and cleats are based on the species of wood listed in Group 1 in Table D-5. Cleats may be made of species of any other group provided that the cross-

(ii) For the side rails of single extension and sectional ladders, the proposed section shall develop an actual stress per square inch not greater than 2,150 pounds for Group 1 woods, 2,000 pounds for Group 2 woods, 1,600 pounds for Group 3 woods, or 1,375 pounds for Group 4 woods when computed by the following formula applying to rectangular sections, with a maximum tolerance of 5 percent over these stresses:

$$S = \frac{8LD(P+W/16)}{2B(D-C)} \quad \frac{1.5LD(25+W/16)}{B(D-0.67)}$$

P = 25 pounds, which is the normal component on each rail of a load of 200 pounds at the center of the ladder, equally distributed between the rails, when the foot of the ladder is moved out of the perpendicular by one-quarter of its length.

S = Stress in extreme fiber in pounds per square inch.

W = Weight of ladder in pounds.

L = Maximum working length of ladder in inches.

B = Net thickness of each side rail in inches.

D = Depth of side rail in inches.

C = Diameter of hole board for rung (C shall be taken as not less than 0.67).

(iii) Adjustment of sizes for wood parts of stepladders and other ladder types covered by this section may be made as follows:

(a) The dimensions specified in later sections for parts having rectangular cross sections generally represent only one of a number of possible combinations of thickness and width which could satisfy the requirements for strength and stiffness. Depending upon the material sizes available, manufacturing practices, and like factors, parts produced by a particular manufacturer may or may not agree exactly with the sizes given later. The following provisions provide means for determining equality of load-carrying capacity of parts of different sizes or of determining sizes needed to provide equality.

(b) Any changes in dimensions shall result in a change in the width-thickness ratio for side rails of back legs not greater than 25 percent from the ratio for a corresponding ladder as now covered in this section.

(c) Where both dimensions are different from those specified, the load-carrying capacity in bending of a part will be equal to or greater than that of a part of specified dimensions if the ratio P_1/P_2 is not less than 1, where

$$P_1 = \frac{B_1 D_1^3}{P_2 = \frac{B_2 D_2^3}$$

B = Dimension of the part at right angles to the direction of load (width of a step, thickness of a side rail or back leg).

D = Dimension of the part parallel to the direction of load (thickness of a step, width of a side rail or back leg).

B_1, D_1 = Dimensions as specified.

B_2, D_2 = Dimensions of part being considered.

(d) The dimensions to be used in the computations are net dimensions. For example, in the case of a stepladder side rail, the dimension B is to be taken as the gross thickness of the rail minus the

(e) Construction requirements—(1) Basis of requirements. (i) Dimensions specified hereinafter for wood ladders are the minimum dressed cross-sectional dimensions for the types of ladders herein designated, based on the species of woods specified in paragraph (b)(4) of this section, at a moisture content of 15 percent. The dimensions for side rails are based on a mortise or gain as specified for the various types of ladders for step or rung attachments. Where the strength of the side rails or back legs is reduced by a greater mortise or gain than shown, or where it is desired to use a cross section for any wood part other than dimension of which is less than that specified, the required dimensions may be found as indicated in subdivision (ii) of this subparagraph.

(ii) The dimensions to be used in the computations are net dimensions. For example, in the case of a stepladder side rail, the dimension B is to be taken as the gross thickness of the rail minus the

depth of the gain for the steps. Where there is a rung hole at the center of depth of a rail, a somewhat more accurate comparison may be made by the use of the formula

$$P_1 = B_1 D_1 (D_1^2 - d^2)$$

$$P_2 = B_2 D_2 (D_2^2 - d^2)$$

where the symbols have the same meanings as before and d is the diameter of the hole for the rung tenon. In most instances the difference in results calculated by this and by the earlier formula will be slight.

(2) **Portable stepladders.** Stepladders longer than 20 feet shall not be supplied. Stepladders as hereinafter specified shall be of three types:

Type I—Industrial stepladder, 3 to 20 feet for heavy duty, such as utilities, contractors, and industrial use.

Type II—Commercial stepladder, 3 to 12 feet for medium duty, such as painters, offices, and light industrial use.

Type III—Household stepladder, 3 to 6 feet for light duty, such as light household use.

(b) **General requirements.** (a) Slope is the inclination of side rails or back legs with respect to the vertical and is expressed as a deviation from the vertical per unit length of the member. Stepladders shall be so constructed, that when in the open position, the slope of the front section shall not be less than 3½ inches and the slope of the back section not less than 2 inches, for each 12-inch length of side rail.

(b) A uniform step spacing shall be employed which shall be not more than 12 inches. Steps shall be parallel and level when the ladder is in position for use.

(c) The minimum width between side rails at the top, inside to inside, shall be not less than 11½ inches. From top to bottom, the side rails shall spread at least 1 inch for each foot of length of stepladder.

(d) When minimum thickness of side rails is used, steps shall be closely fitted into the grooves in the side rails one-eighth inch in depth with a tolerance of one thirty-second inch, and shall be firmly secured as hereinafter described; or they shall be closely fitted into metal brackets of an equivalent strength, which in turn shall be firmly secured to the side rails. The depth of groove herein provided may be increased in proportion to the thickness of side rails as provided in subdivisions (II) (a), (III) (a), and (IV) (a) of this subparagraph.

(e) All stepladders shall have a top with wood or metal brackets or fittings tightly secured to the top, side rails, and back legs, to allow free swinging of the back section without excessive play or wear at the joints.

(f) A metal spreader or locking device of sufficient size and strength to securely hold the front and back sections in open positions shall be a component of each stepladder. The spreader shall have all sharp points covered or removed to protect the user. For Type III ladder, the pull shelf and spreader may be combined in one unit (the so-called shelf-lock ladder).

(g) When measured along the front edge of the side rails, all stepladders

shall measure within 3 inches of the specified length.

(h) Where bucket shelves are provided, they shall be constructed to support a load of 25 pounds and shall be so fastened that they can be folded up when the ladder is closed.

(i) All metal parts and fittings shall be securely attached by means of rivets, bolts, screws, or equivalent fasteners.

(ii) **Type I industrial stepladder.** (a) The minimum dimensions of the parts of the Type I stepladder shall be as shown in Table D-2 when made of Group 2 or Group 3 woods.

(2) The minimum thickness of side rails provides for the cutting of a groove of one-eighth inch in depth with the tolerance indicated in subdivisions (i) (d) of this subparagraph, and shall be increased when grooves of greater depth are used.

(b) Steps shall be secured with at least two 6-d nails at each end, or the equivalent thereof. Each step shall be reinforced by a steel rod not less than 0.160 inch in diameter with standard commercial tolerances, which shall pass through metal washers of sufficient thickness and diameter on each end to prevent pressing—into the side rails, and a truss block which shall be fitted between the rod and the center of each step, or by a metal angle brace on each end firmly secured to the steps and side rails, or by construction of equivalent strength and safety. Where the rod reinforcement construction is used, the bottom step shall be provided further with a metal angle brace on each end which shall be securely attached to the bottom step and side rails. In addition, all steps 3½ inches wide and 27 inches or more in overall length and all steps 4½ inches wide and 32 inches or more in overall length shall be provided with a metal angle brace at each end securely attached to the step and side rail.

(c) The back section shall be braced by one of the following methods:

(1) The back legs shall be braced with 1½-inch diameter rungs of Group 1 woods (see Table D-5), or material of equivalent strength, having ¾-inch diameter tenons or oval wood rungs, or

rectangular wood rungs of equivalent strength, spaced not more than 12 inches apart. The back legs shall be bored with holes either extending through the legs or to within three-sixteenths inch of the outside face of the legs, the size of the hole to be such as to insure a tight fit for the rung. The shoulder of the rung shall be forced firmly against the leg, and the tenon secured in place with a nail, or the equivalent thereof, to prevent turning of the rungs. The back legs shall be braced by a metal angle brace on each side, securely fastened to the rung and the back legs, one rung to be braced for each 4 feet of length or fraction thereof, on ladders 4 feet or more in length, with braces required only on the bottom rung for ladders that are 4 feet or shorter. Where rungs are more than 28 inches in length between the back legs they shall be provided with center bearing consisting of a wood bar not less than ¾ by 2 inches in cross-section securely nailed to each rung passing through it and long enough to include each rung longer than 28 inches.

(2) The back leg shall be braced with horizontal wood bars of Group 1, 2, or 3 woods in Table D-5 and not less than ¾ by 2½ inches in cross-section, spaced not more than 12 inches apart. The ends of the bars shall fit into metal sockets of not less than 20-gauge (Manufacturers Standard) steel, or other material of equivalent strength, or into mortises of not less than one-eighth inch (tolerance of one thirty-second inch) in depth in the back legs. A steel rod not less than 0.160 inch in diameter with standard commercial tolerance shall pass through the back legs, the bar, and at each end through metal washers of sufficient diameter and thickness to prevent passing into the back legs. The back legs shall also be braced by a metal angle brace on each side, securely fastened to the bar and to the legs, one bar to be so braced for at least each 4 feet of length or fraction thereof, with braces required only on bottom bar for ladders that are 4 feet or shorter. Metal sockets when used shall be attached to the back legs by rivets or by means of a rod running through the socket or equivalent thereof.

TABLE D-2

DIMENSIONS FOR TYPE I STEP LADDER

	Length, 12 feet and less		Length, 14 and 16 feet		Length, 18 and 20 feet	
	Thickness (inch)	Depth (inch)	Thickness (inch)	Depth (inch)	Thickness (inch)	Depth (inch)
Side rails	¾	3¼	¾	3¼	1½	3½
Back legs	¾	2¼	¾	2¼	1½	2½
Steps	¾	2¼	¾	2¼	¾	2¼
Top	¾	2¼	¾	2¼	¾	2¼

TABLE D-3

DIMENSIONS FOR TYPE II STEP LADDER

	Length, 3 to 8 feet		Length, 10 feet		Length, 12 feet	
	Thickness (inch)	Depth (inch)	Thickness (inch)	Depth (inch)	Thickness (inch)	Depth (inch)
Side rails	¾	2¼	¾	2¼	¾	3
Back legs	¾	1¾	¾	1¾	¾	2
Steps	¾	2¼	¾	2¼	¾	2¼
Top	¾	2¼	¾	2¼	¾	2¼

BFG30383

nor more than 24 inches clearance between rails. For side-step or offset fixed ladder sections, at landings, the side rails and rungs shall be carried to the next regular rung beyond or above the 3½ feet minimum (fig. D-10).

(4) **Grab bars.** Grab bars shall be spaced by a continuation of the rung spacing when they are located in the horizontal position. Vertical grab bars shall have the same spacing as the ladder side rails. Grab-bar diameters shall be

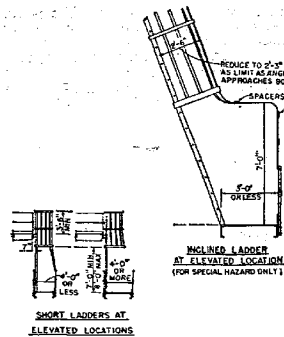


FIGURE D-9—Cages—Special applications.

(vi) Ladder wells shall have a clear width of at least 15 inches measured each way from the centerline of the ladder. Smooth-walled wells shall be a minimum of 27 inches from the centerline of rungs to the well wall on the climbing side of the ladder. Where other obstructions on the climbing side of the ladder exist, there shall be a minimum of 30 inches from the centerline of the rungs.

(2) **Landing platforms.** When ladders are used to ascend to heights exceeding 20 feet (except on chimneys), landing platforms shall be provided for each 30 feet of height or fraction thereof, except that, where no cage, well, or ladder safety device is provided, landing platforms shall be provided for each 20 feet of height or fraction thereof. Each ladder section shall be offset from adjacent sections. Where installation conditions (even for a short, unbroken length) require that adjacent sections be offset, landing platforms shall be provided at each offset.

(i) Where a man has to step a distance greater than 12 inches from the centerline of the rung of a ladder to the nearest edge of structure or equipment, a landing platform shall be provided. The minimum step-across distance shall be 2½ inches.

(ii) All landing platforms shall be equipped with standard railings and toeboards, so arranged as to give safe access to the ladder. Platforms shall be not less than 24 inches in width and 30 inches in length.

(iii) One rung of any section of ladder shall be located at the level of the landing laterally served by the ladder. Where access to the landing is through the ladder, the same rung spacing as used on the ladder shall be used from the landing platform to the first rung below the landing.

(3) **Ladder extensions.** The side rails of through or side-step ladder extensions shall extend 3½ feet above parapets and landings. For through ladder extensions, the rungs shall be omitted from the extension and shall have not less than 18

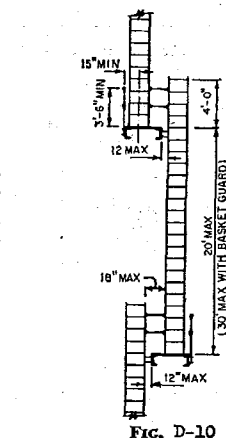


FIG. D-10

Offset Fixed Ladder Sections

the equivalent of the round-rung diameters.

(5) **Ladder safety devices.** Ladder safety devices may be used on tower, water tank, and chimney ladders over 20 feet in unbroken length in lieu of cage protection. No landing platform is required in these cases. All ladder safety devices such as those that incorporate lifelines, friction brakes, and sliding attachments shall meet the design requirements of the ladders which they serve.

(e) **Pitch.** (1) **Preferred pitch.** The preferred pitch of fixed ladders shall be considered to come in the range of 75 degrees and 90 degrees with the horizontal (fig. D-11).

(2) **Substandard pitch.** Fixed ladders shall be considered as substandard if they are installed within the substandard pitch range of 60 and 75 degrees with the horizontal. Substandard fixed ladders are permitted only where it is found necessary to meet conditions of installation. This substandard pitch range shall be considered as a critical range to be avoided, if possible.

(3) **Scope of coverage in this section.** This section covers only fixed ladders within the pitch range of 60 degrees and 90 degrees with the horizontal.

(4) **Pitch greater than 90 degrees.** Ladders having a pitch in excess of 90

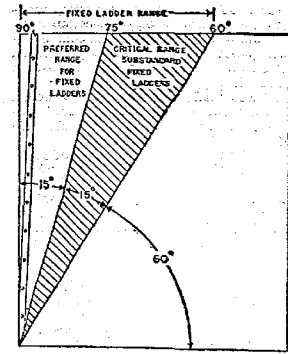


FIG. D-11

Pitch of Fixed Ladders degrees with the horizontal are prohibited.

(f) **Maintenance.** All ladders shall be maintained in a safe condition. All ladders shall be inspected regularly, with the intervals between inspections being determined by use and exposure.

§ 1910.23 Safety requirements for scaffolding.

(a) **General requirements for all scaffolds.** (1) Scaffolds shall be furnished and erected in accordance with this standard for persons engaged in work that cannot be done safely from the ground or from solid construction, except that ladders used for such work shall conform to § 1910.25 and § 1910.26.

(2) The footing or anchorage for scaffolds shall be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Unstable objects such as barrels, boxes, loose brick, or concrete blocks shall not be used to support scaffolds or planks.

(3) Guardrails and toeboards shall be installed on all open sides and ends of platforms more than 10 feet above the ground or floor except:

(i) Scaffolding wholly within the interior of a building and covering the entire floor area of any room therein and not having any side exposed to a hoistway, elevator shaft, stairwell, or other floor openings; and

(ii) Needle-beam scaffolds and floats in use by structural iron workers.

Guardrails should all be 2 x 4 inches or the equivalent, installed no less than 36 inches or not more than 42 inches high, with a midrail, when required, of 1 x 4-inch lumber or equivalent. Supports should be at intervals not to exceed ten feet. Toeboards shall be a minimum of 4 inches in height.

(4) Scaffolds and their components shall be capable of supporting without failure at least four times the maximum intended load.

feet in back of the grab bars shall be not less than 4 inches. Grab bars shall not protrude on the climbing side beyond the rungs of the ladder which they serve.

(6) *Step-across distance.* The step-across distance from the nearest edge of ladder to the nearest edge of equipment or structure shall be not more than 12 inches, or less than 2½ inches (fig. D-4).

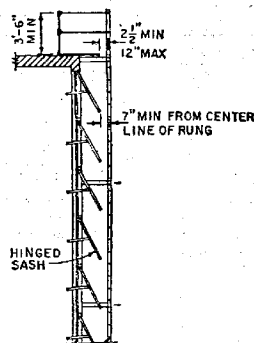
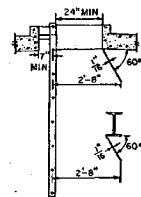


Fig. D-4
Ladder Far from Wall

(7) *Hatch cover.* Counterweighted hatch covers shall open a minimum of 60 degrees from the horizontal. The distance from the centerline of rungs or cleats to the edge of the hatch opening on the climbing side shall be not less than 24 inches for offset wells or 30 inches for straight wells. There shall be no protruding potential hazards within 24 inches of the centerline of rungs or cleats; any such hazards within 30 inches of the centerline of the rungs or cleats shall be fitted with deflector plates placed at an angle of 60 degrees from the horizontal as indicated in figure D-5.



Deflector Plates for Fixed Hazards

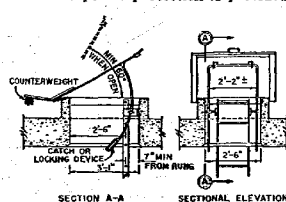
Fig. D-5

The relationship of a fixed ladder to an acceptable counterweighted hatch cover is illustrated in figure D-6.

(d) *Special requirements.* (1) *Cages or wells.* (i) Cages or wells (except on chimney ladders) shall be built, as shown on the applicable drawings, covered in detail in figures D-7, D-8, and D-9, or of equivalent construction.

(ii) Cages or wells (except as provided in subparagraph (5) of this paragraph) conforming to the dimensions shown in figures D-7, D-8, and D-9 shall be provided on ladders of more than 20 feet to a maximum unbroken length of 30 feet.

(iii) Cages shall extend a minimum of 42 inches above the top of landing, unless other acceptable protection is provided.



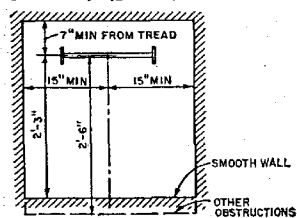
Relationship of Fixed Ladder to a Safe Access Hatch

Fig. D-6

(iv) Cages shall extend down the ladder to a point not less than 7 feet nor more than 8 feet above the base of the ladder, with bottom flared not less

than 4 inches, or portion of cage opposite ladder shall be carried to the base.

(v) Cages shall not extend less than 27 nor more than 28 inches from the centerline of the rungs of the ladder. Cage shall not be less than 27 inches in width. The inside shall be clear of projections. Vertical bars shall be located at a maximum spacing of 40 degrees around the circumference of the cage; this will give a maximum spacing of approximately 9½ inches, center to center.



Clearance Diagram for Fixed Ladder in Well

Figure D-7

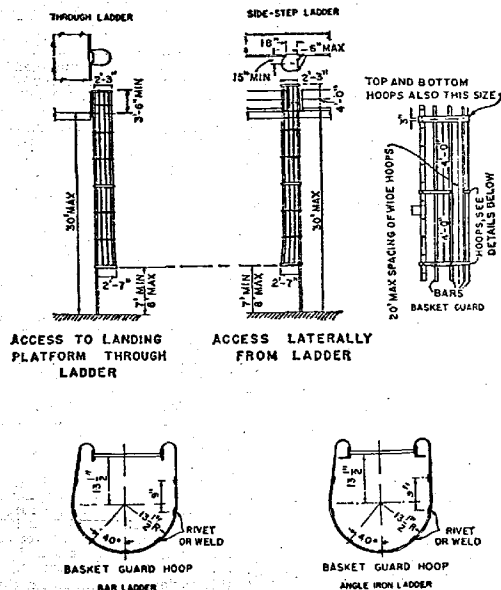


Fig. D-8

Cages for Ladders More Than 20 Feet High

(d) The back legs shall be reinforced by a rivet through the depth of the leg above the hinge point, by metal plates or collars at the hinge point, or by other means suitable for preventing splitting of the back leg from the hinge pin to the top.

(iii) *Type II commercial stepladder.* (a) (1) The minimum dimensions of the parts of the Type II stepladder shall be as given in Table D-3 when made of Group 2 or Group 3 woods.

(2) The minimum thickness of side rails provides for the cutting of a groove of one-eighth inch in depth with the tolerance indicated in subdivision (i) (d) of this subparagraph, and shall be increased when grooves of greater depth are used. (3) Steps shall be secured with at least two 6-d nails at each end, or the equivalent thereof. Each step shall be reinforced by a steel rod not less than 0.160 inch in diameter with standard commercial tolerances which shall pass through metal washers of sufficient thickness and diameter on each end to prevent pressing into the side rails, and a truss block shall be fitted between the truss rod and center of each step, or by a metal angle brace on each end firmly secured to the steps and side rails; or by construction of equivalent strength and safety. Where the rod reinforcement construction is used, the bottom step shall be provided further with a metal angle brace on each end which shall be securely attached to the bottom step and side rails. In addition all steps 27 inches or more in overall length shall be provided with a metal angle brace at each end securely attached to the step and side rails.

(c) The back legs shall be braced by one of the three following methods: (1) (i) With ¾-inch diameter wood dowels of Group 1 woods (see Table D-5) or material of equivalent strength having not less than ¾-inch tenons firmly secured in the back legs and spaced not more than 12 inches apart. The back legs shall be bored with holes either extending through the legs or to within three-sixteenths inch of the outside face of the legs, the size of the hole to be such as to insure a tight fit for the dowel. The shoulder of the dowel shall be forced firmly against the leg and the tenon secured in place with a nail, or the equivalent thereof, to prevent turning of the dowel.

(ii) A bar connecting two or more of the dowels shall be provided on all ladders of 6 feet or more. The cross-sectional dimensions of the bar shall be the same as the cross-sectional dimensions of the back legs, and the dowels shall pass through holes at the centerline of the bar. The bar shall be attached at the center of the length of the lower two dowels on a 6-foot ladder and shall extend upward one dowel for each 2 feet of added length.

(3) With wood dowels as set forth in subdivision (ii) (c) (1), plus an inverted V bracing of ¾- by 1½-inch material through which the dowels extend, the length of the V to extend two-thirds of the way up the back.

(3) With horizontal bracing of Group 1, 2, 3, or 4 woods (see Table D-5) not less than ¾ by 2 inches in cross-section, the ends of which shall fit into metal sockets of not less than 20-gauge (Manufacturing Standard), steel, or other material of equivalent strength or into mortises not less than one-eighth inch in depth in back legs. The bars shall be reinforced by steel rods not less than 0.160 inch in diameter with standard commercial tolerances which shall pass through the back legs, the bar, and, at each end, through metal washers of sufficient diameter and thickness to prevent pressing into the back legs. The spacing of such braces shall not exceed 3 feet, and there shall be one brace on 3- and 4-foot ladders, two braces on 5- and 6-foot ladders, three braces on 7- and 8-foot ladders, and four braces on 10- and 12-foot ladders. The bottom bar shall be not more than 18 inches from the bottom of the ladder, and, where only one bar is used, it shall be braced by a metal angle brace on each end securely attached to the bar and the back leg.

(iv) *Type III household stepladder.* (a) The minimum dimensions of the parts of the Type III stepladder shall be as follows when made of Group 2 or Group 3 woods:

	Length, 3 to 6 feet	
	Thickness (inch)	Depth (inches)
Side rails.....	¾	2 1/4
Back legs.....	¾	2 1/4
Steps.....	¾	2
Top.....	¾	2

The minimum thicknesses of side rails provide for the cutting of a groove one-eighth inch in depth with the tolerance indicated in subdivision (i) (d) of this subparagraph, and shall be increased when grooves of greater depth are used.

(b) Steps shall be secured with at least one 6-d nail at each end, or the equivalent thereof. Each step shall be reinforced by a steel rod not less than 0.160 inch in diameter with standard commercial tolerance which shall pass through metal washers of sufficient thickness and diameter to prevent pressing into the side rails, or by a metal brace at each end firmly secured to steps and side rails or by construction of equivalent strength and safety. Where the rod reinforcement construction is used, the bottom step shall be provided further with a metal angle brace on each end which shall be securely attached to the bottom step and side rail.

(c) Back legs shall be braced by one of the two following methods or by construction of equivalent strength and safety:

(1) By diagonal slates of groups 1, 2, 3, or 4 wood (see Table D-5) not less than ¾ by 1½ inches securely fastened to the back legs by nails, screws, or the equivalent thereof.

(2) With horizontal bracing of Groups 1, 2, 3, or 4 wood (see Table D-5) not less than ¾ by 1½ inches in cross section, the ends of which shall fit into metal sockets of not less than 20-gauge (Manufacturing

Standard) steel or other material of equivalent strength or into mortises not less than one-eighth inch in depth in back legs. The bars shall be reinforced by steel rods not less than 0.160 inch in diameter with standard commercial tolerances which shall pass through the back leg, the bar, and at each end through metal washers of sufficient diameter and thickness to prevent pressing into each leg. The spacing of such bars shall not exceed 3 feet, and there shall be one brace on 3- and 4-foot ladders, two braces on 5- and 6-foot ladders. The bottom bar shall be not more than 18 inches from the bottom of the ladder.

(3) *Portable rung ladders.* Portable rung ladders as herein specified shall be of four types, as follows: single ladder; two-section extension ladder; sectional ladder; trestle and extension trestle ladder.

(1) *General requirements.* (a) The base or lower portion of a ladder may have either parallel sides or flared sides in accordance with commercial practice.

(b) Rungs shall be parallel, level, and uniformly spaced. The spacing shall be not more than 12 inches, except as hereinafter specified.

(c) All holes for wood rungs shall either extend through the side rails or be bored so as to give least a three-sixteenths-inch length of bearing to the rung tenon. In through-bored construction, the rungs shall extend at least flush with the outside rail surface. All holes shall be located on the center line of the wide face of the side rails and shall be of such size as to insure a tight fit for the rung. The shoulder of the rung shall be forced firmly against the side rails and the tenon secured in place with a nail or the equivalent thereof, for the sole purpose of preventing the turning of the rung and maintaining the rung position in the side rail.

(d) Round rungs shall be of Group 1 woods (see Table D-5), shall be not less than 1½ inches in diameter for lengths up to 36 inches between side rails and 1¼ inches in diameter for lengths over 36 up to and including 72 inches, and shall have not less than seven-eighths inch-diameter tenons, or rungs of equivalent strength and bearing shall be provided. When rungs are 28 inches or more in length between side rails, they shall, in addition, be provided with center bearing.

(e) Oval rungs or rungs of any other cross section may be used provided they are secured by a nail at each end or the equivalent thereof, and have at least the same strength and bearing as round rungs of the same length.

(f) All metal parts and fittings shall be securely attached by means of rivets, bolts, screws, or equivalent fasteners.

(g) The construction and assembly of the movable parts shall be such that they shall operate freely and securely without binding or unnecessary play.

(h) When measured along the side rails, no rung ladder or section thereof shall be more than 4 inches shorter than the specified length.

(i) Nonstep bases shall be securely bolted, riveted, or attached by equivalent construction to the side rails.

(j) Hooks shall be securely bolted or riveted to the side rails or equivalent construction and shall be of such dimensions as to withstand the loads imposed upon them.

(k) Single ladders. (a) Single ladders longer than 30 feet shall not be supplied.

(b) The minimum dimensions of the side rails of the single ladder shall be as follows when made of group 2 or group 3 woods:

Length of ladder (feet)	Thickness (inches)	Depth (inches)
Up to and including 16.....	1 1/4	2 1/2
Over 16 up to and including 22.....	1 1/2	2 3/4
Over 22 up to and including 30.....	1 3/4	3

(c) Smaller side rails will be acceptable in all ladders of this type when reinforced by a steel wire, rod, or strap running the length of the side rails and adequately secured thereto. Where such reinforcement is used, the reinforced rails shall be equivalent in strength to the side rails specified in this subdivision (ii) (b).

(d) The width between the side rails at the base, inside to inside, shall be at least 11 1/2 inches for all ladders up to and including 10 feet. Such minimum widths shall be increased at least one-fourth inch for each additional 2 feet of length.

(e) Two-section ladders. (a) Two-section extension ladders longer than 60 feet shall not be supplied. All ladders of this type shall consist of two sections, one to fit within the side rails of the other, and arranged in such a manner that the upper section can be raised and lowered.

(b) The minimum dimensions of the side rails of the two-section extension ladder shall be not less than specified in Table D-4 of this section.

(c) The minimum dimensions of side rails set forth in Table D-4 are based on the maximum working length, which is the size of ladder less the minimum overlap, which shall be as follows:

Size of ladder (feet):	Overlap (feet):
Up to and including 36.....	3
Over 36 up to and including 48.....	4
Over 48 up to and including 60.....	5

(d) Smaller side rails will be acceptable in all ladders of this type when reinforced by a steel wire, rod, or strap running the length of the side rails and adequately secured thereto. Where such reinforcement is used, the reinforced rails shall be equivalent in strength to the side rails specified in Table D-4.

(e) The minimum distance between side rails of the bottom section, inside to inside, shall be 14 1/2 inches on ladders up to and including 28 feet; 16 inches on all ladders over 28 feet up to and including 40 feet; 18 inches on all ladders over 40 feet.

(f) All locks and guide irons shall be of metal and shall be of such construction and strength as to develop the full strength of the side rails. All locks shall

be positive in their action. The guide irons shall be securely attached and so placed as to prevent the upper section from tipping or falling out while raising, lowering, or in use.

(g) (1) Ladders of this type may be equipped with a rope and pulley, which shall be securely attached to the ladder in such manner as not to weaken either the rungs or the side rails. The pulley shall be not less than 1 1/4 inches in diameter.

(2) The rope used with the pulley shall be not less than five-sixteenths inch in diameter having a minimum breaking strength of 560 pounds, and shall be sufficient length for the purpose intended.

(iv) Sectional Ladder. (a) Assembled combinations of sectional ladders longer than lengths specified in this subdivision shall not be used.

(b) The minimum dimensions of side rails shall be as follows for Group 2 or Group 3 woods:

Assembled length of ladder (feet)	Thickness (inches)	Depth (inches)
Up to and including 21.....	1 1/4	2 1/2
Over 21 up to and including 24.....	1 1/2	2 3/4

(c) Ladders of this type shall have either straight sides slightly converging toward the top of each section, or shall have flaring sides at the bottom of the first (or bottom) section, with the top section having converging side rails to a width that shall be not less than 4 inches. Except for the top section, the minimum width between side rails shall be 11 inches.

(f) Adjacent sections shall be jointed by means of a groove in the bottom end of each rail of the upper of the two sections setting firmly over extensions outside the side rails, of the topmost rung of the next lower section and, at the

TABLE D-4. DIMENSIONS OF SIDE RAILS FOR TWO-SECTION LADDER

Size of ladder, overall length (feet)	Rail	
	Thickness (inches)	Depth (inches)
For group 2 woods		
10.....	1 1/4 X	2 1/2
16.....	1 1/4 X	2 3/4
22.....	1 1/4 X	2 3/4
28.....	1 1/4 X	2 3/4
34.....	1 1/4 X	2 3/4
40.....	1 1/4 X	2 3/4
46.....	1 1/4 X	2 3/4
52.....	1 1/4 X	2 3/4
58.....	1 1/4 X	2 3/4
64.....	1 1/4 X	2 3/4
70.....	1 1/4 X	2 3/4
76.....	1 1/4 X	2 3/4
82.....	1 1/4 X	2 3/4
88.....	1 1/4 X	2 3/4
94.....	1 1/4 X	2 3/4
100.....	1 1/4 X	2 3/4
For group 3 woods		
10.....	1 1/4 X	2 1/2
16.....	1 1/4 X	2 3/4
22.....	1 1/4 X	2 3/4
28.....	1 1/4 X	2 3/4
34.....	1 1/4 X	2 3/4
40.....	1 1/4 X	2 3/4
46.....	1 1/4 X	2 3/4
52.....	1 1/4 X	2 3/4
58.....	1 1/4 X	2 3/4
64.....	1 1/4 X	2 3/4
70.....	1 1/4 X	2 3/4
76.....	1 1/4 X	2 3/4
82.....	1 1/4 X	2 3/4
88.....	1 1/4 X	2 3/4
94.....	1 1/4 X	2 3/4
100.....	1 1/4 X	2 3/4

same time, a groove in the top end of each rail of the lower of the two sections setting firmly over the bottom rung, inside the side rails, of the section next above.

(2) The distance between the two rungs (top-most rung of one section, bottom rung of the section next above) mentioned in this subdivision (iv) (c) (1) shall not be less than 1 foot.

(3) The fit between rail grooves and rungs mentioned in this subdivision (iv) (c) (1) shall be such as to provide a good fit without binding or unnecessary play.

(4) The grooved ends of the sections shall be reinforced with a metal plate of not less than 18-gauge (Manufacturing Standard) material properly secured thereto, and a rivet adjacent to the groove, extending through the depth of the rail, or the equivalent thereof.

(v) Trestle and extension trestle ladder. (a) Trestle ladders, or extension sections or base sections of extension trestle ladders longer than 20 feet shall not be supplied.

(b) The minimum dimensions of the side rails of the trestle ladder, or the base sections of the extension trestle ladder, shall be as follows for Group 2 or Group 3 woods:

Size of ladder (feet)	Thickness (inches)	Depth (inches)
Up to and including 16.....	1 1/4	2 1/2
Over 16 up to and including 20.....	1 1/2	2 3/4

The minimum dimensions of the side rails of the extension section of the extension trestle ladder, which shall have parallel sides, shall be as follows for Group 2 or Group 3 woods:

Size of ladder (feet)	Thickness (inches)	Depth (inches)
Up to and including 12.....	1 1/4	2 1/2
Over 12 up to and including 16.....	1 1/2	2 3/4
Over 16 up to and including 20.....	1 1/2	2 3/4

(c) Trestle ladders and base sections of extension trestle ladders shall be so spread that when in an open position the spread of the trestle at the bottom, inside to inside, shall be at least 5 1/2 inches per foot of the length of the ladder.

(d) The width between the side rails at the base of the trestle ladder and base sections of the extension trestle ladder shall be at least 21 inches for all ladders and sections up to and including 6 feet. Longer lengths shall be increased at least 1 inch for each additional foot of length.

The width between the side rails of the extension sections of the trestle ladder shall be not less than 12 inches.

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

(f) A metal spreader or locking device to hold the front and back sections in an open position, and to hold the extension section securely in the elevated position, shall be a component of all extension trestle ladders and all trestle ladders over 12 feet in length.

(g) Rungs shall be parallel and level. On the trestle ladder, or on the base sections of the extension trestle ladder,

(iv) The top of the ladder must be placed with the two rails supported, unless equipped with a single support attachment. Such an attachment should be substantial and large enough to support the ladder under load.

(v) When ascending or descending, the climber must face the ladder.

(vi) Ladders must not be tied or fastened together to provide longer sections. They must be equipped with the hardware fittings necessary if the manufacturer endorses extended uses.

(vii) Ladders should not be used as a brace, skid, guy or gin pole, gangway, or for other uses than that for which they were intended, unless specifically recommended for use by the manufacturer.

(viii) Users are cautioned to take proper safety measures when metal ladders are used in areas containing electric circuits to prevent short circuits or electrical shock.

§ 1910.27 Fixed ladders.

(a) Design requirements—(1) Design considerations. All ladders, appurtenances, and fastenings shall be designed to meet the following load requirements:

(i) The minimum design live load shall be a single concentrated load of 200 pounds.

(ii) The number and position of additional concentrated live-load units of 200 pounds each as determined from anticipated usage of the ladder shall be considered in the design.

(iii) The live loads imposed by persons occupying the ladder shall be considered to be concentrated at such points as will cause the maximum stress in the structural member being considered.

(iv) The weight of the ladder and attached appurtenances together with the live load shall be considered in the design of rails and fastenings.

(2) Design stresses. Design stresses for wood components of ladders shall not exceed those specified in § 1910.25. All wood parts of fixed ladders shall meet the requirements of § 1910.25(b).

For fixed ladders consisting of wood side rails and wood rungs or cleats, used at a pitch in the range 75 degrees to 90 degrees, and intended for use by no more than one person per section, single ladders as described in § 1910.25(c) (3) (ii) are acceptable.

(b) Specific features—(1) Rungs and cleats. (i) All rungs shall have a minimum diameter of three-fourths inch for metal ladders, except as covered in subparagraph (7) (i) of this paragraph, and a minimum diameter of 1 1/4 inches for wood ladders.

(ii) The distance between rungs, cleats, and steps shall not exceed 12 inches and shall be uniform throughout the length of the ladder.

(iii) The minimum clear length of rungs or cleats shall be 16 inches.

(iv) Rungs, cleats, and steps shall be free of splinters, sharp edges, burrs, or projections which may be a hazard.

(v) The rungs of an individual-rung ladder shall be so designed that the foot cannot slide off the end. A suggested design is shown in figure D-1.

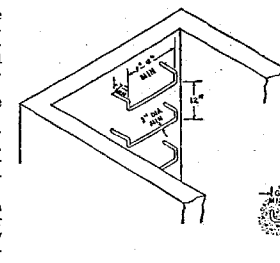


FIGURE D-1.—Suggested design for rungs on individual-rung ladders.

(2) Side rails. Side rails which might be used as a climbing aid shall be of such cross sections as to afford adequate gripping surface without sharp edges, splinters, or burrs.

(3) Fastenings. Fastenings shall be an integral part of fixed ladder design.

(4) Splices. All splices made by whatever means shall meet design requirements as noted in paragraph (a) of this section. All splices and connections shall have smooth transition with original members and with no sharp or extensive projections.

(5) Electrolytic action. Adequate means shall be employed to protect dissimilar metals from electrolytic action when such metals are joined.

(6) Welding. All welding shall be in accordance with the "Code for Welding in Building Construction" (AWS D1.0-1966).

(7) Protection from deterioration. (i) Metal ladders and appurtenances shall be painted or otherwise treated to resist corrosion and rusting when location demands. Ladders formed by individual metal rungs imbedded in concrete, which serve as access to pits and to other areas under floors, are frequently located in an atmosphere that causes corrosion and rusting. To increase rung life in such atmosphere, individual metal rungs shall have a minimum diameter of 1 inch or shall be painted or otherwise treated to resist corrosion and rusting.

(ii) Wood ladders, when used under conditions where decay may occur, shall be treated with a nonirritating preservative, and the details shall be such as to prevent or minimize the accumulation of water on wood parts.

(iii) When different types of materials are used in the construction of a ladder, the materials used shall be so treated as to have no deleterious effect one upon the other.

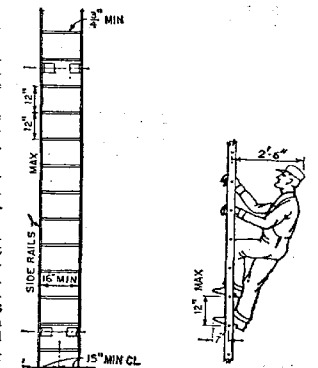
(c) Clearance—(1) Climbing side. On fixed ladders, the perpendicular distance from the centerline of the rungs to the nearest permanent object on the climbing side of the ladder shall be 36 inches for a pitch of 75 degrees, and 30 inches for a pitch of 90 degrees (fig. D-2 of this section), with minimum clearances for intermediate pitches varying between these two limits in proportion to the slope, except as provided in subparagraphs (3) and (5) of this paragraph.

(2) Ladders without cages or wells. A clear width of at least 15 inches shall be provided each way from the centerline of the ladder in the climbing space, except when cages or wells are necessary.

(3) Ladders with cages or baskets. Ladders equipped with cage or basket are excepted from the provisions of subparagraphs (1) and (2) of this paragraph, but shall conform to the provisions of paragraph (d) (1) (v) of this section. Fixed ladders in smooth-walled wells are excepted from the provisions of subparagraph (1) of this paragraph, but shall conform to the provisions of paragraph (d) (1) (vi) of this section.

(4) Clearance in back of ladder. The distance from the centerline of rungs, cleats, or steps to the nearest permanent object in back of the ladder shall be not less than 7 inches, except that when unavoidable obstructions are encountered, minimum clearances as shown in figure D-3 shall be provided.

(5) Clearance in back of grab bar. The distance from the centerline of the grab bar to the nearest permanent ob-



RAIL LADDER WITH BAR STEEL RAILS AND ROUND STEEL RUNGS
FIG. D-2

Minimum Ladder Clearances

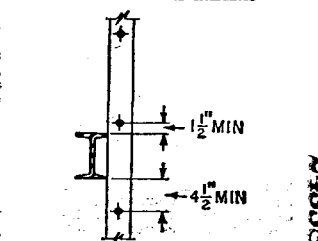


FIG. D-3
Clearance for Unavoidable Obstruction at Rear of Fixed Ladder

Width spread shall not be less than 1 inch per foot of rise.

(iii) Slope of the front rail when unit is in open position shall not be less than 3½ inches per foot of rise, and the back section shall have a minimum slope of 1 inch per foot of rise.

(iv) The platform shall be at least 20 inches from the top of the ladder, and shall have an area of not less than 200 square inches nor more than 400 square inches.

(v) The back legs and side rails of a platform ladder shall extend at least 20 inches above the platform and shall be connected with the top member to form a three-sided top guard rail, or equivalent construction shall be provided.

(vi) Spreaders shall be provided where the hinging apparatus is not designed to lock the unit open.

(b) *Testing.* (1) *General.* The following tests are intended to insure uniform testing methods for metal ladders.

(2) *Straight and extension ladders.*

(i) Ladder incline strength is measured by placing the ladder unit in a flat, horizontal position, supported 6 inches from the ends of the side rails. When testing extensions, the unit is opened to the required overlap. A load of 200 pounds is applied equally to the side rails at the center of the unit by means of a beam. The ladder must withstand this test with no permanent deformation or other visible weakening of the structure. This test is based on a 200-pound man using the ladder, set at 75½° to the ground. With the man on the center rung, the component of his 200-pound weight at right angles to the ladder will be 50 pounds. Applying the load factor of 4, the test weight becomes 200 pounds.

(ii) Test unit need only be of sufficient length for test purposes and is to consist of the base and fly sections of an extension ladder with all the hardware or fittings attached. The ladder unit is placed in a vertical position and a downward load of 775 pounds equally distributed on the ends of the side rails of the upper portion of the test unit. The unit shall withstand this test with no permanent deformation or other visible weakening of the structure.

(iii) A test unit of at least three rungs is to be used from the maximum width portion of the ladder. A load of 800 pounds shall be applied to a 3½-inch wide block resting on the center of the widest rung. A rung of 14 inches or less in length shall withstand this test with no permanent deformation or other visible weakening of the structure. A rung of more than 14 inches in length may have a permanent deflection of not more than one-eighth inch provided the rung cross section is not deformed and there is no other visible weakening of the structure.

(iv) With at least a three-rung test unit set in a vertical position, a load of 800 pounds shall be applied to a 3½-inch wide block resting on the center rung as near to the side rail as possible. On removing the load, the unit must show no indication of failure in the fasteners attaching the rungs to the side rail.

(v) The rung shall be so secured to the side rail that a torque load of 360 inch-pounds applied to the rung at a side rail shall cause no visible relative motion between the rung and the side rail.

(vi) With the ladder extended to its maximum working length, and resting horizontally on level supports located 6 inches from each end of the ladder, a weight of 50 pounds shall be suspended from one of the side rails midway between supports.

The deflection of the loaded rail, and the difference in deflection between the loaded and unloaded rails shall not exceed the values in Table D-5.

(vii) Deflections in Table D-5 are to be determined by measuring, at the midpoint between supports, the distance from the outside edges of both rails to the floor or other reference surface both before and after the test load of 50 pounds is applied to one rail of the ladder. The test is to be repeated loading the other rail of the ladder. The angle (a) between the loaded and unloaded rails and the horizontal is to be calculated from the trigonometric equation:

$$\text{Sine } a = \frac{\text{Difference in deflection}}{\text{Ladder width}}$$

(3) *Step, trestle, extension trestle, and platform ladders.* (i) A load test of the entire ladder is made with the ladder in an open position, and an 800-pound load applied to the center of the top. Resistance to side rail bending is tested by placing an 800-pound load on the center of the middle step. The strength of the step section is tested by applying an 800-pound load to a 3½-inch-wide block resting on the center of the longest or bottom step. The rail shall be so constructed as to support a distributed load of 50 pounds.

(ii) In each test case, the unit must withstand the load without failure or permanent deformation.

(iii) Set ladder in open position on a level floor. Place a 200-pound distributed load on the top step. The ladder is then subjected to a horizontal pulling load, applied at the top step, of 12-pound force to the side; 58-pound force to the front; 33-pound force to the back. In each test, all side rails must remain on the floor.

TABLE D-5—TABLE OF DEFLECTIONS

Length of ladder in feet	Maximum deflection of loaded rail in inches	Maximum difference in deflection between loaded and unloaded rails in degrees from horizontal
20	3.0	3.6
24	3.8	4.7
28	4.6	5.7
32	5.4	6.7
36	6.2	7.7
40	7.0	8.7
44	7.8	9.7
48	8.6	10.7

(c) *Care and maintenance of ladders.* (1) *General.* To get maximum serviceability, safety, and to eliminate unnecessary damage of equipment, good safe practices in the use and care of ladder equipment must be employed by the users.

The following rules and regulations are essential to the life of the equipment and the safety of the user.

(2) *Care of ladders.* (i) Ladders, like any tool, must be handled with care and not subject to unnecessary dropping, jarring, or misuse. They are designed for a specific purpose or use; therefore, any variation from this use constitutes a mis-handling of the equipment.

(ii) Ladders should be stored on racks designed to protect the ladder when not in use. The racks should have sufficient supporting points to prevent any possibility of excessive sagging.

(iii) Ladders transported on vehicles must be properly supported. Supporting points should be of a softer material, such as hardwood or rubber-covered iron pipe, to minimize the chafing and effects of road shock. Tying the ladder to each support point will greatly reduce damage due to road shock.

(iv) Ladders must be maintained in good usable condition at all times. Hardware fittings and accessories should be checked frequently and kept in good working condition.

(v) Ropes or cables should be inspected frequently and replaced if defective.

(vi) Complete ladder inspection should be periodic. If a ladder is involved in any of the following, immediate inspection is necessary:

(a) If ladders tip over, inspect ladder for side rails dent or bends, or excessively dented rungs; check all rung-to-side-rail connections; check hardware connections; check rivets for shear.

(b) If ladders are exposed to excessive heat as in the case of fire, the ladder should be inspected visually for damage and tested for deflection and strength characteristics. In doubtful cases, refer to manufacturer.

(c) If ladders are to be subjected to certain acids or alkali solutions, a protective coating such as asphalt and varnish should be applied to the equipment.

(d) If ladders are exposed to oil and grease, equipment should be cleaned of oil, grease, or slippery materials. This can easily be done with a solvent or steam cleaning.

(vii) Ladders having defects are to be marked and taken out of service until repaired by either maintenance department or the manufacturer.

(3) *Use of ladders.* (i) Portable non-self-supporting ladders should be erected at a pitch of 75½ degrees for maximum balance and strength. A simple rule for setting up a ladder at the proper angle is to place the base a distance from the vertical wall equal to one-fourth the working length of the ladder.

(ii) Portable ladders are designed as a one-man working ladder based on a 200-pound load.

(iii) The ladder base section must be placed with a secure footing. Safety shoes of good substantial design should be installed on all ladders. Where ladders with no safety shoes or spikes are used on hard, slick surfaces, a foot-ladder board should be employed.

rungs shall be spaced not less than 8 inches or more than 18 inches apart; on the extension section of the extension trestle ladder, rungs shall be spaced not less than 6 inches or more than 12 inches apart.

(4) *Special-purpose ladders.* All special-purpose ladders shall comply with the appropriate requirements of subparagraphs (1), (2), and (3) of this paragraph, except as hereinafter modified in this subparagraph.

(i) *Platform stepladder.* A platform stepladder is a modification of a portable stepladder with a working platform provided near the top.

(a) Platform stepladders shall be made in accordance with the requirements of type I stepladders or in accordance with the requirements for type II stepladders.

(b) The slope of the back section shall be such that a vertical from the back edge of the platform will strike the floor at a distance measured toward the front section of not less than 3 inches from the base of the back section.

(c) The minimum width between side rails at the platform shall be not less than 15 inches.

(d) The back legs and side rails shall extend at least 24 inches above the platform and shall be connected with a top member to form a three-sided rail, or equivalent construction shall be provided.

(e) Platforms shall be so constructed as to be capable of supporting a load of 200 pounds placed at any point on the platform.

(f) A separate spreader may be omitted from platform ladders in which the height to the platform is 6 feet or less. If the spreader is omitted, the platform shall be so designed as to function as a spreader or locking device to hold the front and back sections securely in an open position, with the connection between side rails and back legs being through the metal parts of the platform. The wood parts of a combined wood and metal platform functioning as a spreader shall not be depended upon to contribute to the spreading or locking action.

(ii) *Painter's stepladder.* (a) Painter's stepladders longer than 12 feet shall not be supplied.

(b) Painter's stepladders shall be made in accordance with the requirements of type II stepladders except for the following:

(i) The top may be omitted.

(2) A rope spreader may be substituted for the metal spreader required in subparagraph (2) (i) (f) of this paragraph. The rope shall not be less than No. 6 sash cord or its equivalent.

(iii) *Mason's ladder.* A mason's ladder is a special type of single ladder intended for use in heavy construction work.

(a) Mason's ladders longer than 40 feet shall not be supplied.

(b) The minimum dimensions of the side rails when made of Group 2 or Group 3 woods and rungs (Group 1) of the mason's ladder shall be as follows:

RULES AND REGULATIONS

Length of ladder (feet)	Side rails		Diameter	
	Thickness (inches)	Depth (inches)	Rung (inches)	Tenon (inches)
Up to and including 22...	1¾	3¾	1¾	1
Over 22 up to and including 40.....	1¾	4¾	1¾	1

(c) The width between the side rails at the bottom rung, inside to inside, shall be not less than 12 inches for all ladders up to and including 10 feet. Such minimum widths shall be increased by at least one-fourth inch for each additional 2 feet of length.

(d) Rungs shall be parallel and level and shall be spaced not less than 8 inches or more than 12 inches apart.

(5) *Trolley and side-rolling ladders.* (i) *Length.* Trolley ladders and side-rolling ladders longer than 20 feet should not be supplied.

(ii) *Dimensions.* The dimensions of the side rails shall not be less than the following for Group 2 or Group 3 woods:

Length of side rails (feet)	Thickness (inch)	Depth (inches)
Up to and including 10.....	1¾	3
Over 10 up to and including 20....	1¾	3¾

The minimum thicknesses of side rails provide for the cutting of a groove not over one-eighth inch in depth and shall be increased when grooves of greater depth are used. Flat steps shall have the following minimum dimensions for Group 2 or Group 3 woods:

Length of step (inches)	Thickness (inch)	Width (inches)
Up to and including 16.....	1¾	3
Over 16 up to and including 20....	1¾	3¾
Over 20 up to and including 24....	1¾	3¾
Over 24 up to and including 28....	1¾	4

(iii) *Width.* The width between the side rails, inside to inside, shall be at least 12 inches.

(iv) *Step attachment.* Flat steps shall be inset in the side rails one-eighth inch and secured with at least two 6-d nails at each end or the equivalent thereof. They shall be reinforced with angle braces or a ¾-inch steel rod.

(v) *Locking device.* Locking devices should be provided on all trolley ladders.

(vi) *Tracks.* (a) Tracks shall be wood, or metal (excluding cast iron), or a combination of these materials.

(b) Tracks for the top end of ladders shall be fastened securely and shall be so constructed that the wheels will not jump the track. Tracks shall be so designed as to provide for all probable loads to which they will be subjected.

(c) The supports shall be securely fastened by lag screws, machine, hook, or toggle bolts, or their equivalent.

(d) Track for side-rolling ladders shall be supported by metal or wood brackets securely screwed or bolted to

shelving or other permanent structure at not over 3 feet.

(vii) *Wheel carriages.* (a) Wheel carriages shall be so designed as to provide for all loads to which they will be subjected. Two-point suspension should be used.

(b) The wheel carriage for the top end of the ladder shall be securely fastened to the top of the ladder with metal brackets bolted either to the side rails or to the top step. When bolted to the top step, this step shall be secured to the side rails with metal braces in addition to those otherwise provided. The wheel carriage shall be so designed that a loose or broken wheel will not allow the ladder to drop or become detached from the track.

(c) The wheel carriage for the bottom end of the ladder shall be securely fastened to the bottom of the ladder.

(d) The wheels at the upper end of the ladder shall have minimum wheel base of 8 inches.

(e) When wheels are used at the bottom of the ladder, there shall be at least one wheel supporting each side rail.

(f) Running gear for bottoms of both trolley and side-rolling ladders shall be so designed and constructed as to provide for any load to which they will be subjected.

(d) *Care and use of ladders.* (1) *Care.* To insure safety and serviceability the following precautions on the care of ladders shall be observed:

(i) Ladders shall be maintained in good condition at all times, the joint between the steps and side rails shall be tight, all hardware and fittings securely attached, and the movable parts shall operate freely without binding or undue play.

(ii) Metal bearings of locks, wheels, pulleys, etc., shall be frequently lubricated.

(iii) Frayed or badly worn rope shall be replaced.

(iv) Safety feet and other auxiliary equipment shall be kept in good condition to insure proper performance.

(v) Ladders should be stored in such a manner as to provide ease of access or inspection, and to prevent danger of accident when withdrawing a ladder for use.

(vi) Wood ladders, when not in use, should be stored at a location where they will not be exposed to the elements, but where there is good ventilation. They shall not be stored near radiators, stoves, steam pipes, or other places subjected to excessive heat or dampness.

(vii) Ladders stored in a horizontal position should be supported at a sufficient number of points to avoid sagging and permanent set.

(viii) Ladders carried on vehicles should be adequately supported to avoid sagging and securely fastened in position to minimize chafing and the effects of road shocks.

(ix) Ladders should be kept coated with a suitable protective material. The painting of ladders is satisfactory pro-

viding the ladders are carefully inspected prior to painting by competent and experienced inspectors acting for, and responsible to, the purchaser, and providing the ladders are not for resale.

(x) Ladders shall be inspected frequently and those which have developed defects shall be withdrawn from service for repair or destruction and tagged or marked as "Dangerous, Do Not Use."

(xi) Rungs should be kept free of grease and oil.

(2) Use. The following safety precautions shall be observed in connection with the use of ladders:

(i) Portable rung and cleat ladders shall, where possible, be used at such a pitch that the horizontal distance from the top support to the foot of the ladder is one-quarter of the working length of the ladder (the length along the ladder between the foot and the top support). The ladder shall be so placed as to prevent slipping, or it shall be lashed, or held in position. Ladders shall not be used in a horizontal position as platforms, runways, or scaffolds.

(ii) Ladders for which dimensions are specified should not be used by more than one man at a time nor with ladder jacks and scaffold planks where use by more than one man is anticipated. In such cases, specially designed ladders with larger dimensions of the parts should be procured.

(iii) Portable ladders shall be so placed that the side rails have a secure footing. The top rest for portable rung and cleat ladders shall be reasonably rigid and shall have ample strength to support the applied load.

(iv) Ladders shall not be placed in front of doors opening toward the ladder unless the door is blocked upon, locked, or guarded.

(v) Ladders shall not be placed on boxes, barrels, or other unstable bases to obtain additional height.

(vi) To support the top of the ladder at a window opening, a board should be attached across the back of the ladder, extending across the window and providing firm support against the building walls or window frames.

(vii) When ascending or descending, the user should face the ladder.

(viii) Ladders with broken or missing steps, rungs, or cleats, broken side rails, or other faulty equipment shall not be used; improvised repairs shall not be made.

(ix) Short ladders shall not be spliced together to provide long sections.

(x) Ladders made by fastening cleats across a single rail shall not be used.

(xi) Ladders shall not be used as guys, braces, or skids, or for other than their intended purposes.

(xii) Tops of the ordinary types of stepladders shall not be used as steps.

(xiii) On two-section extension ladders the minimum overlap for the two sections in use shall be as follows:

RULES AND REGULATIONS

Size of ladder (feet):	Overlap (feet)
Up to and including 36.....	3
Over 36 up to and including 48.....	4
Over 48 up to and including 60.....	5

(xiv) Portable rung ladders with reinforced rails (see paragraphs (c) (3) (ii) (c) and (iii) (d) this section) shall be used only with the metal reinforcement on the under side. Ladders of this type should be used with great care near electrical conductors, since the reinforcing itself is a good conductor.

(xv) No ladder should be used to gain access to a roof unless the top of the ladder shall extend at least 3 feet above the point of support, at eave, gutter, or roof line.

(xvi) Adjustment of extension ladders should only be made by the user when standing at the base of the ladder, so that the user may observe when the locks are properly engaged. Adjustment of extension ladders from the top of the ladder (or any level over the locking device) is a dangerous practice and should not be attempted. Adjustment should not be made while the user is standing on the ladder.

(xvii) Middle and top sections of sectional or window cleaner's ladders should not be used for bottom section unless the user equips them with safety shoes.

(xviii) Extension ladders should always be erected so that the upper section is resting on the bottom section.

(xix) The user should equip all portable rung ladders with nonslip bases when there is a hazard of slipping. Nonslip bases are not intended as a substitute for care in safely placing, lashing, or holding a ladder that is being used upon oily, metal, concrete, or slippery surfaces.

(xx) The bracing on the back legs of step ladders is designed solely for increasing stability and not for climbing.

(xxi) When service conditions warrant, hooks may be attached at or near the top of portable ladders to give added security.

TABLE D-5—CLASSIFICATION OF VARIOUS SPECIES OF WOOD ACCEPTABLE FOR USE IN LADDERS

The species are listed alphabetically within each group. The position of any species within a group therefore bears no relation to its strength or acceptability. Where ladders are desired for use under conditions favorable to decay, it is recommended that the heartwood of decay-resistant species be used, or that the wood be given a treatment with a wood preservative. The species having the most durable heartwood are marked with an asterisk (*), and these should be preferred where resistance to decay is required.

GROUP 1
The allowable fiber stress in bending for the species listed herein when used for side rails shall not exceed 2,150 pounds per square inch. These species may be substituted for Group 3 woods on the following basis: The dimensions may be not more than 10 percent smaller for each cross-section dimension, or the thickness may remain unchanged, in which case the width may be not more than 11 percent smaller if used edgewise (as in a rail) or 20 percent smaller if used flatwise (as in a tread).

cent smaller for each cross-section dimension, or the thickness may remain unchanged, in which case the width may be not more than 15 percent smaller if used edgewise (as in a rail) or 25 percent smaller if used flatwise (as in a tread).

White ash.....	Fraxinus americana, pennsylvanica, quadrangula
Beech.....	Fagus grandifolia
Birch.....	Betula lenta, alleghaniensis, nigra (2)
Rock elm.....	Ulmus thomasii
Hickory.....	Carya ovata, laevis, tomentosa, glabra
Locust*.....	Robinia pseudoacacia, Gleditsia triacanthos
Hard maple.....	Acer nigrum, saccharum
Red maple.....	Acer rubrum (3)
Red oak.....	Quercus velutina, marilandica, kelloggii, falcata var. pagodae-folia, laurifolia, ellipsoidalis, rubra, nuttallii, palustris, cocinea, shumardii, falcata, laevis, phellos

White oak.....	Quercus arizonica, douglasii, macrocarpa, lobata, prinus, muehlenbergii, emoryi, gambelii, oblongifolia, virginiana, garryana, lyrata, stellata, michauxii, bicolor, alba
Pecan.....	Carya illinoensis, cordiformis, myristiciformis (4), aquatica (4)
Persimmon.....	Diospyros virginiana

GROUP 2
The allowable fiber stress in bending for the species listed herein when used for side rails shall not exceed 2,000 pounds per square inch. These species may be substituted for Group 3 woods on the following basis: The dimensions may be not more than 7½ percent smaller for each cross-section dimension, or the thickness may remain unchanged, in which case the width may be not more than 11 percent smaller if used edgewise (as in a rail) or 20 percent smaller if used flatwise (as in a tread).

Douglas fir (coast region).....	Pseudotsuga menziesii
Western larch.....	Larix occidentalis
Southern yellow pine.....	Pinus taeda, palustris, echinata, elliotii, rigida, virginiana

Red alder.....	Alnus rubra, rhombifolia (2)
Oregon ash.....	Fraxinus latifolia
Pumpkin ash.....	Fraxinus profunda
Alaska cedar*.....	Chamaecyparis nootkatensis
Port Orford cedar*.....	Chamaecyparis lawsoniana

Cucumber.....	Magnolia acuminata
Cypress*.....	Taxodium distichum
Soft elm.....	Ulmus americana, rubra
Douglas fir (Rocky Mountain type).....	Pseudotsuga menziesii var. glauca
Noble fir.....	Abies procera
Gum.....	Liquidambar styraciflua
West coast hemlock.....	Tsuga heterophylla
Magnolia.....	Magnolia grandiflora
Oregon maple.....	Acer macrophyllum
Norway pine.....	Pinus resinosa
Poplar.....	Liriodendron tulipifera
Redwood*.....	Sequoia sempervirens
Eastern spruce.....	Picea glauca, rubens
Sitka spruce.....	Picea sitchensis
Sycamore.....	Platanus occidentalis
Tamarack.....	Larix laricina
Tupelo.....	Nyssa aquatica, sylvatica

GROUP 4
The allowable fiber stress in bending for the species listed herein when used for side rails shall not exceed 1,375 pounds per square inch. These species may be substituted for Group 3 woods on the following basis: The dimensions shall be at least 5 percent greater for each cross-section dimension, or the thickness may remain unchanged, in which case the width shall be at least 7½ percent greater if used edgewise (as in a rail) or 15 percent greater if used flatwise (as in a tread).

Aspen.....	Populus tremuloides, grandidentata
Basswood.....	Tilia americana, heterophylla (2)
Buckeye.....	Aesculus octandra, glabra (2)
Butternut.....	Juglans cinerea
Incense cedar*.....	Libocedrus decurrens
Western red cedar*.....	Thuja plicata
Cottonwood.....	Populus balsamifera, deltoides, sargentii, heterophylla
White fir.....	Abies concolor, grandis, amabilis, lasiocarpa, magnifica
Hackberry.....	Celtis occidentalis, laevigata (2)
Eastern hemlock.....	Tsuga canadensis
Bolly.....	Ilex opaca
Soft maple.....	Acer saccharinum
Lodgepole pine.....	Pinus contorta
Idaho white pine.....	Pinus monticola
Northern white pine.....	Pinus strobus
Ponderosa pine.....	Pinus ponderosa, pinus jeffreyi (Jeffrey pine)
Sugar pine.....	Pinus lambertiana
Engelmann spruce.....	Picea engelmannii

NOTE 1: The common and scientific names of species used conform to the American Lumber Standards nomenclature and in most cases to U.S. Department of Agriculture Handbook No. 41, "Check List of Native and Naturalized Trees of the United States (Including Alaska)," by Elbert L. Little. These publications can be obtained from the Superintendent of Documents, Washington, D.C. 20226.

NOTE 2: This species is commonly associated with others of the same genus under American Lumber Standards nomenclature, but no strength tests have been made on it at the Forest Products Laboratory.

NOTE 3: Included under soft maple in American Lumber Standards nomenclature.

RULES AND REGULATIONS

NOTE 4: This species is not included under this common name in American Lumber Standards nomenclature, but strength data are available and it is accordingly included in this classification.

§ 1910.26 Portable metal ladders.

(a) Requirements—(1) General. Specific design and construction requirements are not part of this section because of the wide variety of metals and design possibilities. However, the design shall be such as to produce a ladder without structural defects or accident hazards such as sharp edges, burrs, etc. The metal selected shall be of sufficient strength to meet the test requirements, and shall be protected against corrosion unless inherently corrosion-resistant.

(i) Because of the varied conditions, and the wide variety of ladder uses, ladders may be designed with parallel side rails, with side rails varying uniformly in separation along the length (tapered), or with side rails flaring at the base to increase stability.

(ii) The design of the side rails shall be such as to insure a product which will conform to the requirements of this section.

(iii) The spacing of rungs or steps shall be on 12-inch centers.

(iv) Rungs or steps to side rail connections should be so constructed as to insure rigidity as well as strength.

(v) Rungs and steps shall be corrugated, knurled, dimpled, coated with skid-resistant material, or otherwise treated to minimize the possibility of slipping.

(vi) Hardware shall meet strength requirements of the ladder's component parts, and shall be of a material that is protected against corrosion unless inherently corrosion-resistant. Metals shall be so selected as to avoid excessive galvanic action.

(2) General specifications—straight and extension ladders. (i) The minimum width between side rails of a straight ladder or any section of an extension ladder shall be 12 inches.

(ii) The length of single ladders or individual sections of ladders shall not exceed 30 feet. Two-section ladders shall not exceed 48 feet in length and over two-section ladders shall not exceed 60 feet in length.

(iii) Based on the nominal length of the ladder, each section of a multisection ladder shall overlap the adjacent section by at least the number of feet stated in the following:

Nominal length of ladder (feet):	Overlap (feet)
Up to and including 36.....	3
Over 36, up to and including 48.....	4
Over 48, up to 60.....	5

(iv) Extension ladders shall be equipped with positive stops which will insure the overlap specified in the table above.

(v) (a) Extension ladders may be equipped with a rope and pulley which shall be securely attached to the ladder in such a manner as not to weaken either the rungs or the side rails. The pulley shall be not less than 1½ inches in diameter.

(b) The rope used with the pulley shall be not less than five-sixteenths inch in diameter, having a minimum breaking strength of 560 pounds, and shall be of sufficient length for the purpose intended.

(3) General specifications—step ladders. (i) Step ladders shall be designed and constructed to give a minimum slope of 3½ inches per foot of length of the front section, and a minimum slope of 2 inches per foot of length of the back section, except that special ladders designed for straight-in-wall work shall maintain at least 1¼-inch back slope per foot of length.

(ii) The minimum width between the side rails at the top step shall be 12 inches. The width spread of the side rails shall increase a minimum of 1 inch per foot of length. The width of the step or tread shall not be less than 3 inches.

(iii) The length of a stepladder is measured by the length of the front rail. To be classified as a standard length ladder, the measured length shall be within plus or minus one-half inch of the specified length. Stepladders shall not exceed 20 feet in length.

(iv) The pall shall be designed to fold completely within the ladder.

(v) The back section may be designed with either rungs or cross bracing as long as it meets the general and testing requirements.

(vi) Steps shall be corrugated, knurled, dimpled, coated with skid-resistant materials, or otherwise treated to minimize the possibility of slipping.

(vii) The bottoms of the four rails are to be supplied with insulating nonslip material for the safety of the user.

(viii) A metal spreader or locking device of sufficient size and strength to securely hold the front and back sections in the open position shall be a component of each stepladder. The spreader shall have all sharp points or edges covered or removed to protect the user.

(4) General specifications—trestles and extension trestle ladders. (i) Trestle ladders or extension sections or base sections of extension trestle ladders shall be not more than 30 feet in length.

(ii) The minimum distance between side rails of the trestle or extension section at the narrowest point shall not be less than 12½ inches. The width spread shall not be less than 1 inch per foot of length of side rail.

(iii) Spread of base when section is open shall not be less than 5½ inches per foot of base section side rail.

(iv) The extension locking device shall be designed to withstand all load tests.

(v) A metal spreader or locking device of sufficient size and strength to securely hold the front and back sections in the open position shall be a component of each trestle ladder. The spreader shall have all sharp points or edges covered or removed to protect the user.

(6) General specifications—platform ladders. (i) The length of a platform ladder shall not exceed 20 feet. The length of a platform ladder shall be measured along the front rail from the floor to the platform.

(ii) Minimum width between side rails at platform level shall be 14 inches.