

guards shall be provided to prevent ignition.

(x) **Noncombustible walls.** If welding is to be done on a metal wall, partition, ceiling or roof, precautions shall be taken to prevent ignition of combustibles on the other side, due to conduction or radiation, preferably by relocating combustibles. Where combustibles are not relocated, a fire watch on the opposite side from the work shall be provided.

(xi) **Combustible cover.** Welding shall not be attempted on a metal partition, wall, ceiling or roof having a combustible covering nor on walls or partitions of combustible sandwich-type panel construction.

(xii) **Pipes.** Cutting or welding on pipes or other metal in contact with combustible walls, partitions, ceilings or roofs shall not be undertaken if the work is close enough to cause ignition by conduction.

(xiii) **Management.** Management shall recognize its responsibility for the safe usage of cutting and welding equipment on its property and:

(a) Based on fire potentials of plant facilities, establish areas for cutting and welding, and establish procedures for cutting and welding, in other areas.

(b) Designate an individual responsible for authorizing cutting and welding operations in areas not specifically designed for such processes.

(c) Insist that cutters or welders and their supervisors are suitably trained in the safe operation of their equipment and the safe use of the process.

(d) Advise all contractors about flammable materials or hazardous conditions of which they may not be aware.

(xiv) **Supervisor.** The Supervisor:

(a) Shall be responsible for the safe handling of the cutting or welding equipment and the safe use of the cutting or welding process.

(b) Shall determine the combustible materials and hazardous areas present or likely to be present in the work location.

(c) Shall protect combustibles from ignition by the following:

(1) Have the work moved to a location free from dangerous combustibles.

(2) If the work cannot be moved, have the combustibles moved to a safe distance from the work or have the combustibles properly shielded against ignition.

(3) See that cutting and welding are so scheduled that plant operations that might expose combustibles to ignition are not started during cutting or welding.

(4) Shall secure authorization for the cutting or welding operations from the designated management representative.

(5) Shall determine that the cutter or welder secures his approval that conditions are safe before going ahead.

(6) Shall determine that fire protection and extinguishing equipment are properly located at the site.

(7) Where fire watches are required, he shall see that they are available at the site.

(xv) **Fire prevention precautions.** Cutting or welding shall be permitted only in areas that are or have been made fire safe. Within the confines of an oper-

ating plant or building, cutting and welding should preferably be done in a specific area designed for such work, such as a maintenance shop or a detached outside location. Such areas should be of noncombustible or fire-resistant construction, essentially free of combustible and flammable contents, and suitably segregated from adjacent areas. When work cannot be moved practically, as in most construction work, the area shall be made safe by removing combustibles or protecting combustibles from ignition sources.

(3) **Welding or cutting containers.** (i) **Used containers.** No welding, cutting, or other hot work shall be performed on used drums, barrels, tanks or other containers until they have been cleaned so thoroughly as to make absolutely certain that there are no flammable materials present or any substances such as greases, tars, acids, or other materials which when subjected to heat, might produce flammable or toxic vapors. Any pipe lines or connections to the drum or vessel shall be disconnected or blanked.

(ii) **Venting and purging.** All hollow spaces, cavities or containers shall be vented to permit the escape of air or gases before preheating, cutting or welding. Purging with inert gas is recommended.

(c) **Confined spaces.** (i) **Accidental contact.** When welding is to be suspended for any substantial period of time, such as during lunch or overnight, all electrodes shall be removed from the holders and the holders carefully located so that accidental contact cannot occur and the machine be disconnected from the power source.

(ii) **Torch valve.** In order to eliminate the possibility of gas escaping through leaks or improperly closed valves, when gas welding or cutting, the torch valves shall be closed and the gas supply to the torch positively shut off at some point outside the confined area whenever the torch is not to be used for a substantial period of time, such as during lunch hour or overnight. Where practicable, the torch and hose shall also be removed from the confined space.

(c) **Protection of personnel.** (i) **General.** (i) **Railings.** A welder or helper working on platforms, scaffolds, or runways shall be protected against falling. This may be accomplished by the use of railings, safety belts, life lines, or some other equally effective safeguards.

(ii) **Welding cable.** Welders shall place welding cable and other equipment so that it is clear of passageways, ladders, and stairways.

(2) **Eye protection.** (i) **Selection.** (a) Helmets or hand shields shall be used during all arc welding or arc cutting operations, excluding submerged arc welding. Goggles should also be worn during arc welding or cutting operations to provide protection from injurious rays from adjacent work, and from flying objects. The goggles may have either clear or colored glass, depending upon the amount of exposure to adjacent welding operations. Helpers or attendants shall be provided with proper eye protection.

(b) Goggles or other suitable eye pro-

tection shall be used during all gas welding or oxygen cutting operations. Spectacles without side shields, with suitable filter lenses are permitted for use during gas welding operations on light work, for torch brazing or for inspection.

(c) All operators and attendants of resistance welding or resistance brazing equipment shall use transparent face shields or goggles, depending on the particular job, to protect their faces or eyes, as required.

(d) Eye protection in the form of suitable goggles shall be provided where needed for brazing operations not covered in (a), (b), and (c) of this subdivision.

(ii) **Specifications for protectors.** (a) Helmets and hand shields shall be made of a material which is an insulator for heat and electricity. Helmets, shields and goggles shall be not readily flammable and shall be capable of withstanding sterilization.

(b) Helmets and hand shields shall be arranged to protect the face, neck and ears from direct radiant energy from the arc.

(c) Helmets shall be provided with filter plates and cover plates designed for easy removal.

(d) All parts shall be constructed of a material which will not readily corrode or discolor the skin.

(e) Goggles shall be ventilated to prevent fogging of the lenses as much as practicable.

(f) Cover lenses or plates should be provided to protect each helmet, hand shield or goggle filter lens or plate.

(g) All glass for lenses shall be tempered, substantially free from striae, air bubbles, waves and other flaws. Except when a lens is ground to provide proper optical correction for defective vision, the front and rear surfaces of lenses and windows shall be smooth and parallel.

(h) Lenses shall bear some permanent distinctive marking by which the source and shade may be readily identified.

(i) The following is a guide for the selection of the proper shade numbers. These recommendations may be varied to suit the individual's needs.

Welding operation	Shade No.
Shielded metal-arc welding— $\frac{1}{8}$ in., $\frac{3}{16}$ in., $\frac{1}{4}$ in., $\frac{5}{16}$ in. electrodes—	10
Gas-shielded arc welding (nonferrous)— $\frac{1}{8}$ in., $\frac{3}{16}$ in., $\frac{1}{4}$ in., $\frac{5}{16}$ in. electrodes—	11
Gas-shielded arc welding (ferrous)— $\frac{1}{8}$ in., $\frac{3}{16}$ in., $\frac{1}{4}$ in., $\frac{5}{16}$ in. electrodes—	12
Shielded metal-arc welding:	
$\frac{3}{16}$ in., $\frac{1}{4}$ in. electrodes—	12
$\frac{5}{16}$ in., $\frac{3}{4}$ in. electrodes—	14
Atomic hydrogen welding—	10-14
Carbon arc welding—	14
Soldering—	2
Torch brazing—	3 or 4
Light cutting, up to 1 inch—	3 or 4
Medium cutting, 1 inch to 6 inches—	4 or 5
Heavy cutting, 6 inches and over—	5 or 6
Gas welding (light) up to $\frac{1}{4}$ inch—	4 or 5
Gas welding (medium) $\frac{1}{4}$ inch to $\frac{1}{2}$ inch—	5 or 6
Gas welding (heavy) $\frac{1}{2}$ inch and over—	6 or 8

Note: In gas welding or oxygen cutting where the torch produces a high yellow light, it is desirable to use a filter or lens that absorbs the yellow or sodium line in the visible light of the operation.

(f) All filter lenses and plates shall meet the test for transmission of radiant energy prescribed in ANSI Z87.1-1968—American National Standard Practice for Occupational and Educational Eye and Face Protection.

(iii) **Protection from arc welding rays.** Where the work permits, the welder should be enclosed in an individual booth painted with a finish of low reflectivity such as zinc oxide (an important factor for absorbing ultraviolet radiations) and lamp black, or shall be enclosed with noncombustible screens similarly painted. Booths and screens shall permit circulation of air at floor level. Workers or other persons adjacent to the welding areas shall be protected from the rays by noncombustible or flameproof screens or shields or shall be required to wear appropriate goggles.

(3) **Protective clothing.** (i) **General requirements.** Employees exposed to the hazards created by welding, cutting, or brazing operations shall be protected by personal protective equipment in accordance with the requirements of § 1910.132. Appropriate protective clothing required for any welding operation will vary with the size, nature and location of the work to be performed.

(ii) **Specified protective clothing.** Protective means which may be employed are as follows:

(a) Except when engaged in light work, all welders should wear flameproof gauntlet gloves.

(b) Flameproof aprons made of other, asbestos, or other suitable material may also be desirable as protection against radiated heat and sparks.

(c) Woolen clothing is preferable to cotton because it is not so readily ignited and helps protect the welder from changes in temperature. Cotton clothing, if used, should be chemically treated to reduce its combustibility. All outer clothing such as jumpers or overalls should be reasonably free from oil or grease.

(d) Sparks may lodge in rolled-up sleeves or pockets of clothing, or cuffs of overalls or trousers. It is therefore recommended that sleeves and collars be kept buttoned and pockets be eliminated from the front of overalls and aprons. Trousers or overalls should not be turned up on the outside.

(e) For heavy work, fire-resistant leggings, high boots, or other equivalent means should be used.

(f) In production work a sheet metal screen in front of the worker's legs can provide further protection against sparks and molten metal in cutting operations.

(g) Capes or shoulder covers made of leather or other suitable materials should be worn during overhead welding or cutting operations. Leather skull caps may be worn under helmets to prevent head burns.

(h) For overhead welding and cutting, or welding and cutting in extremely confined spaces, ear protection is sometimes desirable.

(i) Where there is exposure to sharp or heavy falling objects, or a hazard of bumping in confined spaces, hard hats or head protectors should be used.

(4) **Work in confined spaces.** (i) **General.** As used herein confined space is intended to mean a relatively small or restricted space such as a tank, boiler, pressure vessel, or small compartment of a ship.

(ii) **Ventilation.** Ventilation is a prerequisite to work in confined spaces. For ventilation requirements see paragraph (f) of this section.

(iii) **Securing cylinders and machinery.** When welding or cutting is being performed in any confined spaces the gas cylinders and welding machines shall be left on the outside. Before operations are started, heavy portable equipment mounted on wheels shall be securely blocked to prevent accidental movement.

(iv) **Lifelines.** Where a welder must enter a confined space through a manhole or other small opening, means shall be provided for quickly removing him in case of emergency. When safety belts and lifelines are used for this purpose they shall be so attached to the welder's body that his body cannot be jammed in a small exit opening. An attendant with a preplanned rescue procedure shall be stationed outside to observe the welder at all times and be capable of putting rescue operations into effect.

(v) **Electrode removal.** When arc welding is to be suspended for any substantial period of time, such as during lunch or overnight, all electrodes shall be removed from the holders and the holders carefully located so that accidental contact cannot occur and the machine disconnected from the power source.

(vi) **Gas cylinder shut-off.** In order to eliminate the possibility of gas escaping through leaks or improperly closed valves, when gas welding or cutting, the torch valves shall be closed and the fuel-gas and oxygen supply to the torch positively shut off at some point outside the confined area whenever the torch is not to be used for a substantial period of time, such as during lunch hour or overnight. Where practicable, the torch and hose shall also be removed from the confined space.

(vii) **Warning sign.** After welding operations are completed, the welder shall mark the hot metal or provide some other means of warning other workers.

(f) **Health protection and ventilation.** (i) **General.** (i) **Contamination.** The requirements in this paragraph have been established on the basis of the following three factors: in arc and gas welding which govern the amount of contamination to which welders may be exposed:

(a) Dimensions of space in which welding is to be done (with special regard to height of ceiling).

(b) Number of welders.

(c) Possible evolution of hazardous fumes, gases, or dust according to the metals involved.

(ii) **Ventilation.** It is recognized that in individual instances other factors may be involved in which case ventilation or respiratory protective devices should be provided as needed to meet the equivalent requirements of this section. Such factors would include:

(a) Atmospheric conditions.

(b) Heat generated.

(c) Presence of volatile solvents.

(iii) **Screens.** When welding must be performed in a space entirely screened on all sides, the screens shall be so arranged that no serious restriction of ventilation exists. It is desirable to have the screens so mounted that they are about 2 feet above the floor unless the work is performed at so low a level that the screen must be extended nearer to the floor to protect nearby workers from the glare of welding.

(iv) **Maximum allowable concentration.** Local exhaust or general ventilating systems shall be provided and arranged to keep the amount of toxic fumes, gases, or dusts below the maximum allowable concentration as specified in § 1910.93.

(v) **Precautionary labels.** A number of potentially hazardous materials are employed in fluxes, coatings, coverings, and filler metals used in welding and cutting or are released to the atmosphere during welding and cutting. These include but are not limited to the materials itemized in paragraphs (f) (5) through (12) of this section. The suppliers of welding materials shall determine the hazard, if any, associated with the use of their materials in welding, cutting, etc.

(g) All filler metals and fusible granular materials shall carry the following notice, as a minimum, on tags, boxes, or other containers:

CAUTION

Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. Use adequate ventilation. See ANSI Z49.1-1967 Safety in Welding and Cutting published by the American Welding Society.

(b) Brazing (welding) filler metals containing cadmium in significant amounts shall carry the following notice on tags, boxes, or other containers:

WARNING

CONTAINS CADMIUM—POISONOUS FUMES MAY BE FORMED ON HEATING

Do not breathe fumes. Use only with adequate ventilation such as fume collectors, exhaust ventilators, or air-supplied respirators. See ANSI Z49.1-1967.

If chest pain, cough, or fever develops after use call physician immediately. Keep children away when using.

(c) Brazing and gas welding fluxes containing fluorine compounds shall have a cautionary wording to indicate that they contain fluorine compounds. One such cautionary wording recommended by the American Welding Society for brazing and gas welding fluxes reads as follows:

CAUTION

CONTAINS FLUORIDES

This flux when heated gives off fumes that may irritate eyes, nose and throat.

1. Avoid fumes—use only in well-ventilated spaces.

2. Avoid contact of flux with eyes or skin.

3. Do not take internally.

(2) **Ventilation for general welding and cutting.** (i) **General.** Mechanical ventilation shall be provided when welding or cutting is done on metals not covered in subparagraphs (5) through (12).

22358106
22358105

other) that requires entrance into or close contact with the machinery or equipment, the main power disconnect switch or valve, or both, controlling its source of power or flow of material, shall be locked out or blocked off with padlock, blank flange, or similar device.

(5) *Vessel entering.* Lifelines and safety harness shall be worn by anyone entering closed vessels, tanks, ship bins, and similar equipment, and a person shall be stationed outside in a position to handle the line and to summon assistance in case of emergency. The air in the vessels shall be tested for oxygen deficiency and the presence of both toxic and explosive gases and vapors, before entry into closed vessels, tanks, etc., is permitted. Self-contained air- or oxygen-supply masks shall be readily available in case of emergency. Work shall not be done on equipment under conditions where an injury would result if a valve were unexpectedly opened or closed unless the valve has been locked in a safe position.

(6) *Industrial power trucks.* All industrial power truck operations shall conform to American National Standard B56.1-1969. All forklift trucks shall be provided with overhead guards. All guards shall be designed in compliance with American National Standard B56.1-1969. Design requirements shall provide protection for the liquid petroleum tank.

(7) *Emergency lighting.* Emergency lighting shall be provided wherever it is necessary for employees to remain at their machines or stations to shut down equipment in case of power failure. Emergency lighting shall be provided at stairways and passageways or aislesways used by employees for emergency exit in case of power failure. Emergency lighting shall be provided in all plant first aid and medical facilities.

(c) *Handling and storage of pulpwood and pulp chips.* (1) *Handling pulpwood with forklift trucks.* Where large forklift trucks, or lift trucks with clam-jaws, are used in the yard, the operator's enclosed cab shall be provided with an escape hatch, whenever the hydraulic arm blocks escape through the side doors.

(2) *Handling pulpwood with cranes or stackers.* (i) Where locomotive cranes are used for loading or unloading pulpwood, the pulpwood shall be piled so as to allow a clearance of not less than 24 inches between the pile and the end of the cab of any locomotive crane in use, when the cab is turned in any working position.

(ii) The minimum distance of the pulpwood pile from the centerline of a standard-gage track shall be maintained at not less than 8½ feet.

(iii) Logs shall be piled in an orderly and stable manner, with no projection into walkways or roadways.

(iv) Railroad cars shall not be spotted on tracks adjacent to the locomotive cranes unless a 24-inch clearance is maintained, as required in subdivision (i) of this subparagraph.

(v) The handling and storage of other materials shall conform to subdivisions

(i) and (ii) of this subparagraph with respect to clearance.

(vi) Equipment and practices shall conform to American National Standards B30.2-1943 (Reaffirmed 1952) and B30.2.0-1967.

(vii) Personal protective equipment for such uses as foot, head, and eye protection shall be required for workers on a job basis.

(viii) No person shall be permitted to walk beneath a suspended load, bucket, or hook.

(3) *Handling pulpwood from ships.* (i) Ladders and gangplanks with railings to boat docks shall meet the requirements of American National Standards A12.1-1967, A14.1-1968, A14.2-1956, and A14.3-1956, and shall be securely fastened in place.

(ii) The hatch tender shall be required to signal the hoisting engineer to move the load only after the men working in the hold are in the clear.

(iii) The air in the ship's hold, tanks, or closed vessels shall be tested for oxygen deficiency and for both toxic and explosive gases and vapors.

(4) *Handling pulpwood from flatcars and all other railway cars.* (i) Railroad flatcars for the conveyance of pulpwood loaded parallel to the length of the car shall be equipped with safety-stake pockets.

(ii) Where pulpwood is loaded crosswise on a flatcar sufficient stakes of sizes not smaller than 4 by 4 inches shall be used to prevent the load from shifting.

(iii) When it is necessary to cut stakes, those on the unloading side should be partially cut through first, and then the binder wires cut on the opposite side. Wire cutters equipped with long extension handles shall be used. No person shall be permitted along the dumping side of the car after the stakes have been cut.

(iv) When steel straps without stakes are used, the steel straps shall be cut from a safe area to prevent employees from being struck by the falling logs.

(v) Flatcars and all other cars shall be chocked during unloading. Where equipment is not provided with hand brakes, rail clamping chocks shall be used.

(vi) A derrick shall be used to prevent movement of other rail equipment into cars where persons are working.

(5) *Handling pulpwood from trucks.* (i) Cutting of stakes and binder wires shall be done in accordance with subparagraph (4)(iii) of this paragraph.

(ii) Where binder chain and steel stakes are used, the binder chains shall be released and the stakes tripped from the opposite side of the load spillage.

(iii) Where binder chains and crane slings are used, the crane slings shall be attached and taut before the binder chains are released. The hooker shall see that the helper is clear before signaling for the movement of the load.

(6) *Handling pulp chips from railway cars.* (i) All cars shall be securely fastened in place and all employees in the clear before dumping is started.

(ii) Personal protective equipment for such uses as foot, head, and eye protection shall be provided, and employees shall wear the equipment when working in the woodyard. Ear protection shall be provided when the noise level may be harmful.

(7) *Handling pulp chips from trucks and trailers.* (i) All trucks and trailers shall be securely fastened in place and all employees in the clear before dumping is started.

(ii) Personal protective equipment shall be in accordance with subparagraph (6)(ii) of this paragraph.

(3) *Cranes.* (i) Crane boom and load capacities as specified by the manufacturer shall be posted in the cab of the crane in accordance with American National Standards B30.2-1943 (reaffirmed 1968) and B30.2.0-1967.

(ii) A safety device such as a heavy chain or cable at least equal in strength to the lifting cables shall be fastened to the boom and to the frame of the boom crane (if it is other than locomotive) at the base. Alternatively, a telescoping safety device shall be fastened to the boom and to the cab frame, so as to prevent the boom from snapping back over the cab in the event of lifting cable breakage.

(iii) A crane shall not be operated where any part thereof may come within 10 feet of overhead powerlines (or other overhead obstructions) unless the powerlines have been deenergized. The boom shall be painted bright yellow from and including the head sheave to a point 6 feet down the boom towards the cab.

(iv) Standard signals for the operation of cranes shall be established for all movements of the crane, in accordance with American National Standards B30.2-1943 (reaffirmed 1968) and B30.2.0-1967.

(v) Only one member of the crew shall be authorized to give signals to the crane operator.

(vi) All cranes shall be equipped with a suitable warning device such as a horn or whistle.

(vii) A sheave guard shall be provided beneath the head sheave of the boom.

(8) *Traffic warning signs or signals.* (i) A flagman shall direct the movement of cranes or locomotives being moved across railroad tracks or roads, and at any points where the vision of the operator is restricted. The flagman must always remain in sight of the operator when the crane or locomotive is in motion. The blue flag policy shall be used to mark stationary cars day and night. This policy shall include marking the track in advance of the spotted cars (flag for daytime, light for darkness).

(ii) After cars are spotted for loading or unloading, warning flags or signs shall be placed in the center of the track at least 50 feet away from the cars and a derrick set to protect workmen in the car.

(10) *Illumination.* Artificial illumination shall be provided when loading or unloading is performed after dark, in accordance with American National Standard A11.1-1965 (R-1970).

(11) *Bridge or dock plates.* The construction and use of bridge or dock plates shall conform to requirements of American National Standard B56.1-1969.

(b) Carbide containers to be stored outdoors shall be examined to make sure that they are in good condition. Periodic reexaminations shall be made for rusting or other damage to a container that might affect its water or air tightness.

(c) The bottom tier of each row shall be placed on wooden planking or equivalent, so that the containers will not come in contact with the ground or ground water.

(d) Storage areas shall be at least 10 feet from lines of adjoining property that may be built upon.

(e) Containers of carbide which have been in storage the longest shall be used first.

(8) *Public exhibitions and demonstrations.* (i) *Installation requirements.* Installation and operation of welding, cutting, and related equipment shall be done by, or under the supervision of, a competent operator to insure the personal protection of viewers and demonstrators as well as the protection from fire, of materials in and around the site and the building itself.

(ii) *Procedures.* (a) Cylinders containing compressed gases for use at the site shall not be charged in excess of one-half their maximum permissible content. (Cylinders of nonliquefied gases and acetylene shall be charged to not more than one-half their maximum permissible charged pressure in p.s.i.g. Cylinders of liquefied gases shall be charged to not more than one-half the maximum permissible capacity in pounds.)

(b) Cylinders located at the site shall be connected for use except that enough additional cylinders may be stored at the site to furnish approximately 1 day's consumption of each gas used. Other cylinders shall be stored in an approved storage area preferably outdoors, but this storage area shall not be located near a building exit.

(c) Cylinders in excess of 40 pounds total weight being transported to or from the site shall be carried on a hand or motorized truck.

(d) The site shall be constructed, equipped and operated in such a manner that the demonstration will be carried out so as to minimize the possibility of injury to viewers.

(e) Sites involving the use of compressed gases shall be located so as not to interfere with the egress of people during an emergency.

(f) The fire department shall be notified in advance of such use of the site.

(g) (1) Each site shall be provided with a portable fire extinguisher of appropriate size and type and with a pail of water.

(2) The public and combustible materials at the site shall be protected from flames, sparks, and molten metal.

(h) Hoses shall be located and protected so that they will not be physically damaged.

(i) (1) Cylinder valves shall be closed when equipment is unattended.

(2) Where caps are provided for valve protection, such caps shall be in place except when the cylinders are in service or connected ready for service.

(3) Cylinders shall be located or secured so that they cannot be knocked over.

(b) *Application, installation, and operation of arc welding and cutting equipment.* (1) *General.* (i) *Equipment selection.* Welding equipment shall be chosen for safe application to the work to be done as specified in subparagraph (2) of this paragraph.

(ii) *Installation.* Welding equipment shall be installed safely as specified by subparagraph (3) of this paragraph.

(iii) *Instruction.* Workmen designated to operate arc welding equipment shall have been properly instructed and qualified to operate such equipment as specified in subparagraph (4) of this paragraph.

(2) *Application of arc welding equipment.* (1) *General.* Assurance of consideration of safety in design is obtainable by choosing apparatus complying with the Requirements for Electric Arc-Welding Apparatus, NEMA EW-1-1962, National Electrical Manufacturers Association or the Safety Standard for Transformer-Type Arc-Welding Machines, ANSI C33.2-1956, Underwriters' Laboratories.

(ii) *Environmental conditions.* (a) Standard machines for arc welding service shall be designed and constructed to carry their rated load with rated temperature rises where the temperature of the cooling air does not exceed 40° C. (104° F.) and where the altitude does not exceed 3,500 feet, and shall be suitable for operation in atmospheres containing gases, dust, and light rays produced by the welding arc.

(b) Unusual service conditions may exist, and in such circumstances machines shall be especially designed to safely meet the requirements of the service. Chief among these conditions are:

(1) Exposure to unusually corrosive fumes.

(2) Exposure to steam or excessive humidity.

(3) Exposure to excessive oil vapor.

(4) Exposure to flammable gases.

(5) Exposure to abnormal vibration or shock.

(6) Exposure to excessive dust.

(7) Exposure to weather.

(8) Exposure to unusual seacoast or shipboard conditions.

(iii) *Voltage.* Open circuit (No load) voltages of arc welding and cutting machines should be as low as possible consistent with satisfactory welding or cutting being done. The following limits shall not be exceeded:

(a) Alternating-current machines

(1) Manual arc welding and cutting—80 volts.

(2) Automatic (machine or mechanized) arc welding and cutting—100 volts.

(3) Direct-current machines

(1) Manual arc welding and cutting—100 volts.

(2) Automatic (machine or mechanized) arc welding and cutting—100 volts.

(c) When special welding and cutting processes require values of open circuit voltages higher than the above, means shall be provided to prevent the operator from making accidental contact with the high voltage by adequate insulation or other means.

(d) For a.c. welding under wet conditions or warm surroundings where perspiration is a factor, the use of reliable automatic controls for reducing no load voltage is recommended to reduce the shock hazard.

(iv) *Design.* (a) A controller integrally mounted in an electric motor driven welder shall have capacity for carrying rated motor current, shall be capable of making and interrupting stalled rotor current of the motor, and may serve as the running overcurrent device if provided with the number of overcurrent units as specified by Subpart S of this part. Starters with magnetic under-voltage release should be used with machines installed more than one to a circuit to prevent circuit overload caused by simultaneously starting of several motors upon retaking of voltage.

(b) On all types of arc welding machines, control apparatus shall be enclosed except for the operating wheels, levers, or handles. Control handles and wheels should be large enough to be easily grasped by a gloved hand.

(c) Input power terminals, tap change devices and live metal parts connected to input circuits shall be completely enclosed and accessible only by means of tools.

(d) Terminals for welding leads should be protected from accidental electrical contact by personnel or by metal objects i.e., vehicles, crane hooks, etc. Protection may be obtained by use of: dead-front receptacles for plug connections; recessed openings with non-removable hinged covers; heavy insulating sleeving or taping or other equivalent electrical and mechanical protection. If a welding lead terminal which is intended to be used exclusively for connection to the work is connected to the grounded enclosure, it must be done by a conductor at least two AWG sizes smaller than the grounding conductor and the terminal shall be marked to indicate that it is grounded.

(e) No connections for portable control devices such as push buttons to be carried by the operator shall be connected to an a.c. circuit of higher than 120 volts. Exposed metal parts of portable control devices operating on circuits above 50 volts shall be grounded by a grounding conductor in the control cable.

(f) Auto transformers or a.c. reactors shall not be used to draw welding current directly from any a.c. power source having a voltage exceeding 80 volts.

(3) *Installation of arc welding equipment.* (1) *General.* Installation including power supply shall be in accordance with the requirements of Subpart S of this part.

(ii) *Grounding.* (a) The frame or case of the welding machine (except engine-driven machines shall be grounded under the conditions and according to the

manufacture of oxygen cylinders, the space to be so occupied shall be separated from the generator or carbide storage section by partition walls continuous from floor to roof or ceiling, of the type of construction stated in subdivision (8) of this subdivision. Such separation walls shall be without openings and shall be joined to the floor, other walls and ceiling or roof in a manner to effect a permanent gas-tight joint.

(4) Exit doors shall be located so as to be readily accessible in case of emergency.

(5) Explosion venting for outside generator houses and inside generator rooms shall be provided in exterior walls or roofs. The venting areas shall be equal to not less than 1 square foot per 50 cubic feet of room volume and may consist of any one or any combination of the following: Walls of light, noncombustible material, preferably single-thickness, single-strength glass; lightly fastened hatch covers; lightly fastened swinging doors in exterior walls opening outward; lightly fastened walls or roof designed to relieve at a maximum pressure of 25 pounds per square foot.

(6) The installation of acetylene generators within buildings shall be restricted to buildings not exceeding one story in height; *Provided, however*, That this will not be construed as prohibiting such installations on the roof or top floor of a building exceeding such height.

(7) Generators installed inside buildings shall be enclosed in a separate room of ample size.

(8) The walls, partitions, floors, and ceilings of inside generator rooms shall be of noncombustible construction having a fire-resistance rating of at least 1 hour. The walls or partitions shall be continuous from floor to ceiling and shall be securely anchored. At least one wall of the room shall be an exterior wall.

(9) Openings from an inside generator room to other parts of the building shall be protected by a swinging type, self-closing fire door for a Class B opening and having a rating of at least 1 hour. Windows in partitions shall be wired glass and approved metal frames with fixed sash. Installation shall be in accordance with the Standard for the Installation of Fire Doors and Windows, NFPA 80-1970.

(b) Inside generator rooms or outside generator houses shall be well ventilated with vents located at floor and ceiling levels.

(c) Heating shall be by steam, hot water, enclosed electrically heated elements or other indirect means. Heating by flames or fires shall be prohibited in outside generator houses or inside generator rooms, or in any enclosure communicating with them.

(d) (1) Generator houses or rooms shall have natural light during daylight hours. Where artificial lighting is necessary it shall be restricted to electric lamps installed in a fixed position. Unless specifically approved for use in atmospheres containing acetylene, such lamps shall be provided with enclosures of glass or other noncombustible material so designed and constructed as to prevent gas vapors

from reaching the lamp or socket and to resist breakage. Rigid conduit with threaded connections shall be used.

(2) Lamps installed outside of wired-glass panels set in gas-tight frames in the exterior walls or roof of the generator house or room are acceptable.

(e) Electric switches, telephones, and all other electrical apparatus which may cause a spark, unless specifically approved for use inside acetylene generator rooms, shall be located outside the generator house or in a room or space separated from the generator room by a gas-tight partition, except that where the generator system is designed so that no carbide fill opening or other part of the generator is open to the generator house or room during the operation of the generator, and so that residue is carried in closed piping from the residue discharge valve to a point outside the generator house or room, electrical equipment in the generator house or room shall conform to the provisions of Subpart B of this part for Class I, Division 2 locations.

(vi) *Maintenance and operation.* (a) Unauthorized persons shall not be permitted in outside generator houses or inside generator rooms.

(1) Operating instructions shall be posted in a conspicuous place near the generator or kept in a suitable place available for ready reference.

(2) When recharging generators the order of operations specified in the instructions supplied by the manufacturer shall be followed.

(3) In the case of batch-type generators, when the charge of carbide is exhausted and before additional carbide is added, the generating chamber shall always be flushed out with water, renewing the water supply in accordance with the instruction card furnished by the manufacturer.

(4) The water-carbide residue mixture drained from the generator shall not be discharged into sewer pipes or stored in areas near open flames. Clear water from residue settling pits may be discharged into sewer pipes.

(b) The carbide added each time the generator is recharged shall be sufficient to refill the space provided for carbide without ramming the charge. Steel or other ferrous tools shall not be used in distributing the charge.

(c) Generator water chambers shall be kept filled to proper level at all times except while draining during the recharging operation.

(d) Whenever repairs are to be made or the generator is to be charged or carbide is to be removed, the water chamber shall be filled to the proper level.

(e) Previous to making repairs involving welding, soldering, or other hot work or other operations which produce a source of ignition, the carbide charge and feed mechanism shall be completely removed. All acetylene shall be expelled by completely flooding the generator shell with water and the generator shall be disconnected from the piping system. The generator shall be kept filled with water, if possible, or positioned to hold as much water as possible.

(f) Hot repairs shall not be made in a room where there are other generators unless all the generators and piping have been purged of acetylene. Hot repairs should preferably be made out of doors.

(7) *Calcium carbide storage—(i) Packaging.* (a) Calcium carbide shall be contained in metal packages of sufficient strength to prevent rupture. The packages shall be provided with a screw top or equivalent. These packages shall be constructed water- and air-tight. Solder shall not be used in such a manner that the package would fail if exposed to fire.

(b) Packages containing calcium carbide shall be conspicuously marked "Calcium Carbide—Dangerous If Not Kept Dry" or with equivalent warning.

(c) Caution: Metal tools, even the so-called spark resistant type may cause ignition of an acetylene and air mixture when opening carbide containers.

(d) Sprinkler systems shall not be installed in carbide storage rooms.

(ii) *Storage indoors.* (a) Calcium carbide in quantities not to exceed 600 pounds may be stored indoors in dry, waterproof, and well-ventilated locations.

(1) Calcium carbide not exceeding 600 pounds may be stored indoors in the same room with fuel-gas cylinders.

(2) Packages of calcium carbide, except for one of each size, shall be kept sealed. The seals shall not be broken when there is carbide in excess of 1 pound in any other unsealed package of the same size of carbide in the room.

(b) Calcium carbide exceeding 600 pounds but not exceeding 5,000 pounds shall be stored:

(1) In accordance with subdivision (c) of this subdivision.

(2) In an inside generator room or outside generator house; or

(3) In a separate room in a one-story building which may contain other occupancies, but without cellar or basement beneath the carbide storage section. Such rooms shall be constructed in accordance with subdivision (vi) (a) (8) and (9) of this subdivision and ventilated in accordance with subdivision (vi) (b) of this subdivision. These rooms shall be used for no other purpose.

(c) Calcium carbide in excess of 5,000 pounds shall be stored in one-story buildings without cellar or basement and used for no other purpose, or in outside generator houses. The location of such storage buildings shall be away from congested mercantile and manufacturing districts. If the storage building is of noncombustible construction, it may adjoin other one-story buildings if separated therefrom by unperforated firewalls; if it is detached less than 10 feet from such building or buildings, there shall be no opening in any of the mutually exposing sides of such buildings within 10 feet. If the storage building is of combustible construction, it shall be at least 20 feet from any other one- or two-story building, and at least 30 feet from any other building exceeding two stories.

(iii) *Storage outdoors.* (a) Calcium carbide in unopened metal containers may be stored outdoors.

(12) *Barking devices.* When barking drums are employed in the yard, the requirements of paragraph (e) (12) of this section shall apply.

(13) *Hand tools.* Handles of wood hooks shall be locked to the shank to prevent them from rotating.

(14) *Removal of pulpwood.* (i) The ends of a woodpile shall be properly sloped and cross-tied into the pile. Upright poles shall not be used at the ends of woodpiles. To knock down wood from the woodpile, mechanical equipment shall be used to permit employees to keep in the clear of loosened wood.

(ii) If dynamite is used to loosen the pile, only authorized personnel shall be permitted to handle and discharge the explosive. An electric detonator is preferable for firing; if a fuse is used, it shall be an approved safety fuse with a burning rate of not less than 120 seconds per yard and a minimum length of 3 feet, in accordance with Safety in the Handling and Use of Explosives, IME Pamphlet No. 17, July 1960.

(15) *Belt conveyors.* (i) The sides of the conveyor shall be constructed so that the wood will not fall off.

(ii) Where conveyors cross passageways or roadways, a horizontal platform shall be provided under the conveyor extending out from the sides of the conveyor a distance equal to 1½ times the length of the wood handled. The platform shall extend the width of the road plus 2 feet on each side and shall be kept free of wood and rubbish. The edges of the platform shall be provided with toeboards or other protection to prevent wood from falling, in accordance with American National Standard A12.1—1967.

(iii) All conveyors for pulpwood shall have the inrunning nips between chain and sprockets guarded; also, turning drums shall be guarded.

(iv) Every belt conveyor shall have an emergency stop cable extending the length of the conveyor so that it may be stopped from any location along the line, or conveniently located stop buttons within 10 feet of each work station, in accordance with American National Standard B20.1—1967.

(16) *Signs.* Where conveyors cross walkways or roadways in the yards, signs reading "Danger—Overhead Conveyor" or an equivalent warning shall be erected, in accordance with American National Standard Z35.1—1958.

(d) *Handling and storage of raw materials other than pulpwood or pulp chips—(i) Personal protective equipment.* (i) Whenever possible, all dust, fumes, and gases incident to handling materials shall be controlled at the source, in accordance with American National Standard Z9.2—1966. Where control at the source is not possible, respirators with goggles or protective masks shall be provided, and employees shall wear them when handling alum, clay, soda ash, lime, bleach powder, sulfur, chlorine, and similar materials, and when opening rag bales.

(ii) When handling liquid acid or alkali, workmen shall be provided with approved eye and face protection and

protective clothing, in accordance with American National Standard Z87.1—1968.

(2) *Clearance.* (i) When materials are being piled inside a building and upon platforms, an aisle clearance at least 3 feet greater than the widest truck in use shall be provided.

(ii) Baled paper and rags stored inside a building shall not be piled closer than 18 inches to walls, partitions, or sprinkler heads.

(3) *Piling and unloading pulp.* (i) Piles of wet lap pulp (unless palletized) shall be stepped back one-half the width of the sheet for each 8 feet of pile height. Sheets of pulp shall be interlapped to make the pile secure. Pulp shall not be piled over pipelines to jeopardize pipes, or so as to cause overloading of floors, or to within 18 inches below sprinkler heads.

(ii) Piles of pulp shall not be undermined when being unplied.

(iii) Floor capacities shall be clearly marked on all floors.

(4) *Chocking rolls.* (i) Where pulp or paper rolls are of uniform size, cribbing should be constructed to keep rolls from moving.

(ii) Where rolls are pyramided two or more high, chocks shall be installed between each roll on the floor and at every row. The face of each chock should be formed on a radius to conform to the average roll size in use. Where pulp and paper rolls are stored on smooth floors in processing areas, rubber chocks with wooden core shall be used.

(iii) When rolls are decked two or more high, the bottom rolls shall be chocked on each side to prevent shifting in either direction.

(iv) A supply of portable roll chocks should be available to be used where there are gaps in the bottom row of rolls. These should be as light as possible while still providing maximum blocking effect.

(e) *Preparing pulpwood—(1) Gang and slasher saws.* A guard shall be provided in front of all gang and slasher saws to protect workers from wood thrown by saws. A guard shall be placed over tail sprockets.

(2) *Slasher tables.* Saws shall be stopped and power switches shall be locked out and tagged whenever it is necessary for any person to be on the slasher table.

(3) *Slasher drive belts, pulleys, and shafts.* All belts, pulleys, and shafts shall be guarded in accordance with American National Standard B15.1—1955 (Reaffirmed 1958).

(4) *Runway to the jack ladder.* The runway from the pond or unloading dock to the table shall be protected with standard handrails and toeboards. Inclined portions shall have cleats or equivalent nonslip surfacing, in accordance with American National Standard A12.1—1967. Protective equipment shall be provided for persons working over water.

(5) *Guards below table.* Where not protected by the frame of the machine, the underside of the slasher saws shall be enclosed with guards.

(6) *Conveyors.* The requirements of paragraph (e) (15) (iv) of this section shall apply.

(7) *Circular saws (not slasher saws).* Saws shall be provided with standard guards, in accordance with American National Standard 01.1—1954 (Reaffirmed 1961).

(8) *Barker feed.* Each barker shall be equipped with a feed and turnover device which will make it unnecessary for the operator to hold a bolt or log by hand during the barking operation. Eye, ear, and head protection shall be provided for the operator, in accordance with paragraph (b) (2) of this section.

(9) *Guards.* A guard shall be installed around barkers to confine flying particles, in accordance with American National Standard B15.1—1953 (Reaffirmed 1958).

(10) *Stops.* All control devices shall be locked out and tagged when knives are being changed.

(11) *Speed governor.* Water wheels, when directly connected to marker disks or grinders, shall be provided with speed governors, if operated with gate wide open.

(12) *Continuous barking drums.* (i) When platforms or floors allow access to the sides of the drums, a standard railing shall be constructed around the drums. When two or more drums are arranged side by side, proper walkways with standard handrails shall be provided between each set, in accordance with paragraph (b) (3) of this section.

(ii) Sprockets and chains, gears, and trunnions shall have standard guards, in accordance with paragraph (b) (1) of this section.

(iii) Whenever it becomes necessary for a workman to go within a drum, the driving mechanism shall be locked and tagged, at the main disconnect switch, in accordance with paragraph (b) (4) of this section.

(13) *Intermittent barking drums.* In addition to motor switch, clutch, belt shifter, or other power disconnecting device, intermittent barking drums shall be equipped with a device which may be locked to prevent the drum from moving while it is being emptied or filled.

(14) *Hydraulic barkers.* Hydraulic barkers shall be enclosed with strong baffles at the inlet and the outlet. The operator shall be protected by at least five-ply laminated glass.

(15) *Splitter block.* The block upon or against which the wood is rested shall have a corrugated surface or other means provided that the wood will not slip. Wood to be split, and also the splitting block, shall be free of ice, snow, or chips. The operator shall be provided with eye and foot protection. A clear and unobstructed view shall be maintained between equipment and workers around the block and the workers' help area.

(16) *Power control.* Power for the operation of the splitter shall be controlled by a clutch or equivalent device.

(17) *Knot cleaners.* The operators of knot cleaners of the woodpecker type shall wear eye protection equipment. Knot cleaners of the woodpecker type

should be enclosed to protect passersby from flying chips.

(18) *Chipper spout.* The feed system to the chipper spout shall be arranged in such a way that the operator does not stand in a direct line with the chipper spout. All chipper spouts shall be enclosed to a height of at least 42 inches from the floor or operator's platform. If practical, a mirror should be installed to enable the chipper feeder to see the chute. When other protection is not sufficient, the operator shall wear a safety belt line. The safety belt line shall be fastened in such a manner as to make it impossible for the operator to fall into the throat of the chipper. Ear protection equipment shall be worn by the operator and others in the immediate area if there is any possibility that the noise level may be harmful (see § 1910.95).

(19) *Carriers for knives.* Carriers shall be provided and used for transportation of knives.

(f) *Rag and old paper preparation—(1) Ripping and trimming tools.* (i) Hand knives and scissors shall have blunt points, shall be fastened to the table with chain or thong, and shall not be carried on the person but placed safely in racks or sheaths when not in use.

(ii) Hand knives and sharpening steels shall be provided with guards at the junction of the handle and the blade.

(2) *Shredders, cutters, and dusters.* (i) Rotating heads or cylinders shall be completely enclosed except for an opening at the feed side sufficient to permit only the entry of stock. The enclosure shall extend over the top of the feed rolls. It shall be constructed either of solid material or with mesh or openings not exceeding one-half inch and substantial enough to contain flying particles and prevent accidental contact with moving parts. The enclosure shall be bolted or locked into place.

(ii) A smooth-pivoted idler roll resting on the stock or feed table shall be provided in front of feed rolls except when arrangements prevent the operator from standing closer than 36 inches to any part of the feed rolls.

(iii) Any manually fed cutter, shredder, or duster shall be provided with an idler roll as per subdivision (ii) of this subparagraph or the operator shall use special hand-feeding tools.

(iv) Hoods of cutters, shredders, and dusters shall have exhaust ventilation, in accordance with American National Standard Z9.2—1960.

(3) *Blowers.* (i) Blowers used for transporting rags shall be provided with feed hoppers having outer edges located not less than 48 inches from the fan.

(ii) The arrangement of the blower discharge outlets and work areas shall be such as to prevent material from falling on workers.

(4) *Conveyors.* Conveyors and conveyor drive belts and pulleys shall be fully enclosed or, if open and within 7 feet of the floor, shall be constructed and guarded in accordance with paragraph (c) (15) of this section and Amer-

ican National Standards B15.1—1953 (Reaffirmed 1958) and B20.1—1957.

(5) *Dust.* Measures for the control of dust shall be provided, in accordance with American National Standards Z33.1—1961, Z87.1—1968, and Z88.2—1969.

(6) *Rag cookers.* (i) When cleaning, inspection, or other work requires that persons enter rag cookers, all steam and water valves, or other control devices, shall be locked and tagged in the closed or "off" position. Blank flanging of pipelines is acceptable in place of closed and locked valves.

(ii) When cleaning, inspection, or other work requires that persons must enter the cooker, one person shall be stationed outside in a position to observe and assist in case of emergency, in accordance with paragraph (b) (5) of this section.

(iii) Supplied air respirators should be worn by persons when spreading material inside cookers.

(iv) Rag cookers shall be provided with safety valves in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Unfired Pressure Vessels—1968, with Addenda.

(g) *Chemical processes of making pulp—(1) Sulfur burners.* (i) Sulfur burner houses shall be safely and adequately ventilated, and every precaution shall be taken to guard against dust explosion hazards and fires, in accordance with American National Standards Z9.2—1960 and Z12.12—1968.

(ii) Nonsparking tools and equipment shall be used in handling dry sulfur.

(iii) Sulfur storage bins shall be kept free of sulfur dust accumulation, and buildings should be designed with explosion relief, in accordance with American National Standard Z9.2—1960.

(iv) Electrical equipment shall be of the explosion-proof type, in accordance with the requirements of §§ 1910.322 through 1910.328.

(v) Sulfur-melting equipment shall not be located in the burner room.

(2) *Protection for employees (acid plants).* (i) Gas masks, fitted with canisters containing absorbents for the particular acids, gases, or mists involved, shall be provided for employees of the acid department.

(ii) Supplied air respirators shall be strategically located for emergency and rescue use.

(iii) During inspection, repairs, or maintenance of acid towers, the workman shall be provided with eye protection, a supplied air respirator, a safety belt, and an attached lifeline. The line shall be extended to an attendant stationed outside the tower opening.

(3) *Acid tower structure.* Outside elevators shall be inspected daily during winter months when ice materially affects safety. Elevators, runways, stairs, etc., for the acid tower shall be inspected monthly for defects that may occur because of exposure to acid or corrosive gases.

(4) *Tanks (acid).* (i) Tanks shall be free of acid and shall be washed out with water, and fresh air shall be blown into them before allowing men to enter. Men entering the tanks shall be provided

with supplied air respirators, lifelines, and attached lifelines.

(ii) A man shall be stationed outside to summon assistance if necessary. All intake valves to a tank shall be blanked off or disconnected.

(5) *Clothing.* Where lime slaking takes place, employees shall be provided with rubber boots, rubber gloves, protective aprons, and eye protection. A deluge shower and eye fountain shall be provided to flush the skin and eyes to counteract lime or acid burns.

(6) *Lead burning.* When lead burning is being done within tanks, fresh air shall be forced into the tanks so that fresh air will reach the face of the worker first and the direction of the current will never be from the source of the fumes toward the face of the workers. Supplied air respirators (constant-flow type) shall be provided.

(7) *Hoops for acid storage tanks.* Hoops of tanks shall be made of rods rather than flat strips and shall be safely maintained by scheduled inspections.

(8) *Chip and sand/dust bins.* Steam or compressed-air lances, or other facilities, shall be used for breaking down the arches caused by jamming in chip lofts. No worker shall be permitted to enter a bin unless provided with a safety belt, with line attached, and an attendant stationed at the bin to summon assistance.

(9) *Exits (digester building).* At least one unobstructed exit at each end of the room shall be provided on each floor of a digester building.

(10) *Gas masks (digester building).* Gas masks shall be available. These masks shall furnish adequate protection against sulfuric acid and chlorine gases, and shall be inspected and tested at frequent intervals, not to exceed 1 month, in accordance with American National Standards Z87.1—1968, and Z88.2—1969.

(11) *Elevators.* (i) Elevators shall be constructed in accordance with American National Standard A17.1—1965.

(ii) Elevators shall be equipped with gas masks for the maximum number of passengers.

(iii) Elevators shall be equipped with an alarm system to advise of failure.

(12) *Blowoff valves and piping.* (i) The blowoff valve of a digester shall be arranged so as to be operated from another room, remote from safety valves.

(ii) Through bolts instead of cap bolts shall be used on all digester pipings.

(iii) Heavy duty pipe, valves, and fittings shall be used between the digester and blow pit. These valves, fittings, and pipes shall be inspected at least semi-annually to determine the degree of deterioration and should be replaced when necessary.

(iv) Digester blow valves shall be pinned or locked in closed position throughout the entire cooking period.

(13) *Blow pits and blow tanks.* (i) Blow-pit openings shall be preferably on the side of the pit instead of on top. When located on top, openings shall be as small as possible and shall be provided with railings, in accordance with American National Standard A12.1—1967.

harge. (b) Relief valves shall be regularly operated to insure proper functioning.

Relief valves for generating chambers shall be set to open at a pressure not in excess of 15 p.s.i.g. Relief valves for hydraulic back pressure valves shall be set to open at a pressure not in excess of 20 p.s.i.g.

(c) Nonautomatic generators shall not be used for generating acetylene at pressures exceeding 1 p.s.i.g., and all water overflows shall be visible.

(ii) *Location.* The space around the generator shall be ample for free, unobstructed operation and maintenance and shall permit ready adjustment and changing.

(iv) *Stationary acetylene generators (automatic and nonautomatic).* (a) (1) The foundation shall be so arranged that the generator will be level and so that no excessive strain will be placed on the generator or its connections. Acetylene generators shall be grounded.

(2) Generators shall be placed where water will not freeze. The use of common salt (sodium chloride) or other corrosive chemicals for protection against freezing is not permitted. (For heating systems see subdivision (6) (vi) (c) of this subparagraph.)

(3) Except when generators are prepared in accordance with subdivision (vii) (e) of this subparagraph, sources of ignition shall be prohibited in outside generator houses or inside generator rooms.

(4) Water shall not be supplied through a continuous connection to the generator except when the generator is provided with an adequate open overflow or automatic water shutoff which will effectively prevent overflowing of the generator. Where a noncontinuous connection is used, the supply line shall terminate at a point not less than 2 inches above the regularly provided opening for filling so that the water can be observed as it enters the generator.

(5) Unless otherwise specifically approved, generators shall not be fitted with continuous drain connections leading to sewers, but shall discharge through an open connection into a suitably vented outdoor receptacle or residue pit which may have such connections. An open connection for the sludge drawoff is desirable to enable the generator operator to observe leakage of generating water from the drain valve or sludge cock.

(b) (2) Each generator shall be provided with a vent pipe of Schedule 40 galvanized iron or steel, except that outside of buildings, vent pipes larger than 4 inches in diameter may be not less than 14 gage galvanized tubing or sheet steel.

(2) The escape or relief pipe shall be rigidly installed without traps and so that any condensation will drain back to the generator.

(3) The escape or relief pipe shall be carried full size to a suitable point outside the building. It shall terminate in a hood or bend located at least 12 feet above the ground, preferably above the roof, and as far away as practicable from windows or other openings into build-

ings and as far away as practicable from sources of ignition such as flues or chimneys and tracks used by locomotives. Generating chamber relief pipes shall not be inter-connected but shall be separately led to the outside air. The hood or bend shall be so constructed that it will not be obstructed by rain, snow, ice, insects, or birds. The outlet shall be at least 3 feet from combustible construction.

(c) (1) Gas holders shall be constructed on the gasometer principle, the bell being suitably guided. The gas bell shall move freely without tendency to bind and shall have a clearance of at least 2 inches from the shell.

(2) The gas holder may be located in the generator room, in a separate room or out of doors. In order to prevent collapse of the gas bell or infiltration of air due to a vacuum caused by the compressor or booster pump or cooling of the gas, a compressor or booster cutoff shall be provided at a point 12 inches or more above the landing point of the bell. When the gas holder is located indoors, the room shall be ventilated in accordance with subdivision (vi) (b) of this subparagraph and heated and lighted in accordance with subdivisions (vi) (c) and (d) of this subparagraph.

(3) When the gas holder is not located within a heated building, gas holder seals shall be protected against freezing.

(4) Means shall be provided to stop the generator-feeding mechanism before the gas holder reaches the upper limit of its travel.

(5) When the gas holder is connected to only one generator, the gas capacity of the holder shall be not less than one-third of the hourly rating of the generator.

(6) If acetylene is used from the gas holder without increase in pressure at some points but with increase in pressure by a compressor or booster pump at other points, approved piping protective devices shall be installed in each supply line. The low-pressure protective device shall be located between the gas holder and the shop piping, and the medium-pressure protective device shall be located between the compressor or booster pump and the shop piping (see Figure Q-4). Approved protective equipment (designated P₁) is used to prevent: Backflow of oxygen into the fuel-gas supply system; passage of a flashback into the fuel-gas supply system; and excessive back pressure of oxygen in the fuel-gas supply system. The three functions of the protective equipment may be combined in one device or may be provided by separate devices.

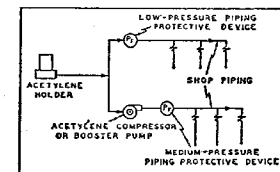


Figure Q-4

(d) (1) The compressor or booster system shall be of an approved type.

(2) Wiring and electrical equipment in compressor or booster pump rooms or enclosures shall conform to the provisions of section 1910.324 for Class I, Division 2 locations.

(3) Compressors and booster pump equipment shall be located in well-ventilated areas away from open flames, electrical or mechanical sparks, or other ignition sources.

(4) Compressor or booster pumps shall be provided with pressure relief valves which will relieve pressure exceeding 15 p.s.i.g. to a safe outdoor location as provided in subdivision (b) of this subdivision, or by returning the gas to the inlet side or to the gas supply source.

(5) Compressor or booster pump discharge outlets shall be provided with approved protective equipment. (See subparagraph (5) of this paragraph.)

(v) *Portable acetylene generators.*

(a) (1) All portable generators shall be of a type approved for portable use.

(2) Portable generators shall not be used within 10 feet of combustible material other than the floor.

(3) Portable generators shall not be used in rooms of total volume less than 35 times the total gas-generating capacity per charge of all generators in the room. Generators shall not be used in rooms having a ceiling height of less than 10 feet. (To obtain the gas-generating capacity in cubic feet per charge, multiply the pounds of carbide per charge by 4.5.)

(4) Portable generators shall be protected against freezing. The use of salt or other corrosive chemical to prevent freezing is prohibited.

(b) (1) Portable generators shall be cleaned and recharged and the air mixture blown off outside buildings.

(2) When charged with carbide, portable generators shall not be moved by crane or derrick.

(3) When not in use, portable generators shall not be stored in rooms in which open flames are used unless the generators contain no carbide and have been thoroughly purged of acetylene. Storage rooms shall be well ventilated.

(4) When portable acetylene generators are to be transported and operated on vehicles, they shall be securely anchored to the vehicles. If transported by truck, the motor shall be turned off during charging, cleaning, and generating periods.

(5) Portable generators shall be located at a safe distance from the welding position so that they will not be exposed to sparks, slag, or misdirection of the torch flame or overheating from hot materials or processes.

(vi) *Outside generator houses and inside generator rooms for stationary acetylene generators.* (a) (1) No opening in any outside generator house shall be located within 5 feet of any opening in another building.

(2) Walls, floors, and roofs of outside generator houses shall be of noncombustible construction.

(3) When a part of the generator house is to be used for the storage or

Identification of Piping Systems, ANSI A13.1-1956.

(c) Station outlets shall be marked to indicate the name of the gas.

(v) **Testing.** (a) Piping systems shall be tested and proved gastight at $1\frac{1}{2}$ times the maximum operating pressure, and shall be thoroughly purged of air before being placed in service. The material used for testing oxygen lines shall be oil free and noncombustible. Flares shall not be used to detect leaks.

(b) When flammable gas lines or other parts of equipment are being purged of air or gas, sources of ignition shall not be permitted near uncapped openings.

(5) **Protective equipment, hose, and regulators.**—(i) **General.** Equipment shall be installed and used only in the service for which it is approved and as recommended by the manufacturer.

(ii) **Pressure relief devices.** Service piping systems shall be protected by pressure relief devices set to function at not more than the design pressure of the systems and discharging upwards to a safe location.

(iii) **Piping protective equipment.** (a) The fuel-gas and oxygen piping systems, including portable outlet headers shall incorporate the protective equipment shown in Figures Q-1, Q-2, and Q-3.

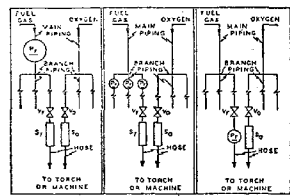


Fig. Q-1
Fig. Q-2
Fig. Q-3

When only a portion of a fuel-gas system is to be used with oxygen, only that portion need comply with subparagraph (5) (iii) (a) of this paragraph.

(b) Approved protective equipment (designated P_r in Figs. Q-1, Q-2, and Q-3) shall be installed in fuel-gas piping to prevent:

(1) Backflow of oxygen into the fuel-gas supply system;

(2) Passage of a flash back into the fuel-gas supply system; and

(3) Excessive back pressure of oxygen in the fuel-gas supply system. The three functions of the protective equipment may be combined in one device or may be provided by separate devices.

(i) The protective equipment shall be located in the main supply line, as in Figure Q-1 or at the head of each branch line, as in Figure Q-2 or at each location where fuel-gas is withdrawn, as in Figure Q-3. Where branch lines are of 2-inch pipe size or larger or of substantial length, protective equipment (designated as P_r) shall be located as shown in either Q-2 and Q-3.

(ii) Backflow protection shall be provided by an approved device that will

prevent oxygen from flowing into the fuel-gas system or fuel from flowing into the oxygen system (see Sr, Figs. Q-1 and Q-2).

(iii) Flash-back protection shall be provided by an approved device that will prevent flame from passing into the fuel-gas system.

(iv) Back-pressure protection shall be provided by an approved pressure-relief device set at a pressure not greater than the pressure rating of the backflow or the flashback protection device, whichever is lower. The pressure-relief device shall be located on the downstream side of the backflow and flashback protection devices. The vent from the pressure-relief device shall be at least as large as the relief device inlet and shall be installed without low points that may collect moisture. If low points are unavoidable, drip pots with drains closed with screw plugs or caps shall be installed at the low points. The vent terminus shall not endanger personnel or property through gas discharge; shall be located away from ignition sources; and shall terminate in a hood or bend.

(c) If pipeline protective equipment incorporates a liquid, the liquid level shall be maintained, and a suitable antifreeze may be used to prevent freezing.

(d) Fuel gas for use with equipment not requiring oxygen shall be withdrawn upstream of the piping protective devices.

(iv) **Station outlet protective equipment.** (a) A check valve, pressure regulator, hydraulic seal, or combination of these devices shall be provided at each station outlet, including those on portable headers, to prevent backflow, as shown in Figures Q-1, Q-2, and Q-3 and designated as Sr and So.

(b) When approved pipeline protective equipment (designated P_r) is located at the station outlet as in Figure Q-3, no additional check valve, pressure regulator, or hydraulic seal is required.

(c) A shutoff valve (designated Vr and Vo) shall be installed at each station outlet and shall be located on the upstream side of other station outlet equipment.

(d) If the station outlet is equipped with a detachable regulator, the outlet shall terminate in a union connection that complies with the Regulator Connection Standards, 1958, Compressed Gas Association.

(e) If the station outlet is connected directly to a hose, the outlet shall terminate in a union connection complying with the Standard Hose Connection Specifications, 1957, Compressed Gas Association.

(f) Station outlets may terminate in pipe threads to which permanent connections are to be made, such as to a machine.

(g) Station outlets shall be equipped with a detachable outlet seal cap secured in place. This cap shall be used to seal the outlet except when a hose, a regulator, or piping is attached.

(h) Where station outlets are equipped with approved backflow and flashback protective devices, as many as four torches may be supplied from one

station outlet through rigid piping, provided each outlet from such piping is equipped with a shutoff valve and provided the fuel-gas capacity of any one torch does not exceed 15 cubic feet per hour.

This subdivision does not apply to machines.

(i) **Hose and hose connections.** (a) Hose for oxy-fuel gas service shall comply with the Specification for Rubber Welding Hose, 1958, Compressed Gas Association and Rubber Manufacturers Association.

(b) The generally recognized colors are red for acetylene and other fuel-gas hose, green for oxygen hose, and black for inert-gas and air hose.

(c) When parallel lengths of oxygen and acetylene hose are taped together for convenience and to prevent tangling, not more than 4 inches out of 12 inches shall be covered by tape.

(d) Hose connections shall comply with the Standard Hose Connection Specifications, 1957, Compressed Gas Association.

(e) Hose connections shall be clamped or otherwise securely fastened in a manner that will withstand, without leakage, twice the pressure to which they are normally subjected in service, but in no case less than a pressure of 300 p.s.i. Oil-free air or an oil-free inert gas shall be used for the test.

(f) Hose showing leaks, burns, worn places, or other defects rendering it unfit for service shall be repaired or replaced.

(vi) **Pressure-reducing regulators.** (a) Pressure-reducing regulators shall be used only for the gas and pressures for which they are intended. The regulator inlet connections shall comply with Regulator Connection Standards, 1958, Compressed Gas Association.

(b) When regulators or parts of regulators, including gages, need repair, the work shall be performed by skilled mechanics who have been properly instructed.

(c) Gages on oxygen regulators shall be marked "USE NO OIL."

(d) Union nuts and connections on regulators shall be inspected before use to detect faulty seats which may cause leakage of gas when the regulators are attached to the cylinder valves. Damaged nuts or connections shall be destroyed.

(e) **Acetylene generators.**—(i) **Approval and marking.** (a) Generators shall be of approved construction and shall be plainly marked with the maximum rate of acetylene in cubic feet per hour for which they are designed; the weight and size of carbide necessary for a single charge; the manufacturer's name and address; and the name or number of the type of generator.

(b) Carbide shall be of the size marked on the generator nameplate.

(ii) **Rating and pressure limitations.** (a) The total hourly output of a generator shall not exceed the rate for which it is approved and marked. Unless specifically approved for higher ratings, carbide-feed generators shall be rated at 1 cubic foot per hour per pound of car-

(ii) A specially constructed ladder shall be used for access to blow pits, to be constructed so that the door of the low pit cannot be closed when the ladder is in place; other means shall be provided to prevent the closing of the pit door when anyone is in the pit.

(iii) A signaling device shall be installed in the digester and blow-pit rooms and chip bins to be operated as a warning before and while digesters are being blown.

(iv) Blow-pit hoops shall be maintained in a safe condition.

(14) **Blowing digester.** (i) Blowoff valves shall be opened slowly.

(ii) After the digester has started to be blown, the blowoff valve shall be left open, and the hand plate shall not be removed until the digester cook signals the blow-pit man that the blow is completed. Whenever it becomes necessary to remove the hand plate to clear stock, operators shall wear eye protection equipment and protective clothing to guard against burns from hot stock.

(iii) Means shall be provided whereby the digester cook shall signal the man in the chip bin before starting to load the digester.

(iv) When a digester is to be blown, or is blowing, red warning lights should be lighted, and these warning lights should be located in such a manner as to alert all personnel to leave whose duties do not require them to be in the vicinity of the digester during this operation.

(15) **Inspecting and repairing digester.** (i) Valves controlling lines leading into a digester shall be locked out and tagged. The keys to the locks shall be in the possession of a person or persons doing the inspecting or making repairs.

(ii) Fresh air shall be blown into the digester constantly while workmen are inside. Stippled air respirators shall be available in the event the fresh air supply fails or is inadequate.

(iii) No inspector shall enter a digester unless a lifeline is securely fastened to his body by means of a safety belt and at least one other experienced employee is stationed outside the digester to handle the line and to summon assistance. All ladders and lifelines shall be inspected before each use.

(iv) The concentration of lead dust in the air shall not exceed the limits specified in § 1910.93.

(v) All employees entering digesters for inspection or repair work shall be provided with protective headgear. Eye protection and dust masks shall be provided to workmen while the old brick lining is being removed, in accordance with American National Standards, Z87.1-1968, Z88.2-1969, and Z89.1-1969.

(vi) Sanitary facilities shall be provided as specified in American National Standard Z4.1-1968.

(16) **Pressure tanks-accumulators.** (i) Safety regulations governing inspection and repairing of pressure tanks-accumulators (acid) shall be the same as those specified in subparagraph (15) of this paragraph.

(ii) The pressure tanks-accumulators shall be inspected twice annually. (See the ASME Boiler and Pressure Vessel Code, Section VIII, Unfired Pressure Vessels-1968, with Addenda.)

(17) **Pressure vessels (safety devices).** (i) A safety valve shall be installed in a separate line from each pressure vessel; no hand valve shall be installed between this safety valve and the pressure vessel. Safety valves shall be checked between each cook to be sure they have not become plugged or corroded to the point of being inoperative. (See the ASME Boiler and Pressure Vessel Code, Section VIII, Unfired Pressure Vessels-1968, with Addenda.)

(ii) All safety devices shall conform to Paragraph U-2 in the ASME Boiler and Pressure Vessel Code, Section VIII, Unfired Pressure Vessels-1968, with Addenda.

(18) **Miscellaneous.** Insofar as the processes of the sulfate and soda operations are similar to those of the sulfite processes, the standard of subparagraphs (1) through (17) of this paragraph shall apply.

(i) Quick operating showers, bubblers, etc., shall be available for emergency use in case of caustic soda burns.

(ii) Rotary tenders, smelter operators, and those cleaning smelt spouts shall be provided with eye protection equipment (fitted with lenses that filter out the harmful rays emanating from the light source) when actively engaged in their duties, in accordance with American National Standard Z87.1-1968.

(iii) Heavy-duty pipe, valves, and fittings shall be used between digester and blow pit. These shall be inspected at least semiannually to determine the degree of deterioration and repaired or replaced when necessary, in accordance with American National Standards B31.1-1955, B31.1a-1963, B31.1.0-1967, and B31.2-1968.

(iv) Smelt-dissolving tanks shall be covered and the cover kept closed, except when samples are being taken.

(v) Smelt tanks shall be provided with vent stacks and explosion doors, in accordance with American National Standard Z9.1-1951.

(19) **Blow lines.** (i) Each digester should have two independent "gas-off" lines and a reducing valve in the high-pressure steam line with a safety valve between the digester and the reducing valve. Two gas-off lines are recommended so that if one plugs with pulp, the other may be used, and the hazard of unplugging with the digester under pressure overcome. With the installation of a reducing valve and a safety valve, it is improbable that pressure will exceed the maximum allowable working pressure of the digester.

(ii) Where the blow-off lines from several digesters lead into one pipe, the handles of all cocks should be set uniformly, or some equivalent arrangement should be provided so that a man can see at a glance whether all cocks are set right or not. If valves instead of cocks are provided, a type with a rising spindle should be used.

(iii) When blow lines from more than one digester lead into one pipe, the cock or valve of the blow line from that tank being inspected or repaired shall be locked or tagged out, or the line shall be disconnected and blocked off.

(20) **Furnace room.** Exhaust ventilation shall be provided where niter cake is fed into a rotary furnace and shall be so designed and maintained as to keep the concentration of hydrogen sulfide gas below the parts per million listed in § 1910.93.

(21) **Inspection and repair of tanks.** All piping leading to tanks shall be blanked off or valved and locked or tagged. Any lines to sewers shall be blanked off to protect workers from air contaminants.

(22) **Welding.** Welding on blow tanks, accumulator tanks, or any other vessels where turpentine vapor or other combustible vapor could gather shall be done only after the vessel has been completely purged of fumes. Fresh air shall be supplied workers inside of vessels.

(23) **Turpentine systems and storage tanks.** Nonsparking tools and ground hose shall be used when pumping out the tank. The tank shall be surrounded by a berm or moat.

(b) **Bleaching.**—(1) **Bleaching engines.** Bleaching engines, except the Bellmer type, shall be completely covered on the top, with the exception of one small opening large enough to allow filling but too small to admit a man. This opening should be covered by a door and guarded with standard guardrails and toeboards. Platforms leading from one engine to another shall have standard guardrails, in accordance with American National Standard A12.1-1967.

(2) **Bleach mixing rooms.** (i) The room in which the bleach powder is mixed shall be provided with adequate exhaust ventilation, located at the floor level, in accordance with American National Standard Z9.1-1951.

(ii) Chlorine gas shall be carried away from the work place and breathing area by an exhaust system. The gas shall be rendered neutral or harmless before being discharged into the atmosphere. The requirements of American National Standard Z9.2-1960 shall apply to this subdivision.

(iii) Gas masks shall be provided for emergency use, in accordance with American National Standards K13.1-1967 and Z88.2-1969.

(iv) For emergency and rescue work, independent self-contained oxygen masks or supplied air equipment shall be provided. (See American National Standards Z88.2-1969.)

(3) **Liquid chlorine.** (i) Tanks of liquid chlorine shall be stored in an adequately ventilated unoccupied room, where their possible leakage cannot affect workers.

(ii) Gas masks capable of absorbing chlorine shall be supplied, conveniently placed, and regularly inspected, and workers who may be exposed to chlorine gas shall be instructed in their use.

(iii) For emergency and rescue work, independent self-contained oxygen-type

masks or supplied air equipment shall be provided.

(iv) At least two exits, remote from each other, shall be provided for all rooms in which chlorine is stored.

(v) Spur tracks upon which tank cars containing chlorine and caustic are spotted and connected to pipelines shall be protected by means of a derail in front of the cars. Blue flag policy should be invoked, in accordance with paragraph (c)(8) of this section.

(vi) All chlorine, caustic, and acid lines shall be marked for positive identification, in accordance with American National Standard A13.1—1967.

(4) **Bagged or drummed chemicals.** Bagged or drummed chemicals require efficient handling to prevent damage and spillage. Certain oxidizing chemicals used in bleaching pulp and also in some sanitizing work require added precautions for safety in storage and handling. In storage, these chemicals must be isolated from combustible materials and other chemicals with which they will react, such as acids. They must also be kept dry, clean and uncontaminated.

(i) **Mechanical pulp process.** (1) **Pulp grinders.** (i) Water wheels directly connected to pulp grinders shall be provided with speed governors limiting the peripheral speed of the grinder to that recommended by the manufacturer.

(ii) Doors of pocket grinders shall be arranged so as to keep them from closing accidentally.

(2) **Butting saws.** Hood guards shall be provided on butting saws, in accordance with American National Standard O1.1—1964 (reaffirmed 1961).

(3) **Floors and platforms.** The requirements of paragraph (b)(3) of this section shall apply.

(4) **Personal protection.** Persons exposed to falling material shall wear eye, head, foot, and shin protection equipment, in accordance with American National Standards Z87.1—1968, Z88.2—1969, Z89.1—1969, and Z41.1—1967.

(i) **Stock preparation.** (1) **Pulp shredders.** (i) Cutting heads shall be completely enclosed except for an opening at the feed side sufficient to permit only entry of stock. The enclosure shall be bolted or locked in place. The enclosure shall be of solid material or with mesh or other openings not exceeding one-half inch.

(ii) Either a slanting feed table with its outer edge not less than 36 inches from the cutting head or an automatic feeding device shall be provided.

(iii) Repairs for cleaning of blockage shall be done only when the shredder is shutdown and control devices locked.

(iv) All power-driven mechanisms shall be guarded in accordance with paragraph (b)(1) of this section.

(2) **Pulp conveyors.** Pulp conveyors and conveyor drive belts and pulleys shall be fully enclosed, or if open and within 7 feet of the floor, shall be constructed and guarded in accordance with American National Standard B20.1—1957.

(3) **Floors, steps, and platforms.** The requirements of paragraph (b)(3) of this section shall apply.

(4) **Beaters.** (i) Beater rolls shall be provided with covers.

(ii) Guard rails 42 inches high shall be provided around beaters where tub tops are less than 42 inches from the floor, in accordance with paragraph (b)(3) of this section and American National Standard A12.1—1967.

(iii) When cleaning, inspecting, or other work requires that persons enter the beaters, all control devices shall be locked or tagged out, in accordance with paragraph (b)(4) of this section.

(iv) When beaters are fed from floor above, the chute opening, if less than 42 inches from the floor, shall be provided with a complete rail or other enclosure. Openings for manual feeding shall be sufficient only for entry of stock and shall be provided with at least two permanently secured crossrails, in accordance with American National Standard A12.1—1967.

(v) When beaters are fed manually from the floor above, conveniently located emergency stop devices should be provided at the top level.

(vi) Floors around beaters shall be provided with sufficient drainage to remove wastes.

(5) **Pulpers.** (i) All pulpers having the top or any other opening of vessel less than 42 inches from the floor or work platform shall have such openings guarded by rail or other enclosures.

For manual charging, openings shall be sufficient only to permit the entry of stock and shall be provided with at least two permanently secured crossrails, in accordance with American National Standard A12.1—1967.

(ii) When cleaning, inspecting, or other work requires that persons enter the pulpers, they shall be equipped with safety belt and lifeline, and one person shall be stationed outside at a position to observe and assist in case of emergency.

(iii) When cleaning, inspecting, or other work requires that persons enter pulpers, all steam, water, or other control devices shall be locked or tagged out. Blank flanging and tagging of pipe lines is acceptable in place of closed and locked or tagged valves. Blank flanging of steam and water lines shall be acceptable in place of valve locks.

(iv) All power mechanisms shall be guarded in accordance with American National Standard B15.1—1953 (reaffirmed 1958).

(6) **Stock chests.** (i) All control devices shall be locked or tagged out when persons enter stock chests, in accordance with paragraph (b)(4) of this section.

(ii) All power mechanisms shall be guarded in accordance with paragraph (b)(1) of this section.

(iii) When cleaning, inspecting, or other work requires that persons enter stock chests, they shall be provided with a low-voltage extension light.

(k) **Machine room.** (1) **Emergency stops.** Paper machines shall be equipped with devices that will stop the machine quickly in an emergency. The devices shall consist of push buttons for electric motive power (or electrically operated engine stops), pull cords connected directly to the prime mover, control

clutches, or other devices, interlocked with adequate braking action. The devices shall be tested periodically by making use of them when stopping the machine and shall be so located that any person working on the machine can quickly disconnect the machine from the source of power in case of emergency.

(2) **Drives.** (i) All drives, pulleys, couplings, and shafts on equipment requiring service while operating shall have standard guards in accordance with paragraph (b)(1) of this section.

(ii) All drives shall be provided with lockout devices at the power switch which interrupts the flow of current to the unit.

(iii) All ends of rotating shafts including dryer drum shafts shall be completely guarded.

(iv) All accessible disengaged doctor blades should be covered.

(v) All exposed shafts shall be guarded. Crossovers shall be provided.

(vi) Oil cups and grease fittings shall be placed in a safe area remote from nip and heat hazards.

(3) **Protective equipment.** Face shields, aprons, and rubber gloves shall be provided for workmen handling acids in accordance with paragraphs (b)(2) and (d)(1) of this section.

(4) **Walkways.** Steps and footwalks along the fourdrinier and press section shall have nonslip surfacing and be complete with standard handrails, when practical, in accordance with paragraph (b)(3) of this section.

(5) **Floor openings.** All flush floor openings in the bottom of the wire pit should be guarded with a barrier-type guard.

(6) **Steps.** Steps of uniform rise and tread with nonslip surfaces shall be provided at each press in accordance with American National Standard A12.1—1967.

(7) **Plank walkways.** A removable plank shall be provided along each press, with standard guardrails installed. The planks shall have nonslip surfaces in accordance with paragraph (b)(3) of this section.

(8) **Dryer lubrication.** If a gear bearing must be oiled while the machine is in operation, an automatic oiling device to protect the oiler shall be provided, or oil cups and grease fittings shall be placed along the walkways out of reach of hot pipes and dryer gears.

(9) **Lever.** All levers carrying weights shall be constructed so that weights will not slip or fall off.

(10) **First dryer.** Either a permanent guardrail or apron guard or both shall be installed in front of the first dryer in each section in accordance with paragraph (b)(1) of this section.

(11) **Steam and hot-water pipes.** All exposed steam and hot-water pipes within 7 feet of the floor or working platform or within 15 inches measured horizontally from stairways, ramps, or fixed ladders shall be covered with an insulating material, or guarded in such manner as to prevent contact.

(12) **Dryer gears.** Dryer gears shall be guarded excepting where the oilers' walkway is removed out of reach of the

(b) Each outlet on the service piping from which oxygen or fuel-gas is withdrawn to supply a portable outlet header shall be equipped with a readily accessible shutoff valve.

(c) Hose and hose connections used for connecting the portable outlet header to the service piping shall comply with subparagraph (5)(v) of this paragraph.

(d) Master shutoff valves for both oxygen and fuel-gas shall be provided at the entry end of the portable outlet header.

(e) Portable outlet headers for fuel-gas service shall be provided with an approved hydraulic back-pressure valve installed at the inlet and preceding the service outlets, unless an approved pressure-reducing regulator, an approved back-flow check valve, or an approved hydraulic back-pressure valve is installed at each outlet. Outlets provided on headers for oxygen service may be fitted for use with pressure-reducing regulators or for direct hose connection.

(f) Each servicing outlet on portable outlet headers shall be provided with a valve assembly that includes a detachable outlet seal cap, chained or otherwise attached to the body of the valve.

(g) Materials and fabrication procedures for portable outlet headers shall comply with subparagraphs (4)(i), (ii), and (v) of this paragraph.

(h) Portable outlet headers shall be provided with frames which will support the equipment securely in the correct operating position and protect them from damage during handling and erection.

(v) **Manifold operating procedures.** (a) Cylinder manifolds shall be installed under the supervision of someone familiar with the proper practices with reference to their construction and use.

(b) All component parts used in the methods of manifolding described in subdivision (i) of this subdivision shall be approved as to materials, design and construction either separately or as an assembled unit.

(c) All manifolds and parts used in methods of manifolding shall be used only for the gas or gases for which they are approved.

(d) When acetylene cylinders are coupled, approved flash arresters shall be installed between the coupler block and the coupler block. For outdoor use only, and when the number of cylinders coupled does not exceed three, one flash arrester installed between the coupler block and regulator is acceptable.

(e) Each fuel-gas cylinder lead should be provided with a backflow check valve.

(f) The aggregate capacity of fuel-gas cylinders connected to a portable manifold inside a building shall not exceed 3,000 cubic feet of gas.

(g) Acetylene and liquefied fuel-gas cylinders shall be manifolded in a vertical position.

(h) The pressure in the gas cylinders connected to and discharged simultaneously through a common manifold shall be approximately equal.

(4) **Service piping systems.** (i) **Materials and design.** (a) (1) Piping and fittings shall comply with Section 2, Industrial Gas and Air Piping Systems, of the American National Standard Code for Pressure Piping ANSI B31.1, 1967, insofar as it does not conflict with subdivisions (i) and (h) of this subdivision:

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

(ii) Copper tubing shall be Types K or L in accordance with the Standard Specification for Seamless Copper Water Tube, ASTM B88-66a.

(2) Piping shall be steel, wrought iron, brass or copper pipe, or seamless copper, brass or stainless steel tubing, except as provided in (b) and (c) of this subdivision.

(b) (1) Oxygen piping and fittings at pressures in excess of 700 p.s.i.g., shall be stainless steel or copper alloys.

(2) Hose connections and hose complying with subparagraph (5)(v) of this paragraph may be used to connect the outlet of a manifold pressure regulator to piping providing the working pressure of the piping is 250 p.s.i.g. or less and the length of the hose does not exceed 5 feet. Hose shall have a minimum bursting pressure of 1,000 p.s.i.g.

(3) When oxygen is supplied to a service piping system from a low-pressure oxygen manifold without an intervening pressure regulating device, the piping system shall have a minimum design pressure of 250 p.s.i.g. A pressure regulating device shall be used at each station outlet when the connected equipment is for use at pressures less than 250 p.s.i.g.

(c) (1) Piping for acetylene or acetylenic compounds shall be steel or wrought iron.

(2) Unalloyed copper shall not be used for acetylene or acetylenic compounds except in listed equipment.

(3) Piping joints. (a) Joints in steel or wrought iron piping shall be welded, threaded or flanged. Fittings, such as elbows, tees, couplings, and unions, may be rolled, forged or cast steel, malleable iron or nodular iron. Gray or white cast iron fittings are prohibited.

(b) Joints in brass or copper pipe shall be welded, brazed, threaded, or flanged. If of the socket type, they shall be brazed with silver-brazing alloy or similar high melting point (not less than 800° F.) filler metal.

(c) Joints in seamless copper, brass, or stainless steel tubing shall be approved gas tubing fittings or the joints shall be brazed. If of the socket type, they shall be brazed with silver-brazing alloy or similar high melting point (not less than 800° F.) filler metal.

(iii) **Installation.** (a) Distribution lines shall be installed and maintained in a safe operating condition.

(b) Piping located inside or outside of buildings may be placed above or below ground. All piping shall be run as directly as practicable, protected against physical damage, proper allowance being made for expansion and contraction, jarring and vibration. Piping laid underground in earth shall be located below the frost line and protected against corrosion. After assembly, piping shall be thor-

oughly blown out with air, nitrogen, or carbon dioxide to remove foreign materials. For oxygen piping, only oil-free air, oil-free nitrogen, or oil-free carbon dioxide shall be used.

(c) Only piping which has been welded or brazed shall be installed in tunnels, trenches or ducts. Shutoff valves shall be located outside such conduits. Oxygen piping may be placed in the same tunnel, trench or duct with fuel-gas pipelines, provided there is good natural or forced ventilation.

(d) Low points in piping carrying moist gas shall be drained into drip pots constructed so as to permit pumping or draining out the condensate at necessary intervals. Drain valves shall be installed for this purpose having outlets normally closed with screw caps or plugs. No open valves or petcocks shall be used, except that in drips located out of doors, underground, and not readily accessible, valves may be used at such points if they are equipped with means to secure them in the closed position. Pipes leading to the surface of the ground shall be cased or jacketed where necessary to prevent loosening or breaking.

(e) Gas cocks or valves shall be provided for all buildings at points where they will be readily accessible for shutting off the gas supply to these buildings in any emergency. Underground valve boxes or manholes should be avoided wherever possible. There shall also be provided a shutoff valve in the discharge line from the generator, gas holder, manifold or other source of supply.

(f) Shutoff valves shall not be installed in safety relief lines in such a manner that the safety relief device can be rendered ineffective.

(g) Fittings and lengths of pipe shall be examined internally before assembly and, if necessary, freed from scale or dirt. Oxygen piping and fittings shall be washed out with a suitable solution which will effectively remove grease and dirt but will not react with oxygen. Hot water solutions of caustic soda or trisodium phosphate are effective cleaning agents for this purpose.

(h) Piping shall be thoroughly blown out after assembly to remove foreign materials. For oxygen piping, oil-free air, oil-free nitrogen, or oil-free carbon dioxide shall be used. For other piping, air or inert gas may be used.

(i) When flammable gas lines or other parts of equipment are being purged of air or gas, open lights or other sources of ignition shall not be permitted near uncapped openings.

(j) No welding or cutting shall be performed on an acetylene or oxygen pipeline, including the attachment of hangers or supports, until the line has been purged. Only oil-free air, oil-free nitrogen, or oil-free carbon dioxide shall be used to purge oxygen lines.

(iv) **Painting and signs.** (a) Underground pipe and tubing and outdoor ferrous pipe and tubing shall be covered or painted with a suitable material for protection against corrosion.

(b) Aboveground piping systems shall be marked in accordance with the American National Standard Scheme for the

marking of piping systems.

(c) Piping shall be marked in accordance with the American National Standard Scheme for the marking of piping systems.

(d) Piping shall be marked in accordance with the American National Standard Scheme for the marking of piping systems.

(e) Piping shall be marked in accordance with the American National Standard Scheme for the marking of piping systems.

(f) Piping shall be marked in accordance with the American National Standard Scheme for the marking of piping systems.

(g) Piping shall be marked in accordance with the American National Standard Scheme for the marking of piping systems.

(h) Piping shall be marked in accordance with the American National Standard Scheme for the marking of piping systems.

(i) Piping shall be marked in accordance with the American National Standard Scheme for the marking of piping systems.

(j) Piping shall be marked in accordance with the American National Standard Scheme for the marking of piping systems.

(k) Piping shall be marked in accordance with the American National Standard Scheme for the marking of piping systems.

(l) Piping shall be marked in accordance with the American National Standard Scheme for the marking of piping systems.

(m) Piping shall be marked in accordance with the American National Standard Scheme for the marking of piping systems.

(n) Piping shall be marked in accordance with the American National Standard Scheme for the marking of piping systems.

(o) Piping shall be marked in accordance with the American National Standard Scheme for the marking of piping systems.

cuits such as for arc welding machines. Any practice such as the tapping of an electrode against a cylinder to strike an arc shall be prohibited.

(11) Cylinders shall never be used as rollers or supports, whether full or empty.

(12) The numbers and markings stamped into cylinders shall not be tampered with.

(13) No person, other than the gas supplier, shall attempt to mix gases in a cylinder. No one, except the owner of the cylinder or person authorized by him, shall refill a cylinder.

(14) No one shall tamper with safety devices in cylinders or valves.

(15) Cylinders shall not be dropped or otherwise roughly handled.

(16) Unless connected to a manifold, oxygen from a cylinder shall not be used without first attaching an oxygen regulator to the cylinder valve. Before connecting the regulator to the cylinder valve, the valve shall be opened slightly for an instant and then closed. Always stand to one side of the outlet when opening the cylinder valve.

(17) A hammer or wrench shall not be used to open cylinder valves. If valves cannot be opened by hand, the supplier shall be notified.

(18) (i) Cylinder valves shall not be tampered with nor should any attempt be made to repair them. If trouble is experienced, the supplier should be sent a report promptly indicating the character of the trouble and the cylinder's serial number. Supplier's instructions as to its disposition shall be followed.

(ii) Complete removal of the stem from a diaphragm-type cylinder valve shall be avoided.

(c) (1) Fuel-gas cylinders shall be placed with valve end up whenever they are in use. Liquefied gases shall be stored and shipped with the valve end up.

(2) Cylinders shall be handled carefully. Rough handling, knocks, or falls are liable to damage the cylinder, valve or safety devices and cause leakage.

(3) Before connecting a regulator to a cylinder valve, the valve shall be opened slightly and closed immediately. The valve shall be opened while standing to one side of the outlet; never in front of it. Never crack a fuel-gas cylinder valve near other welding work or near sparks, flame, or other possible sources of ignition.

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

(5) Nothing shall be placed on top of an acetylene cylinder when in use which may damage the safety device or interfere with the quick closing of the valve.

(6) If cylinders are found to have leaky valves or fittings which cannot be stopped by closing of the valve, the cylinders shall be taken outdoors away from sources of ignition and slowly emptied.

(7) A warning should be placed near cylinders having leaking fuse plugs or other leaking safety devices not to approach them with a lighted cigarette or other source of ignition. Such cylinders should be plainly tagged; the supplier

should be promptly notified and his instructions followed as to their return.

(8) Safety devices shall not be tampered with.

(9) Fuel-gas shall never be used from cylinders through torches or other devices equipped with shutoff valves without reducing the pressure through a suitable regulator attached to the cylinder valve or manifold.

(10) The cylinder valve shall always be opened slowly.

(11) An acetylene cylinder valve shall not be opened more than one and one-half turns of the spindle, and preferably no more than three-fourths of a turn.

(12) Where a special wrench is required it shall be left in position on the stem of the valve while the cylinder is in use so that the fuel-gas flow can be quickly turned off in case of emergency. In the case of manifolded or coupled cylinders at least one such wrench shall always be available for immediate use.

(3) *Manifolding of cylinders*—(1) *Fuel-gas manifolds.* (a) Manifolds shall be approved either separately for each component part or as an assembled unit.

(b) Except as provided in subdivision (c) of this subdivision fuel-gas cylinders connected to a manifold inside a building shall be limited to a total capacity not exceeding 300 pounds of liquefied petroleum gas or 3,000 cubic feet of other fuel-gas. More than one such manifold with connected cylinders may be located in the same room provided the manifolds are at least 50 feet apart or separated by a noncombustible barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.

(c) Fuel-gas cylinders connected to one manifold having an aggregate capacity exceeding 300 pounds of liquefied petroleum gas or 3,000 cubic feet of other fuel-gas shall be located outdoors, or in a separate building or room constructed in accordance with subparagraphs (6) (vi) (a) (8) and (9) of this paragraph.

(d) Separate manifold buildings or rooms may also be used for the storage of drums of calcium carbide and cylinders containing fuel gases as provided in subparagraph (2) (iii) of this paragraph. Such buildings or rooms shall have no open flames for heating or lighting and shall be well-ventilated.

(e) High-pressure fuel-gas manifolds shall be provided with approved pressure regulating devices.

(ii) *High-pressure oxygen manifolds (for use with cylinders having a Department of Transportation service pressure above 200 p.s.i.g.).* (a) Manifolds shall be approved either separately for each component part or as an assembled unit.

(b) Oxygen manifolds shall not be located in an acetylene generator room. Oxygen manifolds shall be separated from fuel-gas cylinders or combustible materials (especially oil or grease), a minimum distance of 20 feet or by a noncombustible barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.

(c) Except as provided in subdivision (d) of this subdivision oxygen cylinders

connected to one manifold shall be limited to a total gas capacity of 6,000 cubic feet. More than one such manifold with connected cylinders may be located in the same room provided the manifolds are at least 50 feet apart or separated by a noncombustible barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.

(d) An oxygen manifold, to which cylinders having an aggregate capacity of more than 6,000 cubic feet of oxygen are connected, should be located outdoors or in a separate noncombustible building. Such a manifold, if located inside a building having other occupancy, shall be located in a separate room of noncombustible construction having a fire-resistance rating of at least one-half hour or in an area with no combustible material within 20 feet of the manifold.

(e) An oxygen manifold or oxygen bulk supply system which has storage capacity of more than 13,000 cubic feet of oxygen (measured at 14.7 p.s.i.a. and 70° F.), connected in service or ready for service, or more than 25,000 cubic feet of oxygen (measured at 14.7 p.s.i.a. and 70° F.), including unconnected reserves on hand at the site, shall comply with the provisions of the Standard for Bulk Oxygen Systems at Consumer Sites, NFPA No. 568-1965.

(f) High-pressure oxygen manifolds shall be provided with approved pressure-regulating devices.

(iii) *Low-pressure oxygen manifolds (for use with cylinders having a Department of Transportation service pressure not exceeding 200 p.s.i.g.).* (a)

Manifolds shall be of substantial construction suitable for use with oxygen at a pressure of 250 p.s.i.g. They shall have a minimum bursting pressure of 1,000 p.s.i.g. and shall be protected by a safety relief device which will relieve at a maximum pressure of 500 p.s.i.g. DOT-4L200 cylinders have safety devices which relieve at a maximum pressure of 250 p.s.i.g. for 235 p.s.i.g. if vacuum insulation is used.

(b) Hose and hose connections subject to cylinder pressure shall comply with subparagraph (5) (v) of this paragraph. Hose shall have a minimum bursting pressure of 1,000 p.s.i.g.

(c) The assembled manifold including leads shall be tested and proven gas-tight at a pressure of 300 p.s.i.g. The fluid used for testing oxygen manifolds shall be oil-free and not combustible.

(d) The location of manifolds shall comply with subdivisions (ii) (b), (c), (d), and (e) of this subdivision.

(e) The following sign shall be conspicuously posted at each manifold:

Low-Pressure Manifold
Do Not Connect High-Pressure Cylinders
Maximum Pressure—250 P.S.I.G.

(iv) *Portable outlet headers.* (a) Portable outlet headers shall not be used indoors except for temporary service where the conditions preclude a direct supply from outlets located on the service piping system.

gears' nips and spokes and hot pipes in accordance with American National Standard B15.1—1953 (reaffirmed 1958).

(13) *Broke hole.* (i) A guardrail shall be provided at broke holes in accordance with American National Standard A12.1—1967.

(ii) Where pulpers are located directly below the broke hole on a paper machine and where the broke hole opening is large enough to permit a worker to fall through, any employee pushing broke down the hole shall wear a safety belt attached to a safety belt line. The safety belt line shall be fastened in such a manner that it is impossible for the person to fall into the pulper.

(iii) An alarm bell or a flashing light shall be actuated before dropping material through the broke hole.

(14) *Feeder belt.* A feeder belt or other effective device shall be provided for starting paper through the calendar stack.

(15) *Steps.* Steps or ladders of uniform rise and tread with nonslip surfaces shall be provided at each calendar stack. Handrails and hand grips shall be provided at each calendar stack in accordance with American National Standard A12.1—1967.

(16) *Grounding.* All calendar stacks and spreader bars shall be grounded as protection against shock induced by static electricity in accordance with the requirements of § 1910.314.

(17) *Sole plates.* All exposed sole plates between dryers, calendars, reels, and rewinders shall have a nonskid surface.

(18) *Nip points.* The hazard of the nip points on all calendar rolls shall be eliminated or minimized by means of an effective barrier device, or by feeding the paper into the rolls by means of a rope carrier, air jets, or hand feeding devices. Nips where paper is not being fed into the calendar should be protected by barriers. Adequate nip warning signs should be used at all nip points that cannot be guarded physically.

(19) *Platforms.* (i) A nonslip walkway with standard handrail should be provided on both sides of the stacks, in accordance with the American National Standard A12.1—1967.

(ii) A nonslip platform should also be provided at the top of the calendar stack if access to that area is required for changing rolls.

(20) *Scrapers.* Alloy steel scrapers with pullthrough blades approximately 3 by 5 inches in size shall be used to remove "scabs" from calendar rolls.

(21) *Illumination.* Permanent lighting shall be installed in all areas where employees are required to make machine adjustments and sheet transfers in accordance with the American National Standard A11.1—1965 (R 1970).

(22) *Control panels.* Floor stand panels should be protected from being hit by moving equipment. All control panel handles and buttons shall be protected from accidental contact.

(23) *Space between reels.* On stack sets, a clearance of at least 8 inches between the reels of paper shall be maintained.

(24) *Lifting reels.* (i) The reels shall stop rotating before being lifted from bearings.

(ii) All lifting equipment (clamps, cables, and slings) shall be maintained in a safe condition and inspected regularly.

(iii) Reel shafts with square block ends shall be guarded.

(25) *Feeder belts.* Feeder belts, carrier ropes, air carriage, or other equally effective means shall be provided for starting paper into the nip or drum-type reels.

(26) *Inrunning nip.* (i) Where the nipping points of all drum winders and rewinders is on the operator's side, it shall be guarded by barrier guards interlocked with the drive mechanism.

(ii) A zero speed switch should be installed to prevent the guard from being raised while the roll is turning.

(27) *Core collars.* Set screws for securing core collars to winding and unwinding shafts shall not protrude above the face of the collar. All edges of the collar with which an operator's hand comes in contact shall be beveled to remove all sharp corners.

(28) *Slitter knives.* Slitter knives shall be guarded so as to prevent accidental contact. Carriers shall be provided and used for transportation of slitter knives.

(29) *Winder shaft.* All shafts should be equipped with a winder collar guide. The winder shall have a guide rail to align the shaft for easy entrance into the opened rewind shaft bearing housings. If the winder is large and the rewind shafts are too heavy for manual insertion, powered rewind shaft injectors should be employed.

(30) *Core shaft.* When the core shaft weighs in excess of the safe standard, a mechanical device such as a dolly shall be provided for carrying all or part of the weight when it is being removed from the set of paper and placed in the dressing brackets on the winder. In the event that the force required to extract the shaft from the cores is excessive, even though the weight of the shaft is being supported, a powered shaft puller should be employed to relieve the operator of physical strain.

(31) *Winder area.* A nonskid surface shall be provided in the front vicinity of the winder to prevent accidental slipping.

(32) *Radiation.* Special standards regarding the use of radiation equipment shall be posted and followed as required by § 1910.96.

(i) *Finishing room*—(1) *Cleaning rolls.* Rolls shall be cleaned only on the outrunning side.

(2) *Emergency stops.* Electrically or manually operated quick power disconnecting devices, interlocked with braking action, shall be provided on all operating sides of the machine within easy reach of all employees. These devices shall be tested by making use of them when stopping the machine.

(3) *Core collars.* The requirements of paragraph (k) (27) of this section and the American National Standard B15.1—1953 (reaffirmed 1958) shall apply.

(4) *Elevators.* These shall be in accordance with American National Standard A17.1—1965.

(5) *Control panels.* The requirements of paragraph (k) (22) of this section shall apply.

(6) *Guillotine-type cutters.* (i) Each guillotine-type cutter shall be equipped with a control which requires the operator and his helper, if any, to use both hands to engage the clutch.

(ii) Each guillotine-type cutter shall be equipped with a nonrepeate device.

(iii) Carriers shall be provided and used for transportation of guillotine-type cutter knives.

(7) *Rotary cutter.* (i) On single-knife machines a guard shall be provided at a point of contact to the knife.

(ii) On duplex cutters the protection required for single-knife machines shall be provided for the first knife, and a hood shall be provided for the second knife.

(iii) Safe access shall be provided to the knives of a rotary cutter by means of catwalks with nonslip surfaces, railings, and toeboards in accordance with paragraph (b) (3) of this section.

(iv) A guard shall be provided for the spreader or squeeze roll at the nip side on sheet cutters.

(v) Electrically or manually operated quick power disconnecting devices with adequate braking action shall be provided on all operating sides of the machine within easy reach of all operators.

(vi) The outside slitters shall be guarded.

(8) *Platers.* (i) A guard shall be arranged across the face of the rolls to serve as a warning that the operator's hand is approaching the danger zone.

(ii) A quick power disconnecting device shall be installed on each machine within easy reach of the operator.

(9) *Finishing room rewinders.* (i) The nipping points of all drum winders and rewinders located on the operator's side shall be guarded by either automatic or manually operated barrier guards of sufficient height to protect fully anyone working around them. The barrier guard shall be interlocked with the drive mechanism to prevent operating above jog speed without the guard in place.

A zero speed switch should be installed to prevent the guard from being raised while the roll is turning.

(ii) A nonskid surface shall be provided in front of the rewinder to prevent an employee from slipping in accordance with paragraph (b) (3) of this section.

(iii) Mechanical lifting devices shall be provided for placing and removing rolls from the machine.

(10) *Control panels.* The requirements of paragraph (k) (22) of this section shall apply.

(11) *Roll-type embosser.* The nipping point located on the operator's side shall be guarded by either automatic or manually operated barrier guards interlocked with the drive.

(12) *Sorting and counting tables.* (i) Tables shall be smooth and free from splinters, with edges and corners rounded.

(ii) Paddles shall be smooth and free from splinters.

(13) *Roll splitters*. The nip point and cutter knife shall be guarded by either automatic or manually operated barrier guards.

(m) *Materials handling*—(1) *Hand trucks*. No person shall be permitted to ride on a powered hand truck unless it is so designed by the manufacturer. A limit switch shall be on operating handle—30 degrees each way from a 45-degree angle up and down.

(2) *Power trucks*. Power trucks shall comply with American National Standard B56.1—1969. Adequate ventilation shall be provided and the trucks properly maintained, so that dangerous concentrations of carbon monoxide cannot be generated, especially in warehouses or other isolated areas of a plant.

(3) *Cartons*. The carton-stitching machine shall be guarded to prevent the operator from coming in contact with the stitching head.

(4) *Banding of skids, cartons, cases, etc.* Banders and helpers shall wear eye protection equipment in accordance with paragraph (b) (2) of this section.

(5) *Unloading cars or trucks*. (i) Where steel bands or wires are used in boxcars or trucks, all loaders and helpers shall wear eye protection in accordance with paragraph (b) (2) of this section.

(ii) The construction and use of bridge or dock plates shall conform to the requirements of American National Standard B56.1—1969.

(iii) Flag signals, derails, or other protective devices shall be used to protect men during switching operations. The blue flag policy shall be invoked according to paragraph (c) (9) (i) of this section.

(n) *Effective dates*. (1) The provisions of this § 1910.261 shall become effective on August 27, 1971, except as provided in the remaining subparagraphs of this paragraph.

(2) The following provisions shall become effective on February 15, 1972:

§ 1910.261 (a) (3), (b) (8), (f) (2) (iv), (f) (5), (g) (1) (iv), (g) (11) (i), (j) (5) (iv), (k) (12), (k) (2), and (m) (2).

(3) Notwithstanding anything in subparagraph (1), (2), or (4) of this paragraph, any provision in any other paragraph of this section which contains in itself a specific effective date or time limitation shall become effective on such date or shall apply in accordance with such limitation.

(4) Notwithstanding subparagraph (1) of this paragraph, if any standard in 41 CFR Part 50-204, other than a national consensus standard incorporated by reference in § 50-204.2(a)(1), is or becomes applicable at any time to any employment and place of employment, by virtue of the Walsh-Healey Public Contracts Act, or the Service Contract Act of 1965, or the National Foundation on Arts and Humanities Act of 1965, any corresponding established Federal standard in this § 1910.261 which is derived from 41 CFR Part 50-204 shall also become effective, and shall be applicable to such employment and place of employment, on the same date.

§ 1910.262 Textiles.

(a) *Application requirements*—(1) *Application*. The requirements of this subpart for textile safety apply to the design, installation, processes, operation, and maintenance of textile machinery, equipment, and other plant facilities in all plants engaged in the manufacture and processing of textiles, except those processes used exclusively in the manufacture of synthetic fibers.

(2) *Standards incorporated by reference*. Standards covering issues of occupational safety and health which are of general application without regard to any specific industry are incorporated by reference in paragraphs of this section and made applicable to textiles. All such standards shall be construed according to the rules of construction set out in § 1910.5.

(b) *Definitions applicable to this section*—(1) *Belt shifter*. A "belt shifter" is a device for mechanically shifting a belt from one pulley to another.

(2) *Belt shifter lock*. A "belt shifter lock" is a device for positively locking the belt shifter in position while the machine is stopped and the belt is idling on the loose pulleys.

(3) *Calender*. A "calender" in essence consists of a set of heavy rollers mounted on vertical side frames and arranged to pass cloth between them. Calenders may have two to ten rollers, or bowls, some of which can be heated.

(4) *Embossing calender*. An "embossing calender" is a calender with two or more rolls, one of which is engraved for producing figured effects of various kinds on a fabric.

(5) *Cans (drying)*. Drying "cans" are hollow cylindrical drums mounted in a frame so they can rotate. They are heated with steam and are used to dry fabrics or yarn as it passes around the perimeter of the can.

(6) *Carbonizing*. "Carbonizing" means the removing of vegetable matter such as burns, straws, etc., from wool by treatment with acid, followed by heat. The undesired matter is reduced to a carbon-like form which may be removed by dusting or shaking.

(7) *Card*. A "card" machine consists of cylinders of various sizes—and in certain cases flats—covered with card clothing and set in relation to each other so that fibers in staple form may be separated into individual relationship. The speed of the cylinders and their direction of rotation varies. The finished product is delivered as a silver. Cards of different types are: The revolving flat card, the roller-and-clearer card, etc.

(8) *Card clothing*. "Card clothing" is the material with which many of the surfaces of a card are covered; e.g., the cylinder, doffer, etc. It consists of a thick foundation material, usually made of textile fabrics, through which are pressed many fine, closely spaced, specially bent wires.

(9) *Comber*. A "comber" is a machine for combing fibers of cotton, wool, etc. The essential parts are a device for feeding forward a fringe of fibers at regular intervals and an arrangement of combs

or pins which, at the right time, pass through the fringe. All tangled fibers, short fibers, and neps are removed and the long fibers are laid parallel.

(10) *Combing machinery*. "Combing machinery" is a general classification, including combers, silver lap machines, ribbon lap machines, and gill boxes, but excluding cards.

(11) *Cutter (rotary staple)*. A rotary staple "cutter" is a machine consisting of one or more rotary blades used for the purpose of cutting textile fibers into staple lengths.

(12) *Exposed to contact*. "Exposed to contact" shall mean that the location of an object, material, nip point, or point of operation is such that a person is liable to come in contact with it in his normal course of employment.

(13) *Garnett machine*. A "Garnett machine" means any of a number of types of machines for opening hard twisted waste of wool, cotton, silk, etc. Essentially, such machines consist of a licerin, one or more cylinders, each having a complement worker and stripper rolls, and a fancy roll and doffer. The action of such machines is somewhat like that of a wool card, but it is much more severe in that the various rolls are covered with garnett wire instead of card clothing.

(14) *Gill box*. A "gill box" is a machine used in the worsted system of manufacturing yarns. Its function is to arrange the fibers in parallel order. Essentially, it consists of a pair of feed rolls and a series of followers where the followers move at a faster surface speed and perform a combing action.

(15) *Interlock*. An "interlock" is a device that operates to prevent the operation of machine while the cover or door of the machine is open or unlocked, and which will also hold the cover or door closed and locked while the machine is in motion.

(16) *Jig (dye)*. A dye "jig" is a machine for dyeing piece goods. The cloth, at full width, passes from a roller through the dye liquor in an open vat and is then wound on another roller. The operation is repeated until the desired shade is obtained.

(17) *Kier*. A "kier" is a large metal vat, usually a pressure type, in which fabrics may be boiled out, bleached, etc.

(18) *Lapper (ribbon)*. A ribbon "lapper" is a machine used to prepare laps for feeding a cotton comb; its purpose is to provide a uniform lap in which the fibers have been straightened as much as possible.

(19) *Lapper (silver)*. A silver "lapper" is a machine in which a number of parallel card silvers are drafted slightly, laid side by side in a compact sheet, and wound into a cylindrical package.

(20) *Loom*. A "loom" is a machine for effecting the interlacing of two series of yarns crossing one another at right angles. The warp yarns are wound on a warp beam and pass through heddles and reed. The filling is shot across in a shuttle and settled in place by reed and lay, and the fabric is wound on a cloth beam.

(21) *Mangle (starch)*. A "starch mangle" is a mangle that is used specifically for starching cotton goods. It commonly

ing laboratory, such as Factory Mutual Engineering Corp., or Underwriters' Laboratories, Inc.

(c) All other welding terms are used in accordance with American Welding Society—Terms and Definitions—A3.0-1969.

§ 1910.252 Welding, cutting, and brazing.

(a) *Installation and operation of oxygen-fuel gas systems for welding and cutting*—(1) *General requirements*. (i) *Flammable mixture*. Mixtures of fuel gases and air or oxygen may be explosive and shall be guarded against. No device or attachment facilitating or permitting mixtures of air or oxygen with flammable gases prior to consumption, except at the burner or in a standard torch, shall be allowed unless approved for the purpose.

(ii) *Maximum pressure*. Under no condition shall acetylene be generated, piped (except in approved cylinder manifolds) or utilized at a pressure in excess of 15 p.s.i. gage pressure or 30 p.s.i. absolute pressure. (The 30 p.s.i. absolute pressure limit is intended to prevent unsafe use of acetylene in pressurized chambers such as caissons, underground excavations or tunnel construction.) This requirement is not intended to apply to storage of acetylene dissolved in a suitable solvent in cylinders manufactured and maintained according to U.S. Department of Transportation requirements, or to acetylene for chemical use. The use of liquid acetylene shall be prohibited.

(iii) *Apparatus*. Only approved apparatus such as torches, regulators or pressure-reducing valves, acetylene generators, and manifolds shall be used.

(iv) *Personnel*. Workmen in charge of the oxygen or fuel-gas supply equipment, including generators and oxygen or fuel-gas distribution piping systems shall be instructed and judged competent by their employers for this important work before being left in charge. Rules and instructions covering the operation and maintenance of oxygen or fuel-gas supply equipment including generators, and oxygen or fuel-gas distribution piping systems shall be readily available.

(2) *Cylinders and containers*—(i) *Approval and marking*. (a) All portable cylinders used for the storage and shipment of compressed gases shall be constructed and maintained in accordance with the regulations of the U.S. Department of Transportation, 49 CFR Parts 171-179.

(b) Compressed gas cylinders shall be legibly marked, for the purpose of identifying the gas content, with either the chemical or the trade name of the gas. Such marking shall be by means of stenciling, stamping, or labeling, and shall not be readily removable. Whenever practical, the marking shall be located on the shoulder of the cylinder. This method conforms to the American National Standard Method for Marking Portable Compressed Gas Containers to Identify the Material Contained, ANSI Z48.1-1954.

(c) Compressed gas cylinders shall be equipped with connections complying with the American National Standard Compressed Gas Cylinder Valve Outlet and Inlet Connections, ANSI B51.1-1965.

(d) All cylinders with a water weight capacity of over 30 pounds shall be equipped with means of connecting a valve protection cap or with a collar or recess to protect the valve.

(ii) *Storage of cylinders—general*. (a) Cylinders shall be kept away from radiators and other sources of heat.

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

(c) Empty cylinders shall have their valves closed.

(d) Valve protection caps, where cylinder is designed to accept a cap, shall always be in place, hand-tight, except when cylinders are in use or connected for use.

(iii) *Fuel-gas cylinder storage*. Inside a building, cylinders, except those in actual use or attached ready for use, shall be limited to a total gas capacity of 2,000 cubic feet or 300 pounds of liquefied petroleum gas.

(a) For storage in excess of 2,000 cubic feet total gas capacity, cylinders or 300 pounds of liquefied petroleum gas, a separate room or compartment conforming to the requirements specified in subparagraphs (f) (vi) (a) (8) and (9) of this paragraph shall be provided, or cylinders shall be kept outside or in a special building. Special buildings, rooms or compartments shall have no open flame for heating or lighting and shall be well ventilated. They may also be used for storage of calcium carbide in quantities not to exceed 600 pounds when contained in metal containers complying with subparagraphs (7) (i) (a) and (b) of this paragraph. Signs should be conspicuously posted in such rooms reading, "Danger—No Smoking, Matches or Open Lights," or other equivalent wording.

(b) Acetylene cylinders shall be stored valve end up.

(iv) *Oxygen storage*. (a) Oxygen cylinders shall not be stored near highly combustible material, especially oil and grease; or near reserve stocks of carbide and acetylene or other fuel-gas cylinders, or near any other substance likely to cause or accelerate fire; or in an acetylene generator compartment.

(b) Oxygen cylinders stored in outside generator houses shall be separated from the generator or carbide storage rooms by a noncombustible partition having a fire-resistance rating of at least 1 hour. This partition shall be without openings and shall be gastight.

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

(d) Where a liquid oxygen system is to be used to supply gaseous oxygen for welding or cutting and the system has a storage capacity of more than 13,000 cubic feet of oxygen (measured at 14.7 p.s.i.a. and 70° F.), connected in service or ready for service, or more than 25,000 cubic feet of oxygen (measured at 14.7 p.s.i.a. and 70° F.), including unconnected reserves on hand at the site, it shall comply with the provisions of the Standard for Bulk Oxygen Systems at Consumer Sites, NFPA No. 566-1965.

(v) *Operating procedures*. (a) Cylinders, cylinder valves, couplings, regulators, hose, and apparatus shall be kept free from oily or greasy substances. Oxygen cylinders or apparatus shall not be handled with oily hands or gloves. A jet of oxygen must never be permitted to strike an oily surface, greasy clothes, or enter a fuel oil or other storage tank.

(b) (i) When transporting cylinders by a crane or derrick, a cradle, boat, or suitable platform shall be used. Slings or electric magnets shall not be used for this purpose. Valve-protection caps, where cylinder is designed to accept a cap, shall always be in place.

(2) Cylinders shall not be dropped or struck or permitted to strike each other violently.

(3) Valve-protection caps shall not be used for lifting cylinders from one vertical position to another. Bars shall not be used under valves or valve-protection caps to pry cylinders loose when frozen to the ground or otherwise fixed; the use of warm (not boiling) water is recommended. Valve-protection caps are designed to protect cylinder valves from damage.

(4) Unless cylinders are secured on a special truck, regulators shall be removed and valve-protection caps, when provided for, shall be put in place before cylinders are moved.

(5) Cylinders not having fixed hand wheels shall have keys, handles, or non-adjustable wrenches on valve stems while these cylinders are in service. In multiple cylinder installations only one key or handle is required for each manifold.

(6) Cylinder valves shall be closed before moving cylinders.

(7) Cylinder valves shall be closed when work is finished.

(8) Valves of empty cylinders shall be closed.

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

(10) Cylinders shall not be placed where they might become part of an electric circuit. Contacts with third rails, trolley wires, etc., shall be avoided. Cylinders shall be kept away from radiators, piping systems, layout tables, etc., that may be used for grounding electrical circuits.

(viii) In a multi-piece blade, the means of fastening the cutting members to the body of the blade or disc shall be so designed that they will not become worn to a hazardous condition before the cutting members themselves are worn beyond use.

(ix) The maximum tip speed of any blade shall be 18,000 feet per minute.

(3) *Walk-behind rotary mowers.* (i) The horizontal angle of the opening(s) in the blade enclosure, intended for the discharge of grass, shall not contact the operator area.

(ii) There shall be one of the following at all openings in the blade enclosure intended for the discharge of grass:

(a) A minimum unobstructed horizontal distance of 3 inches from the end of the discharge chute to the blade tip circle.

(b) A rigid bar fastened across the discharge opening, secured to prevent removal without the use of tools. The bottom of the bar shall be no higher than the bottom edge of the blade enclosure.

(iii) The highest point(s) on the front of the blade enclosure, except discharge openings, shall be such that any line extending a maximum of 15° downward from the horizontal toward the blade shaft axis (axes) shall not intersect the horizontal plane within the blade tip circle. The highest point(s) on the blade enclosure, front, except discharge openings, shall not exceed 1 1/4 inches above the lowest blade position. Mowers with a swing-over handle are to be considered as having no front in the blade enclosure and therefore shall comply with subparagraph (2) (i) of this paragraph.

(iv) The mower handle shall be fastened to the mower so as to prevent loss of control by unintentional uncoupling while in operation.

(v) A positive upstop or latch shall be provided for the mower handle in the normal operating position(s). The upstop shall not be subject to unintentional disengagement during normal operation of the mower. The upstop or latch shall not allow the center or the handle grips to come closer than 17 inches horizontally behind the closest path of the mower blades(s) unless manually disengaged.

(vi) A swing-over handle, which complies with the above requirements, will be permitted.

(4) *Riding rotary mowers.* (i) The highest point(s) of all openings in the blade enclosure, front shall be limited by a vertical angle of opening of 15° and a maximum distance of 1 1/4 inches above the lowest cutting point of the blade in the lowest blade position.

(ii) Opening(s) shall be placed so that grass or debris will not discharge directly toward any part of an operator seated in a normal operator position.

(iii) There shall be one of the following at all openings in the blade enclosure intended for the discharge of grass:

(a) A minimum unobstructed horizontal distance of 6 inches from the end of the discharge chute to the blade tip circle.

(b) A rigid bar fastened across the discharge opening, secured to prevent

removal without the use of tools. The bottom of the bar shall be no higher than the bottom edge of the blade enclosure.

(iv) Mowers shall be provided with stops to prevent jackknifing or locking of the steering mechanism.

(v) Vehicle stopping means shall be provided.

(vi) Hand-operated wheel drive disengaging controls shall move opposite to the direction of vehicle motion in order to disengage the drive. Foot-operated wheel drive disengaging controls shall be depressed to disengage the drive.

Dead-man controls, both hand and foot operated, shall comply with § 1910.241 (c) (11) and may operate in any direction to disengage the drive.

§ 1910.244 Other portable tools and equipment.

(a) *Jacks.*—(i) *Loading and marking.* (i) The operator shall make sure that the jack used has a rating sufficient to lift and sustain the load.

(ii) The rated load shall be legibly and permanently marked in a prominent location on the jack by casting, stamping, or other suitable means.

(2) *Operation and maintenance.* (i) In the absence of a firm foundation, the base of the jack shall be blocked. If there is a possibility of slippage of the cap, a block shall be placed in between the cap and the load.

(ii) The operator shall watch the stop indicator, which shall be kept clean, in order to determine the limit of travel. The indicated limit shall not be overrun.

(iii) After the load has been raised, it shall be cribbed, blocked, or otherwise secured at once.

(iv) Hydraulic jacks exposed to freezing temperatures shall be supplied with an adequate antifreeze liquid.

(v) All jacks shall be properly lubricated at regular intervals. The lubrication instructions of the manufacturer should be followed, and only lubricants recommended by him should be used.

(vi) Each jack shall be thoroughly inspected at times which depend upon the service conditions. Inspections shall be not less frequent than the following:

(a) For constant or intermittent use at one locality, once every 6 months.

(b) For jacks sent out of shop for special work, when sent out and when returned.

(c) For a jack subjected to abnormal load or shock, immediately before and immediately thereafter.

(vii) Repair or replacement parts shall be examined for possible defects.

(viii) Jacks which are out of order shall be tagged accordingly, and shall not be used until repairs are made.

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

§ 1910.245 Effective dates.

(a) The provisions of this Subpart P shall become effective on August 27, 1971, except as provided in the remaining paragraphs of this section.

(b) The following provisions shall become effective on February 15, 1972:

§ 1910.243 (a) (1), (a) (2), (a) (3), (b) (1), (c) (1), (c) (2), (c) (3), (d) (1), (d) (2), and (e).

(c) Notwithstanding anything in paragraph (a), (b), or (d) of this section, any provision in any other section of this subpart which contains in itself a specific effective date or time limitation shall become effective on such date or shall apply in accordance with such limitation.

(d) Notwithstanding anything in paragraph (a) of this section, if any standard in 41 CFR Part 50-204, other than a national consensus standard incorporated by reference in § 50-204.2 (a) (1), is or becomes applicable at any time to any employment and place of employment, by virtue of the Walsh-Healey Public Contracts Act, or the Service Contract Act of 1965, or the National Foundation on Arts and Humanities Act of 1965, any corresponding established Federal standard in this Subpart P which is derived from 41 CFR Part 50-204 shall also become effective, and shall be applicable to such employment and place of employment, on the same date.

§ 1910.246 Sources of standards.

Source
1910.241 (a) ANSI A103 (1970), Safety Requirements for explosive actuated fastening tools.
1910.241 (b) ANSI B7.1-1970, Safety Code for the use, care, and protection of abrasive wheels.
1910.241 (c) ANSI B71.1-1968, Safety Specifications for power lawn mowers.
1910.241 (d) ANSI B30.1-1943, Safety Code for jacks.
1910.242 41 CFR 50-204.4 and 50-204.3.
1910.243 (a) ANSI O1.1-1954 (R1961), Safety Code for woodworking machines.
1910.243 (b) ANSI B19.1-1938, Compressed Air Machinery and Equipment.
1910.243 (c) ANSI B7.1-1970, Safety Code for Abrasive Materials.
1910.243 (d) ANSI 103-1970, Explosive Actuated Fastening Tools.
1910.243 (e) ANSI B71-1968, Safety Specifications for Power Lawn Mowers.
1910.244 (a) ANSI B30.1-1943 (R1952), Safety Code for jacks.
1910.244 (b) ANSI Z9.4-1968, Ventilation and Safe Practices of Abrasive Blasting Operations.

§ 1910.247 Standards organizations.

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

American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

Subpart Q—Welding, Cutting, and Brazing

§ 1910.251 Definitions.

As used in this subpart:

(a) "Welder" and "welding operator" mean any operator of electric or gas welding and cutting equipment.

(b) "Approved" means listed or approved by a nationally recognized test-

consists of two large rolls and a shallow vat with several immersion rolls. The vat contains the starch solution.

(22) *Mangle (water).* A "water mangle" is a calendar having two or more rolls used for squeezing water from fabrics before drying. Water mangles also may be used in other ways during the finishing of various fabrics.

(23) *Mule.* A "mule" is a type of spinning frame having a head stock and a carriage as its two main sections. The head stock is stationary. The carriage is movable and it carries the spindles which draft and spin the roving into the yarn. The carriage extends over the whole width of the machine and moves slowly toward and away from the head stock during the spinning operation.

(24) *Nip.* "Nip" shall mean the point of contact between two in-running rolls.

(25) *Openers and pickers.* "Openers and pickers" means a general classification which includes breaker pickers, intermediate pickers, finisher pickers, single process pickers, multiple process pickers, willow machines, card and picker waste cleaners, thread extractors, shredding machines, roving waste openers, shoddy pickers, bale breakers, feeders, vertical openers, lattice cleaners, horizontal cleaners, and any similar machinery equipped with either cylinders, screen section, calendar section, rolls, or beaters used for the preparation of stock for further processing.

(26) *Paddler.* A "paddler" consists of a trough for a solution and two or more rollers between which cloth passes after being passed through a mordant or dye bath.

(27) *Point of operation.* "Point of operation" shall mean that part of the machine where the work of cutting, shearing, squeezing, drawing, or manipulating the stock in any other way is done.

(28) *Printing machine (roller type).* A "roller printing machine" is a machine consisting of a large central cylinder, or pressure bowl, around the lower part of the perimeter of which is placed a series of engraved color rollers (each having a color trough), a furnisher roller, doctor blades, etc. The machine is used for printing fabrics.

(29) *Ranges (bleaching continuous).* "Continuous bleaching ranges" are of several types and may be made for cloth in rope or open-width form. The goods, after wetting out, pass through a squeeze roll into a saturator containing a solution of caustic soda and then to an enclosed J-box. A V-shaped arrangement is attached to the front part of the J-box for uniform and rapid saturation of the cloth with steam before it is packed down in the J-box. The cloth, in a single strand rope form, passes over a guide roll down the first arm of the "V" and up the second. Steam is injected into the "V" at the upper end of the second arm so that the cloth is rapidly saturated with steam at this point. The J-box capacity is such that cloth will remain hot for a sufficient time to complete the scouring action. It then passes a series of washers with a squeeze roll in between. The cloth then passes through a second set of saturator, J-box, and washer, where it is treated

with the peroxide solution. By slight modification of the form of the unit, the same process can be applied to open-width cloth.

(30) *Range (mercerizing).* A "mercerizing range" consists generally of a 3-bowl mangle, a tenter frame, and a number of boxes for washing and scouring. The whole setup is in a straight line and all parts operate continuously. The combination is used to saturate the cloth with sodium hydroxide, stretch it while saturated, and washing out most of the caustic before releasing tension.

(31) *Sanforizing machine.* A "sanforizing machine" is a machine consisting of a large steam-heated cylinder, an endless, thick, woolen felt blanket which is in close contact with the cylinder for most of its perimeter, and an electrically heated shoe which presses the cloth against the blanket while the latter is in a stretched condition as it curves around feed-in roll.

(32) *Shearing machine.* A "shearing machine" is a machine used in shearing cloth. Cutting action is provided by a number of steel blades spirally mounted on a roller. The roller rotates in close contact with a fixed ledger blade. There may be from one to six such rollers on a machine.

(33) *Singeing machine.* A "singeing machine" is a machine used particularly with cotton; it comprises of a heated roller, plate, or an open gas flame. The material is rapidly passed over the roller or the plate or through the open gas flame to remove, fuzz or hairiness on yarn or cloth by burning.

(34) *Slasher.* A "slasher" is a machine used for applying a size mixture to warp yarns. Essentially, it consists of a stand for holding section beams, a size box, one or more cylindrical dryers or an enclosed hot air dryer, and a beaming end for finding the yarn on the loom beams.

(35) *Solvent (industrial organic).* "Industrial organic solvent" means any organic volatile liquid or compound, or any combination of these substances which are used to dissolve or suspend a nonvolatile or slightly volatile substance for industrial utilization. It shall also apply to such substances when used as detergents or cleansing agents. It shall not apply to petroleum products when such products are used as fuel.

(36) *Tenter frame.* A "tenter frame" is a machine for drying cloth under tension. It essentially consists of a pair of endless traveling chains fitted with clips of fine pins and carried on tracks. The cloth is firmly held at the selvages by the two chains which diverge as they move forward so that the cloth is brought to the desired width.

(37) *Warper.* A "warper" is any machine for preparing and arranging the yarns intended for the warp of a fabric, specifically, a beam warper.

(c) *General safety requirements.*—(1) *Means of stopping machines.* Every textile machine shall be provided with individual mechanical or electrical means for stopping such machines. On machines driven by belts and shafting, a locking-type shifter or an equivalent positive device shall be used. On operations

where injury to the operator might result if motors were to restart after power failures, provision shall be made to prevent machines from automatically restarting upon restoration of power.

(2) *Handles.* Stopping and starting handles shall be designed to the proper length to prevent the worker's hand or fingers from striking against any revolving part, gear guard, or any other part of the machine.

(3) *Machine guarding.* Mechanical power-transmission equipment shall be guarded in conformity with § 1910.219.

(4) *Housekeeping.* Aisles and working spaces shall be kept in good order, clean and free of obstructions in accordance with requirements of § 1910.141.

(5) *Inspection and maintenance.* All guards and other safety devices, including starting and stopping devices, shall be properly maintained.

(6) *Lighting.* Lighting shall conform to American National Standard A11.1—1965.

(7) *Identification of piping systems.* Identification of piping systems shall conform to American National Standard A13.1—1956.

(8) *Identification of physical hazards.* Identification of physical hazards shall be in accordance with the requirements of § 1910.144.

(9) *Steam pipes.* All pipes carrying steam or hot water for process or servicing machinery, when exposed to contact and located within seven feet of the floor or working platform shall be covered with a heat-insulating material, or otherwise properly guarded.

(d) *Openers and pickers.*—(1) *Beater guards.* When any opening or picker machinery is equipped with a beater, such beater shall be provided with metal covers which will prevent contact with the beater. Such covers shall be provided with an interlock which will prevent the cover from being raised while the machine is in motion and prevent the operation of the machine while the cover is open.

(2) *Cleanout holes.* Cleanout holes within reaching distance of the fan or picker beater shall have their covers securely fastened and they shall not be opened while the machine is in motion.

(3) *Feed rolls.* The feed rolls on all opening and picking machinery shall be covered with a guard designed to prevent the operator from reaching the nip while the machinery is in operation.

(4) *Removal of foreign ferrous material.* All textile opener lines shall be equipped with magnetic separators, tramp iron separators, or other means for the removal of foreign ferrous material.

(e) *Cotton cards.*—(1) *Enclosures.* Cylinder and lickerins shall be completely protected and the doffers should be enclosed.

(2) *Enclosure fastenings.* The enclosures or covers shall be kept in place while the machine is in operation, except when stripping or grinding.

(3) *Stripping rolls.* On operations calling for flat strippings which are allowed to fall on the doffer cover, where such strippings are removed by hand, the

doffer cover shall be kept closed and securely fastened to prevent the opening of the cover while the machine is in operation. When it becomes necessary to clean the cards while they are in motion, a long-handled brush or dust mop shall be used.

(f) *Garnett machines*—(1) *Lickerin*. Garnett lickerins shall be enclosed.

(2) *Fancy rolls*. Garnett fancy rolls shall be enclosed by covers. These shall be installed in a way that keeps worker rolls reasonably accessible for removal or adjustment.

(3) *Underside of machine*. The underside of the garnett shall be guarded by a screen mesh or other form of enclosure to prevent access.

(g) *Spinning mules*—A substantial fender of metal or hardwood shall be installed in front of the carriage wheels, the fender to extend to within one-fourth inch of the rail.

(h) *Slashers*—(1) *Cylinder dryers*—

(i) *Reducing valves, safety valves, and pressure gages*. Reducing valves, safety valves, and pressure gages shall conform to the ASME Pressure Vessel Code, Section VIII, Unfired Pressure Vessels, 1968.

(ii) *Vacuum relief valves*. Vacuum relief valves shall conform to the ASME Code for Pressure Vessels, Section VIII, Unfired Pressure Vessels, 1968.

(iii) *Lever control*. When slashers are operated by control levers, these levers shall be connected to a horizontal bar or treadle located not more than 69 inches above the floor to control the operation from any point.

(iv) *Pushbutton control*. Slashers operated by pushbutton control shall have stop and start buttons located at each end of the machine, and additional buttons located on both sides of the machine, at the size box and the delivery end. If calendar rolls are used, additional buttons shall be provided at both sides of the machine at points near the nips, except when slashers are equipped with an enclosed dryer.

(v) *Nip guards*. All nip guards shall comply with the requirements of subparagraph (2)(iv) of this paragraph.

(vi) *Cylinder enclosure*. When enclosures or hoods are used over cylinder drying rolls, such enclosures or hoods shall be provided with an exhaust system which will effectively prevent wet air and steam from escaping into the workroom.

(vii) *Expansion chambers*. Slasher kettles and cookers shall be provided with expansion chambers in the covers, or drains, to prevent surging over. Steam-control valves shall be so located that they can be operated without exposing the worker to moving parts, hot surfaces, or steam.

(2) *Enclosed hot air dryer*—(i) *Lever control*. When slashers are operated by control levers, these levers shall be connected to a horizontal bar or treadle located not more than 69 inches above the floor to control the operation from any point.

(ii) *Push-button control*. Slashers operated by push-button control shall have one start button at each end of the machine and stop buttons shall be located on both sides of the machines at

intervals spaced not more than 6 feet on centers. Inching buttons should be installed.

(iii) *Dryer enclosure*. The dryer enclosure shall be provided with an exhaust system which will effectively prevent wet air and steam from escaping into the workroom.

(iv) *Nip guards*. All nip guards shall comply with Table R-1.

TABLE R-1
GUARD OPENINGS

Openings in the guard or between the guard and working surface shall not be greater than the following:

Distance of opening from nip point	Maximum width of opening
0 to 1 1/2".....	3/4"
1 1/2" to 2 1/2".....	1/2"
2 1/2" to 3 1/2".....	1/2"
3 1/2" to 5 1/2".....	1/2"
5 1/2" to 6 1/2".....	1/2"
6 1/2" to 7 1/2".....	1/2"
7 1/2" to 8 1/2".....	1/2"
8 1/2" to 10 1/2".....	1 1/4"

The measurements in Table R-1 are all in inches.

(v) *Expansion chambers*. Slasher kettles and cookers shall be provided with expansion chambers in the covers, or drains, to prevent surging over. Steam control valves shall be so located that they can be operated without exposing the worker to moving parts, hot surfaces, or steam.

(i) *Warpers*—(1) *Twisted double-bar gates*. Swiveled double-bar gates shall be installed on all warpers operating in excess of 450 yards per minute. These gates shall be so interlocked that the machine cannot be operated until the gate is in the "closed position," except for the purpose of inching or jogging.

(2) *Closed position*. "Closed position" shall mean that the top bar of the gate shall be at least 42 inches from the floor or working platform; and the lower bar shall be at least 21 inches from the floor or working platform; and the gate shall be located 15 inches from the vertical tangent to the beam head.

(j) *Drawing frames, slubbers, roving parts, cotton combers, ring spinning frames, twisters*. Gear housing covers on all installations of drawing frames, slubbers, roving frames, cotton combers, ring spinning frames, and twisters shall be equipped with interlocks.

(k) *Gill boxes*—(1) *Pin guard*. A guard shall be placed ahead of the feed end and shall be so designed that it will prevent the worker's fingers from being caught in the pins of the intersecting fallers.

(2) *Nip guards*. All nip guards shall comply with the requirements of paragraph (h)(2)(iv) of this section.

(i) *Heavy draw boxes, finishers, and speeders used in worsted drawing*—(1) *Band pulley covers*. Covers for band pulleys shall be closed when the machine is in motion.

(2) *Benchers or working platforms*. Branches or working platforms approximately 10 inches in height and 8 inches in width should be installed along the entire running length of the machine for the worker to stand on while creeling

the machine. Such benches or platforms shall be covered with an abrasive or nonslip material.

(m) *Silver and ribbon lappers (cot-ton)*. Cover guard. An interlocking cover guard shall be installed over the large calendar drums and the lap spool, designed to prevent the operator from coming in contact with the nip.

(n) *Looms*—(1) *Shuttle guard*. Each loom shall be equipped with a guard designed to minimize the danger of the shuttle flying out of the shed.

(2) *Protection for loom fixer*. Provisions shall be made so that every loom fixer can prevent the loom from being started while he is at work on the loom. This may be accomplished by means of a lock, the key to which is retained in the possession of the loom fixer, or by some other effective means to prevent starting the loom.

(o) *Shearing machines*. All revolving blades on shearing machines shall be guarded so that the opening between the cloth surface and the bottom of the guard will not exceed three-eighths inch.

(p) *Continuous bleach range (cotton and rayon)*—(1) *J-box protection*. Each valve controlling the flow of steam, injurious gases, or liquids into a J-box shall be equipped with a chain, lock, and key, so that any worker who enters the J-box can lock the valve and retain the key in his possession. Any other method which will prevent steam, injurious gases, or liquids from entering the J-box while the worker is in it will be acceptable.

(2) *Open-width bleaching*. The nip of all in-running rolls on open-width bleaching machine rolls shall be protected with a guard to prevent the worker from being caught at the nip. The guard shall extend across the entire length of the nip.

(q) *Kiers*—(1) *Reducing valves, safety valves, and pressure gages*. Reducing valves, safety valves, and pressure gages shall conform to the ASME Code for Unfired Pressure Vessels, Section VIII, Unfired Pressure Vessels, 1968.

(2) *Kier valve protection*. Each valve controlling the flow of steam, injurious gases, or liquids into a kier shall be equipped with a chain, lock, and key, so that any worker who enters the kier can lock the valve and retain the key in his possession. Any other method which will prevent steam, injurious gases, or liquids from entering the kier while the worker is in it will be acceptable.

(r) *Gray and white bins*. On new installations, guard rails conforming to § 1910.23 shall be provided where workers are required to plait by hand from the top of the bin so as to protect the worker from falling to a lower level.

(s) *Mercerizing range (piece goods)*—(1) *Stopping devices*. A stopping device shall be provided at each end of the machine.

(2) *Frame ends*. A guard shall be installed at each end of the frame between the in-running chain and the clip opener to prevent the worker's fingers from being caught.

and built by the manufacturer of the tool being used, can be mounted perpendicular to the barrel. A standard spall shield shall be supplied with each tool.

(b) The tool shall be so designed that it shall not in ordinary usage propel or discharge a stud, pin, or fastener while loading, or during preparation to fire, or if the tool should be dropped while loaded.

(c) Firing of the tool shall be dependent upon at least two separate and distinct operations of the operator, with the final firing movement being separate from the operation of bringing the tool into the firing position.

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

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

(3) *Requirements for loads and fasteners*. (i) There shall be a standard means of identifying the power levels of loads used in tools. Such means of identification shall be a uniform color and numbering system, as shown in Table P-1. Colors and printed descriptions shall be strikingly printed on the container to provide a visual indication of the power level of the load.

(ii) Caseless loads shall be coded to identify similar powerload levels by color, number, configuration, or other appropriate method.

TABLE P-1—IDENTIFICATION OF CASED LOADS

Power level	Color identification		Nominal velocity (= 45 f.p.s.)
	Case color	Load color	
1.....	Brass.....	Gray.....	300
2.....	Brass.....	Brown.....	350
3.....	Brass.....	Green.....	400
4.....	Brass.....	Yellow.....	450
5.....	Brass.....	Red.....	500
6.....	Brass.....	Purple.....	550
7.....	Nickel.....	Gray.....	550
8.....	Nickel.....	Brown.....	600
9.....	Nickel.....	Green.....	1,020
10.....	Nickel.....	Yellow.....	1,110
11.....	Nickel.....	Red.....	1,200
12.....	Nickel.....	Purple.....	1,290

NOTE: The nominal velocity applies to 1/4-inch diameter 350-grain ballistics slug fired in a test device and has no reference to actual fastener velocity developed in any specific size or type of tool.

(iii) No load (cased or caseless) shall be used if it will accurately chamber in any existing approved commercially available low-velocity piston tool or hammer operated piston tool—low-velocity type and will cause a fastener to have a mean velocity in excess of 300 feet per second when measured 6.5 feet from the muzzle end of the barrel. No individual test firing of a series shall exceed 300 feet per second by more than 8 percent.

(iv) Fasteners used in tools shall be only those specifically manufactured for use in such tools.

(4) *Operating requirements*. (i) Before using a tool, the operator shall inspect it to determine to his satisfaction

that it is clean, that all moving parts operate freely, and that the barrel is free from obstructions.

(ii) When a tool develops a defect during use, the operator shall immediately cease to use it, until it is properly repaired.

(iii) Tools shall not be loaded until just prior to the intended firing time. Neither loaded nor empty tools are to be pointed at any workmen, and hands should be kept clear of the open barrel end.

(iv) No tools shall be loaded unless being prepared for immediate use, nor shall an unattended tool be left loaded.

(v) In case of a misfire, the operator shall hold the tool in the operating position for at least 30 seconds. He shall then try to operate the tool a second time. He shall wait another 30 seconds, holding the tool in the operating position; then he shall proceed to remove the explosive load in strict accordance with the manufacturer's instructions. Misfired cartridges should be placed carefully in a metal container filled with water, and returned to the supervisor for disposal.

(vi) A tool shall never be left unattended in a place where it would be available to unauthorized persons.

(vii) Fasteners shall not be driven into very hard or brittle materials including, but not limited to, cast iron, glazed tile, surface-hardened steel, glass block, live rock, face brick, or hollow tile.

(viii) Driving into materials easily penetrated shall be avoided unless such materials are backed by a substance that will prevent the pin or fastener from passing completely through and creating a flying-missile hazard on the other side.

(ix) (a) Fasteners shall not be driven directly into materials such as brick or concrete closer than 3 inches from the unsupported edge or corner, or into steel surfaces closer than one-half inch from the unsupported edge or corner, unless a special guard, fixture, or jig is used. (Exception: Low-velocity tools may drive no closer than 2 inches from an edge in concrete or one-fourth inch in steel.)

(b) When fastening other materials, such as a 2- by 4-inch wood section to a concrete surface, it is permissible to drive a fastener of no greater than 1/2-inch shank diameter not closer than 2 inches from the unsupported edge or corner of the work surface.

(x) Fasteners shall not be driven through existing holes unless a positive guide is used to secure accurate alignment.

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

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

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

(xiv) Any tool found not in proper working order shall be immediately removed from service. The tool shall be inspected at regular intervals and shall be repaired in accordance with the manufacturer's specifications.

(e) *Power lawnmowers*—(1) *General requirements*. (i) Power lawnmowers of the walk-behind, riding-rotary, and reel power lawnmowers designed for sale to the general public shall meet the design specifications in "American National Standard Safety Specifications for Power Lawnmowers" ANSI B71.1-1968. These specifications do not apply to suiky-type mowers, flail mowers, sicklebar mowers, or mowers designed for commercial use.

(ii) All power-driven chains, belts, and gears shall be so positioned or otherwise guarded to prevent the operator's accidental contact therewith, during normal starting, mounting, and operation of the machine.

(iii) A shutoff device shall be provided to stop operation of the motor or engine. This device shall require manual and intentional reactivation to restart the motor or engine.

(iv) All positions of the operating controls shall be clearly identified.

(v) The words, "Caution. Be sure the operating controls" is in neutral before starting the engine," or similar wording shall be clearly visible at an engine starting control point on self-propelled mowers.

(2) *Walk-behind and riding rotary mowers*. (i) The mower blade shall be enclosed except on the bottom and the enclosure shall extend to or below the lowest cutting point of the blade in the lowest blade position.

(ii) Guards which must be removed to install a catcher assembly shall comply with the following:

(a) Warning instructions shall be affixed to the mower near the opening stating that the mower shall not be used without either the catcher assembly or the guard in place.

(b) The catcher assembly or the guard shall be shipped and sold as part of the mower.

(c) The instruction manual shall state that the mower shall not be used without either the catcher assembly or the guard in place.

(d) The catcher assembly, when properly and completely installed, shall not create a condition which violates the limits given for the guarded opening.

(iii) Openings in the blade enclosure, intended for the discharge of grass, shall be limited to a maximum vertical angle of the opening of 30°. Measurements shall be taken from the lowest blade position.

(iv) The total effective opening area of the grass discharge opening(s) shall not exceed 1,000 square degrees on units having a width of cut less than 27 1/2 inches, or 2,000 square degrees on units having a width of cut 27 1/2 inches or over.

(v) The word "Caution," or stronger wording, shall be placed on the mower at or near each discharge opening.

(vi) Wheel drive disengaging controls, except dead-man controls, shall move opposite to the direction of vehicle motion in order to disengage the drive. Dead-man controls shall comply with § 1910.241(c)(11), and may operate in any direction to disengage the drive.

(vii) Blades(s) shall stop rotating from the manufacturer's specified maximum speed within 15 seconds after declutching, or shutting off power.

(iii) Some other form of guard that will insure as good protection as that which would be provided by the guards specified in subdivision (i) or (ii) of this subparagraph.

(3) **Vertical portable grinders.** Safety guards used on machines known as right angle head or vertical portable grinders shall have a maximum exposure angle of 180°, and the guard shall be so located so as to be between the operator and the wheel during use. Adjustment of guard shall be such that pieces of an accidentally broken wheel will be deflected away from the operator. (See Figure P-4.)

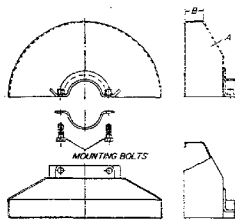


FIGURE NO. P-4

(4) **Other portable grinders.** The maximum angular exposure of the grinding wheel periphery and sides for safety guards used on other portable grinding machines shall not exceed 180° and the top half of the wheel shall be enclosed at all times. (See Figures P-5 and P-6.)

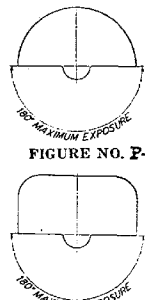


FIGURE NO. P-5

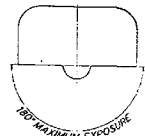


FIGURE NO. P-6

(5) **Mounting and inspection of abrasive wheels.** (i) Immediately before mounting, all wheels shall be closely inspected and sounded by the user (ring test, see Subpart O, § 1910.215(d)(1)) to make sure they have not been damaged in transit, storage, or otherwise. The spindle speed of the machine shall be checked before mounting of the wheel to be certain that it does not exceed the maximum operating speed marked on the wheel.

(ii) Grinding wheels shall fit freely on the spindle and remain free under

all grinding conditions. A controlled clearance between the wheel hole and the machine spindle (or wheel sleeves or adapters) is essential to avoid excessive pressure from mounting and spindle expansion. To accomplish this, the machine spindle shall be made to nominal (standard) size plus zero minus .002 inch, and the wheel hole shall be made suitably oversize to assure safety clearance under the conditions of operating heat and pressure.

(iii) All contact surfaces of wheels, blotters, and flangers shall be flat and free of foreign matter.

(iv) When a bushing is used in the wheel hole it shall not exceed the width of the wheel and shall not contact the flanges.

(v) Requirements for the use of flanges and blotters, see Subpart O, § 1910.215(c).

(d) **Explosive actuated fastening tools.**—(1) **General requirements.** (i) Explosive-actuated fastening tools which are actuated by explosives or any similar means and propel a stud, pin, fastener, or other object for the purpose of affixing it by penetration to any other object shall meet the design requirements in "American National Standard Safety Requirements for Explosive-Actuated Fastening Tools," ANSI A10.3-1970. This requirement does not apply to devices designed for attaching objects to soft construction materials, such as wood, plaster, tar, dry wallboard, and the like, or to stud welding equipment.

(ii) Operators and assistants using tools shall be safeguarded by means of eye protection. Head and face protection shall be used, as required by working conditions, as set forth in Subpart I.

(2) **Inspection, maintenance, and tool handling.**—(i) **High-velocity tools.** Tools of this type shall have the characteristics outlined in (a) through (h) of this subdivision and, at the discretion of the manufacturer, any additional safety features he may wish to incorporate.

(a) The muzzle end of the tool shall have a protective shield or guard at least 3½ inches in diameter, mounted perpendicular to and concentric with the barrel, and designed to confine any flying fragments or particles that might otherwise create a hazard at the time of firing.

(b) Where a standard shield or guard cannot be used, or where it does not cover all apparent avenues through which flying particles might escape, a special shield, guard, fixture, or jig designed and built by the manufacturer of the tool being used, which provides this degree of protection, shall be used as a substitute.

(c) The tool shall be so designed that it cannot be fired unless it is equipped with a standard protective shield or guard, or a special shield, guard, fixture, or jig.

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

(2) Firing of the tool shall be dependent upon at least two separate and distinct operations of the operator, with the final firing movement being separate

from the operation of bringing the tool into the firing position.

(e) The tool shall be so designed as not to be operable other than against a work surface, and unless the operator is holding the tool against the work surface with a force at least 5 pounds greater than the total weight of the tool.

(f) The tool shall be so designed that it will not operate when equipped with the standard guard indexed to the center position if any bearing surface of the guard is tilted more than 8° from contact with the work surface.

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

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

(i) Tools of the low-velocity-piston type shall have the characteristics outlined in (a) through (e) of this subdivision and, at the discretion of the manufacturer, any additional safety features he may wish to incorporate.

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

(b) (i) The tool shall be designed so that it shall not in ordinary usage propel or discharge a stud, pin, or fastener while loading or during preparation to fire, or if the tool should be dropped while loaded.

(2) Firing of the tool shall be dependent upon at least two separate and distinct operations of the operator, with the final firing movement being separate from the operation of bringing the tool into the firing position.

(c) The tool shall be so designed as not to be operable other than against a work surface, and unless the operator is holding the tool against the work surface with a force at least 5 pounds greater than the total weight of the tool.

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

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

(iii) Tools of the hammer-operated piston tools—low-velocity type shall have the characteristics outlined in (a) through (e) of this subdivision and, at the discretion of the manufacturer, any additional safety features he may wish to incorporate.

(a) The muzzle end of the tool shall be so designed that suitable protective shields, guards, jigs, or fixtures, designed

(3) **Mangle and washers.** The nip at the in-running rolls shall conform to § 1910.264.

(i) **Tenter frames.**—(1) **Stopping devices.** A stopping device shall be provided at each end of the machine.

(2) **Frame ends.** A guard shall be installed at each end of the frame at the in-running chain and clip opener.

(3) **Oil cups.** Oil cups shall be safely located to permit easy access.

(u) **Dyeing jigs.**—(1) **Stopping devices.** Each dye jig shall be equipped with individual mechanical or electrical means for stopping the machine.

(2) **Roll arms.** Roll arms on jigs shall be built to allow for extra large batches, and to prevent the center bar from being forced off, causing the batch to fall.

(v) **Padders.**—Nip guards. All nip guards shall comply with the requirements of paragraph (h) (2) (iv) of this section.

(w) **Drying cans.**—(1) **Pressure reducing valves and pressure gauges.** Pressure reducing valves and pressure gauges shall conform to the ASME Code for Pressure Vessels, Section VIII, 1968, Unfired Pressure Vessels.

(2) **Vacuum collapse.** If cans are not designed to prevent vacuum collapse, each can shall be equipped with one or more vacuum relief valves with openings of sufficient size to prevent the collapse of the can if vacuum occurs.

(x) **Feed rolls.**—(1) **Feed rolls.** The feed rolls shall be guarded to conform to § 1910.264.

(2) **Pressure rolls.** Pressure rolls shall be covered or guarded to conform to § 1910.264.

(y) **Extractors.**—(1) **Centrifugal extractor.**—(i) **Cover.** Each extractor shall be equipped with a metal cover.

(ii) **Interlocking device.** Each extractor shall be equipped with an interlocking device that will prevent the cover from being opened while the basket is in motion, and also prevent the power operation of the basket while the cover is open.

(iii) **Brakes.** Each extractor shall be equipped with a mechanically or electrically operated brake to quickly stop the basket when the power driving the basket is shut off.

(iv) **Maximum allowable speed.** Each centrifugal extractor shall be effectively secured in position on the floor or foundation so as to eliminate unnecessary vibration, and should not be operated at a speed greater than the manufacturer's rating, which shall be stamped where easily visible in letters not less than one-quarter inch in height. The maximum allowable speed shall be given in revolutions per minute (rpm).

(2) **Engine drum extractor.**—Over-speed governor. Each engine individually driving an extractor shall be provided with an approved engine stop and speed limit governor.

(3) **Squeezer or wringer extractor.**—Nip guards. All nip guards shall comply with the requirements of paragraph (h) (2) (iv) of this section.

(u) **Nip guards.** All nip guards for water mangle, starch mangle, back-washer (worsted yarn) crabbing ma-

chines, decating machines, shall comply with the requirements of paragraph (h) (2) (iv).

(aa) **Sanforizing and palmer machine.** A safety trip rod, cable, or wire center cord shall be provided across the front and back of all palmer cylinders extending the length of the face of the cylinder. It shall operate readily whether pushed or pulled. This safety trip shall be not more than 72 inches above the level on which the operator stands and shall be readily accessible.

(bb) **Rope washers.**—(1) **Splash guard.** Splash guards shall be installed on all rope washers unless the machine is so designed as to prevent the water or liquid from splashing the operator, the floor, or working surface.

(2) **Safety stop bar.** A safety trip rod, cable or wire center cord shall be provided across the front and back of all rope washers extending the length of the face of the washer. It shall operate readily whether pushed or pulled. This safety trip shall be not more than 72 inches above the level on which the operator stands and shall be readily accessible.

(cc) **Laundry washer tumbler or shaker.**—(1) **Interlocking device.** Each drying tumbler, each double cylinder shaker or clothes tumbler, and each washing machine shall be equipped with an interlock device which will prevent the power operation of the inside cylinder when the outer door on the case or shell is open, and which will also prevent the outer door on the case or shell from being opened without shutting off the power. This should not prevent the movement of the inner cylinder by means of a hand operated mechanism or an "inching device."

(2) **Means of holding covers or doors in open position.** Each enclosed barrel shall also be equipped with adequate means for holding open the doors or covers of the inner and outer cylinders or shells while it is being loaded or unloaded.

(dd) **Printing machine (roller type).**—(1) **Nip Guards.** All nip guards shall comply with the requirements of paragraph (h) (2) (iv) of this section.

(2) **Crown wheel and roller gear nip protection.** The engraved roller gears and the large crown wheel shall be provided with a protective disc which will enclose the nips of the in-running gears. Individual discs for each nip will be acceptable.

(ee) **Calenders.** The nip at the in-running side of the rolls shall be provided with a guard extending across the entire length of the nip and arranged to prevent the fingers of the workers from being pulled in between the rolls or between the guard and the rolls, and constructed so that the cloth can be fed into the rolls safely.

(ff) **Rotary staple cutters.** A guard shall be installed completely enclosing the cutters to prevent the hands of the operator from reaching the cutting zone.

(gg) **Clothing folding machine.** The crank arm and blade guide rods on both sides of the cloth-folding machines shall

be protected from contact by barrier guards constructed to conform to the requirements of § 1910.219.

(hh) **Hand bolting machine.** An angle-iron-handle stop guard shall be installed at the right angle to the frame of the machine. The stop guard shall be so designed and so located that it will prevent the handle from traveling beyond the vertical position should the handle slip from the operator's hand when the pawl has been released from the teeth of the takeup gear.

(ii) **Roll bench.** Cleats shall be installed on the ends of roll benches.

(jj) **Cattle or swine folder (overhead type).** The bottom of the overhead folders shall be located not less than 7 feet from the floor or working surface.

(kk) **Color-mixing room.** Floors in color-mixing rooms shall be constructed to drain easily.

(ll) **Open tanks and vats for mixing and storage of hot or corrosive liquids.**—

(1) **Protection against falls.** Open tanks and vats containing hot or corrosive liquids shall be protected to conform to the requirements of § 1910.23.

(2) **Shutoff valves.** Boiling tanks, caustic tanks, and hot liquid containers, so located that the operator cannot see the contents from the floor or working area, shall have emergency shutoff valves controlled from a point not subject to danger of splash. Valves shall conform to the ASME Pressure Vessel Code, section VIII, Unfired Pressure Vessels, 1968.

(mm) **Dye kettles and vats.** Pipes or drains of sufficient capacity to carry the contents safely away from the working area shall be installed where there are dye kettles and vats which may at any time contain hot or corrosive liquids. These shall not empty directly onto the floor.

(nn) **Acid carboys.** Carboys shall be provided with inclinators, or the acid shall be withdrawn from the carboys by means of pumping without pressure in the carboy, or by means of hand operated siphons.

(oo) **Handling caustic soda and caustic potash.** Means shall be provided for handling and emptying caustic soda and caustic potash containers to prevent workers from coming in contact with the caustic (see paragraph (qq) of this section).

(pp) **First aid.** Wherever acids or caustics are used, provision shall be made for a copious and flowing supply of fresh, clean water.

(qq) **Personal protective equipment.**—(1) **Personal protective equipment.** Workers engaged in handling acids or caustics in bulk, repairing pipe lines containing acids or caustics, etc., shall be provided with protective occupational (safety) equipment to conform to the requirements of § 1910.132, § 1910.133, and § 1910.134.

(2) **Respirators, gas masks, and such appliances, for emergency use only, shall be of a type required by § 1910.134.**

(rr) **Workroom ventilation.** In all workrooms in which potentially toxic substances are used, the maximum allowable concentrations listed in § 1910.93

shall be maintained. Open surface tanks shall conform to the requirements of § 1910.94(d).

§ 1910.263 Bakery equipment.

(a) **General requirements**—(1) **Application.** The requirements of this section shall apply to the design, installation, operation and maintenance of machinery and equipment used within a bakery.

(2) **Standards incorporated by reference.** Standards covering issues of occupational safety and health which are of general application without regard to any specific industry are incorporated by reference in paragraphs of this section and made applicable to bakeries. All such standards shall be construed according to the rules of construction set out in § 1910.5.

(b) **Definitions applicable to this section**—(1) **Dumpbin and blender.** The term "dumpbin and blender" applies to those elements of a flour handling system in which flour in bags is first emptied for distribution.

(2) **Flour elevator.** The term "flour elevator" means the conveyor which is used to convey flour in a vertical direction and it includes bucket, spiral screw, or bulkflow conveyors.

(3) **Screw conveyor.** The term "screw conveyor" means the conveyor which is used to convey flour in a horizontal or inclined plane by means of a continuous spiral screw enclosed in a suitable casing which follows the same general contour of the perimeter of the screw.

(4) **Boiling reel.** The term "boiling reel" means a device in which the flour is screened through a rotating drum.

(5) **Sifter.** The term "sifter" means a device in which flour is sifted. It may be of the brush, oscillating, or vibrating type.

(6) **Flour scale.** The term "flour scale" means a scale for weighing flour.

(7) **Flour gate.** The term "flour gate" means the device or devices used to control the delivery of flour.

(8) **Direct fired ovens.** Direct fired ovens are ovens which burn fuel directly inside the baking chamber.

(9) **Direct recirculating ovens.** "Direct recirculating ovens" are ovens which have heating systems consisting of one or more heaters (located inside or outside the baking chamber), each heater being equipped with a burner, the products of combustion of which are mixed with spent gasses returned from the oven. Combustion gasses are circulated through the heater and oven chamber by a fan. An overflow or vent removes part of the spent combustion gasses to compensate for fresh combustion gasses added by the burner.

(10) **Flue-type ovens.** "Flue-type ovens" are ovens which burn fuel in a furnace which is connected through flues which carry the combustion gasses to a stack.

(11) **Indirect multiple-burner ovens.** "Indirect multiple-burner ovens" are ovens which are heated by burners (usually gas) which are totally enclosed in such a way that unburned gasses or

products of combustion cannot enter the baking chamber.

(12) **Steam-tube ovens.** "Steam-tube ovens" are ovens which are heated by a group of tubes which are partially filled with liquid and sealed at both ends. A small part of each tube is exposed to the heat of a furnace and the larger part placed inside the baking chamber. Heat is transmitted by evaporating liquid in the furnace end of the tube. Steam thus formed travels to the other end of the tube, where the steam condenses and returns to the furnace by gravity.

(13) **Indirect recirculating ovens.** "Indirect recirculating ovens" are ovens which are equipped with a gas tight duct system, a furnace, and a circulating fan. Gases of combustion are circulated through this enclosed system and mixed with fresh combustion gasses generated by the burner in the combustion chamber. A vent or overflow removes a portion of the gasses to compensate for the fresh gasses added by the burner. No unburned gasses or products of combustion have access to the baking chamber.

(14) **Electric ovens.** "Electric ovens" are ovens which are heated entirely by passing an electric current through resistance elements.

(c) **General machine guarding**—(1) **Electrical grounding.** The frame of each machine which is driven by an electric motor or has any electrical connection shall be effectively grounded.

(2) **Gears.** All gears shall be completely enclosed regardless of location.

(3) **Sprockets and V-belt drives.** Sprockets and V-belt drives located within reach from platforms or passageways or located within 8 feet 6 inches from the floor shall be completely enclosed.

(4) **Rotating parts.** Lubrication fittings on rotating parts shall be recessed or covered with collars so that the rotating surface will be smooth and flush.

(5) **Lubrication.** Where machinery must be lubricated while in motion, stationary lubrication fittings inside a machine shall be provided with extension piping to a point of safety so that the employee will not have to reach into any dangerous part of the machine when lubricating.

(6) **Removable covers or guards.** Any covers or guards which must be removed for cleaning and adjustment shall be made easily removable in order that they may be removed and replaced with the least effort.

(7) **Ventilation through machine guards.** Where it is necessary to guard motors or other equipment which require ventilation, guards should be so designed that they will not restrict the circulation of the air.

(8) **Hot pipes.** Exposed hot water and steam pipes shall be covered with insulating material wherever necessary to protect employee from contact.

(d) **Flour-handling equipment**—(1) **General requirements for flour handling.** (i) Wherever any of the various pieces of apparatus comprising a flour-handling system are run in electrical unity with one another the following safeguards shall apply:

(a) Each apparatus shall be properly safeguarded by of disconnecting means for the motor circuits as required by §§ 1910.312 and 1910.320.

(b) Wherever a flour-handling system is of such size that the beginning of its operation is far remote from its final delivery end, all electric motors operating each apparatus comprising this system shall be controlled at each of two points, one located at each remote end, either of which will stop all motors.

(c) Motor control switches shall be capable of being locked in the open position.

(d) Control circuits for magnetic controllers shall be so arranged that the opening of any one of several limit switches, which may be on an individual unit, will serve to de-energize all of the motors of that unit.

(i) Removable covers on all flour-handling equipment shall be so designed that the lifting effort shall not be more than 50 pounds.

(ii) Wherever flour-handling systems are of large construction, suitable walkways or platforms or both shall be constructed around and over bins and apparatus, in accordance with the requirements of §§ 1910.22 and 1910.23.

(a) All walkway surfaces shall be maintained in nonslip condition.

(b) Elevated walkways shall have railings and toeboards.

(c) All ladders leading to upper walkways shall be in accordance with the requirements of § 1910.25, § 1910.26, and § 1910.27.

(d) Wherever walkways are near the ceiling construction of the building, where obstruction to head room is lower than normal standing height, proper methods shall be provided to warn any occupant of the walkway. This should be done by means of "tell tales" or other suitable means located ahead of the obstruction. Suitable signs shall also be placed on walkways warning occupants of possible danger.

(iv) All oscillating and vibrating sifters shall be protected with guard rails of suitable height and design.

(v) All mechanical transmission shafting, gearing, and sprocket drives shall be completely guarded, preferably with dust-tight housing. Lubrication fittings shall extend to the outside of the guard.

(vi) All guards shall be readily removable.

(vii) All flour-handling equipment, each individual unit or the entire system collectively, shall be so constructed that all interior or exterior protruding corners are of a rounded nature.

(viii) When Class II hazardous conditions prevail, electric motors, motor controllers, and switches shall be of the type approved for such locations in accordance with the requirements of § 1910.326.

(2) **Bag chutes and bag lifts (bag-arm elevators).** (i) Bag chutes (gravity chutes for handling flour bags) shall be so designed so as to keep to a minimum the speed of flour bags. If the chute inclines more than 30° from the horizontal,

TYPE 6 STRAIGHT CUP WHEELS

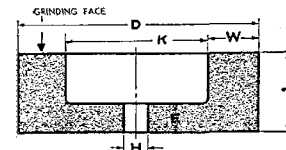


Figure P-2

Type 6—Straight-cup Wheel
Side grinding wheel having a diameter, thickness and hole with one side straight or flat and the opposite side recessed. This type, however, differs from Type 5 in that the grinding is performed on the wall of the recess created by the difference between the diameter of the recess and the outside diameter of the wheel. Therefore, the wall dimension "H" takes precedence over the diameter of the recess as an essential intermediate dimension to describe this shape type.

(10) **Type 1 straight wheels.** Type 1 straight wheels have diameter, thickness, and hole size dimensions and should be used only on the periphery. Type 1 wheels shall be mounted between flanges.

Limitation: Hole dimension (H) should not be greater than two-thirds of wheel diameter dimension (D) for precision, cylindrical, centerless, or surface grinding applications. Maximum hole size for all other applications should not exceed one-half wheel diameter.

TYPE 1 STRAIGHT WHEELS



Figure P-3

Type 1—Straight Wheel
Peripheral grinding wheel having a diameter, thickness and hole.

(c) **Power lawnmower terms**—(1) **Blade tip circle.** The path described by the outermost point of the blade as it is rotated about its shaft axis.

(2) **Guards.** A part or an assembly provided for shielding a hazardous area of a machine.

(3) **Catcher assemblies.** Parts or combinations of parts which provide a means for collecting grass clippings or debris.

(4) **Walk-behind mower.** A mower either pushed or self-propelled and normally guided by the operator walking behind the unit.

(5) **Operator area, walk-behind mowers.** For discharge interference purposes, that area confined within a circle no smaller than 30 inches in diameter, the center of which is located to the rear of the mower on its longitudinal centerline 30 inches behind the nearest blade tip circle.

(6) **Power reel mower.** A lawn-cutting machine utilizing a power source to rotate one or more helically formed blades about a horizontal axis to provide a shearing action with a stationary cutter bar or bed knife.

(7) **Power rotary mower.** A lawn-cutting machine utilizing a power source to rotate one or more cutting blades about a vertical axis.

(8) **Lowest blade position.** The lowest blade position under static conditions.

(9) **Riding mower.** A powered, self-propelled lawn-cutting vehicle on which the operator rides and controls the machine.

(10) **Sulky type mower.** Normally, a walk-behind mower which has been converted to a riding mower by the addition of a sulky.

(11) **Deadman control.** A control designed so that it will automatically interrupt power to a drive when the operator's actuating force is removed.

(d) **Jack terms**—(1) **Jack.** A jack is an appliance for lifting and lowering or moving horizontally a load by application of a pushing force.

Note: Jacks may be of the following types: Lever and ratchet, screw and hydraulic.

(2) **Rating.** The rating of a jack is the maximum working load for which it is designed to lift safely that load throughout its specified amount of travel.

Note: To raise the rated load of a jack, the point of application of the load, the applied force, and the length of lever arm should be those designated by the manufacturer for the particular jack considered.

§ 1910.242 Hand and portable powered tools and equipment, general.

(a) **General requirements.** Each employer shall be responsible for the safe condition of tools and equipment used by employees, including tools and equipment which may be furnished by employees.

(b) **Compressed air used for cleaning.** Compressed air shall not be used for cleaning purposes except where reduced to less than 30 p.s.i. and then only with effective chip guarding and personal protective equipment.

§ 1910.243 Guarding of portable powered tools.

(a) **Woodworking, portable powered tools**—(1) **Portable circular saws.** All portable, power-driven saws shall be equipped with guards above and below the base plate or shoe. The upper guard shall cover the saw to the depth of the teeth, except for the minimum arc required to permit the base to be tilted for bevel cuts. The lower guard shall cover the saw to the depth of the teeth, except for the minimum arc required to allow proper retraction and contact with the work. When the tool is withdrawn from the work, the lower guard shall automatically and instantly return to covering position.

(2) **"Dead man" controls.** Hand-held, power-driven woodworking tools shall be provided with "dead man" control, such as a spring-actuated switch, valve, or equivalent device, so that the power will be automatically shut off whenever the operator releases the control.

(3) **Portable belt sanding machines.** Belt sanding machines shall be provided with guards at each nip point where the sanding belt runs onto a pulley. These guards shall effectively prevent the hands or fingers of the operator from coming in contact with the nip points. The un-

used run of the sanding belt shall be guarded against accidental contact.

(4) **Cracked saws.** All cracked saws shall be removed from service.

(5) **Grounding.** Electrical grounding requirements for portable woodworking machinery see Subpart O, § 1910.213(a) (11).

(b) **Pneumatic powered tools and hose**—(1) **Portable tools.** (i) The operating trigger on portable hand-operated utilization equipment shall be so located as to minimize the possibility of its accidental operation and shall be arranged to close the air inlet valve automatically when the pressure of the operator's hand is removed.

(ii) A tool retainer shall be installed on each piece of utilization equipment which, without such a retainer, may eject the tool.

(2) **Airhose.** Hose and hose connections used for conducting compressed air to utilization equipment shall be designed for the pressure and service to which they are subjected.

(c) **Portable abrasive wheels**—(1) **General requirements.** (i) All abrasive wheels shall be used only on machines provided with safety guards as defined in the following subparagraphs of this paragraph.

Exceptions: This requirement shall not apply to the following classes of wheels and conditions.

(a) Wheels used for internal work while within the work being ground.

(b) Mounted wheels used in portable operations (see definition § 1910.241(b) (1)) 2 inches and smaller in diameter.

(c) Types 16, 17, 18, 18R, and 19 cones and plugs and threaded hole pot balls where the work offers protection.

(ii) (a) The safety guard shall cover the spindle end, nut, and flange projections. The safety guard shall be mounted so as to maintain proper alignment with the wheel, and the strength of the fastenings shall exceed the strength of the guard.

(b) Exception: Safety guards on all operations where the work provides a suitable measure of protection to the operator, may be so constructed that the spindle end, nut, and outer flange are exposed; and where the nature of the work is such as to entirely cover the side of the wheel, the side covers of the guard may be omitted.

(c) Exception: The spindle end, nut, and outer flange may be exposed on machines designed as portable saws.

(2) **Cup wheels.** Cup wheels (Types 6 and 11) shall be protected by:

(i) Safety guards as specified in subparagraph (1) of this paragraph; or,

(ii) Special "revolving cup guards" which mount behind the wheel and turn with it. They shall be made of steel or other material with adequate strength and shall enclose the wheel sides upward from the back for one-third of the wheel thickness. The mounting features shall conform with all regulations. (See subparagraph (5) of this paragraph.) It is necessary to maintain clearance between the wheel side and the guard. The clearance shall not exceed one-sixteenth inch; or,

- § 1910.212 (a), (b), (c), (d), (e), (f), (g), (h), (i), (j), (k), (l), (m), (n), (o), (p), (q), and (r).
 § 1910.214 (a), (b), (c), (d), (e), (f), (g), (h), (i), (j), (k), (l), (m), (n), (o), (p), (q), (r), (s), (t), (u), and (v).
 § 1910.215 (a) and (b).
 § 1910.216 (a), (b), (c), and (f).
 § 1910.217 (a), (b), (c), and (d).
 § 1910.218 (a), (b), (d), (e), (g), and (j).
 § 1910.219 (b), (c), (d), (e), (f), (g), (h), (i), and (k).

(c) Notwithstanding anything in paragraph (a), (b), or (d) of this section, any provision in any other section of this subpart which contains in itself a specific effective date or time limitation shall become effective on such date or shall apply in accordance with such limitation.

(d) Notwithstanding anything in paragraph (a) or (b) of this section, if any standard in 41 CFR Part 50-204, other than a national consensus standard incorporated by reference in § 50-204.2 (a) (1), is or becomes applicable at any time to any employment and place of employment, by virtue of the Walsh-Healey Public Contracts Act, or the Service Contract Act of 1965, or the National Foundation on Arts and Humanities Act of 1965, any corresponding established Federal standard in this Subpart O which is derived from 41 CFR Part 50-204 shall also become effective, and shall be applicable to such employment and place of employment, on the same date.

[36 F.R. 15106, Aug. 18, 1971]

§ 1910.221 Sources of standards.

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

Standard	Source
§ 1910.212 ..	41 CFR 50-204.6.
§ 1910.213 ..	AMCI 01.1-1964 (R 1961), Safety Code for Woodworking Machinery.
§ 1910.214 ..	ANSI 01.1-1964 (R 1961), Safety Code for Woodworking Machinery.
§ 1910.215 ..	ANSI B7.1-1970, Safety Code for Abrasive Wheels.
§ 1910.216 ..	ANSI B28.1-1967, Safety Code for Mills Calenders in the Rubber and Plastic Industries.
§ 1910.217 ..	ANSI B11.1-1970, Safety Standard for Construction Care and Use of Mechanical Power Presses.
§ 1910.218 ..	ANSI B34.1, 1970, Safety Standard for Forging.
§ 1910.219 ..	ANSI B15.1-1963 (P 1968), Safety Code for Mechanical Power Transmission Apparatus.

§ 1910.222 Standards organizations.

The standards and specifications of the following organizations have been referenced in this Subpart O: Copies of the references materials may be obtained from the issuing organizations

1. American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.
2. American Society of Mechanical Engineers, 345 East 47 Street, New York, NY 10017.

Subpart P—Hand and Portable Powered Tools and Other Hand-Held Equipment

§ 1910.241 Definitions.

As used in this subpart:

(a) **Explosive-actuated fastening tool terms**—(1) **Hammer-operated piston tool—low-velocity type.** A tool which, by means of a heavy mass hammer supplemented by a load, moves a piston designed to be captive to drive a stud, pin, or fastener into a work surface, always starting the fastener at rest and in contact with the work surface. It shall be so designed that when used with any load that accurately chambers in it and that is commercially available at the time the tool is submitted for approval, it will not cause such stud, pin, or fastener to have a mean velocity in excess of 300 feet per second when measured 6.5 feet from the muzzle end of the barrel.
 (2) **High-velocity tool.** A tool or machine which when used with a load, propels or discharges a stud, pin, or fastener, at velocities in excess of 300 feet per second when measured 6.5 feet from the muzzle end of the barrel, for the purpose of impinging it upon, affixing it to, or penetrating another object or material.
 (3) **Low-velocity piston tool.** A tool that utilizes a piston designed to be captive to drive a stud, pin, or fastener into a work surface. It shall be so designed that when used with any load that accurately chambers in it and that is commercially available at the time the tool is submitted for approval, it will not cause such stud, pin, or fastener to have a mean velocity in excess of 300 feet per second when measured 6.5 feet from the muzzle end of the barrel.

(4) **Stud, pin, or fastener.** A fastening device specifically designed and manufactured for use in explosive-actuated fastening tools.
 (5) **To chamber.** To fit properly without the use of excess force, the case being duly supported.
 (6) **Explosive powerload, also known as load.** Any substance in any form capable of producing a propellant force.

(7) **Tool.** An explosive-actuated fastening tool, unless otherwise indicated, and all accessories pertaining thereto.
 (8) **Protective shield or guard.** A device or guard attached to the muzzle end of the tool, which is designed to confine flying particles.
 (9) **Abrasive wheel terms**—(1) **Mounted wheels.** Mounted wheels, usually 2-inch diameter or smaller, and of various shapes, may be either organic or inorganic bonded abrasive wheels. They are secured to plain or threaded steel mandrels.

(2) **Tuck pointing.** Removal, by grinding, of cement, mortar, or other non-metallic jointing material.
 (3) **Tuck pointing wheels.** Tuck pointing wheels, usually Type 1, reinforced organic bonded wheels have diameter, thickness and hole size dimension. They

are subject to the same limitations of use and mounting as Type 1 wheels defined in subparagraph (10) of this paragraph.

LIMITATION: Wheels used for tuck pointing should be reinforced, organic bonded. (See § 1910.243 (c) (1) (ii) (e).)

(4) **Portable grinding.** A grinding operation where the grinding machine is designed to be hand held and may be easily moved from one location to another.

(5) **Organic bonded wheels.** Organic wheels are wheels which are bonded by means of an organic material such as resin, rubber, shellac, or other similar bonding agent.

(6) **Safety guard.** A safety guard is an enclosure designed to restrain the pieces of the grinding wheel and furnish all possible protection in the event that the wheel is broken in operation.

(7) **Reinforced wheels.** The term "reinforced" as applied to grinding wheels shall define a class of organic wheels which contain strengthening fabric or filament. The term "reinforced" does not cover wheels using such mechanical additions as steel rings, steel cup backs or wire or tape winding.

(8) **Type 11 flaring cup wheels.** Type 11 flaring cup wheels have double diameter dimensions D and J, and in addition have thickness, hole size, rim and back

TYPE 11 FLARING CUP WHEELS

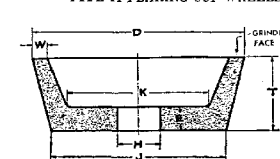


Figure P-1
Type 11—Flaring-cup Wheel
Side grinding wheel having a wall flared or tapered outward from the back. Wall thickness at the back is normally greater than at the grinding face (W).

thickness dimensions. Grinding is always performed on rim face, W dimension. Type 11 wheels are subject to all limitations of use and mounting listed for Type 6 straight sided cup wheels definition in subparagraph (9) of this paragraph.

LIMITATION: Minimum back thickness, E dimension, should not be less than one-fourth T dimension. In addition when unthreaded hole wheels are specified the inside flat, K dimension, shall be large enough to accommodate a suitable flange.

(9) **Type 6 straight cup wheels.** Type 6 cup wheels have diameter, thickness, hole size, rim thickness, and back thickness dimensions. Grinding is always performed on rim face, W dimension.

LIMITATION: Minimum back thickness, E dimension, should not be less than one-fourth T dimension. In addition, when unthreaded hole wheels are specified, the inside flat, K dimension, must be large enough to accommodate a suitable flange.

there shall be an upturn at the lower end of the chute to slow down the bags.

(i) Bag-arm elevators with manual eoff shall be designed to operate at a capacity not exceeding seven bags per minute. The arms on the conveyor chain shall be so spaced as to obtain the full capacity of the elevator with the lowest possible chain speed. There shall be an electric limit switch at the unloading end of the bag-arm elevator so installed as to automatically stop the conveyor chain if any bag fails to clear the conveyor arms.

(ii) The conveyor chain on bag-arm elevators shall travel in a suitable structure and all drums shall be completely guarded, so that in case of a broken chain link the remainder of the chain will remain within its guides.

(iv) Man lifts shall be prohibited in bakeries. Bag or barrel lifts shall not be used as man lifts.

(3) **Dumpbin and Blender.** (i) The dumpbin or blender shall be constructed of metal or other nonsplintering material.
 (ii) Openings shall be protected by means of bars or grids. If grids are made of mesh, the openings shall be not more than 3 inches in either length or width. If parallel bars or rods are used, they shall be spaced not more than 3 inches apart on centers.

(iii) Hinged dumpbin covers shall be provided with locks or latches to hold the covers in the open position, so that they will not accidentally fall down while the dumpbin is in operation.

(iv) Dumpbins and blenders shall be constructed that no separate pits in floors shall be required at the point which connects the final discharge to the usual elevator.

(v) All dumpbin and blender hoods shall be of sufficient capacity to prevent circulation of flour dust outside the hoods.

(vi) All dumpbins shall be of a suitable height from floor to enable the operator to dump flour from bags, without causing undue strain or fatigue. Where the edge of any bin is more than 24 inches above the floor, a bag rest step shall be provided.

(vii) A control device for stopping the dumpbin and blender shall be provided close to the normal location of the operator.

(viii) A screen shall be provided in the suction nozzle over the bin or blender to prevent sacks that are being cleaned from getting into the rotor of the dust collecting fan.

(4) **Flour elevators.** (i) Flour elevators shall be constructed of metal or other nonsplintering material.

(ii) All removable sections of the elevator casing shall be equipped with suitable stationary clamps for quick removal, or shall be equipped with equivalent locking devices which contain no loose parts which may become detached from either the casing or the cover.

(5) **Bolting reels.** (i) Bolting reels shall be constructed of metal or other nonsplintering material, with the exception of the bolting cloth.

(ii) Refuse tailing spouts shall be readily accessible and shall be located at

a safe distance from unguarded moving parts.

(6) **Storage bins.** (i) Storage bins shall be constructed of metal or other nonsplintering material.

(ii) Storage bins shall be provided with gaskets and locks or latches to keep the cover closed, or other equivalent devices in order to insure the dust tightness of the cover. Covers at openings where an employee may enter the bin shall also be provided with a hasp and a lock, so located that the employee may lock the cover in the open position whenever it is necessary to enter the bin.

(iii) Storage bins where the side is more than 5 feet in depth shall be provided with standard stationary safety ladders, both inside and outside, to reach from floor level to top of bin and from top of bin to inside bottom, keeping the ladder end away from the moving screw conveyor.

(iv) Loading distribution conveyors shall be located in top of bin centrally unobscured, and all covers for entrance to the bins shall be located away from the loading distribution conveyor.

(v) An electric limit switch or other suitable protective device shall be provided in the top of the bin centrally over the loading screw conveyor on the opposite end of the flour entrance opening. It shall be so designed as to stop the loading screw if an excessive amount of flour is delivered to the bin.

(vi) The main entrance cover of large storage bins located at the interior exit ladder shall be provided with an electric interlock for motors operating both feed and unloading screw, so that these motors cannot operate while the cover is open.

(7) **Screw conveyors.** (i) Screw conveyors shall be constructed of metal or other nonsplintering material.

(ii) Each dead-end screw conveyor shall be provided with an overflow safety gate which will operate an electric limit switch to shut down the conveyor before dangerous pressure of material is built up at the dead end.

(iii) The covers of all screw conveyors shall be made removable in convenient sections, held on with stationary clamps located at proper intervals keeping all covers dust-tight. Where drop or hinged bottom sections are provided this provision shall not apply.

(8) **Sifters.** (i) Enclosures of all types of flour sifters shall be so constructed that they are dust-tight but readily accessible for interior inspection.

(ii) Oscillating and vibrating sifters shall be so constructed that all moving parts are well within the outer frame of the apparatus.

(iii) Refuse tailing spouts of all types of sifters shall be readily accessible and shall be located at a safe distance from unguarded moving parts.

(9) **Flour scales.** (i) Flour scales shall be constructed of metal or other nonsplintering material.

(ii) Where a transparent covering is provided over dial scales it shall be made of a nonshatterable transparent material.

(iii) Traveling or track-type flour scales shall be equipped with bar handles

for moving same. The bar should be at least 1 inch in diameter and well away from trolley track wheels.

(iv) All moving trolley wheels located within 8 feet 6 inches of floors or platforms shall be fully guarded on sides and ahead of rotating motion.

(v) The scale cutoff switch shall be totally enclosed and connected to the scale beam in such a manner as to protect the operator from contact.

(vi) Where two or more scales are used on travelling flour scales, interlocks shall be provided so that the gate will not open unless the hopper is below.

(10) **Automatic flour gates.** Automatic flour-gate equipment shall be constructed of metal or other nonsplintering material.

(e) **Mixers**—(1) **Horizontal dough mixers.** (i) Mixers with external power application shall have all belts, chains, gears, pulleys, sprockets, clutches, and other moving parts completely enclosed.

(ii) Mixers with built-in power units shall have a drive element enclosed in such a manner as to prevent injury to operators or maintenance personnel performing their normal duties.

(iii) Each mixer shall be equipped with an individual motor and control, and with a conveniently located manual switch to prevent the mixer from being started in the usual manner while the machine is being serviced and cleaned.

(iv) All electrical control stations shall be so located that the operator must be in full view of the bowl in its open position. No duplication of such controls other than a stop switch shall be permitted.

(v) All mixers with power and manual dumping arrangements shall be equipped with safety devices which shall:

(a) Engage both hands of the operator, when the agitator is in motion under power, and while the bowl is opened more than one-fifth of its total opening.

(b) Prevent the agitator from being started, while the bowl is more than one-fifth open, without engaging both hands of the operator;

(c) Permit the operator to have a full view of the bowl opening while he is in the act of maintaining operation of the agitator at any time while the bowl is more than one-fifth open.

(vi) Mixers with power dumping devices shall be arranged so that the bowl opening cannot be closed beyond four-fifths of its total opening unless the operator maintains the control contact which causes the dump motor to complete the bowl closure. Alternatively the control may be so arranged that the operator must keep at least one hand engaged, by holding in a push button, during the entire closure of the mixing bowl.

(vii) Mixers shall be provided with flour-gate operating mechanisms, ingredient openings, and water inlets, which can be conveniently manipulated by the operator from the normal area of activity (either platform or floor) without requiring abnormal reaching, or improvisations which might jeopardize his safety.

RULES AND REGULATIONS

(viii) Every mixer shall be equipped with a full enclosure over the bowl which is closed at all times while the agitator is in motion. Only minor openings in this enclosure, such as ingredient doors, flour inlets, etc., each representing less than 1½ square feet in area, shall be capable of being opened while the mixer is in operation.

(ix) No loose access doors and covers weighing more than 2 pounds shall be used on mixers. Such parts shall be hinged or otherwise held in proximity to the openings that they cover.

(x) Overhead covers or doors which are subject to accidental closure shall be counterbalanced to remain in an open position or provided with means to hold them open until positively released by the operator.

(xi) Provision shall be made to bolt mixers solidly to the floor to prevent dislocation or excessive vibration, and no open space between mixers and platforms shall be permitted which may endanger the operator.

(xii) Mixers shall be installed only on substantial foundations which are capable of safely withstanding the live loads incurred in full-capacity mixing operations.

(xiii) Access for lubrication at all points shall be provided so as to avoid contact between the lubricating device or the operator's hands and any moving parts.

(xiv) Any device or mechanism used to return "sponges" to a mixer shall be so interlocked with the mixer as to prevent injury to the operator.

(xv) No electrical pilot or control circuits shall be employed at a potential in excess of 240 volts.

(xvi) A motor-running overcurrent protective device shall be provided for each motor. Undervoltage protection shall be provided in all magnetic controllers.

(xvii) Positive means shall be provided to prevent application of pressure above the stipulated maximum in all mixer cooling jackets.

(xviii) Valves and controls to regulate the coolant in mixer jackets shall be located so as to permit access by the operator without jeopardizing his safety.

(2) *Vertical Mixers.* (i) Vertical mixers shall comply with subdivisions (i), (ii), (iii), (ix) through (xii), (xv), (xvi), and (xvii) of subparagraph (1) of this paragraph.

(ii) Positive means shall be provided to prevent injury to the operator during speed-change manipulation.

(iii) Bowl locking devices shall be of a positive type which require the attention of the operator for unlocking.

(iv) Devices shall be made available for moving bowls weighing more than 80 pounds, with contents, into and out of the mixing position on the machine.

(v) Every precaution which does not impair the normal operation of the mixer shall be exercised in providing protection of the operator against injury by the moving agitators.

(f) *Dividers—(1) Pinch and shear points.* All pinch points and shear points from reciprocating or rotating parts of

the divider shall be enclosed or guarded, to protect the operator's hands and fingers from these hazards.

(2) *Front guards.* Guards at front of a divider shall be so arranged that the weight of dough can be adjusted without removing the guard.

(3) *Rear of divider.* The back of the divider shall have a complete cover to enclose all of the moving parts, or each individual part shall be enclosed or guarded to remove the separate hazards. The rear cover shall be provided with a limit switch in order that the machine cannot operate when this cover is open. The guard on the back shall be hinged so that it cannot be completely removed and if a catch or brace is provided for holding the cover open, it shall be designed so that it will not release due to vibrations or minor bumping whereby the cover may drop on an employee.

(4) *Oil holes in knife.* The oil holes in the knife at the back of the divider shall be of such size that an employee's finger cannot go through the hole.

(5) *Knife actuating arm.* There shall be a saddle guard or other protective device on any elongated hole in the knife actuating arm at the back of the divider.

(6) *Shear pins.* Dividers shall be equipped with mechanical overload release devices such as shear pins.

(g) *Moulders—(1) Hoppers.* Mechanical feed moulders shall be provided with hoppers so designed and connected to the proofer that an employee's hands cannot get into the hopper where they will come in contact with the in-running rolls.

(2) *Hand-fed moulders.* Hand-fed moulders shall be provided with a belt-feed device or the hopper shall be extended high enough so that the hands of the operator cannot get into the feed rolls. The top edge of such a hopper shall be well rounded to prevent injury when it is struck or bumped by the employee's hand.

(3) *Stopping devices.* There shall be a stopping device within easy reach of the operator who feeds the moulder and another stopping device within the reach of the employee taking the dough away from the moulder.

(4) *Cleanout holes.* Machines shall be so designed that there is no shear point in close proximity to the cleanout holes.

(5) *Rear of moulders.* At the rear of moulders all revolving shafts shall have round corners or cylindrical surfaces, and all bolts shall be flush. The rods shall be far enough from revolving parts to prevent a shearing or pinching hazard.

(6) *Adjustment crank.* Where a removable crank is used to adjust the moulder for different sizes of loaf, brackets shall be provided on the side of the machine for holding the crank when it is not in use.

(h) *Manually fed dough brakes—(1) Top-roll protection.* The top roll shall be protected by a heavy gage metal shield extending over the roll to go within 6 inches of the hopper bottom board. The shield may be perforated to permit observation of the dough entering the rolls.

(2) *Emergency stop bar.* An emergency stop bar shall be provided, so

located that the body will press against it if the operator slips and falls toward the rolls, or if the operator sets his hand caught in the rolls, and this pressure shall positively open a circuit which will demerge the drive motor. In addition a magnetic, spring-set brake shall be demergerized at the same time, causing the rolls to stop instantly. The emergency stop bar shall be checked every 30 days.

(i) *Miscellaneous equipment—(1) Proof boxes.* All door locks shall be operable both from within and outside the box. Guide rails shall be installed to center the rack as it enters, passes through, and leaves the proof box.

(2) *Fermentation room.* Fermentation room doors shall have nonshatterable wire glass or plastic panels for vision through doors.

(3) *Troughs.* Troughs shall be mounted on antifriction bearing casters thus making it possible for the operator to move and direct the motion of the trough with a minimum of effort.

(4) *Hand trucks.* (i) Casters shall be set back from corners to be out of the way of toes and heels, but not far enough back to cause the truck to be unstable.

(ii) A lock or other device shall be provided to hold the handle in vertical position when the truck is not in use.

(5) *Lift trucks.* A lock or other device shall be provided to hold the handle in vertical position when the truck is not in use.

(6) *Racks.* (i) Sharp splintered or rough corners and edges shall be eliminated.

(ii) Racks shall be equipped with handles so located with reference to the frame of the rack that no part of the operator's hands extends beyond the outer edge of the frame when holding onto the handles.

(iii) Antifriction bearing casters shall be used to give the operator better control of the rack.

(iv) End guards shall be used at shelf levels on proofing racks.

(7) *Conveyors.* (i) Wherever a conveyor passes over a main aisleway, regularly occupied work area, or passageway, the underside of the conveyor shall be completely enclosed to prevent broken chains or other material from falling in the passageway.

(ii) Stop bumpers shall be installed on all delivery ends of conveyors, wherever manual removal of the product carried is practiced.

(iii) Where hazard of getting caught exists a sufficient number of stop buttons shall be provided to enable quick stopping of the conveyor.

(8) *Overhead rail systems.* (i) Handles for operating devices for trolley switches which hang less than 6 feet 8 inches from the floor shall be of pliable material.

(ii) Floor scales. Nonshatterable transparent material shall be used to cover dials.

(9) *Dough chutes.* The entrance to the chute shall be guarded so as to protect the employee from falling into chute, stepping into chute, or tripping over too low an edge of the chute.

not be used as a filler in horizontal belt guards.

(v) For clearance between guards and belts, ropes or chains of various center to center dimensions between the shafts, see bottom of Table O-13.

(4) *Guards for horizontal overhead rope and chain drives.* Overhead-rope and chain-drive guard construction shall conform to the rules for overhead-belt guard construction of similar width, except that the filler material shall be of the solid type as shown in Table O-13, unless the fire hazard demands the use of open construction. A side guard member of the same solid filling material should be carried up in a vertical position two (2) inches above the level of the lower run of the rope or chain drive and two (2) inches within the periphery of the pulleys which the guard encloses thus forming a trough. These side filler members should be reinforced on the edges with ½-inch by ½-inch flat steel, riveted to the filling material at not greater than eight (8) inch centers; the reinforcing strip should be fastened or bolted to all guard supporting members with at least one ¾-inch rivet or bolt at each intersection, and the ends should be secured to the ceiling with lag screws or bolts. The filling material shall be fastened to the framework of the guard and the filler supports by ¼-inch rivets spaced on 4-inch centers. The width of the multiple drive shall be determined by measuring the distance from the outside of the first to the outside of the last rope or chain in the group accommodated by the pulley.

(5) *Guardrails and toeboards.* (i) Guardrail shall be forty-two (42) inches in height, with midrail between top rail and floor.

(ii) Posts shall be not more than eight (8) feet apart; they are to be permanent and substantial, smooth, and free from protruding nails, bolts, and splinters. If made of pipe, the post shall be one and one-fourth (1¼) inches inside diameter, or larger. If made of metal shapes or bars, their section shall be equal in strength to that of one and one-half (1½) by one and one-half (1½) by three-sixteenths (⅜) inch angle iron. If made of wood, the posts shall be two by four (2 x 4) inches or larger. The upper rail shall be two by four (2 x 4) inches, or two by four (1 x 4) strips, one at the top and one at the side of posts. The midrail may be one by four (1 x 4) inches or more. The rails (metal shapes, metal bars, or wood), should be on that side of the posts which gives the best protection and support. Where panels are fitted with expanded metal or wire mesh as noted in Table O-12 the middle rails may be omitted. Where guard is exposed to contact with moving equipment, additional strength may be necessary.

(iii) Toeboards shall be four (4) inches or more in height, of wood, metal, or of metal grill not exceeding one (1) inch mesh. Toeboards at flywheel pits should preferably be placed as close to edge of the pit as possible.

RULES AND REGULATIONS

22293

(p) *Care of equipment—(1) General.* All power-transmission equipment shall be inspected at intervals not exceeding 60 days and be kept in good working condition at all times.

(2) *Shafting.* (i) Shafting shall be kept in alignment, free from rust and excess oil or grease.

(ii) Where explosives, explosive dusts, flammable vapors or flammable liquids exist, the hazard of static sparks from shafting shall be carefully considered.

(3) *Bearings.* Bearings shall be kept in alignment and properly adjusted.

(4) *Hangers.* Hangers shall be inspected to make certain that all supporting bolts and screws are tight and that supports of hanger boxes are adjusted properly.

(5) *Pulleys.* (i) Pulleys shall be kept in proper alignment to prevent belts from running off.

(ii) One or both pulleys carrying a nonshifting belt should have crowned faces.

(iii) Cast-iron pulleys should be tested frequently with a hammer to disclose cracks in rim or spokes. It should be

TABLE O-13—HORIZONTAL OVERHEAD BELTS, ROPES, AND CHAINS 7 FEET OR MORE ABOVE FLOOR OR PLATFORM

	Width			Material
	From 10' to 14' inclusive	Over 14' to 24' inclusive	Over 24'	
MEMBERS				
Framework.....	1½" x 1½" x ¾"	2" x 2" x ¾"	3" x 3" x ¾"	Angle iron.
Filler (belt guards).....	1½" x ¾"	2" x ¾"	2" x ¾"	Flat iron.
Filler and vertical side member.....	No. 20 A. W. G.	No. 18 A. W. G.	No. A. W. G.	Solid sheet metal.
Filler supports.....	2" x ¾" flat iron.	2" x ¾" flat iron.	2½" x 2½" x ¾" angle	Flat and angle.
Guard supports.....	2" x ¾"	2" x ¾"	2½" x ¾"	Flat iron.
FASTENINGS				
Filler supports to framework.....	(2) ¾"	(2) ¾"	(2) ¾"	Rivets.
Filler flats to supports (belt guards).....	(1) ¾"	(1) ¾"	(2) ¾"	Flush rivets.
Filler to frame and supports (chain guards).....	¾" rivets spaced.....	8" centers on sides and 4" centers on bottom.	(2) ¾"	
Guard supports to frame work.....	(2) ¾"	(2) ¾"	(2) ¾"	Rivets or bolts.
Guard and supports to overhead ceiling.....	¾" x 3½" lag screws or ¾" bolts.	¾" x 4" lag screws or ¾" bolts.	¾" x 6" lag screws or ¾" bolts.	Lag screws or bolts.
DETAILS—SPACING, ETC.				
Width of guards.....	One-quarter wider than belt, rope, or chain drive.			
Spacing between filler supports.....	20" C. to C.	16" C. to C.	16" C. to C.	
Spacing between filler flats (belt guards).....	2" apart.	2½" apart.	3" apart.	
Spacing between guard supports.....	36" C. to C.	36" C. to C.	36" C. to C.	
OTHER BELT GUARD FILLING PERMITTED				
Sheet metal fastened as in chain guards.....	No. 20 A. W. G.	No. 18 A. W. G.	No. 18 A. W. G.	Solid or perforated.
Woven wire, 2" mesh.....	No. 12 A. W. G.	No. 10 A. W. G.	No. 8 A. W. G.	
CLEARANCE FROM OUTSIDE OF BELT, ROPE, OR CHAIN DRIVE TO GUARD				
Distance center to center of shafts.....	Up to 16' inclusive.	Over 16' to 25' inclusive.	Over 25' to 40' inclusive.	Over 40'.
Clearance from belt, or chain to guard.....	6".	10".	15".	20".

borne in mind that the sound is usually the pulley.

(iv) Split pulleys should be inspected to ascertain if all bolts holding together the sections of the pulley are tight.

(6) *Care of belts.* (i) Quarter-twist belts when installed without an idler can be used on drives running in one direction only. They will run off a pulley when direction of motion is reversed.

(ii) Inspection shall be made of belts, lacing, and fasteners and such equipment kept in good repair.

(iii) Where possible, dressing should not be applied when belt or rope is in motion; but, if this is necessary, it should be applied where belts or rope leave pulley,

not where they approach. The same precautions apply to lubricating chains. In the case of V-belts, belt dressing is neither necessary nor advisable.

(7) *Lubrication.* The regular oils shall wear tight-fitting clothing and should use cans with long spouts to keep their hands out of danger. Machinery shall be oiled when not in motion, wherever possible.

§ 1910.220 Effective dates.

(a) The provisions of this Subpart O shall become effective on August 27, 1971, except as provided in the remaining paragraphs of this section.

(b) The following provisions shall become effective on February 15, 1972: