



Interoffice Communication

To Recipients of OSHA Standards 1910
From C. H. Klunick - Safety - Houston
Date July 13, 1979
Subject OSHA 1910 - "General Industry Standards" Change 7

Attached is change 7 for your Volume I, OSHA General Industry Standards. Please follow change instructions. The change that was sent to you previously was incorrect. Please discard the incorrect copy and replace with this second copy.

If you have any questions, please call the Safety Division in Houston, extension 2338.

C. H. Klunick

C. H. Klunick
Manager of Safety

ad

Attachment

16

Docs. resp. to

RPOD II

2(a)

from pp. 31-290

MCD 000011094

OCCUPATIONAL SAFETY AND HEALTH SUBSCRIPTION SERVICE



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SAFETY DIVISION

VOLUME I-GENERAL INDUSTRY STANDARDS AND INTERPRETATIONS

CHANGE 7—NOVEMBER 13, 1978

OSHA 2077

INTRODUCTION

This change incorporates the following changes published in the Federal Register:

1. Revises 29 CFR 1910 by revoking selected general and special industry safety and health standards. (See 43 F.R. 49725, 10/24/78.)
2. Corrects certain errors in the published revision of 29 CFR 1910 dated 10/24/78. (See 43 F.R. 51759, 11/7/78.)

INSTRUCTIONS

1. Substitute or add the attached pages as indicated in the following table:

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2. Enter a record of this change on page i.
3. Retain this cover sheet as a record of the contents of this change.

MCD 000011097

NOTICE TO SUBSCRIBERS

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DATE	PART	CHANGE	TITLE
11/14/78	29CFR1910.1025	Added	Occupational Exposure to Lead
12/8/78	29CFR1910.1000	Amended	Air Contaminants Tables, Corrections
1/26/79	29CFR1910.1925	Corrections	Occupational Exposure to Lead
4/6/79	29CFR1910.1025	Corrections	Occupational Exposure to Lead

Change 8 incorporating the above will be issued at a later date.

MCD 000011098

General Industry Standards and Interpretations

July, 1977

Change 7—November 13, 1978

U.S. Department of Labor

Ray Marshall, Secretary

Occupational Safety and Health Administration

Eula Bingham, Assistant Secretary

Volume 1 OSHA 2077



MCD 000011099

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

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

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

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

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

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

(c) Protection of open-sided floors, platforms, and runways.

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

(i) Persons can pass.

(ii) There is moving machinery, or

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

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

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

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

(d) Stairway railings and guards.

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

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

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

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

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- (iv) On stairways more than 44 inches wide but less than 88 inches wide, one handrail on each enclosed side and one stair railing on each open side.
- (v) On stairways 88 or more inches wide, one handrail on each enclosed side, one stair railing on each open side, and one intermediate stair railing located approximately midway of the width.
- (2) Winding stairs shall be equipped with a handrail offset to prevent walking on all portions of the treads having width less than 6 inches.
- (e) Railing, toeboards, and cover specifications.**
- (1) A standard railing shall consist of top rail, intermediate rail, and posts, and shall have a vertical height of 42 inches nominal from upper surface of top rail to floor, platform, runway, or ramp level. The top rail shall be smooth-surfaced throughout the length of the railing. The intermediate rail shall be approximately halfway between the top rail and the floor, platform, runway, or ramp. The ends of the rails shall not overhang the terminal posts except where such overhang does not constitute a projection hazard.
- (2) A stair railing shall be of construction similar to a standard railing but the vertical height shall be not more than 34 inches nor less than 30 inches from upper surface of top rail to surface of tread in line with face of riser at forward edge of tread.
- (3) Revoked
- (i) For wood railings, the posts shall be of at least 2-inch by 4-inch stock spaced not to exceed 6 feet; the top and intermediate rails shall be of at least 2-inch by 4-inch stock. If top rail is made of two right-angle pieces of 1-inch by 4-inch stock, posts may be spaced on 8-foot centers, with 2-inch by 4-inch intermediate rail.
- (ii) For pipe railings, posts and top and intermediate railings shall be at least 1-1/2 inches nominal diameter with posts spaced not more than 8 feet on centers. INTERP
- (iii) For structural steel railings, posts and top and intermediate rails shall be of 2-inch by 2-inch by 3/8-inch angles or other metal shapes of equivalent bending strength with posts spaced not more than 8 feet on centers.
- (iv) The anchoring of posts and framing of members for railings of all types shall be of such construction that the completed structure shall be capable of withstanding a load of at least 200 pounds applied in any direction at any point on the top rail.
- (v) Other types, sizes, and arrangements of railing construction are acceptable provided they meet the following conditions:
- (a) A smooth-surfaced top rail at a height above floor, platform, runway, or ramp level of 42 inches nominal;
- (b) A strength to withstand at least the minimum requirement of 200 pounds top rail pressure;
- (c) Protection between top rail and floor, platform, runway, ramp, or stair treads, equivalent at least to that afforded by a standard intermediate rail;
- (d) Revoked

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TABLE D-1

Angle to horizontal	Rise (in inches)	Tread run (in inches)
30°35'	8½	11
32°08'	8¾	10¾
33°41'	7	10¾
35°16'	7½	10¾
36°52'	7¼	10
38°29'	7¾	9¾
40°08'	8	9¾
41°44'	8¼	9¾
43°22'	8½	9
45°00'	8¾	8¾
46°38'	9	8¾
48°16'	9¼	8¾
49°54'	9½	8

(f) Stair treads.

Each tread and the top landing of a stairway, where risers are used, should have a nose which extends one-half inch to 1 inch beyond the face of the lower riser. Noses should have an even leading edge. All treads shall be reasonably slip-resistant and the nosings shall be of nonslip finish. Welded bar grating treads without nosings are acceptable providing the leading edge can be readily identified by personnel descending the stairway and provided the tread is serrated or is of definite nonslip design. Rise height and tread width shall be uniform throughout any flight of stairs including any foundation structure used as one or more treads of the stairs.

(g) Length of stairways.

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

(h) Railings and handrails.

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

(i) Vertical clearance.

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

(j) Open risers.

Stairs having treads of less than 9-inch width should have open risers.

(k) General.

Revoked

1910.25—PORTABLE WOOD LADDERS

(a) Application of requirements.

This section is intended to prescribe rules and establish minimum requirements for the construction, care, and use of the common types of portable wood ladders, in order to insure safety under normal conditions of usage. Other types of special ladders, fruit-picker's ladders, combination step and extension ladders, stockroom step ladders, aisle-

way step ladders, shelf ladders, and library ladders are not specifically covered by this section.

(b) Materials.**(1) Requirements applicable to all wood parts.**

(i) All wood parts shall be free from sharp edges and splinters; sound and free by ac-

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cepted visual inspection from shake, wane, compression failures, decay, or other irregularities. Low-density wood shall not be used.

(2) **Permissible irregularities in side rails and back rails.** Revoked

(3) **Permissible irregularities in flat steps, rungs, and cleats.** Revoked

(4) **Classification of species of wood.** Revoked

(5) **Metal parts.** Revoked

(c) Construction requirements.

(1) **Basis of requirements.** Revoked

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

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

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

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

(i) General requirements.

(a) Revoked

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

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

(d) Revoked

(e) Revoked

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

(ii) **Type I industrial stepladder.** Revoked

(iii) **Type II commercial stepladder.** Revoked

(iv) **Type III household stepladder.** Revoked

(3) Portable rung ladders.

(i) **General requirements.** Revoked

(ii) **Single ladder.**

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

(iii) **Two-section ladder.**

(a) Two-section extension ladders longer than 60 feet shall not be supplied. All ladders of this type shall consist of two sections, one to fit within the side rails of the other, and arranged in such a manner that the upper section can be raised and lowered.

(iv) **Sectional ladder.**

(a) Assembled combinations of sectional ladders longer than lengths specified in this subdivision shall not be used.

(v) **Trestle and extension trestle ladder.**

(a) Trestle ladders, or extension sections or base sections of extension trestle ladders longer than 20 feet shall not be supplied.

(4) Special-purpose ladders.

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(i) Platform stepladder. Revoked

(ii) Painter's stepladder.

(a) Painter's stepladders longer than 12 feet shall not be supplied.

(iii) **Mason's ladder.** A mason's ladder is a special type of single ladder intended for use in heavy construction work.

(a) Mason's ladders longer than 40 feet shall not be supplied.

(5) **Trolley and side-rolling ladders.**

(i) **Length.** Trolley ladders and side-rolling ladders longer than 20 feet should not be supplied.

(d) **Care and use of ladders.**

(1) **Care.** To insure safety and serviceability the following precautions on the care of ladders shall be observed:

(i) Ladders shall be maintained in good condition at all times, the joint between the steps and side rails shall be tight, all hardware and fittings securely attached, and the movable parts shall operate freely without binding or undue play.

(ii) Metal bearings of locks, wheels, pulleys, etc., shall be frequently lubricated.

(iii) Frayed or badly worn rope shall be replaced.

(iv) Safety feet and other auxiliary equipment shall be kept in good condition to insure proper performance.

(v) thru (ix) Revoked

(x) Ladders shall be inspected frequently and those which have developed defects shall be withdrawn from service for repair or destruction and tagged or marked as "Dangerous, Do Not Use."

(xi) Rungs should be kept free of grease and oil.

(2) **Use.** The following safety precautions shall be observed in connection with the use of ladders:

(i) Portable rung and cleat ladders shall, where possible, be used at such a pitch that the horizontal distance from the top support to the foot of the ladder is one-quarter of the working length of the ladder (the length along the ladder between the foot and the top support). The ladder shall be so placed as to prevent slipping, or it shall be lashed, or held in position. Ladders shall not be used in a horizontal position as platforms, runways, or scaffolds;

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(ii) Ladders for which dimensions are specified should not be used by more than one man at a time nor with ladder jacks and scaffold planks where use by more than one man is anticipated. In such cases, specially designed ladders with larger dimensions of the parts should be procured;

(iii) Portable ladders shall be so placed that the side rails have a secure footing. The top rest for portable rung and cleat ladders shall be reasonably rigid and shall have ample strength to support the applied load;

(iv) Ladders shall not be placed in front of doors opening toward the ladder unless the door is blocked upon, locked, or guarded.

(v) Ladders shall not be placed on boxes, barrels, or other unstable bases to obtain additional height;

(vi) To support the top of the ladder at a window opening, a board should be attached across the back of the ladder, extending across the window and providing firm support against the building walls or window frames;

(vii) When ascending or descending, the user should face the ladder;

(viii) Ladders with broken or missing steps, rungs, or cleats, broken side rails, or other faulty equipment shall not be used; improvised repairs shall not be made;

(ix) Short ladders shall not be spliced together to provide long sections;

(x) Ladders made by fastening cleats across a single rail shall not be used;

(xi) Ladders shall not be used as guys, braces, or skids, or for other than their intended purposes;

(xii) Tops of the ordinary types of stepladders shall not be used as steps;

(xiii) On two-section extension ladders the minimum overlap for the two sections in use shall be as follows:

Size of ladder (feet):	Overlap (feet)
Up to and including 36	3
Over 36 up to and including 48	4
Over 48 up to and including 60	5

(xiv) Portable rung ladders with reinforced rails (see paragraphs (c)(3)(ii)(c) and (iii)(d) this section) shall be used only with the metal reinforcement on the under side. Ladders of this type should be used with great care near electrical conductors, since the reinforcing itself is a good conductor;

(xv) No ladder should be used to gain access to a roof unless the top of the ladder shall extend at least 3 feet above the point of support, at eave, gutter, or roof line;

(xvi) Adjustment of extension ladders should only be made by the user when standing at the base of the ladder, so that the user may observe when the locks are properly engaged. Adjustment of extension ladders from the top of the ladder (or any level over the locking device) is a dangerous practice and should not be attempted. Adjustment should not be made while the user is standing on the ladder.

(xvii) Middle and top sections of sectional or window cleaner's ladders should not be used for bottom section unless the user equips them with safety shoes.

(xviii) Extension ladders should always be erected so that the upper section is resting on the bottom section.

(xix) The user should equip all portable rung ladders with nonslip bases when there is a hazard of slipping. Nonslip bases are not intended as a substitute for care in safely placing, lashing, or holding a ladder that is being used upon oily, metal, concrete, or slippery surfaces.

(xx) The bracing on the back legs of step ladders is designed solely for increasing stability and not for climbing.

(xxi) Revoked

1910.26—PORTABLE METAL LADDERS

(a) Requirements.

(1) **General.** Specific design and construction requirements are not part of this section because of the wide variety of metals and design possibilities. However, the design shall be such as to produce a ladder without structural defects or accident hazards such as sharp edges, burrs, etc. The metal selected shall be of sufficient strength to meet the test requirements, and shall be protected against corrosion unless inherently corrosion-resistant.

(i) thru (ii) Revoked

(iii) The spacing of rungs or steps shall be on 12-inch centers.

(iv) Revoked

(v) Rungs and steps shall be corrugated, knurled, dimpled, coated with skid-resistant material, or otherwise treated to minimize the possibility of slipping.

(2) General specifications—straight and extension ladders.

(i) The minimum width between side rails of a straight ladder or any section of an extension ladder shall be 12 inches.

(ii) The length of single ladders or individual sections of ladders shall not exceed 30 feet. Two-section ladders shall not exceed 48 feet in length and over two-section ladders shall not exceed 60 feet in length.

(iii) Based on the nominal length of the ladder, each section of a multisection ladder shall overlap the adjacent section by at least the number of feet stated in the following:

Nominal length of ladder (feet):	Overlap (feet)
Up to and including 36	3
Over 36, up to and including 48	4
Over 48, up to 60	5

(iv) Extension ladders shall be equipped with positive stops which will insure the overlap specified in the table above.

(3) General specifications—step ladders.

(i) thru (ii) Revoked

(iii) The length of a stepladder is measured by the length of the front rail. To be classified as a standard length ladder, the measured length shall be within plus or minus one-half inch of the specified length. Stepladders shall not exceed 20 feet in length.

(iv thru (vi) Revoked

(vii) The bottoms of the four rails are to be supplied with insulating nonslip material for the safety of the user.

(viii) A metal spreader or locking device of sufficient size and strength to securely hold the front and back sections in the open position shall be a component of each stepladder. The spreader shall have all sharp points or edges covered or removed to protect the user.

(4) General specifications—trestles and extension trestle ladders.

(i) Trestle ladders or extension sections or base sections of extension trestle ladders shall be not more than 20 feet in length.

(5) General specifications—platform ladders.

(i) The length of a platform ladder shall not exceed 20 feet. The length of a platform ladder shall be measured along the front rail from the floor to the platform.

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Pages 41 thru 54 deleted

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STANDARDS AND INTERPRETATIONS

(b) Testing. Revoked**(c) Care and maintenance of ladders.**

(1) General. To get maximum serviceability, safety, and to eliminate unnecessary damage of equipment, good safe practices in the use and care of ladder equipment must be employed by the users.

The following rules and regulations are essential to the life of the equipment and the safety of the user.

(2) Care of ladders.

(i) thru (iii) Revoked

(iv) Ladders must be maintained in good usable condition at all times. Hardware fittings and accessories should be checked frequently and kept in good working condition.

(v) Ropes or cables should be inspected frequently and replaced if defective.

(vi) Complete ladder inspection should be periodical. If a ladder is involved in any of the following, immediate inspection is necessary:

(a) If ladders tip over, inspect ladder for side rails dents or bends, or excessively dented rungs; check all rung-to-side-rail

connections; check hardware connections; check rivets for shear.

(b) If ladders are exposed to excessive heat as in the case of fire, the ladder should be inspected visually for damage and tested for deflection and strength characteristics. In doubtful cases, refer to manufacturer.

(c) If ladders are to be subjected to certain acids or alkali solutions, a protective coating such as asphalt and varnish should be applied to the equipment.

(d) If ladders are exposed to oil and grease, equipment should be cleaned of oil, grease, or slippery materials. This can easily be done with a solvent or steam cleaning.

(vii) Ladders having defects are to be marked and taken out of service until repaired by either maintenance department or the manufacturer.

(3) Use of ladders.

(i) Portable non-self-supporting ladders should be erected at a pitch of 75½ degrees for maximum balance and strength. A simple rule for setting up a ladder at the proper angle is to place the base a distance from the vertical wall equal to one-fourth the working length of the ladder.

(ii) Portable ladders are designed as a one-man working ladder based on a 200-pound load.

(iii) The ladder base section must be placed with a secure footing. Safety shoes of good substantial design should be installed on all ladders. Where ladders with no safety shoes or spikes are used on hard, slick surfaces, a foot-ladder board should be employed.

(iv) The top of the ladder must be placed with the two rails supported, unless equipped with a single support attachment. Such an attachment should be substantial and large enough to support the ladder under load.

STANDARDS AND INTERPRETATIONS

(v) When ascending or descending, the climber must face the ladder.

(vi) Ladders must not be tied or fastened together to provide longer sections. They must be equipped with the hardware, fittings necessary if the manufacturer endorses extended uses.

(vii) Ladders should not be used as a brace.

skid, guy or gin pole, gangway, or for other uses than that for which they were intended, unless specifically recommended for use by the manufacturer.

(viii) Users are cautioned to take proper safety measures when metal ladders are used in areas containing electric circuits to prevent short circuits or electrical shock.

1910.27—FIXED LADDERS

(a) Design requirements.

(1) **Design considerations.** All ladders, appurtenances, and fastenings shall be designed to meet the following load requirements:

(i) The minimum design live load shall be a single concentrated load of 200 pounds.

(ii) The number and position of additional concentrated live-load units of 200 pounds each as determined from anticipated usage of the ladder shall be considered in the design.

(iii) The live loads imposed by persons occupying the ladder shall be considered to be concentrated at such points as will cause the maximum stress in the structural member being considered.

(iv) The weight of the ladder and attached appurtenances together with the live load shall be considered in the design of rails and fastenings.

(2) **Design stresses.** Design stresses for wood components of ladders shall not exceed those specified in § 1910.25. All wood parts of fixed ladders shall meet the requirements of § 1910.25(b).

For fixed ladders consisting of wood side rails and wood rungs or cleats, used at a pitch in the range 75 degrees to 90 degrees, and intended for use by no more than one

person per section, single ladders as described in § 1910.25(c)(3)(ii) are acceptable.

(b) Specific features.

(1) Rungs and cleats.

(i) All rungs shall have a minimum diameter of three-fourths inch for metal ladders, except as covered in subparagraph (7)(i) of this paragraph, and a minimum diameter of 1¼ inches for wood ladders.

(ii) The distance between rungs, cleats, and steps shall not exceed 12 inches and shall be uniform throughout the length of the ladder.

(iii) The minimum clear length of rungs or cleats shall be 16 inches.

(iv) Rungs, cleats, and steps shall be free of splinters, sharp edges, burrs, or projections which may be a hazard.

(v) The rungs of an individual-rung ladder shall be so designed that the foot cannot slide off the end. A suggested design is shown in figure D-1.

(2) **Side rails.** Side rails which might be used as a climbing aid shall be of such cross sections as to afford adequate gripping surface without sharp edges, splinters, or burrs.

STANDARDS AND INTERPRETATIONS

other mechanisms or gears may expose personnel to a hazard.

(iv) Friction devices or clutches shall not be used for connecting the main driving mechanism to the drum or drums. Belt- or chain-driven machines are prohibited.

(18) Hoisting motors.

(i) Hoisting motors shall be electric and of weather-proof construction.

(ii) Hoisting motors shall be in conformance with applicable provisions of subparagraph (22) of this paragraph, Electrical wiring and equipment.

(iii) Hoisting motors shall be directly connected to the hoisting machinery. Motor couplings, if used, shall be of steel construction.

(19) Brakes. The hoisting machine(s) shall have two independent braking means, each designed to stop and hold the working platform with 125 percent of rated load.

(20) Hoisting ropes and rope connections.

(i) Working platforms shall be suspended by wire ropes of either 6 x 19 or 6 x 37 classification, preformed or nonpreformed.

(ii) Revoked

(iii) The minimum factor of safety shall be ten, and shall be calculated by the following formula:

$$F = \frac{S \times N}{W}$$

where

S Manufacturer's rated breaking strength of one rope.

N Number of ropes under load.

W Maximum static load on all ropes with the platform and its rated load at any point of its travel.

(iv) Hoisting ropes shall be sized to conform with the required factor of safety, but in no case shall the size be less than five-sixteenths-inch diameter.

(v) Winding drums shall have at least three turns of rope remaining when the platform has landed at the lowest possible point of its travel.

(vi) The lengthening or repairing of wire rope by the joining of two or more lengths is prohibited.

(vii) The nondrum ends of the hoisting ropes shall be provided with individual shackle rods which will permit individual adjustment of rope lengths, if required.

(viii) Reverse bends in rope arrangement should be avoided. More than two reverse bends in each rope is prohibited.

(21) Rope tag data.

(i) A metal data tag shall be securely attached to one of the wire rope fastenings. This data tag shall bear the following wire rope data:

(a) The diameter in inches.

(b) Construction classification.

(c) Whether nonpreformed or preformed.

(d) The grade of material used.

(e) The manufacturer's rated breaking strength.

(f) Name of the manufacturer of the rope.

(g) The month and year the ropes were installed.

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(22) Electrical wiring and equipment.

(i) All electrical equipment and wiring shall conform to the requirements of the National Electrical Code, NFPA No. 70-1971; ANSI C1-1971 (Rev. of C1-1968), except as modified by ANSI A120.1-1970 "American National Standard Safety Requirements for Powered Platforms for Exterior Building Maintenance." For detail design specifications for electrical equipment, see Part 2, ANSI A120.1-1970.

(ii) All motors and operation and control equipment shall be supplied from a single power source.

(iii) The power supply for the powered platform shall be an independent circuit supplied through a fused disconnect switch.

(iv) Electrical conductor parts of the power supply system shall be protected against accidental contact.

(v) Electrical grounding shall be provided.

(a) Provision for electrical grounding shall be included with the power-supply system.

(b) Controller cabinets, motor frames, hoisting machines, the working platform, roof car and roof car track system, and noncurrent carrying parts of electrical equipment, where provided, shall be grounded.

(c) The controller, where used, shall be so designed and installed that a single ground or short circuit will not prevent both the normal and final stopping device from stopping the working platform.

(d) Means shall be provided on the roof car and working platform for grounding portable electric tools.

(e) The working platform shall be grounded through a grounding connection in a traveling cable. Electrically powered tools utilized on the working platform shall be grounded.

(vi) Electrical receptacles located on the roof or other exterior location shall be of a weatherproof type and shall be located so as not to be subject to contact with water or accumulated snow. The receptacles shall be grounded and the electric cable shall include a grounding conductor. The receptacle and plug shall be a type designed to avoid hazard to persons inserting or withdrawing the plug. Provision shall be made to prevent application of cable strain directly to the plug and receptacle.

(vii) Electric runway conductor systems shall be of the type designed for use in exterior locations and shall be located so as not to be subject to contact with water or accumulated snow. The conductors, collectors, and disconnecting means shall conform to the same requirements as those for cranes and hoists in Article 610 of the National Electrical Code, NFPA 70-1971; ANSI C1-1971 (Rev. of C1-1968). A grounded conductor shall parallel the power conductors and be so connected that it cannot be opened by the disconnecting means. The system shall be designed to avoid hazard to persons in the area.

(viii) Electrical protective devices and interlocks of the weatherproof type shall be provided.

(ix) Where the installation includes a roof car, electric contact(s) shall be provided

STANDARDS AND INTERPRETATIONS

with a bevel guard or cone meeting the following requirements:

(a) The cone shall make an angle of not less than 45° with the horizontal. An angle of 60° or greater shall be used where ceiling heights permit.

(b) The lower edge of this guard shall extend at least 42 inches outward from any handhold on the belt. It shall not extend beyond the upper surface of the floor above.

(c) The cone shall be made of not less than No. 18 U.S. gauge sheet steel or material of equivalent strength or stiffness. The lower edge shall be rolled to a minimum diameter of one-half inch and the interior shall be smooth with no rivets, bolts or screws protruding.

(ii) **Floating type.** In lieu of the fixed guards specified in subdivision (i) of this subparagraph, a floating type safety cone may be used, such floating cones to be mounted on hinges at least 6 inches below the underside of the floor and so constructed as to actuate a limit switch should a force of 2 pounds be applied on the edge of the cone closest to the hinge. The depth of this floating cone need not exceed 12 inches.

(8) Protection of entrances and exits.

(i) **Guardrail requirement.** The entrances and exits at all floor landings affording access to the manlift shall be guarded by a maze (staggered railing) or a handrail equipped with self-closing gates.

(ii) **Construction.** The rails shall be standard guardrails with toeboards meeting the provisions of the Safety Requirements for Floor and Wall Openings, Railings and Toeboards, ANSI A12.1-1967 and section 1910.23.

(iii) **Gates.** Gates, if used, shall open outward and shall be self-closing. Corners of gates shall be rounded.

(iv) **Maze.** Maze or staggered openings shall

offer no direct passage between enclosure and outer floor space.

(v) Except where building layout prevents, entrances at all landings shall be in the same relative position.

(9) Guards for openings.

(i) **Construction.** The floor opening at each landing shall be guarded on sides not used for entrance or exit by a wall, a railing and toeboard or by panels of wire mesh of suitable strength.

(ii) **Height and location.** Such rails or guards shall be at least 42 inches in height on the up-running side and 66 inches on the down-running side.

(10) Bottom arrangement.

(i) **Bottom landing.** At the bottom landing the clear area shall be not smaller than the area enclosed by the guardrails on the floors above, and any wall in front of the down-running side of the belt shall be not less than 48 inches from the face of the belt. This space shall not be encroached upon by stairs or ladders.

(ii) **Location of lower pulley.** The lower (boot) pulley shall be installed so that it is supported by the lowest landing served. The sides of the pulley support shall be guarded to prevent contact with the pulley or the steps.

(iii) **Mounting platform.** A mounting platform shall be provided in front or to one side of the uprun at the lowest landing, unless the floor level is such that the following requirement can be met: The floor or platform shall be at or above the point at which the upper surface of the ascending step completes its turn and assumes a horizontal position.

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(iv) **Guardrails.** To guard against persons walking under a descending step, the area on the downside of the manlift shall be guarded in accordance with subparagraph (8) of this paragraph. To guard against a person getting between the mounting platform and an ascending step, the area between the belt and the platform shall be protected by a guard-rail.

(11) **Top arrangements.**

(i) **Clearance from floor.** A top clearance shall be provided of at least 11 feet above the top terminal landing. This clearance shall be maintained from a plane through each face of the belt to a vertical cylindrical plane having a diameter 2 feet greater than the diameter of the floor opening, extending upward from the top floor to the ceiling on the up-running side of the belt. No encroachment of structural or machine supporting members within this space will be permitted.

(ii) **Pulley clearance.**

(a) There shall be a clearance of at least 5 feet between the center of the head pulley shaft and any ceiling obstruction.

(b) The center of the head pulley shaft shall be not less than 6 feet above the top terminal landing.

(iii) **Emergency grab rail.** An emergency grab bar or rail and platform shall be provided at the head pulley when the distance to the head pulley is over 6 feet above the top landing, otherwise only a grab bar or rail is to be provided to permit the rider to swing free should the emergency stops become inoperative.

(12) **Emergency exit ladder.** A fixed metal ladder accessible from both the "up" and "down" run of the manlift shall be provided for the entire travel of the manlift. Such ladder shall be in accordance with the existing ANSI A14.3-1956. Safety Code for Fixed Ladders and section 1910.27.

(13) **Superstructure bracing.** Manlift rails shall be secured in such a manner as to avoid spreading, vibration, and misalignment.

(14) **Illumination.**

(i) **General.** Both runs of the manlift shall be illuminated at all times when the lift is in operation. An intensity of not less than 1-foot candle shall be maintained at all points. (However, see subparagraph (6)(iii) of this paragraph for illumination requirements at landings.)

(ii) **Control of illumination.** Lighting of manlift runways shall be by means of circuits permanently tied in to the building circuits (no switches), or shall be controlled by switches at each landing. Where separate switches are provided at each landing, any switch shall turn on all lights necessary to illuminate the entire runway.

(15) **Weather protection.** The entire manlift and its driving mechanism shall be protected from the weather at all times.

(c) **Mechanical requirements.**

(1) **Machines, general.**

(i) **Brakes.** Brakes provided for stopping and holding a manlift shall be inherently self-engaging, by requiring power or force from an external source to cause disengagement. The brakes shall be electrically released, and shall be applied to the motor shaft for direct-connected units or to the input shaft for belt-driven units. The brake shall be capable of stopping and holding the manlift when the descending side is loaded with 250 pounds on each step.

[38 F.R. 16223, June 21, 1973.]

(ii) **Belt.**

(a) The belts shall be of hard-woven canvas, rubber-coated canvas, leather, or other material meeting the strength

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requirements of paragraph (b)(3) of this section and having a co-efficient of friction such that when used in conjunction with an adequate tension device it will meet the brake test specified in subdivision (i) of this subparagraph.

(b) The width of the belt shall be not less than 12 inches for a travel not exceeding 100 feet, not less than 14 inches for a travel greater than 100 feet but not exceeding 150 feet and 16 inches for a travel exceeding 150 feet.

(c) A belt that has become torn while in use on a manlift shall not be spliced and put back in service.

(2) Speed.

(i) **Maximum speed.** No manlift designed for a speed in excess of 80 feet per minute shall be installed.

(3) Platforms or steps.

(i) **Minimum depth.** Steps or platforms shall be not less than 12 inches nor more than 14 inches deep, measured from the belt to the edge of the step or platform.

(ii) **Width.** The width of the step or platform shall be not less than the width of the belt to which it is attached.

(iii) **Distance between steps.** The distance between steps shall be equally spaced and not less than 16 feet measured from the upper surface of one step to the upper surface of the next step above it.

(iv) **Angle of step.** The surface of the step shall make approximately a right angle with the "up" and "down" run of the belt, and shall travel in the approximate horizontal position with the "up" and "down" run of the belt.

(v) **Surfaces.** The upper or working surfaces of the step shall be of a material having inherent nonslip characteristics (coefficient of friction not less than 0.5) or shall be covered completely by a nonslip tread securely fastened to it.

(vi) **Strength of step supports.** When subjected to a load of 400 pounds applied at the approximate center of the step, step frames, or supports and their guides shall be of adequate strength to:

(a) Prevent the disengagement of any step roller.

(b) Prevent any appreciable misalignment.

(c) Prevent any visible deformation of the steps or its support.

(vii) **Prohibition of steps without handholds.** No steps shall be provided unless there is a corresponding handhold above or below it meeting the requirements of subparagraph (4) of this paragraph. If a step is removed for repairs or permanently, the handholds immediately above and below it shall be removed before the lift is again placed in service.

(4) Handholds.

(i) **Location.** Handholds attached to the belt shall be provided and installed so that they are not less than 4 feet nor more than 4 feet 8 inches above the step tread. These shall be so located as to be available on the both "up" and "down" run of the belt.

(ii) **Size.** The grab surface of the handhold shall be not less than 4½ inches in width, not less than 3 inches in depth, and shall provide 2 inches of clearance from the belt. Fastenings for handholds shall be located not less than 1 inch from the edge of the belt.

(iii) **Strength.** The handhold shall be capable of withstanding, without damage, a load of 300 pounds applied parallel to the run of the belt.

(iv) **Prohibition of handhold without steps.** No handhold shall be provided without a corresponding step. If a handhold is removed permanently or temporarily, the corresponding step and handhold for the opposite direction of travel shall also be

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removed before the lift is again placed in service.

(v) **Type.** All handholds shall be of the closed type.

(5) Up limit stops.

(i) **Requirements.** Two separate automatic stop devices shall be provided to cut off the power and apply the brake when a loaded step passes the upper terminal landing. One of these shall consist of a split-rail switch mechanically operated by the step roller and located not more than 6 inches above the top terminal landing. The second automatic stop device may consist of any of the following:

(a) Any split-rail switch placed 6 inches above and on the side opposite the first limit switch.

(b) An electronic device.

(c) A switch actuated by a lever, rod, or plate, the latter to be placed on the "up" side of the head pulley so as to just clear a passing step.

(ii) **Manual reset location.** After the manlift has been stopped by a stop device it shall be necessary to reset the automatic stop manually. The device shall be so located that a person resetting it shall have a clear view of both the "up" and "down" runs of the manlift. It shall not be possible to reset the device from any step or platform.

(iii) **Cut-off point.** The initial limit stop device shall function so that the manlift will be stopped before the loaded step has reached a point 24 inches above the top terminal landing.

(iv) Electrical requirements.

(a) Where such switches open the main motor circuit directly they shall be of the multipole type.

(b) Where electronic devices are used they shall be so designed and installed that failure will result in shutting off the power to the driving motor.

(c) Where flammable vapors or dusts may be present all electrical installations shall be in accordance with the National Electrical Code, NFPA No. 70-1971; ANSI C1-1971 (Rev. of C1-1968), requirements for such locations.

(d) Unless of the oil-immersed type controller contacts carrying the main motor current shall be copper to carbon or equal, except where the circuit is broken at two or more points simultaneously.

(6) Emergency stop.

(i) **General.** An emergency stop means shall be provided.

(ii) **Location.** This stop means shall be within easy reach of the ascending and descending runs of the belt.

(iii) **Operation.** This stop means shall be so connected with the control lever or operating mechanism that it will cut off the power and apply the brake when pulled in the direction of travel.

(iv) **Rope.** If rope is used, it shall be not less than three-eighths inch in diameter. Wire rope, unless marlin-covered, shall not be used.

(7) Instruction and warning signs.

(i) **Instruction signs at landings or belts.** Signs of conspicuous and easily read style giving instructions for the use of the manlift shall be posted at each landing or stenciled on the belt.

(a) **Revoked**

(b) **The instructions shall read approximately as follows:**

Face the Belt.
Use the Handholds.
To Stop—Pull Rope.

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(ii) Top floor warning sign and light.

(a) At the top floor an illuminated sign shall be displayed bearing the following wording:

"TOP FLOOR—GET OFF"

Signs shall be in block letters not less than 2 inches in height. This sign shall be located within easy view of an ascending passenger and not more than 2 feet above the top terminal landing.

(b) In addition to the sign required by subdivision (a) of this subdivision, a red warning light of not less than 40-watt rating shall be provided immediately below the upper landing terminal and so located as to shine in the passenger's face.

(iii) Visitor warning. A conspicuous sign having the following legend—AUTHORIZED PERSONNEL ONLY—shall be displayed at each landing.

(d) Operating rules.

(1) Proper use of manlifts. No freight, packaged goods, pipe, lumber, or construction materials of any kind shall be handled on any manlift.

(e) Periodic inspection.

(1) Frequency. All manlifts shall be inspected by a competent designated person at inter-

vals of not more than 30 days. Limit switches shall be checked weekly. Manlifts found to be unsafe shall not be operated until properly repaired.

(2) Items covered. This periodic inspection shall cover but is not limited to the following items:

Steps.
Step Fastenings.
Rails.
Rail Supports and Fastenings.
Rollers and Slides.
Belt and Belt Tension.
Handholds and Fastenings.
Floor Landings.
Guardrails.
Lubrication.
Limit Switches.
Warning Signs and Lights.
Illumination.
Drive Pulley.
Bottom (hoist) Pulley and Clearance.
Pulley Supports.
Motor.
Driving Mechanism.
Brake.
Electrical Switches.
Vibration and Misalignment.
"Skip" on up or down run when mounted (to point indicating worn gears).

(3) Inspection log. A written record shall be kept of findings at each inspection. Records of inspection shall be made available to the Assistant Secretary of Labor or his duly authorized representative.

(SOURCE: ANSI A90.1-1969 Safety Code for Manlifts.)

1910.69—SOURCES OF STANDARDS

Sec.	Source
1910.66	ANSI A120.1-1970 Safety Code for Powered Platforms for Exterior Building Maintenance.

Sec.	Source
1910.67	ANSI A92.2-1969 American National Standard for Vehicle-Mounted Elevating and Rotating Work Platforms.
1910.68	ANSI A90.1-1969 Safety Code for Manlifts.

STANDARDS AND INTERPRETATIONS

1910.70—STANDARDS ORGANIZATIONS

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

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

American Welding Society
2501 NW. 7th Street
Miami, Florida 33125

[40 F.R. 13435, March 26, 1975.]

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(b) In no case shall combustible material be used in the construction of a spray booth and supply or exhaust duct connected to it.

(ii) Unobstructed walkways shall not be less than 6½ feet high and shall be maintained clear of obstruction from any work location in the booth to a booth exit or open booth front. In booths where the open front is the only exit, such exits shall be not less than 3 feet wide. In booths having multiple exits, such exits shall not be less than 2 feet wide, provided that the maximum distance from the work location to the exit is 25 feet or less. Where booth exits are provided with doors, such doors shall open outward from the booth.

(iii) Baffles, distribution plates, and dry-type overspray collectors shall conform to the requirements of § 1910.107(b)(4) and (5). (See sections 304 and 305 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33-1969.)

(a) Overspray filters shall be installed and maintained in accordance with the requirements of § 1910.107(b)(5), (see section 305 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33-1969), and shall only be in a location easily accessible for inspection, cleaning, or replacement.

(b) Where effective means, independent of the overspray filters, are installed which will result in design air distribution across the booth cross section, it is permissible to operate the booth without the filters in place.

(iv)

(a) For wet or water-wash spray booths, the water-chamber enclosure, within which intimate contact of contaminated air and cleaning water or other cleaning medium is maintained, if made of steel, shall be 18 gage or heavier and adequately protected against corrosion.

(b) Chambers may include scrubber spray nozzles, headers, troughs, or other devices. Chambers shall be provided with adequate means for creating and maintaining scrubbing action for removal of particulate matter from the exhaust air stream.

(v) Collecting tanks shall be of welded steel construction or other suitable non-combustible material. If pits are used as collecting tanks, they shall be concrete, masonry, or other material having similar properties.

(a) Tanks shall be provided with weirs, skimmer plates, or screens to prevent sludge and floating paint from entering the pump suction box. Means for automatically maintaining the proper water level shall also be provided. Fresh water inlets shall not be submerged. They shall terminate at least one pipe diameter above the safety overflow level of the tank.

(b) Tanks shall be so constructed as to discourage accumulation of hazardous deposits.

(vi) Pump manifolds, risers, and headers shall be adequately sized to insure sufficient water flow to provide efficient operation of the water chamber.

(4) Design and construction of spray rooms.

(i) Spray rooms, including floors, shall be constructed of masonry, concrete, or other noncombustible material.

(ii) Spray rooms shall have noncombustible fire doors and shutters.

(iii) Spray rooms shall be adequately ventilated so that the atmosphere in the breathing zone of the operator shall be maintained in accordance with the requirements of subparagraph (6)(ii) of this paragraph.

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(iv) Spray rooms used for production spray-finishing operations shall conform to the requirements for spray booths.

(iii) Revoked

(5) Ventilation.

(i) Ventilation shall be provided in accordance with provisions of § 1910.107(d) (see chapter 5 of the Standard for Spray Finishing Using Flammable or Combustible Materials, NFPA No. 33-1969), and in accordance with the following:

(a) Where a fan plenum is used to equalize or control the distribution of exhaust air movement through the booth, it shall be of sufficient strength or rigidity to withstand the differential air pressure or other superficially imposed loads for which the equipment is designed and also to facilitate cleaning. Construction specifications shall be at least equivalent to those of subdivision (iii) of this subparagraph.

(a) Exhaust ductwork shall be adequately supported throughout its length to sustain its weight plus any normal accumulation in interior during normal operating conditions and any negative pressure exerted upon it.

(ii) Inlet or supply ductwork used to transport makeup air to spray booths or surrounding areas shall be constructed of noncombustible materials.

(b) Exhaust ductwork shall be sized in accordance with good design practice which shall include consideration of fan capacity, length of duct, number of turns and elbows, variation in size, volume, and character of materials being exhausted. See American National Standard Z9.2-1960 for further details and explanation concerning elements of design.

(a) If negative pressure exists within inlet ductwork, all seams and joints shall be sealed if there is a possibility of infiltration of harmful quantities of noxious gases, fumes, or mists from areas through which ductwork passes.

(c) Longitudinal joints in sheet steel ductwork shall be either lock-seamed, riveted, or welded. For other than steel construction, equivalent securing of joints shall be provided.

(b) Inlet ductwork shall be sized in accordance with volume flow requirements and provide design air requirements at the spray booth.

(d) Circumferential joints in ductwork shall be substantially fastened together and lapped in the direction of airflow. At least every fourth joint shall be provided with connecting flanges, bolted together, or of equivalent fastening security.

(c) Inlet ductwork shall be adequately supported throughout its length to sustain at least its own weight plus any negative pressure which is exerted upon it under normal operating conditions.

(e) Inspection or clean-out doors shall be provided for every 9 to 12 feet of running length for ducts up to 12 inches in diameter, but the distance between clean-out doors may be greater for larger pipes. (See 8.3.21 of American National Standard Z9.1-1951.) A clean-out door or doors shall be provided for

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(v) If it is more convenient to measure the neutron flux, or equivalent, than to determine the neutron dose in rads, as provided in subdivision (iii) of this subparagraph, 1 rem of neutron radiation may, for purposes of the provisions in this section be assumed to be equivalent to 14 million neutrons per square centimeter incident upon the body; or, if there is sufficient information to estimate with reasonable accuracy the approximate distribution in energy of the neutrons, the incident number of neutrons per square centimeter equivalent to 1 rem may be estimated from Table G-17:

TABLE G-17—NEUTRON FLUX DOSE EQUIVALENTS

Neutron energy (million electron volts (Mev))	Number of neutrons per square centimeter equivalent to a dose of 1 rem (neutrons/cm ²)	Average flux to deliver 100 millirem in 40 hours (neutrons/cm ² per sec.)
Thermal.....	970×10^6	670
0.0001.....	720×10^6	600
0.005.....	820×10^6	570
0.02.....	400×10^6	290
0.1.....	120×10^6	80
0.5.....	43×10^6	30
1.0.....	28×10^6	18
2.5.....	21×10^6	20
5.0.....	26×10^6	18
7.5.....	24×10^6	17
10.....	24×10^6	17
10 to 30.....	14×10^6	10

(8) For determining exposures to X- or gamma rays up to 3 Mev., the dose limits specified in this section may be assumed to be equivalent to the "air dose." For the purpose of this section "air dose" means that the dose is measured by a properly calibrated appropriate instrument in air at or near the body surface in the region of the highest dosage rate.

(b) Exposure of individuals to radiation in restricted areas.

(1) Except as provided in subparagraph (2) of this paragraph, no employer shall possess, use, or transfer sources of ionizing radiation in such a manner as to cause any individual in a restricted area to receive in any period of one calendar quarter from sources in the employer's possession or con-

trol a dose in excess of the limits specified in Table G-18:

TABLE G-18

	Rems per calendar quarter
Whole body: Head and trunk; active blood-forming organs; lens of eyes; or gonads.....	1¼
Hands and forearms; feet and ankles.....	18¾
Skin of whole body.....	7½

(2) An employer may permit an individual in a restricted area to receive doses to the whole body greater than those permitted under subparagraph (1) of this paragraph, so long as:

(i) During any calendar quarter the dose to the whole body shall not exceed 3 rems; and

(ii) The dose to the whole body, when added to the accumulated occupational dose to the whole body, shall not exceed 5 (N-18) rems, where "N" equals the individual's age in years at his last birthday; and

(iii) The employer maintains adequate past and current exposure records which show that the addition of such a dose will not cause the individual to exceed the amount authorized in this subparagraph. As used in this subparagraph, "dose to the whole body" shall be deemed to include any dose to the whole body, gonad, active bloodforming organs, head and trunk, or lens of the eye.

(3) No employer shall permit any employee who is under 18 years of age to receive in any period of one calendar quarter a dose in excess of 10 percent of the limits specified in Table G-18.

(4) "Calendar quarter" means any 3-month period determined as follows:

(i) The first period of any year may begin on any date in January: *Provided*, That the second, third, and fourth periods accordingly begin on the same date in

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April, July, and October, respectively, and that the fourth period extends into January of the succeeding year, if necessary to complete a 3-month quarter. During the first year of use of this method of determination, the first period for that year shall also include any additional days in January preceding the starting date for the first period; or

(ii) The first period in a calendar year of 13 complete, consecutive calendar weeks; the second period in a calendar year of 13 complete consecutive weeks; the third period in a calendar year of 13 complete, consecutive calendar weeks; the fourth period in a calendar year of 13 complete, consecutive calendar weeks. If at the end of a calendar year there are any days not falling within a complete calendar week of that year, such days shall be included within the last complete calendar week of that year. If at the beginning of any calendar year there are days not falling within a complete calendar week of that year, such days shall be included within the last complete calendar week of the previous year; or

(iii) The four periods in a calendar year may consist of the first 14 complete, consecutive calendar weeks; the next 12 complete, consecutive calendar weeks, the next 14 complete, consecutive calendar weeks, and the last 12 complete, consecutive calendar weeks. If at the end of a calendar year there are any days not falling within a complete calendar week of that year, such days shall be included (for purposes of this section) within the last complete calendar week of the year. If at the beginning of any calendar year there are days not falling within a complete calendar week of that year, such days shall be included (for purposes of this section) within the last complete week of the previous year.

(c) Exposure to airborne radioactive material.

(1) No employer shall possess, use or transport radioactive material in such a manner

as to cause any employee, within a restricted area, to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in Table I of Appendix B to 10 CFR Part 20. The limits given in Table I are for exposure to the concentrations specified for 40 hours in any workweek of 7 consecutive days. In any such period where the number of hours of exposure is less than 40, the limits specified in the table may be increased proportionately. In any such period where the number of hours of exposure is greater than 40, the limits specified in the table shall be decreased proportionately.

(2) No employer shall possess, use, or transfer radioactive material in such a manner as to cause any individual within a restricted area, who is under 18 years of age, to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in Table II of Appendix B to 10 CFR Part 20. For purposes of this subparagraph, concentrations may be averaged over periods not greater than 1 week.

(3) "Exposed" as used in this paragraph means that the individual is present in an airborne concentration. No allowance shall be made for the use of protective clothing or equipment, or particle size.

(d) Precautionary procedures and personal monitoring.

(1) Every employer shall make such surveys as may be necessary for him to comply with the provisions in this section. "Survey" means an evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive materials or other sources of radiation under a specific set of conditions. When appropriate, such evaluation includes a physical survey of the location of materials and equipment, and measurements of levels of radiation or concentrations of radioactive material present.

(2) Every employer shall supply appropriate personnel monitoring equipment, such as

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(1) A room or area is not required to be posted with a caution sign because of the presence of a sealed source, provided the radiation level 12 inches from the surface of the source container or housing does not exceed 5 millirem per hour.

(2) Rooms or other areas in onsite medical facilities are not required to be posted with caution signs because of the presence of patients containing radioactive material, provided that there are personnel in attendance who shall take the precautions necessary to prevent the exposure of any individual to radiation or radioactive material in excess of the limits established in the provisions of this section.

(3) Caution signs are not required to be posted at areas or rooms containing radioactive materials for periods of less than 8 hours: *Provided, That*

(i) The materials are constantly attended during such periods by an individual who shall take the precautions necessary to prevent the exposure of any individual to radiation or radioactive materials in excess of the limits established in the provisions of this section; and

(ii) Such area or room is subject to the employer's control.

(h) Exemptions for radioactive materials packaged for shipment.

Radioactive materials packaged and labeled in accordance with regulations of the Department of Transportation published in 49 CFR Chapter I, are exempt from the labeling and posting requirements of this subpart during shipment, provided that the inside containers are labeled in accordance with the provisions of paragraph (e) of this section.

(i) Instruction of personnel, posting.

(1) Employers regulated by the Atomic Energy Commission shall be governed by 10 CFR Part 20 standards. Employers in a State named in paragraph (p)(3) of this section shall be governed by the requirements of the laws and regulations of that State.

All other employers shall be regulated by the following:

(2) All individuals working in or frequenting any portion of a radiation area shall be informed of the occurrence of radioactive materials or of radiation in such portions of the radiation area; shall be instructed in the safety problems associated with exposure to such materials or radiation and in precautions or devices to minimize exposure; shall be instructed in the applicable provisions of this section for the protection of employees from exposure to radiation or radioactive materials; and shall be advised of reports of radiation exposure which employees may request pursuant to the regulations in this section.

(3) Each employer to whom this section applies shall post a current copy of its provisions and a copy of the operating procedures applicable to the work conspicuously in such locations as to insure that employees working in or frequenting radiation areas will observe these documents on the way to and from their place of employment, or shall keep such documents available for examination of employees upon request.

(j) Storage of radioactive materials.

Radioactive materials stored in a nonradiation area shall be secured against unauthorized removal from the place of storage.

(k) Waste disposal.

No employer shall dispose of radioactive material except by transfer to an authorized recipient, or in a manner approved by the Atomic Energy Commission or a State named in paragraph (p)(3) of this section.

(l) Notification of incidents.

(1) **Immediate notification.** Each employer shall immediately notify the Assistant Secretary of Labor or his duly authorized representative, for employees not protected by the Atomic Energy Commission by means of 10 CFR Part 20; paragraph (p)(2) of this section, or the requirements of the laws and

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regulations of States named in paragraph (p)(3) of this section, by telephone or telegraph of any incident involving radiation which may have caused or threatens to cause:

(i) Exposure of the whole body of any individual to 25 rems or more of radiation; exposure of the skin of the whole body of any individual to 150 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms of any individual to 375 rems or more of radiation; or

(ii) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 5,000 times the limit specified for such materials in Table II of Appendix B to 10 CFR Part 20.

(2) **Twenty-four hour notification.** Each employer shall within 24 hours following its occurrence notify the Assistant Secretary of Labor or his duly authorized representative for employees not protected by the Atomic Energy Commission by means of 10 CFR Part 20; paragraph (p)(2) of this section, or the requirements of the laws and applicable regulations of States named in paragraph (p)(3) of this section, by telephone or telegraph of any incident involving radiation which may have caused or threatens to cause:

(i) Exposure of the whole body of any individual to 5 rems or more of radiation; exposure of the skin of the whole body of any individual to 30 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms to 75 rems or more of radiation; or

(m) Reports of overexposure and excessive levels and concentrations.

(1) In addition to any notification required by paragraph (1) of this section each employer shall make a report in writing within 30 days to the Assistant Secretary of Labor or his duly authorized representative, for employees not protected by the Atomic Energy Commission by means of 10 CFR Part 20; or under paragraph (p)(2) of this section, or the requirements of the laws and regulations of States named in paragraph (p)(3) of this section, of each exposure of an individual to radiation or concentrations of radioactive material in excess of any applicable limit in this section. Each report required under this subparagraph shall describe the extent of exposure of persons to radiation or to radioactive material; levels of radiation and concentration of radioactive material involved, the cause of the exposure, levels of concentrations; and corrective steps taken or planned to assure against a recurrence.

(2) In any case where an employer is required pursuant to the provisions of this paragraph to report to the U.S. Department of Labor any exposure of an individual to radiation or to concentrations of radioactive material, the employer shall also notify such individual of the nature and extent of exposure. Such notice shall be in writing and shall contain the following statement: "You should preserve this report for future reference."

(n) Records.

(1) Every employer shall maintain records of the radiation exposure of all employees for whom personnel monitoring is required under paragraph (d) of this section and advise each of his employees of his individual exposure on at least an annual basis.

(2) Every employer shall maintain records in the same units used in tables in paragraph (b) of this section and Appendix B to 10 CFR Part 20.

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(o) Disclosure to former employee of individual employee's record.

(1) At the request of a former employee an employer shall furnish to the employee a report of the employee's exposure to radiation as shown in records maintained by the employer pursuant to paragraph (n)(1) of this section. Such report shall be furnished within 30 days from the time the request is made, and shall cover each calendar quarter of the individual's employment involving exposure to radiation or such lesser period as may be requested by the employee. The report shall also include the results of any calculations and analysis of radioactive material deposited in the body of the employee. The report shall be in writing and contain the following statement: "You should preserve this report for future reference."

(p) Atomic Energy Commission licensees—AEC contractors operating AEC plants and facilities—AEC agreement State licensees or registrants.

(1) Any employer who possesses or uses source material, byproduct material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended, under a license issued by the Atomic Energy Commission and in accordance with the requirements of 10 CFR Part 20 shall be deemed to be in compliance with the requirements of this section with respect to such possession and use.

(2) AEC contractors operating AEC plants and facilities: Any employer who possesses or uses source material, byproduct material, special nuclear material, or other radiation sources under a contract with the Atomic Energy Commission for the operation of AEC plants and facilities and in accordance with the standards, procedures, and other requirements for radiation protection established by the Commission for such contract pursuant to the Atomic Energy Act of 1954 as amended (42 U.S.C. 2011 et seq.), shall be deemed to be in com-

pliance with the requirements of this section with respect to such possession and use.

(3) AEC-agreement State licensees or registrants:

(i) **Atomic Energy Act sources.** Any employer who possesses or uses source material, byproduct material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), and has either registered such sources with, or is operating under a license issued by, a State which has an agreement in effect with the Atomic Energy Commission pursuant to section 274(b) (42 U.S.C. 2021(b)) of the Atomic Energy Act of 1954, as amended, and in accordance with the requirements of that State's laws and regulations shall be deemed to be in compliance with the radiation requirements of this section, insofar as his possession and use of such material is concerned, unless the Secretary of Labor, after conference with the Atomic Energy Commission, shall determine that the State's program for control of these radiation sources is incompatible with the requirements of this section. Such agreements currently are in effect only in the States of Alabama, Arkansas, California, Kansas, Kentucky, Florida, Mississippi, New Hampshire, New York, North Carolina, Texas, Tennessee, Oregon, Idaho, Arizona, Colorado, Louisiana, Nebraska, Washington, Maryland, North Dakota, South Carolina, and Georgia.

(ii) **Other sources.** Any employer who possesses or uses radiation sources other than source material, byproduct material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), and has either registered such sources with, or is operating under a license issued by a State which has an agreement in effect with the Atomic Energy Commission pursuant to section 274(b) (42 U.S.C. 2021(b)) of the Atomic Energy Act of 1954, as amended, and in accordance with the requirements of that State's laws and regulations shall be deemed to be in compliance with the radiation requirements of this section, insofar as his possession

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and use of such material is concerned, provided the State's program for control of these radiation sources is the subject of a currently effective determination by the Assistant Secretary of Labor that such program is compatible with the requirements of this section. Such determinations currently are in effect only in the States of Alabama, Arkansas, California, Kansas, Kentucky, Florida, Mississippi, New Hampshire, New York, North Carolina, Texas, Tennessee, Oregon, Idaho, Arizona, Colorado, Louisiana, Nebraska, Washington, Maryland, North Dakota, South Carolina, and Georgia.

(q) [Reserved]

(r) Radiation standards for mining. Revoked

1910.97—NONIONIZING RADIATION

(a) Electromagnetic radiation.

(1) Definitions applicable to this paragraph.

(i) The term "electromagnetic radiation" is restricted to that portion of the spectrum commonly defined as the radio fre-

quency region, which for the purpose of this specification shall include the microwave frequency region.

(ii) **Partial body irradiation.** Pertains to the case in which part of the body is exposed to the incident electromagnetic energy.

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(ii) Specific requirements.

(a) The location of a system, as determined by the maximum total contained volume of hydrogen, shall be in the order of preference as indicated by Roman numerals in Table H-1.

(b) The minimum distance in feet from a hydrogen system of indicated capacity located outdoors, in separate buildings or in special rooms to any specified outdoor exposure shall be in accordance with Table H-2.

TABLE H-1

Nature of location	Size of hydrogen system		
	Less than 3,000 CF	3,000 CF to 15,000 CF	In excess of 15,000 CF
Outdoors.....	I.....	I.....	I.....
In a separate building.....	II.....	II.....	II.....
In a special room.....	III.....	III.....	Not permitted.
Inside buildings not in a special room and exposed to other occupancies.....	IV.....	Not permitted.	Not permitted.

TABLE H-2

Type of outdoor exposure		Size of hydrogen system		
		Less than 3,000 CF	3,000 CF to 15,000 CF	In excess of 15,000 CF
1. Building or structure.....	Wood frame construction*.....	10	25	50
	Heavy timber, noncombustible or ordinary construction*.....	0	10	**25
	Fire-resistive construction*.....	0	0	0
2. Wall openings.....	Not above any part of a system.....	10	10	10
	Above any part of a system.....	25	25	25
3. Flammable liquids above ground.....	0 to 1,000 gallons.....	10	25	25
	In excess of 1,000 gallons.....	25	50	50
4. Flammable liquids below ground—0 to 1,000 gallons.....	Tank.....	10	10	10
	Vent or fill opening of tank.....	25	25	25
5. Flammable liquids below ground—in excess of 1,000 gallons.....	Tank.....	20	20	20
	Vent or fill opening of tank.....	25	25	25
6. Flammable gas storage, either high pressure or low pressure.....	0 to 15,000 CF capacity.....	10	25	25
	In excess of 15,000 CF capacity.....	25	50	50
7. Oxygen storage.....	12,000 CF or less.....	Refer to NFPA No. 51, gas systems for welding and cutting (1969).		
	More than 12,000 CF.....	Refer to NFPA No. 566, bulk oxygen systems at consumer sites (1969).		
8. Fast burning solids such as ordinary lumber, excelsior or paper.....		50	50	50
9. Slow burning solids such as heavy timber or coal.....		25	25	25
10. Open flames and other sources of ignition.....		25	25	25
11. Air compressor intakes or inlets to ventilating or air-conditioning equipment.....		50	50	50
12. Concentration of people***.....		25	50	50

*Refer to NFPA No. 220 Standard Types of Building Construction for definitions of various types of construction. (1969 Ed.)

**But not less than one-half the height of adjacent side wall of the structure.

***In congested areas such as offices, lunchrooms, locker rooms, time-clock areas, and places of public assembly

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(c) The distances in Table H-2 Items 1, 14, and 3 to 10 inclusive do not apply where protective structures such as adequate fire walls are located between the system and the exposure.

(d) Hydrogen systems of less than 3,000 CF when located inside buildings and exposed to other occupancies shall be situated in the building so that the system will be as follows:

(1) In an adequately ventilated area as in subparagraph (3)(ii)(b) of this paragraph.

(2) Twenty feet from stored flammable materials or oxidizing gases.

(3) Twenty-five feet from open flames, ordinary electrical equipment or other sources of ignition.

(4) Twenty-five feet from concentrations of people.

(5) Fifty feet from intakes of ventilation or air-conditioning equipment and air compressors.

(6) Fifty feet from other flammable gas storage.

(7) Protected against damage or injury due to falling objects or working activity in the area.

(8) More than one system of 3,000 CF or less may be installed in the same room, provided the systems are separated by at least 50 feet. Each such system shall meet all of the requirements of this paragraph.

(3) Design consideration at specific locations.

(i) Outdoor locations.

(a) Where protective walls or roofs are provided, they shall be constructed of noncombustible materials.

(b) Where the enclosing sides adjoin each other, the area shall be properly ventilated.

(c) Electrical equipment within 15 feet shall be in accordance with subpart S of this part.

(ii) Separate buildings.

(a) Separate buildings shall be built of at least noncombustible construction. Windows and doors shall be located so as to be readily accessible in case of emergency. Windows shall be of glass or plastic in metal frames.

(b) Adequate ventilation to the outdoors shall be provided. Inlet openings shall be located near the floor in exterior walls only. Outlet openings shall be located at the high point of the room in exterior walls or roof. Inlet and outlet openings shall each have minimum total area of one (1) square foot per 1,000 cubic feet of room volume. Discharge from outlet openings shall be directed or conducted to a safe location.

(c) Explosion venting shall be provided in exterior walls or roof only. The venting area shall be equal to not less than 1 square foot per 30 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.

(d) There shall be no sources of ignition from open flames, electrical equipment, or heating equipment.

(e) Electrical equipment shall be in accordance with subpart S of this part for Class I, Division 2 locations.

(f) Heating, if provided, shall be by steam, hot water, or other indirect means.

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TABLE II-4—MINIMUM DISTANCE (FEET) FROM LIQUEFIED HYDROGEN SYSTEMS TO EXPOSURE

Type of exposure	Liquefied hydrogen storage (capacity in gallons)		
	39.63 (150 liters) to 3,500	3,501 to 15,000	15,001 to 30,000
1. Fire-resistant building and fire walls*	5	5	5
2. Noncombustible building*	25	50	75
3. Other buildings*	50	75	100
4. Wall openings, air-compressor intakes, inlets for air-conditioning or ventilating equipment	75	75	75
5. Flammable liquids (above ground and vent or fill openings if below ground) (see 513 and 514)	50	75	100
6. Between stationary liquefied hydrogen containers	5	5	5
7. Flammable gas storage	50	75	100
8. Liquid oxygen storage and other oxidizers (see 513 and 514)	100	100	100
9. Combustible solids	50	75	100
10. Open flames, smoking, and welding	50	50	50
11. Concentrations of people†	75	75	75

* Refer to Standard Types of Building Construction, NFPA No. 220-1969 for definitions of various types of construction.

† In congested areas such as offices, lunchrooms, locker rooms, time-clock areas,

electrical equipment and other sources of ignition including process or analytical equipment.

(c) Be located 25 feet from concentrations of people.

(d) Be located 50 feet from intakes of ventilation and air-conditioning equipment or intakes of compressors.

(e) Be located 50 feet from storage of other flammable-gases or storage of oxidizing gases.

(f) Containers shall be protected against damage or injury due to falling objects or work activity in the area.

(g) Containers shall be firmly secured and stored in an upright position.

(h) Welding or cutting operations, and smoking shall be prohibited while hydrogen is in the room.

(i) The area shall be adequately ventilated. Safety relief devices on the containers shall be vented directly outdoors or to a suitable hood. See subparagraph (1)(iv)(b) of this paragraph and subdivision (i)(f) of this subparagraph.

(3) Design considerations at specific locations.

(i) Outdoor locations.

(a) Outdoor location shall mean outside of any building or structure, and includes locations under a weather shelter or canopy provided such locations are not enclosed by more than two walls set at right angles and are provided with vent space between the walls and vented roof or canopy.

(b) Roadways and yard surfaces located below liquefied hydrogen piping, from which liquid air may drip, shall be constructed of noncombustible materials.

(c) If protective walls are provided, they shall be constructed of noncombustible materials and in accordance with the provisions of subdivision (a) of this subdivision as applicable.

(d) Electrical wiring and equipment shall comply with subparagraph (1)(ix)(a) and (b) of this paragraph.

(e) Adequate lighting shall be provided for nighttime transfer operation.

(ii) Separate buildings.

(a) Separate buildings shall be of light noncombustible construction on a substantial frame. Walls and roofs shall be lightly fastened and designed to relieve

STANDARDS AND INTERPRETATIONS

at a maximum internal pressure of 25 pounds per square foot. Windows shall be of shatterproof glass or plastic in metal frames. Doors shall be located in such a manner that they will be readily accessible to personnel in an emergency.

(b) Adequate ventilation to the outdoors shall be provided. Inlet openings shall be located near the floor level in exterior walls only. Outlet openings shall be located at the high point of the room in exterior walls or roof. Both the inlet and outlet vent openings shall have a minimum total area of 1 square foot per 1,000 cubic feet of room volume. Discharge from outlet openings shall be directed or conducted to a safe location.

(c) There shall be no sources of ignition.

(d) Electrical wiring and equipment shall comply with subparagraph (1)(ix)(a) and (b) of this paragraph except that the provisions of subparagraph (1)(ix)(b) of this paragraph shall apply to all electrical wiring and equipment in the separate building.

(e) Heating, if provided, shall be by steam, hot water, or other indirect means.

(iii) **Special rooms.**

(a) Floors, walls, and ceilings shall have a fire resistance rating of at least 2 hours. Walls or partitions shall be continuous from floor to ceiling and shall be securely anchored. At least one wall shall be an exterior wall. Openings to other parts of the building shall not be permitted. Windows and doors shall be in exterior walls and doors shall be located in such a manner that they will be accessible in an emergency. Windows shall be of shatterproof glass or plastic in metal frames.

(b) Ventilation shall be as provided in subdivision (ii)(b) of this subparagraph.

(c) Explosion venting shall be provided in exterior walls or roof only. The vent-

ing area shall be equal to not less than 1 square foot per 30 cubic feet of room volume and may consist of any one or any combination of the following: walls of light noncombustible material; lightly fastened hatch covers; lightly fastened swinging doors opening outward in exterior walls; lightly fastened walls or roofs designed to relieve at a maximum pressure of 25 pounds per square foot.

(d) There shall be no sources of ignition.

(e) Electrical wiring and equipment shall comply with subparagraph (1)(ix)(a) and (b) of this paragraph except that the provision of subparagraph (1)(ix)(b) of this paragraph shall apply to all electrical wiring and equipment in the special room.

(f) Heating, if provided, shall be steam, hot water, or by other indirect means.

(4) **Operating instructions.**

(i) **Written instructions.** For installation which require any operation of equipment by the user, legible instructions shall be maintained at operating locations.

(ii) **Attendant.** A qualified person shall be in attendance at all times while the mobile hydrogen supply unit is being unloaded.

(iii) **Security.** Each mobile liquefied hydrogen supply unit used as part of a hydrogen system shall be adequately secured to prevent movement.

(iv) **Grounding.** The mobile liquefied hydrogen supply unit shall be grounded for static electricity.

(5) **Maintenance.** The equipment and functioning of each charged liquified hydrogen system shall be maintained in a safe operating condition in accordance with the requirements of this section. Weeds or similar combustibles shall not be permitted within 25 feet of any liquified hydrogen equipment.

[39 F.R. 9957, March 10, 1974.]

1910.104—Oxygen

(a) Scope.

This section applies to the installation of bulk oxygen systems on industrial and institutional consumer premises. This section does not apply to oxygen manufacturing plants or other establishments operated by the oxygen supplier or his agent for the purpose of storing oxygen and refilling portable containers, trailers, mobile supply trucks, or tank cars, nor to systems having capacities less than those stated in paragraph (b)(1) of this section.

(b) Bulk oxygen systems.

(1) **Definition.** As used in this section: A bulk oxygen system is an assembly of equipment, such as oxygen storage containers, pressure regulators, safety devices, vaporizers, manifolds, and interconnecting piping, which has storage capacity of more than 13,000 cubic feet of oxygen, Normal Temperature and Pressure (NTP), connected in service or ready for service, or more than 25,000 cubic feet of oxygen (NTP) including unconnected reserves on hand at the site. The bulk oxygen system terminates at the point where oxygen at service pressure first enters the supply line. The oxygen containers may be stationary or movable, and the oxygen may be stored as gas or liquid.

(2) Location.

(i) **General.** Bulk oxygen storage systems shall be located above ground out of doors, or shall be installed in a building of non-combustible construction, adequately vented, and used for that purpose exclusively. The location selected shall be such that containers and associated equipment shall not be exposed by electric power lines, flammable or combustible liquid lines, or flammable gas lines.

(ii) **Accessibility.** The system shall be located so that it is readily accessible to mobile supply equipment at ground level and to authorized personnel.

(iii) **Leakage.** Where oxygen is stored as a liquid, noncombustible surfacing shall be provided in an area in which any leakage of liquid oxygen might fall during operation of the system and filling of a storage container. For purposes of this paragraph, asphaltic or bituminous paving is considered to be combustible.

(iv) **Elevation.** When locating bulk oxygen systems near above-ground flammable or combustible liquid storage which may be either indoors or outdoors, it is advisable to locate the system on ground higher than the flammable or combustible liquid storage.

(v) **Dikes.** Where it is necessary to locate a bulk oxygen system on ground lower than adjacent flammable or combustible liquid storage suitable means shall be taken (such as by diking, diversion curbs, or grading) with respect to the adjacent flammable or combustible liquid storage to prevent accumulation of liquids under the bulk oxygen system.

(3) Distance between systems and exposures.

(i) **General.** The minimum distance from any bulk oxygen storage container to exposures, measured in the most direct line except as indicated in subdivisions (vi) and (viii) of this subparagraph, shall be as indicated in subdivisions (ii) to (xviii) of this subparagraph inclusive.

(ii) **Combustible structures.** Fifty feet from any combustible structures.

(iii) **Fire resistive structures.** Twenty-five feet from any structures with fire-resistive exterior walls or sprinklered buildings of other construction, but not less than one-half the height of adjacent side wall of the structure.

(iv) **Openings.** At least 10 feet from any opening in adjacent walls of fire resistive structures. Spacing from such structures shall be adequate to permit maintenance, but shall not be less than 1 foot.

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(v) Flammable liquid storage aboveground.

	Distance (feet)	Capacity (gallons)
50		0-1000
90		1001 or more

(vi) Flammable liquid storage belowground.

Distance measured horizontally from oxygen storage container to flammable liquid tank (feet)	Distance from oxygen storage container to filling and vent connections or openings to flammable liquid tank (feet)	Capacity (gallons)
15	50	0-1000
30	50	1001 or more

(vii) Combustible liquid storage aboveground.

Distance (feet)	Capacity (gallons)
25	0-1000
50	1001 or more

(viii) Combustible liquid storage belowground.

Distance measured horizontally from oxygen storage container to combustible liquid tank (feet)	Distance from oxygen storage container to filling and vent connections or openings to combustible liquid tank (feet)
15	40

(ix) Flammable gas storage. (Such as compressed flammable gases, liquefied flammable gases and flammable gases in low pressure gas holders):

Distance (feet)	Capacity (cu. ft. NTP)
50	Less than 5000
90	5000 or more

(x) Highly combustible materials. Fifty feet from solid materials which burn rapidly, such as excelsior or paper.

(xi) Slow-burning materials. Twenty-five feet from solid materials which burn slowly, such as coal and heavy timber.

(xii) Ventilation. Seventy-five feet in one direction and 35 feet in approximately 90° direction from confining walls (not including firewalls less than 20 feet high) to provide adequate ventilation in courtyards and similar confining areas.

(xiii) Congested areas. Twenty-five feet from congested areas such as offices, lunchrooms, locker rooms, time clock areas, and similar locations where people may congregate.

(xiv) thru (xvii) Revoked

(xviii) Exceptions. The distances in subdivisions (ii), (iii), (v) to (xi) inclusive,

of this subparagraph do not apply where protective structures such as firewalls of adequate height to safeguard the oxygen storage systems are located between the bulk oxygen storage installation and the exposure. In such cases, the bulk oxygen storage installation may be a minimum distance of 1 foot from the firewall.

(4) Storage containers.

(i) Foundations and supports. Permanently installed containers shall be provided with substantial noncombustible supports on firm noncombustible foundations.

(ii) Construction—liquid. Liquid oxygen storage containers shall be fabricated from materials meeting the impact test requirements of paragraph UG-84 of ASME Boiler and Pressure Vessel Code, Section VIII—Unfired Pressure Vessels—1968. Containers operating at pressures above 15 pounds per square inch gage (p.s.i.g.) shall be designed, constructed, and tested in accordance with appropriate requirements of ASME Boiler and Pressure Vessel Code, Section VIII—Unfired Pressure Vessels—1968. Insulation surrounding the liquid oxygen container shall be noncombustible.

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(ii) Class IB shall include liquids having flashpoints below 73°F. (22.8°C.) and having a boiling point at or above 100°F. (37.8°C.).

(iii) Class IC shall include liquids having flashpoints at or above 73°F. (22.8°C.) and below 100°F. (37.8°C.).

[38 F.R. 27047, Sept. 28, 1973.]

(20) Unstable (reactive) liquid shall mean a liquid which in the pure state or as commercially produced or transported will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure, or temperature.

(21) Low-pressure tank shall mean a storage tank which has been designed to operate at pressures above 0.5 p.s.i.g. but not more than 15 p.s.i.g.

(22) Marine service station shall mean that portion of a property where flammable or combustible liquids used as fuels are stored and dispensed from fixed equipment on shore, piers, wharves, or floating docks into the fuel tanks of self-propelled craft, and shall include all facilities used in connection therewith.

(23) Mercantile occupancy shall mean the occupancy or use of a building or structure or any portion thereof for the displaying, selling, or buying of goods, wares, or merchandise.

(24) Office occupancy shall mean the occupancy or use of a building or structure or any portion thereof for the transaction of business, or the rendering or receiving of professional services.

(25) Portable tank shall mean a closed container having a liquid capacity over 60 U.S. gallons and not intended for fixed installation.

(26) Pressure vessel shall mean a storage tank or vessel which has been designed to operate at pressures above 15 p.s.i.g.

(27) Protection for exposure shall mean adequate fire protection for structures on prop-

erty adjacent to tanks, where there are employees of the establishment.

[39 F.R. 9957, March 15, 1974.]

(28) Refinery shall mean a plant in which flammable or combustible liquids are produced on a commercial scale from crude petroleum, natural gasoline, or other hydrocarbon sources.

(29) Safety can shall mean an approved container, of not more than 5 gallons capacity, having a spring-closing lid and spout cover and so designed that it will safely relieve internal pressure when subjected to fire exposure.

(30) Vapor pressure shall mean the pressure, measured in pounds per square inch (absolute) exerted by a volatile liquid as determined by the "Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method)," American Society for Testing and Materials ASTM D323-68.

(31) Ventilation as specified in this section is for the prevention of fire and explosion. It is considered adequate if it is sufficient to prevent accumulation of significant quantities of vapor-air mixtures in concentration over one-fourth of the lower flammable limit.

(32) Storage: Flammable or combustible liquids shall be stored in a tank or in a container that complies with paragraph (d)(2) of this section.

(33) Barrel shall mean a volume of 42 U.S. gallons.

(34) Container shall mean any can, barrel, or drum.

(35) Approved unless otherwise indicated, approved, or listed by at least one of the following nationally recognized testing laboratories: Underwriters' Laboratories, Inc.; Factory Mutual Engineering Corp.

(36) Listed see "approved" in § 1910.106(a)(35).

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(37) "SUS" means Saybolt Universal Seconds as determined by the Standard Method of Test for Saybolt Viscosity (ASTM D-88-56), and may be determined by use of the SUS conversion tables specified in ASTM Method D2161-66 following determination of viscosity in accordance with the procedures specified in the Standard Method of Test for Viscosity of Transparent and Opaque Liquids (ASTM D445-65).

(38) "Viscous" means a viscosity of 45 SUS or more.

[38 F.R. 27047, Sept. 28, 1973.]

(b) Tank storage.

(1) Design and construction of tanks.

(i) Materials.

(a) Tanks shall be built of steel except as provided in (b) through (e) of this subdivision.

(b) Tanks may be built of materials other than steel for installation underground or if required by the properties of the liquid stored. Tanks located above ground or inside buildings shall be of noncombustible construction.

(c) Tanks built of materials other than steel shall be designed to specifications embodying principles recognized as good engineering design for the material used.

(d) Unlined concrete tanks may be used for storing flammable or combustible liquids having a gravity of 40° API or heavier. Concrete tanks with special lining may be used for other services provided the design is in accordance with sound engineering practice.

(e) Revoked

(f) Special engineering consideration shall be required if the specific gravity

of the liquid to be stored exceeds that of water or if the tanks are designed to contain flammable or combustible liquids at a liquid temperature below 0° F.

(ii) Fabrication.

(a) Revoked

(b) Metal tanks shall be welded, riveted, and caulked, brazed, or bolted, or constructed by use of a combination of these methods. Filler metal used in brazing shall be nonferrous metal or an alloy having a melting point above 1000° F. and below that of the metal joined.

(iii) Atmospheric tanks.

(a) Atmospheric tanks shall be built in accordance with acceptable good standards of design. Atmospheric tanks may be built in accordance with:

(1) Underwriters' Laboratories, Inc., Subjects No. 142, Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids, 1968; No. 58, Standard for Steel Underground Tanks for Flammable and Combustible Liquids, Fifth Edition, December 1961; or No. 80, Standard for Steel Inside Tanks for Oil-Burner Fuel, September 1963.

(2) American Petroleum Institute Standards No. 12A, Specification for Oil Storage Tanks with Riveted Shells, Seventh Edition, September 1951, or No. 650, Welded Steel Tanks for Oil Storage, Third Edition, 1966.

(3) American Petroleum Institute Standards No. 12B, Specification for Bolted Production Tanks, Eleventh Edition, May 1958, and Supplement 1, March 1962; No. 12D, Specification for Large Welded Production Tanks, Seventh Edition, August 1957; or No. 12F, Specification for Small Welded Production Tanks, Fifth Edition, March 1961. Tanks built in accordance

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with these standards shall be used only as production tanks for storage of crude petroleum in oil-producing areas.

(b) Tanks designed for underground service not exceeding 2,500 gallons capacity may be used aboveground.

(c) Low-pressure tanks and pressure vessels may be used as atmospheric tanks.

(d) Atmospheric tanks shall not be used for the storage of a flammable or combustible liquid at a temperature at or above its boiling point.

(iv) Low pressure tanks.

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

(b) Low-pressure tanks shall be built in accordance with acceptable standards of design. Low-pressure tanks may be built in accordance with:

(1) American Petroleum Institute Standard No. 620, Recommended Rules for the Design and Construction of Large, Welded, Low-Pressure Storage Tanks, Third Edition, 1966.

(2) The principles of the Code for Unfired Pressure Vessels, Section VIII of the ASME Boiler and Pressure Vessels Code, 1968.

(c) Atmospheric tanks built according to Underwriters' Laboratories, Inc., requirements in subdivision (iii)(a) of this subparagraph may be used for operating pressures not exceeding 1 p.s.i.g. and shall be limited to 2.5 p.s.i.g. under emergency venting conditions.

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

(v) Pressure vessels.

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

(b) Pressure vessels shall be built in accordance with the Code for Unfired Pressure Vessels, Section VIII of the ASME Boiler and Pressure Vessel Code, 1968.

(vi) Provisions for internal corrosion. When tanks are not designed in accordance with the American Petroleum Institute, American Society of Mechanical Engineers, or the Underwriters' Laboratories, Inc.'s, standards, or if corrosion is anticipated beyond that provided for in the design formulas used, additional metal thickness or suitable protective coatings or linings shall be provided to compensate for the corrosion loss expected during the design life of the tank.

(2) Installation of outside aboveground tanks.

(i) Location with respect to property lines and public ways. Revoked

(ii) Spacing (shell-to-shell) between above-ground tanks.

(a) The distance between any two flammable or combustible liquid storage tanks shall not be less than 3 feet.

(b) Except as provided in subdivision (c) of this subdivision, the distance between any two adjacent tanks shall not be less than one-sixth the sum of their diameters. When the diameter of one tank is less than one-half the diameter of the adjacent tank, the distance between the two tanks shall not be less than one-half the diameter of the smaller tank.

(c) Where crude petroleum in conjunction with production facilities are located in noncongested areas and have capacities not exceeding 126,000 gallons (3,000 barrels), the distance between such tanks shall not be less than 3 feet.

(d) Where unstable flammable or combustible liquids are stored, the distance between such tanks shall not be less than one-half the sum of their diameters.

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(e). When tanks are compacted in three or more rows or in an irregular pattern, greater spacing or other means shall be provided so that inside tanks are accessible for firefighting purposes.

(f) The minimum separation between a liquefied petroleum gas container and a flammable or combustible liquid storage tank shall be 20 feet, except in the case of flammable or combustible liquid tanks operating at pressures exceeding 2.5 p.s.i.g. or equipped with emergency venting which will permit pressures to exceed 2.5 p.s.i.g. in which case the provisions of subdivisions (a) and (b) of this subdivision shall apply. Suitable means shall be taken to prevent the accumulation of flammable or combustible liquids under adjacent liquefied petroleum gas containers such as by diversion curbs or grading. When flammable or combustible liquid storage tanks are within a diked area, the liquefied petroleum gas containers shall be outside the diked area and at least 10 feet away from the centerline of the wall of the diked area. The foregoing provisions shall not apply when liquefied petroleum gas containers of 125 gallons or less capacity are installed adjacent to fuel oil supply tanks of 550 gallons or less capacity.

(iii) Location of outside aboveground tanks with respect to important buildings on same property.

Revoked

(iv) Normal venting for aboveground tanks.

(a) Atmospheric storage tanks shall be adequately vented to prevent the development of vacuum or pressure sufficient to distort the roof of a cone roof tank or exceeding the design pressure in the case of other atmospheric tanks, as a result of filling or emptying, and atmospheric temperature changes.

(b) Normal vents shall be sized either in accordance with:

(1) The American Petroleum Institute Standard 2000 (1968), Venting Atmospheric and Low-Pressure Storage Tanks; or

(2) Other accepted standard; or

(3) Shall be at least as large as the filling or withdrawal connection, whichever is larger but in no case less than 1¼ inch nominal inside diameter.

(c) Low-pressure tanks and pressure vessels shall be adequately vented to prevent development of pressure or vacuum, as a result of filling or emptying and atmospheric temperature changes, from exceeding the design pressure of the tank or vessel. Protection shall also be provided to prevent overpressure from any pump discharging into the tank or vessel when the pump discharge pressure can exceed the design pressure of the tank or vessel.

(d) If any tank or pressure vessel has more than one fill or withdrawal connec-

Pages 181 thru 182 deleted

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(vii) Drainage, dikes, and walls for aboveground tanks.

INTERP

(a) **Drainage and diked areas.** The area surrounding a tank or a group of tanks shall be provided with drainage as in subdivision (b) of this subdivision, or shall be diked as provided in subdivision (c) of this subdivision, to prevent accidental discharge of liquid from endangering adjoining property or reaching waterways.

(b) **Drainage.** Where protection of adjoining property or waterways is by means of a natural or manmade drainage system, such systems shall comply with the following:

(1) Revoked

(2) The drainage system shall terminate in vacant land or other area or in an impounding basin having a capacity not smaller than that of the largest tank served. This termination area and the route of the drainage system shall be so located that, if the flammable or combustible liquids in the drainage system are ignited, the fire will not seriously expose tanks or adjoining property.

(3) Revoked

(c) **Diked areas.** Where protection of adjoining property or waterways is accomplished by retaining the liquid around the tank by means of a dike, the volume of the diked area shall comply with the following requirements:

(1) Except as provided in subdivision (2) of this subdivision, the volumetric capacity of the diked area shall not

be less than the greatest amount of liquid that can be released from the largest tank within the diked area, assuming a full tank. The capacity of the diked area enclosing more than one tank shall be calculated by deducting the volume of the tanks other than the largest tank below the height of the dike.

(2) For a tank or group of tanks with fixed roofs containing crude petroleum with boilover characteristics, the volumetric capacity of the diked area shall be not less than the capacity of the largest tank served by the enclosure, assuming a full tank. The capacity of the diked enclosure shall be calculated by deducting the volume below the height of the dike of all tanks within the enclosure.

(3) Walls of the diked area shall be of earth, steel, concrete or solid masonry designed to be liquidtight and to withstand a full hydrostatic head. Earthen walls 3 feet or more in height shall have a flat section at the top not less than 2 feet wide. The slope of an earthen wall shall be consistent with the angle of repose of the material of which the wall is constructed.

(4) The walls of the diked area shall be restricted to an average height of 6 feet above interior grade.

NOTE

(5) Revoked

(6) No loose combustible material, empty or full drum or barrel, shall be permitted within the diked area.

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(viii) Tank openings other than vents for above-ground tanks.

(a) thru (c) Revoked

(d) Openings for gaging shall be provided with a vaportight cap or cover.

(e) For Class IB and Class IC liquids other than crude oils, gasolines, and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity. A fill pipe entering the top of a tank shall terminate within 6 inches of the bottom of the tank and shall be installed to avoid excessive vibration.

(f) Filling and emptying connections which are made and broken shall be located outside of buildings at a location free from any source of ignition and not less than 5 feet away from any building opening. Such connection shall be closed and liquidtight when not in use. The connection shall be properly identified.

(3) Installation of underground tanks.

(i) **Location.** Excavation for underground storage tanks shall be made with due care

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the liquid level, except for connections used for emergency disposal, to prevent continued flow in the event of fire in the vicinity of the tank. This function may be incorporated in the valve required in (b) of this subdivision, and if a separate valve, shall be located adjacent to the valve required in (b) of this subdivision.

(d) Openings for manual gaging, if independent of the fill pipe (see (f) of this subdivision), shall be provided with a vaportight cap or cover. Each such opening shall be protected against liquid overflow and possible vapor release by means of a spring loaded check valve or other approved device.

(e) For Class IB and Class IC liquids other than crude oils, gasolines, and asphalts, the fill pipe shall be so designed and installed as to minimize the possibility of generating static electricity by terminating within 6 inches of the bottom of the tank.

(f) The fill pipe inside of the tank shall be installed to avoid excessive vibration of the pipe.

(g) The inlet of the fill pipe shall be located outside of buildings at a location free from any source of ignition and not less than 5 feet away from any building opening. The inlet of the fill pipe shall be closed and liquidtight when not in use. The fill connection shall be properly identified.

(h) Tanks inside buildings shall be equipped with a device, or other means shall be provided, to prevent overflow into the building.

(5) Supports, foundations, and anchorage for all tank locations.

(i) **General.** Tank supports shall be installed on firm foundations. Tank supports shall be of concrete, masonry, or protected steel. Single wood timber supports (not cribbing) laid horizontally may be used for outside aboveground tanks if not

more than 12 inches high at their lowest point.

(ii) **Fire resistance.** Steel supports or exposed piling shall be protected by materials having a fire resistance rating of not less than 2 hours, except that steel saddles need not be protected if less than 12 inches high at their lowest point. Water spray protection or its equivalent may be used in lieu of fire-resistive materials to protect supports.

(iii) **Spheres.** The design of the supporting structure for tanks such as spheres shall receive special engineering consideration.

(iv) **Load distribution.** Every tank shall be so supported as to prevent the excessive concentration of loads on the supporting portion of the shell.

(v) **Foundations.** Tanks shall rest on the ground or on foundations made of concrete, masonry, piling, or steel. Tank foundations shall be designed to minimize the possibility of uneven settling of the tank and to minimize corrosion in any part of the tank resting on the foundation.

(vi) **Flood areas.** Where a tank is located in an area that may be subjected to flooding, the applicable precautions outlined in this subdivision shall be observed.

(a) No aboveground vertical storage tank containing a flammable or combustible liquid shall be located so that the allowable liquid level within the tank is below the established maximum flood stage, unless the tank is provided with a guiding structure such as described in (m), (n), and (o) of this subdivision.

(b) Independent water supply facilities shall be provided at locations where there is no ample and dependable public water supply available for loading partially empty tanks with water.

(c) In addition to the preceding requirements, each tank so located that more than 70 percent, but less than 100 percent, of its allowable liquid storage

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capacity will be submerged at the established maximum flood stage, shall be safeguarded by one of the following methods: Tank shall be raised, or its height shall be increased, until its top extends above the maximum flood stage a distance equivalent to 30 percent or more of its allowable liquid storage capacity: *Provided, however,* That the submerged part of the tank shall not exceed two and one-half times the diameter. Or, as an alternative to the foregoing, adequate noncombustible structural guides, designed to permit the tank to float vertically without loss of product, shall be provided.

(d) Each horizontal tank so located that more than 70 percent of its storage capacity will be submerged at the established flood stage, shall be anchored, attached to a foundation of concrete or of steel and concrete, of sufficient weight to provide adequate load for the tank when filled with flammable or combustible liquid and submerged by flood waters to the established flood stage, or adequately secured by other means.

(e) Revoked

(f) At locations where there is no ample and dependable water supply, or where filling of underground tanks with liquids is impracticable because of the character of their contents, their use, or for other reasons, each tank shall be safeguarded against movement when empty and submerged by high ground water or flood waters by anchoring, weighting with concrete or other approved solid loading material, or securing by other means. Each such tank shall be so constructed and installed that it will safely resist external pressures due to high ground water or flood waters.

(g) At locations where there is an ample and dependable water supply available, underground tanks containing flammable or combustible liquids, so in-

stalled that more than 70 percent of their storage capacity will be submerged at the maximum flood stage, shall be so anchored, weighted, or secured by other means, as to prevent movement of such tanks when filled with flammable or combustible liquids, and submerged by flood waters to the established flood stage.

(h) Pipe connections below the allowable liquid level in a tank shall be provided with valves or cocks located as closely as practicable to the tank shell. Such valves and their connections to tanks shall be of steel or other material suitable for use with the liquid being stored. Cast iron shall not be permitted.

(i) At locations where an independent water supply is required, it shall be entirely independent of public power and water supply. Independent source of water shall be available when flood waters reach a level not less than 10 feet below the bottom of the lowest tank on a property.

(j) The self-contained power and pumping unit shall be so located or so designed that pumping into tanks may be carried on continuously throughout the rise in flood waters from a level 10 feet below the lowest tank to the level of the potential flood stage.

(k) Capacity of the pumping unit shall be such that the rate of rise of water in all tanks shall be equivalent to the established potential average rate of rise of flood waters at any stage.

(l) Each independent pumping unit shall be tested periodically to insure that it is in satisfactory operating condition.

(m) Structural guides for holding floating tanks above their foundations shall be so designed that there will be no resistance to the free rise of a tank, and shall be constructed of noncombustible material.

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(ii) **Fire resistance.** Storage cabinets shall be designed and constructed to limit the internal temperature to not more than 325° F. when subjected to a 10-minute fire test using the standard time-temperature curve as set forth in Standard Methods of Fire Tests of Building Construction and Materials, NFPA 251-1969. All joints and seams shall remain tight and the door shall remain securely closed during the fire test. Cabinets shall be labeled in conspicuous lettering, "Flammable—Keep Fire Away."

(a) Metal cabinets constructed in the following manner shall be deemed to be in compliance. The bottom, top, door, and sides of cabinet shall be at least No. 18 gage sheet iron and double walled with 1½-inch air space. Joints shall be riveted, welded or made tight by some equally effective means. The door shall be provided with a three-point lock, and the door sill shall be raised at least 2 inches above the bottom of the cabinet.

(b) Wooden cabinets constructed in the following manner shall be deemed in compliance. The bottom, sides, and top shall be constructed of an approved grade of plywood at least 1 inch in thickness, which shall not break down or delaminate under fire conditions. All joints shall be rabbetted and shall be fastened in two directions with flathead wood screws. When more than one door is used, there shall be a rabbetted overlap of not less than 1 inch. Hinges shall be mounted in such a manner as not to lose their holding capacity due to loosening or burning out of the screws when subjected to the fire test.

(4) Design and construction of inside storage rooms.

(i) **Construction.** Inside storage rooms shall be constructed to meet the required fire-resistive rating for their use. Such construction shall comply with the test specifications set forth in Standard Methods of Fire Tests of Building Construction and Materials, NFPA 251-1969. Where an automatic sprinkler system is provided, the system shall be designed

and installed in an acceptable manner. Openings to other rooms or buildings shall be provided with noncombustible liquid-tight raised sills or ramps at least 4 inches in height, or the floor in the storage area shall be at least 4 inches below the surrounding floor. Openings shall be provided with approved self-closing fire doors. The room shall be liquid-tight where the walls join the floor. A permissible alternate to the sill or ramp is an open-grated trench inside of the room which drains to a safe location. Where other portions of the building or other properties are exposed, windows shall be protected as set forth in the Standard for Fire Doors and Windows, NFPA No. 80-1968, for Class E or F openings. Wood at least 1 inch nominal thickness may be used for shelving, racks, dunnage, scuffboards, floor overlay, and similar installations.

(ii) **Rating and capacity.** Storage in inside storage rooms shall comply with Table H-13.

TABLE H-13—STORAGE IN INSIDE ROOMS

Fire protection* provided	Fire resistance	Maximum size	Total allowable quantities (gals./sq. ft./ floor area)
Yes.....	2 hours.....	500 sq. ft.....	10
No.....	2 hours.....	500 sq. ft.....	4
Yes.....	1 hour.....	150 sq. ft.....	5
No.....	1 hour.....	150 sq. ft.....	2

*Fire protection system shall be sprinkler, water spray, carbon dioxide, or other system.

(iii) **Wiring.** Electrical wiring and equipment located in inside storage rooms used for Class I liquids shall be approved under subpart S of this part for Class I, Division 2 Hazardous Locations; for Class II and Class III liquids, shall be approved for general use.

(iv) **Ventilation.** Every inside storage room shall be provided with either a gravity or a mechanical exhaust ventilation system. Such system shall be designed to

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provide for a complete change of air within the room at least six times per hour. If a mechanical exhaust system is used, it shall be controlled by a switch located outside of the door. The ventilating equipment and any lighting fixtures shall be operated by the same switch. A pilot light shall be installed adjacent to the switch if Class I flammable liquids are dispensed within the room. Where gravity ventilation is provided, the fresh air intake, as well as the exhaust outlet from the room, shall be on the exterior of the building in which the room is located.

(v) **Storage in inside storage rooms.** In every inside storage room there shall be maintained one clear aisle at least 3 feet wide. Containers over 30 gallons capacity shall not be stacked one upon the other. Dispensing shall be by approved pump or self-closing faucet only.

(5) Storage inside building.

(i) **Egress.** Flammable or combustible liquids, including stock for sale, shall not be stored so as to limit use of exits, stairways, or areas normally used for the safe egress of people.

(ii) **Containers.** The storage of flammable or combustible liquids in containers or portable tanks shall comply with subdivisions (iii) through (v) of this subparagraph.

(iii) **Office occupancies.** Storage shall be prohibited except that which is required for maintenance and operation of building and operation of equipment. Such storage shall be kept in closed metal containers stored in a storage cabinet or in safety cans or in an inside storage room not having a door that opens into that portion of the building used by the public.

(iv) **Mercantile occupancies and other retail stores.**

(a) thru (d) Revoked

(e) Leaking containers shall be removed to a storage room or taken to a safe location outside the building and the contents transferred to an undamaged container.

(v) **General purpose public warehouses.** Storage shall be in accordance with Table H-14 or H-15 and in buildings or in portions of such buildings cut off by standard firewalls. Material creating no fire exposure hazard to the flammable or combustible liquids may be stored in the same area.

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TABLE II-14--INDOOR CONTAINER STORAGE

Class liquid	Storage level	Protected storage maximum per pile	Unprotected storage maximum per pile
		Gallons	Gallons
IA.....	Ground and upper floors.....	2,750 (50)	660 (12)
	Basement.....	Not permitted	Not permitted
IB.....	Ground and upper floors.....	5,500 (100)	1,375 (25)
	Basement.....	Not permitted	Not permitted
IC.....	Ground and upper floors.....	16,500 (300)	4,125 (75)
	Basement.....	Not permitted	Not permitted
II.....	Ground and upper floors.....	16,500 (300)	4,125 (75)
	Basement.....	5,500 (100)	Not permitted
III.....	Ground and upper floors.....	55,000 (1,000)	13,750 (250)
	Basement.....	8,250 (450)	Not permitted

NOTE 1: When 2 or more classes of materials are stored in a single pile, the maximum gallonage permitted in that pile shall be the smallest of the 2 or more separate maximum gallonages.

NOTE 2: Aisles shall be provided so that no container is more than 12 ft. from an aisle. Main aisles shall be at least 8 ft. wide and side aisles at least 4 ft. wide.

(Numbers in parentheses indicate corresponding number of 55-gal. drums.)

NOTE 3: Each pile shall be separated from each other by at least 4 ft.

TABLE II-15--INDOOR PORTABLE TANK STORAGE

Class liquid	Storage level	Protected storage maximum per pile	Unprotected storage maximum per pile
		Gallons	Gallons
IA.....	Ground and upper floors.....	Not permitted	Not permitted
	Basement.....	Not permitted	Not permitted
IB.....	Ground and upper floors.....	20,000	2,000
	Basement.....	Not permitted	Not permitted
IC.....	Ground and upper floors.....	40,000	5,500
	Basement.....	Not permitted	Not permitted
II.....	Ground and upper floors.....	40,000	5,500
	Basement.....	20,000	Not permitted
III.....	Ground and upper floors.....	60,000	22,000
	Basement.....	20,000	Not permitted

NOTE 1: When 2 or more classes of materials are stored in a single pile, the maximum gallonage permitted in that pile shall be the smallest of the 2 or more separate maximum gallonages.

NOTE 2: Aisles shall be provided so that no portable tank is more than 12 ft. from an aisle. Main aisles shall be at least 8 ft. wide and side aisles at least 4 ft. wide.

NOTE 3: Each pile shall be separated from each other by at least 4 ft.

(vi) Flammable and combustible liquid warehouses or storage buildings.

(a) If the storage building is located 50 feet or less from a building or line of adjoining property that may be built upon, the exposing wall shall be a blank wall having a fire-resistance rating of at least 2 hours.

(b) The total quantity of liquids within a building shall not be restricted, but the arrangement of storage shall comply with Table H-14 or H-15.

(c) Containers in piles shall be separated by pallets or dunnage where necessary to provide stability and to prevent excessive stress on container walls.

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(d) Portable tanks stored over one tier high shall be designed to nest securely, without dunnage, and adequate materials handling equipment shall be available to handle tanks safely at the upper tier level.

(e) No pile shall be closer than 3 feet to the nearest beam, chord, girder, or other obstruction, and shall be 3 feet below sprinkler deflectors or discharge orifices of water spray, or other overhead fire protection systems.

(f) Aisles of at least 3 feet wide shall be provided where necessary for reasons of access to doors, windows or standpipe connections.

(6) Storage outside buildings.

(i) **General.** Storage outside buildings shall be in accordance with Table H-16 or H-17, and subdivisions (ii) and (iv) of this subparagraph.

TABLE H-16—OUTDOOR CONTAINER STORAGE

1	2	3	4	5
Class	Maximum per pile (see note 1)	Distance between piles (see note 2)	Distance to property line that can be built upon (see notes 3 and 4)	Distance to street, alley, public way (see note 4)
	gal.	ft.	ft.	ft.
IA.....	1,100	5	20	10
IB.....	2,200	5	20	10
IC.....	4,400	5	20	10
II.....	8,800	5	10	5
III.....	22,000	5	10	5

NOTE 1: When 2 or more classes of materials are stored in a single pile, the maximum gallonage in that pile shall be the smallest of the 2 or more separate gallonages.

NOTE 2: Within 200 ft. of each container, there shall be a 12-ft. wide access way to permit approach of fire control apparatus.

NOTE 3: The distances listed apply to properties that have protection for exposures as defined. If there are exposures, and such protection for exposures does not exist, the distances in column 4 shall be doubled.

NOTE 4: When total quantity stored does not exceed 50 percent of maximum per pile, the distances in columns 4 and 5 may be reduced 50 percent, but not less than 3 ft.

TABLE H-17—OUTDOOR PORTABLE TANK STORAGE

1	2	3	4	5
Class	Maximum per pile	Distance between piles	Distance to property line that can be built upon	Distance to street, alley, public way
	gal.	ft.	ft.	ft.
IA.....	2,200	5	20	10
IB.....	4,400	5	20	10
IC.....	8,800	5	20	10
II.....	17,600	5	10	5
III.....	44,000	5	10	5

NOTE 1: When 2 or more classes of materials are stored in a single pile, the maximum gallonage in that pile shall be the smallest of the 2 or more separate gallonages.

NOTE 2: Within 200 ft. of each portable tank, there shall be a 12-ft. wide access way to permit approach of fire control apparatus.

NOTE 3: The distances listed apply to properties that have protection for exposures as defined. If there are exposures, and such protection for exposures does not exist, the distances in column 4 shall be doubled.

NOTE 4: When total quantity stored does not exceed 50 percent of maximum per pile, the distances in columns 4 and 5 may be reduced 50 percent, but not less than 3 ft.

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(ii) **Maximum storage.** A maximum of 1,100 gallons of flammable or combustible liquids may be located adjacent to buildings located on the same premises and under the same management provided the provisions of subdivisions (a) and (b) of this subdivision are complied with.

(a) Revoked

(b) Where quantity stored exceeds 1,100 gallons, or provisions of subdivision (a) of this subdivision cannot be met, a minimum distance of 10 feet between buildings and nearest container of flammable or combustible liquid shall be maintained.

(iii) **Spill containment.** The storage area shall be graded in a manner to divert possible spills away from buildings or other exposures or shall be surrounded by a curb at least 6 inches high. When curbs are used, provisions shall be made for draining of accumulations of ground or rain water or spills of flammable or combustible liquids. Drains shall terminate at a safe location and shall be accessible to operation under fire conditions.

(iv) **Security.** The storage area shall be protected against tampering or trespassers where necessary and shall be kept free of weeds, debris and other combustible material not necessary to the storage.

(7) **Fire control**

(i) **Extinguishers.** Suitable fire control devices, such as small hose or portable fire extinguishers, shall be available at locations where flammable or combustible liquids are stored.

(a) At least one portable fire extinguisher having a rating of not less than 12-B units shall be located outside of, but not more than 10 feet from, the

door opening into any room used for storage.

(b) At least one portable fire extinguisher having a rating of not less than 12-B units must be located not less than 10 feet, nor more than 25 feet, from any Class I or Class II liquid storage area located outside of a storage room but inside a building.

(ii) **Sprinklers.** When sprinklers are provided, they shall be installed in accordance with § 1910.159.

[39 F.R. 9957, March 15, 1974.]

(iii) **Open flames and smoking.** Open flames and smoking shall not be permitted in flammable or combustible liquid storage areas.

(iv) **Water reactive materials.** Materials which will react with water shall not be stored in the same room with flammable or combustible liquids.

[38 F.R. 27047, Sept. 28, 1973.]

(e) **Industrial plants.**

(1) **Scope.**

(i) **Application.** This paragraph shall apply to those industrial plants where:

(a) The use of flammable or combustible liquids is incidental to the principal business, or

(b) Where flammable or combustible liquids are handled or used only in unit physical operations such as mixing, drying, evaporating, filtering, distillation, and similar operations which do not involve chemical reaction. This paragraph shall not apply to chemical plants, refineries or distilleries.

(ii) **Exceptions.** Where portions of such plants involve chemical reactions such as oxidation, reduction, halogenation, hydrogenation, alkylation, polymerization, and other chemical processes, those portions of the plant shall be in accordance with paragraph (h) of this section.

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(2) Incidental storage or use of flammable and combustible liquids.

(i) **Application.** This subparagraph shall be applicable to those portions of an industrial plant where the use and handling of flammable or combustible liquids is only incidental to the principal business, such as automobile assembly, construction of electronic equipment, furniture manufacturing, or other similar activities.

(ii) **Containers.** Flammable or combustible liquids shall be stored in tanks or closed containers.

(a) Except as provided in subdivisions (b) and (c) of this subdivision, all storage shall comply with paragraph (d)(3) or (4) of this section.

(b) The quantity of liquid that may be located outside of an inside storage room or storage cabinet in a building or in any one fire area of a building shall not exceed:

(1) 25 gallons of Class IA liquids in containers.

(2) 120 gallons of Class IB, IC, II, or III liquids in containers.

(3) 660 gallons of Class IB, IC, II, or III liquids in a single portable tank.

(c) Where large quantities of flammable or combustible liquids are necessary, storage may be in tanks which shall comply with the applicable requirements of paragraph (b) of this section.

(iii) **Separation and protection.** Areas in which flammable or combustible liquids are transferred from one tank or container to another container shall be separated from other operations in the building by adequate distance or by construction having adequate fire resistance. Drainage or other means shall be provided to control spills. Adequate natural or mechanical ventilation shall be provided.

(iv) Handling liquids at point of final use.

(a) Flammable liquids shall be kept in covered containers when not actually in use.

(b) Where flammable or combustible liquids are used or handled, except in closed containers, means shall be provided to dispose promptly and safely of leakage or spills.

(c) Class I liquids may be used only where there are no open flames or other sources of ignition within the possible path of vapor travel.

(d) Flammable or combustible liquids shall be drawn from or transferred into vessels, containers, or portable tanks within a building only through a closed piping system, from safety cans, by means of a device drawing through the top, or from a container or portable tanks by gravity through an approved self-closing valve. Transferring by means of air pressure on the container or portable tanks shall be prohibited.

(3) Unit physical operations.

(i) **Application.** This subparagraph shall be applicable in those portions of industrial plants where flammable or combustible liquids are handled or used in unit physical operations such as mixing, drying, evaporating, filtering, distillation, and similar operations which do not involve chemical change. Examples are plants compounding cosmetics, pharmaceuticals, solvents, cleaning fluids, insecticides, and similar types of activities.

(ii) **Location.** Industrial plants shall be located so that each building or unit of equipment is accessible from at least one side for firefighting and fire control purposes. Buildings shall be located with respect to lines of adjoining property which may be built upon as set forth in paragraph (h)(2)(i) and (ii) of this section except that the blank wall referred to in paragraph (h)(2)(ii) of this section shall

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have a fire resistance rating of at least 2 hours.

(iii) **Chemical processes.** Areas where unstable liquids are handled or small scale unit chemical processes are carried on shall be separated from the remainder of the plant by a fire wall of 2-hour minimum fire resistance rating.

(iv) **Drainage.**

(a) Emergency drainage systems shall be provided to direct flammable or combustible liquid leakage and fire protection water to a safe location. This may require curbs, scuppers, or special drainage systems to control the spread of fire; see paragraph (b)(2)(vii)(b) of this section.

(b) Emergency drainage systems, if connected to public sewers or discharged into public waterways, shall be equipped with traps or separators.

(c) Revoked

(v) **Ventilation.**

(a) Areas as defined in subdivision (i) of this subparagraph using Class I liquids shall be ventilated at a rate of not less than 1 cubic foot per minute per square foot of solid floor area. This shall be accomplished by natural or mechanical ventilation with discharge or exhaust to a safe location outside of the building. Provision shall be made for introduction of makeup air in such a manner as not to short circuit the ventilation. Ventilation shall be arranged to include all floor areas or pits where flammable vapors may collect.

(b) Equipment used in a building and the ventilation of the building shall be designed so as to limit flammable vapor-air mixtures under normal operating conditions to the interior of equipment,

and to not more than 5 feet from equipment which exposes Class I liquids to the air. Examples of such equipment are dispensing stations, open centrifuges, plate and frame filters, open vacuum filters, and surfaces of open equipment.

(vi) **Storage and handling.** The storage, transfer, and handling of liquid shall comply with paragraph (h)(4) of this section.

(4) **Tank vehicle and tank car loading and unloading.**

(i) Tank vehicle and tank car loading or unloading facilities shall be separated from aboveground tanks, warehouses, other plant buildings or nearest line of adjoining property which may be built upon by a distance of 25 feet for Class I liquids and 15 feet for Class II and Class III liquids measured from the nearest position of any fill stem. Buildings for pumps or shelters for personnel may be a part of the facility. Operations of the facility shall comply with the appropriate portions of paragraph (f)(3) of this section.

(5) **Fire control.**

(i) **Portable and special equipment.** Portable fire extinguishment and control equipment shall be provided in such quantities and types as are needed for the special hazards of operation and storage.

(ii) **Water supply.** Water shall be available in volume and at adequate pressure to supply water hose streams, foam-producing equipment, automatic sprinklers, or water spray systems as the need is indicated by the special hazards of operation, dispensing and storage.

(iii) **Special extinguishers.** Special extinguishing equipment such as that utilizing foam, inert gas, or dry chemical shall be provided as the need is indicated by the special hazards of operation dispensing and storage.

(iv) **Special hazards.** Where the need is indicated by special hazards of operation, flammable or combustible liquid processing equipment, major piping, and sup-

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porting steel shall be protected by approved water spray systems, deluge systems, approved fire-resistant coatings, insulation, or any combination of these.

(v) **Maintenance.** All plant fire protection facilities shall be adequately maintained and periodically inspected and tested to make sure they are always in satisfactory operating condition, and they will serve their purpose in time of emergency.

(6) Sources of ignition.

(i) **General.** Adequate precautions shall be taken to prevent the ignition of flammable vapors. Sources of ignition include but are not limited to open flames; lightning; smoking; cutting and welding; hot surfaces; frictional heat; static, electrical, and mechanical sparks; spontaneous ignition, including heat-producing chemical reactions; and radiant heat.

(ii) **Grounding.** Class I liquids shall not be dispensed into containers unless the nozzle and container are electrically interconnected. Where the metallic floorplate on which the container stands while filling is electrically connected to the fill stem or where the fill stem is bonded to the container during filling operations by means of a bond wire, the provisions of this section shall be deemed to have been complied with.

(7) Electrical.

(i) Equipment.

(a) All electrical wiring and equipment shall be installed according to the requirements of Subpart S of this part.

(b) Locations where flammable vapor-air mixtures may exist under normal operations shall be classified Class I, Division 1 according to the requirements of Subpart S of this part. For those pieces of equipment installed in accordance with subparagraph (3)(v)(b) of this paragraph, the Division 1 area

shall extend 5 feet in all directions from all points of vapor liberation. All areas within pits shall be classified Division 1 if any part of the pit is within a Division 1 or 2 classified area, unless the pit is provided with mechanical ventilation.

(c) Locations where flammable vapor-air mixtures may exist under abnormal conditions and for a distance beyond Division 1 locations shall be classified Division 2 according to the requirements of Subpart S of this part. These locations include an area within 20 feet horizontally, 3 feet vertically beyond a Division 1 area, and up to 3 feet above floor or grade level within 25 feet, if indoors, or 10 feet if outdoors, from any pump, bleeder, withdrawal fitting, meter, or similar device handling Class I liquids. Pits provided with adequate mechanical ventilation within a Division 1 or 2 area shall be classified Division 2. If Class II or Class III liquids only are handled, then ordinary electrical equipment is satisfactory though care shall be used in locating electrical apparatus to prevent hot metal from falling into open equipment.

(d) Where the provisions of subdivisions (a), (b), and (c), of this subdivision require the installation of electrical equipment suitable for Class I, Division 1 or Division 2 locations, ordinary electrical equipment including switchgear may be used if installed in a room or enclosure which is maintained under positive pressure with respect to the hazardous area. Ventilation makeup air shall be uncontaminated by flammable vapors.

(8) **Repairs to equipment.** Hot work, such as welding or cutting operations, use of spark-producing power tools, and chipping operations shall be permitted only under supervision of an individual in responsible charge. The individual in responsible charge shall make an inspection of the area to be sure that it is safe for the work to be done and that safe procedures will be followed for the work specified.

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trically interconnected. Where the metallic floorplate on which the container stands while filling is electrically connected to the fill stem or where the fill stem is bonded to the container during filling operations by means of a bond wire, the provisions of this section shall be deemed to have been complied with.

(4) Wharves.

(i) Definition, application. The term wharf shall mean any wharf, pier, bulkhead, or other structure over or contiguous to navigable water used in conjunction with a bulk plant, the primary function of which is the transfer of flammable or combustible liquid cargo in bulk between the bulk plant and any tank vessel, ship, barge, lighter boat, or other mobile floating craft; and this subparagraph shall apply to all such installations except Marine Service Stations as covered in paragraph (g) of this section.

(ii) Package cargo. Revoked

(iii) Location. Revoked

(iv) Design and construction. Substructure and deck shall be substantially designed for the use intended. Deck may employ any material which will afford the desired combination of flexibility, resistance to shock, durability, strength, and fire resistance. Heavy timber construction is acceptable.

(v) Tanks. Tanks used exclusively for ballast water or Class II or Class III liquids may be installed on suitably designed wharves.

(vi) Pumps. Loading pumps capable of building up pressures in excess of the safe working pressure of cargo hose or loading arms shall be provided with bypasses, relief valves, or other arrangement to protect the loading facilities against excessive pressure. Relief devices shall be tested at not more than yearly intervals to determine that they function satisfactorily at the pressure at which they are set.

(vii) Hoses and couplings. All pressure hoses and couplings shall be inspected at intervals appropriate to the service. The hose and couplings shall be tested with the hose extended and using the "inservice maximum operating pressures." Any hose showing material deteriorations, signs of leakage, or weakness in its carcass or at the couplings shall be withdrawn from service and repaired or discarded.

(viii) Piping and fittings. Piping, valves, and fittings shall be in accordance with paragraph (c) of this section, with the following exceptions and additions:

(a) Flexibility of piping shall be assured by appropriate layout and arrangement of piping supports so that motion of the wharf structure resulting from wave action, currents, tides, or the mooring of vessels will not subject the pipe to repeated strain beyond the elastic limit.

(b) Pipe joints depending upon the friction characteristics of combustible materials or grooving of pipe ends for mechanical continuity of piping shall not be used.

(c) Swivel joints may be used in piping to which hoses are connected, and for articulated swivel-joint transfer systems, provided that the design is such that the mechanical strength of the joint will not be impaired if the packing

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material should fail, as by exposure to fire.

(d) Piping systems shall contain a sufficient number of valves to operate the system properly and to control the flow of liquid in normal operation and in the event of physical damage.

(e) In addition to the requirements of subdivision (d) of this subdivision, each line conveying flammable liquids leading to a wharf shall be provided with a readily accessible block valve located on shore near the approach to the wharf and outside of any diked area. Where more than one line is involved, the valves shall be grouped in one location.

(f) Means of easy access shall be provided for cargo line valves located below the wharf deck.

(g) Pipelines on flammable or combustible liquids wharves shall be adequately bonded and grounded. If excessive stray currents are encountered, insulating joints shall be installed. Bonding and grounding connections on all pipelines shall be located on wharf-side of hose-riser insulating flanges, if used, and shall be accessible for inspection.

(h) Hose or articulated swivel-joint pipe connections used for cargo transfer shall be capable of accommodating the combined effects of change in draft and maximum tidal range, and mooring lines shall be kept adjusted to prevent the surge of the vessel from placing stress on the cargo transfer system.

(i) Hose shall be supported so as to avoid kinking and damage from chafing.

(ix) **Fire protection.** Suitable portable fire extinguishers with a rating of not less than 12-BC shall be located within 75 feet of those portions of the facility where fires are likely to occur, such as hose connections, pumps, and separator tanks.

(a) Where piped water is available, ready-connected fire hose in size appropriate for the water supply shall

be provided so that manifolds where connections are made and broken can be reached by at least one hose stream.

(b) Material shall not be placed on wharves in such a manner as to obstruct access to firefighting equipment, or important pipeline control valves.

(c) Where the wharf is accessible to vehicle traffic, an unobstructed roadway to the shore end of the wharf shall be maintained for access of firefighting apparatus.

(x) **Operations control.** Loading or discharging shall not commence until the wharf superintendent and officer in charge of the tank vessel agree that the tank vessel is properly moored and all connections are properly made. Mechanical work shall not be performed on the wharf during cargo transfer, except under special authorization based on a review of the area involved, methods to be employed, and precautions necessary.

(5) Electrical equipment.

(i) **Application.** This subparagraph shall apply to areas where Class I liquids are stored or handled. For areas where Class II or Class III liquids only are stored or handled, the electrical equipment may be installed in accordance with the provisions of subpart S of this part, for ordinary locations.

(ii) **Conformance.** All electrical equipment and wiring shall be of a type specified by and shall be installed in accordance with subpart S of this part.

(iii) **Classification.** So far as it applies Table H-18 shall be used to delineate and classify hazardous areas for the purpose of installation of electrical equipment under normal circumstances. In Table H-18 a classified area shall not extend beyond an unpierced wall, roof, or other solid partition. The area classifications listed shall be based on the premise that the installation meets the applicable requirements of this section in all respects.

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(3) [Revoked]

[39 F.R. 9957, March 15, 1974.]

(4) The dispensing hose does not exceed 50 feet in length.

(5) The dispensing nozzle is a listed automatic-closing type without a latch-open device.

(f) Class I liquids shall not be stored or handled within a building having a basement or pit into which flammable vapors may travel, unless such area is provided with ventilation designed to prevent the accumulation of flammable vapors therein.

(g) Accurate inventory records shall be maintained and reconciled on all Class I liquid storage tanks for possible indication of leakage from tanks or piping.

(ii) Special enclosures.

(a) When installation of tanks in accordance with paragraph (b)(3) of this section is impractical because of property or building limitations, tanks for flammable or combustible liquids may be installed in buildings if properly enclosed.

(b) The enclosure shall be substantially liquid and vaportight without backfill. Sides, top, and bottom of the enclosure shall be of reinforced concrete at least 6 inches thick, with openings for inspection through the top only. Tank connections shall be so piped or closed that neither vapors nor liquid can escape into the enclosed space. Means shall be provided whereby portable equipment may be employed to discharge to the outside any liquid or vapors which might accumulate should leakage occur.

(c) Revoked

(iii) Inside buildings.

(a) Except where stored in tanks as provided in subdivision (ii) of this subparagraph, no Class I liquids shall be stored within any service station building except in closed containers of aggregate capacity not exceeding 60 gallons. One container not exceeding 60 gallons capacity equipped with an approved pump is permitted.

(b) Class I liquids may be transferred from one container to another in lubrication or service rooms of a service station building provided the electrical installation complies with Table H-19 and provided that any heating equipment complies with subparagraph (6) of this paragraph.

(c) Class II and Class III liquids may be stored and dispensed inside service station buildings from tanks of not more than 120 gallons capacity each.

(iv) Labeling. Revoked

(v) **Dispensing into portable containers.** No delivery of any Class I liquids shall be made into portable containers unless the container is constructed of metal, has a tight closure with screwed or spring cover, and is fitted with a spout or so designed that the contents can be poured without spilling.

(2) Private stations. Service stations not accessible to or open to the public do not require an attendant or supervisor. Such stations may be used by commercial, industrial, governmental, or manufacturing establishments.

(3) Dispensing systems.

(i) Location. Dispensing devices at automotive service stations shall be so located that all parts of the vehicle being serviced

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will be on the premises of the service station.

(ii) **Inside location.** Approved dispensing units may be located inside of buildings. The dispensing area shall be separated from other areas in an approved manner. The dispensing unit and its piping shall be mounted either on a concrete island or protected against collision damage by suitable means and shall be located in a position where it cannot be struck by a vehicle descending a ramp or other slope out of control. The dispensing area shall be provided with an approved mechanical or gravity ventilation system. When dispensing units are located below grade, only approved mechanical ventilation shall be used and the entire dispensing area shall be protected by an approved automatic sprinkler system. Ventilating systems shall be electrically interlocked with gasoline dispensing units so that the dispensing units cannot be operated unless the ventilating fan motors are energized.

(iii) **Emergency power cutoff.** A clearly identified and easily accessible switch(es) or a circuit breaker(s) shall be provided at a location remote from dispensing devices, including remote pumping systems, to shut off the power to all dispensing devices in the event of an emergency.

(iv) **Dispensing units.**

(a) Class I liquids shall be transferred from tanks by means of fixed pumps so designed and equipped as to allow control of the flow and to prevent leakage or accidental discharge.

(b)

(1) Only listed devices may be used for dispensing Class I liquids. No such device may be used if it shows evidence of having been dismantled.

(2) Every dispensing device for Class I liquids installed after December 31, 1978, shall contain evidence of listing so placed that any attempt to dismantle

the device will result in damage to such evidence, visible without disassembly or dismantling of the nozzle.

[39 F.R. 9967, March 15, 1974.]

(c) Class I liquids shall not be dispensed by pressure from drums, barrels, and similar containers. Approved pumps taking suction through the top of the container or approved self-closing faucets shall be used.

(d) The dispensing units, except those attached to containers, shall be mounted either on a concrete island or protected against collision damage by suitable means.

(v) **Remote pumping systems.**

(a) This subdivision shall apply to systems for dispensing Class I liquids where such liquids are transferred from storage to individual or multiple dispensing units by pumps located elsewhere than at the dispensing units.

(b) Pumps shall be designed or equipped so that no part of the system will be subjected to pressures above its allowable working pressure. Pumps installed above grade, outside of buildings, shall be located not less than 10 feet from lines of adjoining property which may be built upon, and not less than 5 feet from any building opening. When an outside pump location is impractical, pumps may be installed inside of buildings, as provided for dispensers in subdivision (ii) of this subparagraph, or in pits as provided in subdivision (c) of this subdivision. Pumps shall be substantially anchored and protected against physical damage by vehicles.

(c) Pits for subsurface pumps or piping manifolds of submersible pumps shall withstand the external forces to which they may be subjected without damage to the pump, tank, or piping. The pit shall be no larger than necessary for inspection and maintenance and shall be provided with a fitted cover.

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TABLE H-19—ELECTRICAL EQUIPMENT HAZARDOUS AREAS—SERVICE STATIONS—Continued

Location	NEC Class I Group D division	Extent of classified area
Remote pump—Indoor.....	1 Entire area within any pit. 2 Within 5 feet of any edge of pump, extending in all directions. Also up to 3 feet above floor or grade level within 25 feet horizontally from any edge of pump.	
Lubrication or service room.....	1 Entire area within any pit. 2 Area up to 18 inches above floor or grade level within entire lubrication room.	
Dispenser for Class I Liquids.....	2 Within 3 feet of any fill or dispensing point, extending in all directions.	
Special enclosure inside building per § 1910.106 (f) (1) (II).	1 Entire enclosure.	
Sales, storage and rest rooms.....	Ordinary	If there is any opening to these rooms within the extent of a Division 1 area, the entire room shall be classified as Division 1.

(6) Heating equipment.

(i) **Conformance.** Heating equipment shall be installed as provided in subdivisions (ii) through (v) of this subparagraph.

(ii) **Application.** Heating equipment may be installed in the conventional manner in an area except as provided in subdivisions (iii), (iv), or (v) of this subparagraph.

(iii) **Special room.** Heating equipment may be installed in a special room separated from an area classified by Table H-19 by walls having a fire resistance rating of at least 1 hour and without any openings in the walls within 8 feet of the floor into an area classified in Table H-19. This room shall not be used for combustible storage and all air for combustion purposes shall come from outside the building.

(iv) **Work areas.** Heating equipment using gas or oil fuel may be installed in the lubrication, sales, or service room where there is no dispensing or transferring of Class I liquids provided the bottom of the combustion chamber is at least 18 inches above the floor and the heating equipment is protected from physical damage by vehicles. Heating equipment using gas or oil fuel listed for use in garages may be installed in the lubrication or service room where Class I liquids are dispensed provided the equipment is installed at least 8 feet above the floor.

(v) **Electric heat.** Electrical heating equipment shall conform to subparagraph (5) of this paragraph.

(7) **Drainage and waste disposal.** Provision shall be made in the area where Class I liquids are dispensed to prevent spilled liquids from flowing into the interior of service station buildings. Such provision may be by grading driveways, raising door sills, or other equally effective means. Crankcase drainings and flammable or combustible liquids shall not be dumped into sewers but shall be stored in tanks or drums outside of any building until removed from the premises.

(8) **Sources of ignition.** In addition to the previous restrictions of this paragraph, the following shall apply: There shall be no smoking or open flames in the areas used for fueling, servicing fuel systems for internal combustion engines, receiving or dispensing of flammable or combustible liquids. Conspicuous and legible signs prohibiting smoking shall be posted within sight of the customer being served. The motors of all equipment being fueled shall be shut off during the fueling operation.

(9) **Fire control.** Each service station shall be provided with at least one fire extinguisher having a minimum approved classification of 6 B, C located so that an extinguisher will be within 75 feet of each pump, dispenser, underground fill pipe opening, and lubrication or service room.

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(h) Processing plants.

(1) Scope. This paragraph shall apply to those plants or buildings which contain chemical operations such as oxidation, reduction, halogenation, hydrogenation, alkylation, polymerization, and other chemical processes but shall not apply to chemical plants, refineries or distilleries.

(2) Location.

(i) Classification. The location of each processing vessel shall be based upon its flammable or combustible liquid capacity.

with load-bearing walls may be permitted for plants utilizing only stable Class II or Class III liquids. Except as provided in subparagraph (2)(ii) of this paragraph or in the case of explosion resistant walls used in conjunction with explosion relieving facilities, see subparagraph (3)(iv) of this paragraph, load-bearing walls are prohibited. Buildings shall be without basements or covered pits.

(b) Areas shall have adequate exit facilities arranged to prevent occupants from being trapped in the event of fire. Exits shall not be exposed by the drainage facilities described in subdivision (ii) of this subparagraph.

(ii) Drainage.

(a) Emergency drainage systems shall be provided to direct flammable or combustible liquid leakage and fire protection water to a safe location. This may require curbs, scuppers, or special drainage systems to control the spread of fire, see paragraph (b)(2)(vii)(b) of this section.

(b) Emergency drainage systems, if connected to public sewers or discharged into public waterways, shall be equipped with traps or separators.

(c) Revoked

(iii) Ventilation.

(a) Enclosed processing buildings shall be ventilated at a rate of not less than 1 cubic foot per minute per square foot of solid floor area. This shall be accomplished by natural or mechanical ventilation with discharge or exhaust to a safe location outside of the building. Provision shall be made for introduction of makeup air in such a manner as not to short circuit the ventilation. Ventilation shall be arranged to include all floor

(3) Processing building.**(i) Construction.**

(a) Processing buildings shall be of fire-resistance or noncombustible construction, except heavy timber construction

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charge who shall make an inspection of the area to be sure that it is safe for the work to be done and that safe procedures will be followed for the work specified.

(iii) Electrical.

(a) All electrical wiring and equipment within storage or processing areas shall be installed in accordance with nationally recognized good practice.

(b) Locations where flammable vapor-air mixtures may exist under normal operations shall be classified Class I, Division 1 according to the requirements of Subpart S of this part. For those pieces of equipment installed in accordance with subparagraph (3)(iii)(b) of this paragraph, the Division 1 area shall extend 5 feet in all directions from all points of vapor liberation. All areas within pits shall be classified Division 1 if any part of the pit is within a Division 1 or 2 classified area, unless the pit is provided with mechanical ventilation.

(c) Locations where flammable vapor-air mixtures may exist under abnormal conditions and for a distance beyond Division 1 locations shall be classified Division 2 according to the requirements of Subpart S of this Part. These locations include an area within 20 feet horizontally, 3 feet vertically beyond a Division 1 area, and up to 3 feet above floor or grade level within 25 feet, if indoors, or 10 feet if outdoors, from any pump, bleeder, withdrawal fitting, meter, or similar device handling Class I liquids. Pits provided with adequate mechanical ventilation within a Division 1 or 2 area shall be classified Division 2. If Class II or Class III liquids only are handled, then ordinary electrical equipment is satisfactory though care shall be used in locating electrical apparatus to prevent hot metal from falling into open equipment.

(d) Where the provisions of (a), (b), and (c), of this subdivision (iii) require the installation of explosion-proof equip-

ment, ordinary electrical equipment including switchgear may be used if installed in a room or enclosure which is maintained under positive pressure with respect to the hazardous area. Ventilation makeup air shall be uncontaminated by flammable vapors.

(8) Housekeeping.

(i) **General.** Maintenance and operating practices shall be in accordance with established procedures which will tend to control leakage and prevent the accidental escape of flammable or combustible liquids. Spills shall be cleaned up promptly.

(ii) **Access.** Adequate aisles shall be maintained for unobstructed movement of personnel and so that fire protection equipment can be brought to bear on any part of the processing equipment.

(iii) **Waste and residues.** Combustible waste material and residues in a building or operating area shall be kept to a minimum, stored in closed metal waste cans, and disposed of daily.

(iv) **Clear zone.** Ground area around buildings and operating areas shall be kept free of tall grass, weeds, trash, or other combustible materials.

(i) Refineries, chemical plants, and distilleries.

(1) **Storage tanks.** Flammable or combustible liquids shall be stored in tanks, containers, or in portable tanks. Tanks shall be installed in accordance with paragraph (b) of this section. Tanks for the storage of flammable or combustible liquids in tank farms and in locations other than process areas shall be located in accordance with paragraph (b)(2)(i) and (ii) of this section.

(2) **Wharves.** Wharves handling flammable or combustible liquids shall be in accordance with paragraph (f)(4) of this section.

(3) Fired and unfired pressure vessels.

(i) **Fired vessels.** Fired pressure vessels shall be constructed in accordance with the

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Code for Fired Pressure Vessels, Section I of the ASME Boiler and Pressure Vessel Code—1968.

(ii) Unfired pressure vessels shall be constructed in accordance with the Code for Unfired Pressure Vessels, Section VIII of the ASME Boiler and Pressure Vessel Code—1968.

(4) **Location of process units.** Process units shall be located so that they are accessible from at least one side for the purpose of fire control.

suitable means.

(5) Fire control.

(i) **Portable equipment.** Portable fire extinguishment and control equipment shall be provided in such quantities and types as are needed for the special hazards of operation and storage.

(ii) **Water supply.** Water shall be available in volume and at adequate pressure to supply water hose streams, foam producing equipment, automatic sprinklers, or water spray systems as the need is indicated by the special hazards of operation and storage.

(iii) **Special equipment.** Special extinguishing equipment such as that utilizing foam, inert gas, or dry chemical shall be provided as the need is indicated by the special hazards of operation and storage.

(i) Scope.

This section applies to the handling, storage, and use of flammable and combusti-

ble liquids with a flash point below 200° F. This section does not apply to:

(1) Bulk transportation of flammable and combustible liquids;

(2) Storage, handling, and use of fuel oil tanks and containers connected with oil burning equipment;

(3) Storage of flammable and combustible liquids on farms;

(4) Liquids without flashpoints that may be flammable under some conditions, such as certain halogenated hydrocarbons and mixtures containing halogenated hydrocarbons;

(5) Mists, sprays, or foams, except flammable aerosols covered in paragraph (d) of this section; or

(6) Installations made in accordance with requirements of the following standards:

(i) National Fire Protection Association Standard for Drycleaning Plants, NFPA No. 32-1970;

(ii) National Fire Protection Association Standard for the Manufacture of Organic Coatings, NFPA No. 35-1970;

(iii) National Fire Protection Association Standard for Solvent Extraction Plants, NFPA No. 36-1967; or

(iv) National Fire Protection Association Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, NFPA No. 37-1970.

1910.107—SPRAY FINISHING USING FLAMMABLE AND COMBUSTIBLE MATERIALS

(a) Definitions applicable to this section.

(1) **Aerated solid powders.** Aerated powders shall mean any powdered material used as

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a coating material which shall be fluidized within a container by passing air uniformly from below. It is common practice to fluidize such materials to form a fluidized powder

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Class B, and Class C explosives by the U.S. Department of Transportation, and includes, but is not limited to dynamite, black powder, pellet powders, initiating explosives, blasting caps, electric blasting caps, safety fuse, fuse lighters, fuse igniters, squibs, cordeau detonant fuse, instantaneous fuse, igniter cord, igniters, small arms ammunition, small arms ammunition primers, smokeless propellant, cartridges for propellant-actuated power devices, and cartridges for industrial guns. Commercial explosives are those explosives which are intended to be used in commercial or industrial operations.

(i) **Class A explosives.** Possessing, detonating, or otherwise maximum hazard; such as dynamite, nitroglycerin, picric acid, lead azide, fulminate of mercury, black powder, blasting caps, and detonating primers.

(ii) **Class B explosives.** Possessing flammable hazard, such as propellant explosives (including some smokeless propellants), photographic flash powders, and some special fireworks.

(iii) **Class C explosives.** Includes certain types of manufactured articles which contain Class A or Class B explosives, or both, as components but in restricted quantities.

(iv) **Forbidden or not acceptable explosives.** Explosives which are forbidden or not acceptable for transportation by common carriers by rail freight, rail express, highway, or water in accordance with the regulations of the U.S. Department of Transportation, 49 CFR Chapter I.

(4) **Highway.** Highway—any public street, public alley, or public road.

(5) **Inhabited building.** Revoked

(6) **Magazine.** Magazine—any building or structure, other than an explosives manufacturing building, used for the storage of explosives.

(7) **Motor vehicle.** Motor vehicle—any self-propelled vehicle, truck, tractor, semi-trailer, or truck-full trailers used for the transportation of freight over public highways.

(8) **Propellant-actuated power devices.** Propellant-actuated power devices—any tool or special mechanized device or gas generator system which is actuated by a smokeless propellant or which releases and directs work through a smokeless propellant charge.

(9) **Public conveyance.** Revoked

(10) **Pyrotechnics.** Pyrotechnics—any combustible or explosive compositions or manufactured articles designed and prepared for the purpose of producing audible or visible effects which are commonly referred to as fireworks.

(11) **Railway.** Revoked

(12) **Semiconductive hose.** Semiconductive hose—a hose with an electrical resistance high enough to limit flow of stray electric currents to safe levels, yet not so high as to prevent drainage of static electric charges to ground; hose of not more than

NOTE 1: Classification of explosives is described by the U.S. Department of Transportation as follows (see 49 CFR Chapter I):

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2 megohms resistance over its entire length and of not less than 5,000 ohms per foot meets the requirement.

(13) **Small arms ammunition.** Small arms ammunition—any shotgun, rifle, pistol, or revolver cartridge, and cartridges for propellant-actuated power devices and industrial guns. Military-type ammunition containing explosive-bursting charges, incendiary, tracer, spotting, or pyrotechnic projectiles is excluded from this definition.

(14) **Small arms ammunition primers.** Small arms ammunition primers—small percussion-sensitive explosive charges, encased in a cup, used to ignite propellant powder.

(15) **Smokeless propellants.** Smokeless propellants—solid propellants, commonly called smokeless powders in the trade, used in small arms ammunition, cannon, rockets, propellant-actuated power devices, etc.

(16) **Special industrial explosives devices.** Special industrial explosives devices—explosive-actuated power devices and propellant-actuated power devices.

(17) **Special industrial explosives materials.** Special industrial explosives materials—shaped materials and sheet forms and various other extrusions, pellets, and packages of high explosives, which include dynamite, trinitrotoluene (TNT), pentaerythritol tetranitrate (PETN), hexahydro-1,3,5-trinitro-s-triazine (RDX), and other similar compounds used for high-energy-rate forming, expanding, and shaping in metal fabrication, and for dismemberment and quick reduction of scrap metal.

(18) **Water gels or slurry explosives.** These comprise a wide variety of materials used for blasting. They all contain substantial proportions of water and high proportions of ammonium nitrate, some of which is in solution in the water. Two broad classes of water gels are (i) those which are sensitized by a material classed as an explosive, such as TNT or smokeless powder, (ii) those which contain no ingredient classified as an explosive; these are sensitized with metals such as aluminum or with other fuels. Water

gels may be premixed at an explosives plant or mixed at the site immediately before delivery into the borehole.

(19) **DOT specifications.** Regulations of the Department of Transportation published in 49 CFR Chapter I.

(b) Miscellaneous provisions.

(1) **General hazard.** No person shall store, handle, or transport explosives or blasting agents when such storage, handling, and transportation of explosives or blasting agents constitutes an undue hazard to life

(c) Storage of explosives.

(1) General provisions.

(i) All Class A, Class B, Class C explosives, and special industrial explosives, and any newly developed and unclassified explosives, shall be kept in magazines which meet the requirements of this paragraph.

(ii) Blasting caps, electric blasting caps, detonating primers, and primed cartridges shall not be stored in the same magazine with other explosives.

(iii) Ground around magazines shall slope away for drainage. The land surrounding magazines shall be kept clear of brush, dried grass, leaves, and other materials for a distance of at least 25 feet.

(iv) Magazines as required by this paragraph shall be of two classes; namely,

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Class I magazines, and Class II magazines.

(v) Class I magazines shall be required where the quantity of explosives stored is more than 50 pounds. Class II magazines may be used where the quantity of explosives stored is 50 pounds or less.

(vi) Class I magazines shall be located away from inhabited buildings, passenger railways, and public highways and from other magazines in conformity with Table H-21.

TABLE H-21—AMERICAN TABLE OF DISTANCES FOR STORAGE OF EXPLOSIVES

As revised and approved by the Institute of Makers of Explosives, June 5, 1964

Explosives		Distances in feet when storage is barricaded	Separation of magazines
Pounds over	Pounds not over		
2	5	6	
5	10	8	
10	20	10	
20	30	11	
30	40	12	
40	50	14	
50	75	15	
75	100	16	
100	125	18	
125	150	19	
150	200	21	
200	250	23	
250	300	24	
300	400	27	
400	500	29	
500	600	31	
600	700	32	
700	800	33	
800	900	35	
900	1,000	36	
1,000	1,200	39	
1,200	1,400	41	
1,400	1,600	43	
1,600	1,800	44	
1,800	2,000	45	
2,000	2,500	49	
2,500	3,000	52	
3,000	4,000	58	
4,000	5,000	61	
5,000	6,000	65	
6,000	7,000	68	
7,000	8,000	72	
8,000	9,000	75	
9,000	10,000	78	
10,000	12,000	82	

TABLE H-21—AMERICAN TABLE OF DISTANCES FOR STORAGE OF EXPLOSIVES

As revised and approved by the Institute of Makers of Explosives, June 5, 1964

Explosives		Distances in feet when storage is barricaded	Separation of magazines
Pounds over	Pounds not over		
12,000	14,000	87	
14,000	15,000	90	
15,000	18,000	94	
18,000	20,000	98	
20,000	25,000	106	
25,000	30,000	112	
30,000	35,000	119	
35,000	40,000	124	
40,000	45,000	129	
45,000	50,000	135	
50,000	55,000	140	
55,000	60,000	145	
60,000	65,000	150	
65,000	70,000	155	
70,000	75,000	160	
75,000	80,000	165	
80,000	85,000	170	
85,000	90,000	175	
90,000	95,000	180	
95,000	100,000	185	
100,000	110,000	195	
110,000	120,000	206	
120,000	130,000	215	
130,000	140,000	225	
140,000	150,000	235	
150,000	160,000	245	
160,000	170,000	255	
170,000	180,000	265	
180,000	190,000	275	
190,000	200,000	285	
200,000	210,000	295	
210,000	230,000	315	
230,000	250,000	335	
250,000	275,000	360	
275,000	300,000	385	

NOTE 1. "Natural barricade" means natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures which require protection cannot be seen from the magazine when the trees are bare of leaves.

NOTE 2. "Artificial barricade" means an artificial mound or revetted wall of earth of a minimum thickness of three feet.

NOTE 3. "Barricaded" means that a building containing explosives is effectually screened from a magazine, building, railway, or highway, either by a natural barricade, or by an artificial barricade of such height that a straight line from the top of any sidewall of the building containing explosives to the eave line of any magazine, or building, or to a point 12 feet above the center of a railway or

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highway, will pass through such intervening natural or artificial barricade.

NOTE 4. When two or more storage magazines are located on the same property, each magazine must comply with the minimum distances specified from inhabited buildings, railways, and highways, and in addition, they should be separated from each other by not less than the distances shown for "Separation of Magazines," except that the quantity of explosives contained in cap magazines shall govern in regard to the spacing of said cap magazines from magazines containing other explosives. If any two or more magazines are separated from each other by less than the specified "Separation of Magazines" distances, then such two or more magazines, as a group, must be considered as one magazine, and the total quantity of explosives stored in such group must be treated as if stored in a single magazine located on the site of any magazine of the group, and must comply with the minimum of distances specified from other magazines, inhabited buildings, railways, and highways.

NOTE 5. This table applies only to the manufacture and permanent storage of commercial explosives. It is not applicable to transportation of explosives, or any handling or temporary storage necessary or incident thereto. It is not intended to apply to bombs, projectiles, or other heavily encased explosives.

(vii) Except as provided in subdivision (viii) of this subparagraph, class II magazines shall be located in conformity with Table H-21, but may be permitted in warehouses and in wholesale and retail establishments when located on a floor which has an entrance at outside grade level and the magazine is located not more than 10 feet from such an entrance. Two class II magazines may be located in the same building when one is used only for blasting caps in quantities not in excess of 5,000 caps and a distance of 10 feet is maintained between magazines.

(viii) When used for temporary storage at a site for blasting operations, class II magazines shall be located away from other magazines. A distance of at least one hundred and fifty (150) feet shall be maintained between class II magazines and the work in progress when the quantity of explosives kept therein is in excess of 25 pounds, and at least 50 feet when the quantity of explosives is 25 pounds, or less.

(ix) This paragraph (c) does not apply to:

(a) Stocks of small arms ammunition, propellant-actuated power cartridges, small arms ammunition primers in quantities of less than 750,000, or of smokeless propellants in quantities less than 750 pounds;

(b) Explosive-actuated power devices when in quantities less than 50 pounds net weight of explosives;

(c) Fuse lighters and fuse igniters;

(d) Safety fuses other than cordeau detonant fuses.

(2) Construction of magazines—general.

(i) Magazines shall be constructed in conformity with the provisions of this paragraph.

(ii) Magazines for the storage of explosives, other than black powder, class B and class C explosives shall be bullet resistant, weather resistant, fire resistant, and ventilated sufficiently to protect the explosive in the specific locality. Magazines used only for storage of black powder, class B and class C explosives shall be weather resistant, fire-resistant, and have ventilation. Magazines for storage of blasting and electric blasting caps shall be weather resistant, fire-resistant, and ventilated.

(iii) Property upon which Class I magazines are located and property where Class II magazines are located outside of buildings shall be posted with signs reading "Explosives—Keep Off."

(iv) Magazines requiring heat shall be heated by either hot-water radiant heating with the magazine building; or air directed into the magazine building over either hot water or low pressure steam (15 p.s.i.g.) coils located outside the magazine building.

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(v) The magazine heating systems shall meet the following requirements:

(a) The radiant heating coils within the building shall be installed in such a manner that the explosives or explosives containers cannot contact the coils and air is free to circulate between the coils and the explosives or explosives containers.

(b) The heating ducts shall be installed in such a manner that the hot-air discharge from the duct is not directed against the explosives or explosives containers.

(c) The heating device used in connection with a magazine shall have controls which prevent the ambient building temperature from exceeding 130° F.

(d) The electric fan or pump used in the heating system for a magazine shall be mounted outside and separate from the wall of the magazine and shall be grounded.

(e) The electric fan motor and the controls for electrical heating devices used in heating water or steam shall have overloads and disconnects, which comply with subpart S of this part. All electrical switch gear shall be located a minimum distance of 25 feet from the magazine.

(f) The heating source for water or steam shall be separated from the magazine by a distance of not less than 25 feet when electrical and 50 feet when fuel fired. The area between the heating unit and the magazine shall be cleared of all combustible materials.

(g) The storage of explosives and explosives containers in the magazine shall allow uniform air circulation so product temperature uniformity can be maintained.

(vi) When lights are necessary inside the magazine, electric safety flashlight, or electric safety lanterns shall be used.

(3) Construction of Class I magazines.

(i) Class I magazines shall be of masonry construction or of wood or of metal construction, or a combination of these types. Thickness of masonry units shall not be less than 8 inches. Hollow masonry units used in construction required to be bullet resistant shall have all hollow spaces filled with weak cement or well-tamped sand. Wood constructed walls, required to be bullet resistant, shall have at least a 6-inch space between interior and exterior sheathing and the space between sheathing shall be filled with well-tamped sand. Metal wall construction, when required to be bullet resistant, shall be lined with brick at least 4 inches in thickness or shall have at least a 6-inch sandfill between interior and exterior walls.

(ii) Floors and roofs of masonry magazines may be of wood construction. Wood floors shall be tongue and grooved lumber having a nominal thickness of 1 inch.

(iii) Roofs required to be bullet resistant shall be protected by a sand tray located at the line of eaves and covering the entire area except that necessary for ventilation. Sand in the sand tray shall be maintained at a depth of not less than 4 inches.

(iv) All wood at the exterior of magazines, including eaves, shall be protected by being covered with black or galvanized steel or aluminum metal of thickness of not less than No. 26 gage. All nails exposed to the interior of magazines shall be well countersunk.

(v) Foundations for magazines shall be of substantial construction and arranged to provide good cross ventilation.

(vi) Magazines shall be ventilated sufficiently to prevent dampness and heating of stored explosives. Ventilating openings shall be screened to prevent the entrance of sparks.

(vii) Openings to magazines shall be restricted to that necessary for the place-

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ment and removal of stocks of explosives. Doors for openings in magazines for Class A explosives shall be bullet resistant. Doors for magazines not required to be bullet resistant shall be designed to prevent unauthorized entrance to the magazine.

(viii) Revoked

(ix) Provisions shall be made to prevent the piling of stocks of explosives directly against masonry walls, brick-lined or sand-filled metal walls and single-thickness metal walls; such protection, however, shall not interfere with proper ventilation at the interior of side and end walls.

(4) Construction of Class II magazines.

(i) Class II magazines shall be of wood or metal construction, or a combination thereof.

(ii) Wood magazines of this class shall have sides, bottom, and cover constructed of 2-inch hardwood boards well braced at corners and protected by being entirely covered with sheet metal of not less than No. 20 gage. All nails exposed to the interior of the magazine shall be well countersunk. All metal magazines of this class shall have sides, bottom, and cover constructed of sheet metal, and shall be lined with three-eighths-inch plywood or equivalent. Edges of metal covers shall overlap sides at least 1 inch.

(iii) Covers for both wood- and metal-constructed magazines of this class shall be provided with substantial strap hinges and shall be provided with substantial means for locking.

(iv) Magazines of this class shall be painted red and shall bear lettering in

white, on all sides and top, at least 3 inches high, "Explosives—Keep Fire Away." Class II magazines when located in warehouses, and in wholesale and retail establishments shall be provided with substantial wheels or casters to facilitate easy removal in the case of fire. Where necessary due to climatic conditions, Class II magazines shall be ventilated.

(5) Storage within magazines.

(i) Packages of explosives shall be laid flat with top side up. Black powder when stored in magazines with other explosives shall be stored separately. Black powder stored in kegs shall be stored on ends, bungs down, or on side, seams down. Corresponding grades and brands shall be stored together in such a manner that brands and grade marks show. All stocks shall be stored so as to be easily counted and checked. Packages of explosives shall be piled in a stable manner. When any kind of explosive is removed from a magazine for use, the oldest explosive of that particular kind shall always be taken first.

(ii) Packages of explosives shall not be unpacked or repacked in a magazine nor within 50 feet of a magazine or in close proximity to other explosives. Tools used for opening packages of explosives shall be constructed of nonsparking materials, except that metal slitters may be used for opening fiberboard boxes. A wood wedge and a fiber, rubber, or wood mallet shall be used for opening or closing wood packages of explosives. Opened packages of explosives shall be securely closed before being returned to a magazine.

(iii) Magazines shall not be used for the storage of any metal tools nor any commodity except explosives, but this restriction shall not apply to the storage of blasting agents and blasting supplies.

(iv) Magazine floors shall be regularly swept, kept clean, dry, free of grit, paper, empty used packages, and rubbish. Brooms and other cleaning utensils shall

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not have any spark-producing metal parts. Sweepings from floors of magazines shall be properly disposed of. Magazine floors stained with nitroglycerin shall be cleaned according to instructions by the manufacturer.

(v) When any explosive has deteriorated to an extent that it is in an unstable or dangerous condition, or if nitroglycerin leaks from any explosives, then the person in possession of such explosive shall immediately proceed to destroy such explosive in accordance with the instructions of the manufacturer. Only experienced persons shall be allowed to do the work of destroying explosives.

(vi) When magazines need inside repairs, all explosives shall be removed therefrom and the floors cleaned. In making outside repairs, if there is a possibility of causing sparks or fire the explosives shall be removed from the magazine. Explosives removed from a magazine under repair shall either be placed in another magazine or placed a safe distance from the magazine where they shall be properly guarded and protected until repairs have been completed, when they shall be returned to the magazine.

(vii) Smoking, matches, open flames, spark-producing devices, and firearms (except firearms carried by guards) shall not be permitted inside of or within 50 feet of magazines. The land surrounding a magazine shall be kept clear of all combustible materials for a distance of at least 25 feet. Combustible materials shall not be stored within 50 feet of magazines.

(viii) Magazines shall be in the charge of a competent person at all times who shall

be held responsible for the enforcement of all safety precautions.

(ix) Explosives recovered from blasting misfires shall be placed in a separate magazine until competent personnel has determined from the manufacturer the method of disposal. Caps recovered from blasting misfires shall not be reused. Such explosives and caps shall then be

disposed of in the manner recommended by the manufacturer.

(d) Transportation of explosives.

(1) General provisions.

(i) No employee shall be allowed to smoke, carry matches or any other flame-producing device, or carry any firearms or loaded cartridges while in or near a motor vehicle transporting explosives; or drive, load, or unload such vehicle in a careless or reckless manner.

(ii) Revoked

(iii) Explosives shall not be transferred from one vehicle to another within the confines of any jurisdiction (city, county, State, or other area) without informing the fire and police departments thereof. In the event of breakdown or collision the local fire and police departments shall be promptly notified to help safeguard such emergencies. Explosives shall be transferred from the disabled vehicle to another only when proper and qualified supervision is provided.

(iv) Blasting caps or electric blasting caps shall not be transported over the highways on the same vehicles with other explosives.

(2) Transportation vehicles.

(i) Vehicles used for transporting explosives shall be strong enough to carry the load without difficulty and be in good mechanical condition. If vehicles do not have a closed body, the body shall be covered with a flameproof and moisture-proof tarpaulin or other effective protection against moisture and sparks. All vehicles used for the transportation of explosives shall have tight floors and any exposed spark-producing metal on the inside of the body shall be covered with wood or other nonsparking materials to prevent contact with packages of explo-

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sives. Packages of explosives shall not be loaded above the sides of an open-body vehicle.

(ii) Every vehicle used for transporting explosives and oxidizing materials listed in (a) of this subdivision shall be marked as follows:

(a) Exterior markings or placards required on applicable vehicles shall be as follows for the various classes of commodities:

<i>Commodity</i>	<i>Type of marking or placard</i>
Explosives, Class A, any quantity or a combination of Class A and Class B explosives.	Explosives A (Red letters on white background).
Explosives, Class B, any quantity.	Explosives B (Red letters on white background).
Oxidizing material (blasting agents, ammonium nitrate, etc.), 1,000 pounds or more gross weight.	Oxidizers (Yellow letters on black background).

(b) Revoked

(c) Such markings or placards shall be displayed at the front, rear, and on each side of the motor vehicle or trailer, or other cargo carrying body while it contains explosives or other dangerous articles of such type and in such quantity as specified in (a) of this subdivision. The front marking or placard may be displayed on the front of either the truck, truck body, truck tractor or the trailer.

(d) Any motor vehicle, trailer, or other cargo-carrying body containing more than one kind of explosive as well as an oxidizing material requiring a placard under the provisions of subdivision (a), the aggregate gross weight of which totals 1,000 pounds or more, shall be marked or placarded "Dangerous" as well as "Explosive A" or "Explosive B" as appropriate. If explosives Class A and explosives Class B are loaded on the same vehicle, the "Explosives B" marking need not be displayed.

(e) In any combination of two or more vehicles containing explosives or other dangerous articles each vehicle shall be marked or placarded as to its contents and in accordance with (a) and (c) of this subdivision.

(iii) Each motor vehicle used for transporting explosives shall be equipped with a minimum of two extinguishers, each having a rating of at least 10-BC.

(a) Only extinguishers listed or approved by Underwriters' Laboratories, Inc., or the Factory Mutual Engineering Corp. shall be deemed suitable for use on explosives-carrying vehicles.

(b) Extinguishers shall be filled and ready for immediate use and located near the driver's seat. Extinguishers shall be examined periodically by a competent person.

(iv) A motor vehicle used for transporting explosives shall be given the following inspection to determine that it is in proper condition for safe transportation of explosives:

(a) Fire extinguishers shall be filled and in working order.

(b) All electrical wiring shall be completely protected and securely fastened to prevent short-circuiting.

(c) Chassis, motor, pan, and underside of body shall be reasonably clean and free of excess oil and grease.

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(d) Fuel tank and feedline shall be secure and have no leaks.

(e) Brakes, lights, horn, windshield wipers, and steering apparatus shall function properly.

(f) Tires shall be checked for proper inflation and defects.

(g) The vehicle shall be in proper condition in every other respect and acceptable for handling explosives.

(3) Operation of transportation vehicles.

(i) Vehicles transporting explosives shall only be driven by and be in the charge of a driver who is familiar with the traffic regulations, State laws, and the provisions of this section.

(ii) Except under emergency conditions, no vehicle transporting explosives shall be parked before reaching its destination, even though attended, on any public street adjacent to or in proximity to any place where people work.

(iii) Every motor vehicle transporting any quantity of Class A or Class B explosives shall, at all times, be attended by a driver or other attendant of the motor carrier. This attendant shall have been made aware of the class of the explosive material in the vehicle and of its inherent dangers, and shall have been instructed in the measures and procedures to be followed in order to protect the public from those dangers. He shall have been made familiar with the vehicle he is assigned, and shall be trained, supplied with the necessary means, and authorized to move the vehicle when required.

(a) For the purpose of this subdivision, a motor vehicle shall be deemed "attended" only when the driver or

other attendant is physically on or in the vehicle, or has the vehicle within his field of vision and can reach it quickly and without any kind of interference; "attended" also means that the driver or attendant is awake, alert, and not engaged in other duties or activities which may divert his attention from the vehicle, except for necessary communication with public officers, or representatives of the carrier, shipper, or consignee, or except for necessary absence from the vehicle to obtain food or to provide for his physical comfort.

(b) However, an explosive-laden vehicle may be left unattended if parked within a securely fenced or walled area with all gates or entrances locked where parking of such vehicle is otherwise permissible, or at a magazine site established solely for the purpose of storing explosives.

(iv) No spark-producing metal, spark-producing metal tools, oils, matches, firearms, electric storage batteries, flammable substances, acids, oxidizing materials, or corrosive compounds shall be carried in the body of any motor truck and/or vehicle transporting explosives, unless the loading of such dangerous articles and the explosives comply with U.S. Department of Transportation regulations.

(v) Vehicles transporting explosives shall avoid congested areas and heavy traffic. Where routes through congested areas have been designated by local authorities such routes shall be followed.

(vi) Delivery shall only be made to authorized persons and into authorized magazines or authorized temporary storage or handling areas.

(e) Use of explosives and blasting agents.

(1) General provisions.

(i) While explosives are being handled or used, smoking shall not be permitted and no one near the explosives shall possess

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matches, open light or other fire or flame. No person shall be allowed to handle explosives while under the influence of intoxicating liquors, narcotics, or other dangerous drugs.

(ii) Original containers or Class II magazines shall be used for taking detonators and other explosives from storage magazines to the blasting area.

(iii) When blasting is done in congested areas or in close proximity to a structure, or any other installation that may be damaged, the blast shall be covered before firing with a mat constructed so that it is capable of preventing fragments from being thrown.

(iv) Persons authorized to prepare explosive charges or conduct blasting operations shall use every reasonable precaution, including but not limited to warning signals, flags, barricades, or woven wire mats to insure the safety of the general public and workmen.

(v) Blasting operations shall be conducted during daylight hours.

(vi) Whenever blasting is being conducted in the vicinity of gas, electric, water, fire alarm, telephone, telegraph, and steam utilities, the blaster shall notify the appropriate representatives of such utilities at least 24 hours in advance of blasting, specifying the location and intended time of such blasting. Verbal notice shall be confirmed with written notice.

(vii) Due precautions shall be taken to prevent accidental discharge of electric blasting caps from current induced by radar, radio transmitters, lightning, adjacent powerlines, dust storms, or other sources of extraneous electricity. These precautions shall include:

(a) The suspension of all blasting operations and removal of persons from the blasting area during the approach and progress of an electric storm.

(b) The posting of signs warning against the use of mobile radio transmitters on all roads within 350 feet of the blasting operations.

(2) Storage at use sites.

(i) Empty boxes and paper and fiber packing materials which have previously contained high explosives shall not be used again for any purpose, but shall be destroyed by burning at an approved isolated location out of doors, and no person shall be nearer than 100 feet after the burning has started.

(ii) Containers of explosives shall not be opened in any magazine or within 50 feet of any magazine. In opening kegs or wooden cases, no sparking metal tools shall be used; wooden wedges and either wood, fiber or rubber mallets shall be used. Nonsparking metallic slitters may be used for opening fiberboard cases.

(iii) Explosives or blasting equipment that are obviously deteriorated or damaged shall not be used.

(iv) No explosives shall be abandoned.

(3) Loading of explosives in blast holes.

(i) All drill holes shall be sufficiently large to admit freely the insertion of the cartridges of explosives.

(ii) Tamping shall be done only with wood rods without exposed metal parts, but nonsparking metal connectors may be used for jointed poles. Violent tamping shall be avoided. Primed cartridges shall not be tamped.

(iii) When loading blasting agents pneumatically over electric blasting caps, semiconductive delivery hose shall be used and the equipment shall be bonded and grounded.

(iv) No holes shall be loaded except those to be fired in the next round of blasting. After loading, all remaining explosives shall be immediately returned to an authorized magazine.

(v) Drilling shall not be started until all remaining butts of old holes are examined with a wooden stick for unexploded

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charges, and if any are found, they shall be refired before work proceeds.

(vi) No person shall be allowed to deepen drill holes which have contained explosives.

(vii) After loading for a blast is completed, all excess blasting caps or electric blasting caps and other explosives shall immediately be returned to their separate storage magazines.

(4) Initiation of explosive charges.

(i) Revoked

(ii) When fuse is used, the blasting cap shall be securely attached to the safety fuse with a standard-ring type cap crimper. All primers shall be assembled at least 50 feet from any magazine.

(iii) Primers shall be made up only as required for each round of blasting.

(iv) No blasting cap shall be inserted in the explosives without first making a hole in the cartridge for the cap with a wooden punch of proper size or standard cap crimper.

(v) Explosives shall not be extracted from a hole that has once been charged or has misfired unless it is impossible to detonate the unexploded charge by insertion of a fresh additional primer.

(vi) If there are any misfires while using cap and fuse, all persons shall be required to remain away from the charge for at least 1 hour. If electric blasting caps are used and a misfire occurs, this waiting period may be reduced to 30 minutes. Misfires shall be handled under the direction of the person in charge of the blasting and all wires shall be carefully traced and search made for unexploded charges.

(vii) Blasters, when testing circuits to charged holes, shall use only blasting galvanometers designed for this purpose.

(viii) Only the employee making leading wire connections in electrical firing shall be allowed to fire the shot. Leading wires shall remain shorted and not be connected to the blasting machine or other source of current until the charge is to be fired.

(5) Warning required. Before a blast is fired, the employer shall require that a loud warning signal be given by the person in charge, who has made certain that all surplus explosives are in a safe place, all persons and vehicles are at a safe distance or under sufficient cover, and that an adequate warning has been given.

(f) Explosives at piers, railway stations, and cars or vessels not otherwise specified in this standard.

(1) Railway cars. Except in an emergency and with permission of the local authority, no person shall have or keep explosives in a railway car unless said car and contents and methods of loading are in accordance with the U.S. Department of Transportation Regulations for the Transportation of Explosives, 49 CFR Chapter I.

(2) Packing and marking. No person shall deliver any explosive to any carrier unless such explosive conforms in all respects, including marking and packing, to the U.S. Department of Transportation Regulations for the Transportation of Explosives.

(3) Marking cars. Every railway car containing explosives which has reached its designation, or is stopped in transit so as no longer to be in interstate commerce, shall have attached to both sides and ends of the car, cards with the words "Explosives—Handle Carefully—Keep Fire Away" in red letters at least 1½ inches high on a white background.

(4) Storage. Any explosives at a railway facility, truck terminal, pier, wharf, harbor

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facility, or airport terminal, whether for delivery to a consignee, or forwarded to some other destination, shall be kept in a safe place, isolated as far as practicable and in such manner that they can be easily and quickly removed.

(5) **Hours of transfer.** Explosives shall not be delivered to or received from any railway station, truck terminal, pier, wharf, harbor facility, or airport terminal between the hours of sunset and sunrise.

(g) Blasting agents.

(1) **General.** Unless otherwise set forth in this paragraph, blasting agents, excluding water gels, shall be transported, stored, and used in the same manner as explosives. Water gels are covered in paragraph (h) of this section.

(2) Fixed location mixing.

(i) Revoked

(ii) Buildings used for the mixing of blasting agents shall conform to the requirements of this section.

(a) Buildings shall be of noncombustible construction or sheet metal on wood studs.

(b) Floors in a mixing plant shall be of concrete or of other nonabsorbent materials.

(c) All fuel oil storage facilities shall be separated from the mixing plant and located in such a manner that in case of tank rupture, the oil will drain away from the mixing plant building.

(d) The building shall be well ventilated.

(e) Heating units which do not depend on combustion processes, when properly designed and located, may be used in the building. All direct sources of heat shall be provided exclusively from units located outside the mixing building.

(f) All internal-combustion engines used for electric power generation shall be located outside the mixing plant building, or shall be properly ventilated and isolated by a firewall. The exhaust systems on all such engines shall be located so any spark emission cannot be a hazard to any materials in or adjacent to the plant.

(iii) Equipment used for mixing blasting agents shall conform to the requirements of this subdivision.

(a) The design of the mixer shall minimize the possibility of frictional heating, compaction, and especially confinement. All bearings and drive assemblies shall be mounted outside the mixer and protected against the accumulation of dust. All surfaces shall be accessible for cleaning.

(b) Mixing and packaging equipment shall be constructed of materials compatible with the fuel-ammonium nitrate composition.

(c) Suitable means shall be provided to prevent the flow of fuel oil to the mixer in case of fire. In gravity flow systems an automatic spring-loaded shutoff valve with fusible link shall be installed.

(iv) The provisions of this subdivision shall be considered when determining blasting agent compositions.

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from product movement within the bin and accidental vehicle contact with the support legs.

(ii) The bin discharge gate shall be designed to provide a closure tight enough to prevent leakage of the stored product. Provision shall also be made so that the gate can be locked.

(iii) Bin loading manways or access hatches shall be hinged or otherwise attached to the bin and be designed to permit locking.

(iv) Any electrically driven conveyors for loading or unloading bins shall conform to the requirements of Subpart S of this Part. They shall be designed to minimize damage from corrosion.

(v) Bins containing blasting agent shall be located, with respect to inhabited buildings, passenger railroads, and public highways, in accordance with Table H-21 and separation from other blasting agent storage and explosives storage shall be in conformity with Table H-22.

(vi) Bins containing ammonium nitrate shall be separated from blasting agent storage and explosives storage in conformity with Table H-22.

(5) Storage of blasting agents and supplies.

(i) Blasting agents and oxidizers used for mixing of blasting agents shall be stored in the manner set forth in this subdivision.

(a) Blasting agents or ammonium nitrate, when stored in conjunction with explosives, shall be stored in the manner set forth in paragraph (c) of this section for explosives. The mass of blasting agents and one-half the mass of ammonium nitrate shall be included when computing the total quantity of explosives for determining distance requirements.

(b) Blasting agents, when stored entirely separate from explosives, may

be stored in the manner set forth in paragraph (c) of this section or in one-story warehouses (without basements) which shall be:

(1) Noncombustible or fire resistive;

(2) Constructed so as to eliminate open floor drains and piping into which molten materials could flow and be confined in case of fire;

(3) Weather resistant;

(4) Well ventilated; and

(5) Equipped with a strong door kept securely locked except when open for business.

(c) Semitrailer or full-trailer vans used for highway or onsite transportation of the blasting agents are satisfactory for temporarily storing these materials, provided they are located in accordance with Table H-22 with respect to one another. Trailers shall be provided with substantial means for locking, and the trailer doors shall be kept locked, except during the time of placement and removal of stocks and blasting agents.

(ii) Warehouses used for the storage of blasting agents separate from explosives shall be located as set forth in this subdivision.

(a) Warehouses used for the storage of blasting agents shall be located in accordance with Table H-22 with respect to one another.

(b) If both blasting agents and ammonium nitrate are handled or stored within the distance limitations prescribed through subparagraph (2) of this paragraph, one-half the mass of the ammonium nitrate shall be added to the

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mass of the blasting agent when computing the total quantity of explosives for determining the proper distance for compliance with Table H-21.

(iii) Smoking, matches, open flames, spark producing devices, and firearms are prohibited inside of or within 50 feet of any warehouse used for the storage of blasting agents. Combustible materials shall not be stored within 50 feet of warehouses used for the storage of blasting agents.

(iv) The interior of warehouses used for the storage of blasting agents shall be kept clean and free from debris and empty containers. Spilled materials shall be cleaned up promptly and safely removed. Combustible materials, flammable liquids, corrosive acids, chlorates, or nitrates shall not be stored in any warehouse used for blasting agents unless separated therefrom by a fire resistive separation of not less than 1 hour resistance. The provisions of this subdivision shall not prohibit the storage of blasting agents together with nonexplosive blasting supplies.

(v) Piles of ammonium nitrate and warehouses containing ammonium nitrate shall be adequately separated from readily combustible fuels.

(vi) Caked oxidizers, either in bags or in bulk, shall not be loosened by blasting.

(vii) Every warehouse used for the storage of blasting agents shall be under the supervision of a competent person.

(6) Transportation of packaged blasting agents.

(i) When blasting agents are transported in the same vehicle with explosives, all of the requirements of paragraph (d) of this section shall be complied with.

(ii) Vehicles transporting blasting agents shall only be driven by and be in charge of a driver in possession of a valid motor vehicle

operator's license. Such a person shall also be familiar with the States vehicle and traffic laws.

(iii) No matches, firearms, acids, or other corrosive liquids shall be carried in the bed or body of any vehicle containing blasting agents.

(iv) No person shall be permitted to ride upon, drive, load, or unload a vehicle containing blasting agents while smoking or under the influence of intoxicants, narcotics, or other dangerous drugs.

(v) Revoked

(vi) Vehicles transporting blasting agents shall be in safe operating condition at all times.

(7) Use of blasting agents. Persons using blasting agents shall comply with all of the applicable provisions of paragraph (e) of this section.

(h) Water gel (Slurry) explosives and blasting agents.

(1) General provisions. Unless otherwise set forth in this paragraph, water gels shall be transported, stored and used in the same manner as explosives or blasting agents in accordance with the classification of the product.

(2) Types and classifications.

(i) Water gels containing a substance in itself classified as an explosive shall be

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classified as an explosive and manufactured, transported, stored, and used as specified for "explosives" in this section, except as noted in subdivision (iv) of this subparagraph.

TABLE H-22—TABLE OF RECOMMENDED SEPARATION DISTANCES OF AMMONIUM NITRATE AND BLASTING AGENTS FROM EXPLOSIVES OR BLASTING AGENTS 1, 2

Donor weight		Minimum separation distance of receptor when barricaded 3 (ft.)		Minimum thickness of artificial barricades 4 (in.)
Pounds over	Pounds not over	Ammonium nitrate 5	Blasting agent 6	
	100	3	11	12
100	300	4	14	12
300	600	5	18	12
600	1,000	6	22	12
1,000	1,600	7	25	12
1,600	2,000	8	29	12
2,000	3,000	9	32	15
3,000	4,000	10	36	15
4,000	6,000	11	40	15
6,000	8,000	12	43	20
8,000	10,000	13	47	20
10,000	12,000	14	50	20
12,000	16,000	15	54	25
16,000	20,000	16	58	25
20,000	25,000	18	65	25
25,000	30,000	19	68	30
30,000	35,000	20	72	30
35,000	40,000	21	76	30
40,000	45,000	22	79	35
45,000	50,000	23	83	35
50,000	55,000	24	86	35
55,000	60,000	25	90	35
60,000	70,000	26	94	40
70,000	80,000	28	101	40
80,000	90,000	30	108	40
90,000	100,000	32	115	40
100,000	120,000	34	122	50
120,000	140,000	37	133	50
140,000	160,000	40	144	50
160,000	180,000	44	158	50
180,000	200,000	48	173	50
200,000	220,000	52	187	60
220,000	250,000	56	202	60
250,000	275,000	60	216	60
275,000	300,000	64	230	60

Notes to Table of Recommended Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents:

NOTE 1. These distances apply to the separation of stores only. Table H-21 shall be used in determining separation distances from inhabited buildings, passenger railways, and public highways.

NOTE 2. When the ammonium nitrate and/or blasting agent is not barricaded, the distances shown in the table shall be multiplied by six. These distances allow for the

possibility of high velocity metal fragments from mixers, hoppers, truck bodies, sheet metal structures, metal containers, and the like which may enclose the "donor". Where storage is in bullet-resistant magazines recommended for explosives or where the storage is protected by a bullet-resistant wall, distances, and barricade thicknesses in excess of those prescribed in Table H-21 are not required.

NOTE 3. The distances in the table apply to ammonium nitrate that passes the insensitivity test prescribed in the definition of ammonium nitrate fertilizer promulgated by the National Plant Food Institute⁷; and ammonium nitrate failing to pass said test shall be stored at separation distances determined by competent persons. (*Definition and Test Procedures for Ammonium Nitrate Fertilizer, National Plant Food Institute, November 1964.)

NOTE 4. These distances apply to nitro-carbo-nitrates and blasting agents which pass the insensitivity test prescribed in the U.S. Department of Transportation (DOT) regulations.

NOTE 5. Earth, or sand dikes, or enclosures filled with the prescribed minimum thickness of earth or sand are acceptable artificial barricades. Natural barricades, such as hills or timber of sufficient density that the surrounding exposures which require protection cannot be seen from the "donor" when the trees are bare of leaves, are also acceptable.

NOTE 6. When the ammonium nitrate must be counted in determining the distances to be maintained from inhabited buildings, passenger railways and public highways, it may be counted at one-half its actual weight because its blast effect is lower.

NOTE 7. Guide to use of table of recommended separation distances of ammonium nitrate and blasting agents from explosives or blasting agents.

(a) Sketch location of all potential donor and acceptor materials together with the maximum mass of material to be allowed in that vicinity. (Potential donors are high explosives, blasting agents, and combination of masses of detonating materials. Potential acceptors are high explosives, blasting agents, and ammonium nitrate.)

(b) Consider separately each donor mass in combination with each acceptor mass. If the masses are closer than table allowance (distances measured between nearest edges), the combination of masses becomes a new

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potential donor of weight equal to the total mass. When individual masses are considered as donors, distances to potential acceptors shall be measured between edges. When combined masses within propagating distance of each other are considered as a donor, the appropriate distance to the edge of potential acceptors shall be computed as a weighted distance from the combined masses.

Calculation of weighted distance from combined masses:

Let $M_1, M_2, \dots, M_n$ be donor masses to be combined.

M_1 is a potential acceptor mass.

D_{12} is distance from M_1 to M_2 (edge to edge).

D_{13} is distance from M_1 to M_3 (edge to edge), etc.

To find weighted distance $[D_1, \dots, n]$ from combined masses to M_1 , add the products of the individual masses and distances and divide the total by the sum of the masses thus:

$$D_1, \dots, n = \frac{M_2 \times D_{12} + M_3 \times D_{13} \dots + M_n \times D_{1n}}{M_2 + M_3 \dots + M_n}$$

Propagation is possible if either an individual donor mass is less than the tabulated distance from an acceptor or a combined mass is less than the weighted distance from an acceptor.

(c) In determining the distances separating highways, railroads, and inhabited buildings from potential explosions (as prescribed in Table H-21), the sum of all masses which may propagate (i.e., lie at distances less than prescribed in the Table) from either individual or combined donor masses are included. However, when the ammonium nitrate must be included, only 50 percent of its weight shall be used because of its reduced blast effects. In applying Table H-21 to distances from highways, railroads, and inhabited buildings, distances are measured from the nearest edge of potentially explodable material as prescribed in Table H-21, Note 5.

(d) When all or part of a potential acceptor comprises Explosives Class A as defined in DOT regulations, storage in bullet-resistant magazines is required. Safe distances to stores in bullet-resistant magazines may be obtained from the intermagazine distances prescribed in Table H-21.

(e) Barricades must not have line-of-sight openings between potential donors and acceptors which permit blast or missiles to move directly between masses.

(f) Good housekeeping practices shall be maintained around any bin containing ammonium nitrate or blasting agent. This includes keeping weeds and other combustible materials cleared within 25 feet of such bin. Accumulation of spilled product on the ground shall be prevented.

(ii) Water gels containing no substance in itself classified as an explosive and which are cap-sensitive as defined in paragraph (a) of this section under Blasting Agent shall be classified as an explosive and manufactured, transported, stored and used as specified for "explosives" in this section.

(iii) Water gels containing no substance in itself classified as an explosive and which are not cap-sensitive as defined in paragraph (a) of this section under Blasting Agent shall be classified as blasting agents and manufactured, transported, stored, and used as specified for "blasting agents" in this section.

(iv) When tests on specific formulations of water gels result in Department of Transportation classification as a Class B explosive, bullet-resistant magazines are not required, see paragraph (c)(2)(ii) of this section.

(3) Fixed location mixing.

(i) Revoked

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vehicle into the borehole loading vehicle shall be away from the blasthole site when the boreholes are loaded or in the process of being loaded.

(i) Storage of ammonium nitrate.**(1) Scope and definitions.****(i)**

(a) Except as provided in subdivision (d) of this subdivision this paragraph applies to the storage of ammonium nitrate in the form of crystals, flakes, grains, or prills including fertilizer grade, dynamite grade, nitrous oxide grade, technical grade, and other mixtures containing 60 percent or more ammonium nitrate by weight but does not apply to blasting agents.

(b) This paragraph does not apply to the transportation of ammonium nitrate.

(c) This paragraph does not apply to storage under the jurisdiction of and in compliance with the regulations of the U.S. Coast Guard (see 46 CFR Parts 146-149).

(d) The storage of ammonium nitrate and ammonium nitrate mixtures that are more sensitive than allowed by the "Definition of Test Procedures for Ammonium Nitrate Fertilizer" is prohibited.

(e) Nothing in this paragraph shall apply to the production of ammonium nitrate or to the storage of ammonium nitrate on the premises of the producing plant.

(ii)

(a) Revoked

(b) The standards for ammonium nitrate (nitrous oxide grade) are those found in the "Specifications, Properties, and Recommendations for Packaging, Transportation, Storage, and Use of Ammonium Nitrate," available from the Compressed Gas Association, Inc., 500 Fifth Avenue, New York, NY 10036.

(2) General provisions.

(i) This paragraph applies to all persons storing, having, or keeping ammonium nitrate, and to the owner or lessee of any building, premises, or structure in which ammonium nitrate is stored in quantities of 1,000 pounds or more.

(ii) Approval of large quantity storage shall be subject to due consideration of the fire and explosion hazards, including exposure to toxic vapors from burning or decomposing ammonium nitrate.

(iii)

(a) Storage buildings shall not have basements unless the basements are open on at least one side. Storage buildings shall not be over one story in height.

(b) Storage buildings shall have adequate ventilation or be of a construction that will be self-ventilating in the event of fire.

(c) The wall on the exposed side of a storage building within 50 feet of a combustible building, forest, piles of combustible materials and similar exposure hazards shall be of fire-resistive construction. In lieu of the fire-resistive wall, other suitable means of exposure protection such as a free standing wall may be used. The roof coverings shall be Class C or better, as defined in the

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Manual on Roof Coverings, NFPA 203M-1970.

(d) All flooring in storage and handling areas, shall be of noncombustible material or protected against impregnation by ammonium nitrate and shall be without open drains, traps, tunnels, pits, or pockets into which any molten ammonium nitrate could flow and be confined in the event of fire.

(e) The continued use of an existing storage building or structure not in strict conformity with this paragraph may be approved in cases where such continued use will not constitute a hazard to life

(f) Buildings and structures shall be dry and free from water seepage through the roof, walls, and floors.

(3) Storage of ammonium nitrate in bags, drums, or other containers.

(i)

(a) Bags and containers used for ammonium nitrate must comply with specifications and standards required for use in interstate commerce (see 49 CFR Chapter I).

(b) Containers used on the premises in the actual manufacturing or processing need not comply with provisions of subdivision (a) of this subdivision.

(ii)

(a) Containers of ammonium nitrate shall not be accepted for storage when the temperature of the ammonium nitrate exceeds 130° F.

(b) Bags of ammonium nitrate shall not be stored within 30 inches of the storage building walls and partitions.

(c) The height of piles shall not exceed 20 feet. The width of piles shall not exceed 20 feet and the length 50 feet except that where the building is of non-

combustible construction or is protected by automatic sprinklers the length of piles shall not be limited. In no case shall the ammonium nitrate be stacked closer than 36 inches below the roof or supporting and spreader beams overhead.

(d) Aisles shall be provided to separate piles by a clear space of not less than 3 feet in width. At least one service or main aisle in the storage area shall be not less than 4 feet in width.

(4) Storage of bulk ammonium nitrate.

(i)

(a) Warehouses shall have adequate ventilation or be capable of adequate ventilation in case of fire.

(b) Unless constructed of noncombustible material or unless adequate facilities for fighting a roof fire are available, bulk storage structures shall not exceed a height of 40 feet.

(ii)

(a) Bins shall be clean and free of materials which may contaminate ammonium nitrate.

(b) Due to the corrosive and reactive properties of ammonium nitrate, and to avoid contamination, galvanized iron, copper, lead, and zinc shall not be used in a bin construction unless suitably protected. Aluminum bins and wooden bins protected against impregnation by ammonium nitrate are permissible. The partitions dividing the ammonium nitrate storage from other products which would contaminate the ammonium nitrate shall be of tight construction.

(c) The ammonium nitrate storage bins or piles shall be clearly identified by signs reading "Ammonium Nitrate" with letters at least 2 inches high.

(iii)

(a) Piles or bins shall be so sized and arranged that all material in the pile

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is moved out periodically in order to minimize possible caking of the stored ammonium nitrate.

(b) Height or depth of piles shall be limited by the pressure-setting tendency of the product. However, in no case shall the ammonium nitrate be piled higher at any point than 36 inches below the roof or supporting and spreader beams overhead.

(c) Ammonium nitrate shall not be accepted for storage when the temperature of the product exceeds 130° F.

(d) Dynamite, other explosives, and blasting agents shall not be used to break up or loosen caked ammonium nitrate.

(5) Contaminants.

(i)

(a) Ammonium nitrate shall be in a separate building or shall be separated by approved type firewalls of not less than 1 hour fire-resistance rating from storage of organic chemicals, acids, or other corrosive materials, materials that may require blasting during processing or handling, compressed flammable gases, flammable and combustible materials or other contaminating substances, including but not limited to animal fats, baled cotton, baled rags, baled scrap paper, bleaching powder, burlap or cotton bags, caustic soda, coal, coke, charcoal, cork, camphor, excelsior, fibers of any kind, fish oils, fish meal, foam rubber, hay, lubricating oil, linseed oil, or other oxidizable or drying oils, naphthalene, oakum, oiled clothing, oiled paper, oiled textiles, paint, straw, sawdust, wood shavings, or vegetable oils. Walls referred to in this subdivision need extend only to the underside of the roof.

(b) In lieu of separation walls, ammonium nitrate may be separated from the materials referred to in sub-

division (a) of this subdivision by a space of at least 30 feet.

(c) Flammable liquids such as gasoline, kerosene, solvents, and light fuel oils shall not be stored on the premises except when such storage conforms to § 1910.106, and when walls and sills or curbs are provided in accordance with subdivisions (a) or (b) of this subdivision.

(d) LP-Gas shall not be stored on the premises except when such storage conforms to § 1910.110.

(ii)

(a) Sulfur and finely divided metals shall not be stored in the same building with ammonium nitrate except when such storage conforms to paragraphs (a) through (h) of this section.

(b) Explosives and blasting agents shall not be stored in the same building with ammonium nitrate except on the premises of makers, distributors, and user-compounders of explosives or blasting agents.

(c) Where explosives or blasting agents are stored in separate buildings, other than on the premises of makers, distributors, and user-compounders of explosives or blasting agents, they shall be separated from the ammonium nitrate by the distances and/or barricades specified in Table H-22 of this subpart, but by not less than 50 feet.

(d) Storage and/or operations on the premises of makers, distributors, and user-compounders of explosives or blasting agents shall be in conformity with paragraphs (a) through (h) of this section.

(6) General precautions.

(i) Electrical installations shall conform to the requirements of subpart S of this part, for ordinary locations. They shall be designed to minimize damage from corrosion.

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(ii) In areas where lightning storms are prevalent, lightning protection shall be provided. (See the Lightning Protection Code, NFPA 78-1968.)

(iii) Provisions shall be made to prevent unauthorized personnel from entering the ammonium nitrate storage area.

(7) Fire protection.

(i) Not more than 2,500 tons of bagged ammonium nitrate shall be stored in a building or structure not equipped with an automatic sprinkler system. Sprinkler systems shall be of approved type and installed in accordance with the Standard for the Installation of Sprinkler Systems, NFPA 13-1969.

(ii)

(a) Suitable fire control devices such as small hose or portable extinguishers shall be provided throughout the warehouse and in the loading and unloading areas. See the Standard for the Installation of Portable Fire Extinguishers, NFPA 10-1970, and the Standard for the Installation of Standpipe and Hose Systems, NFPA 14-1970.

(b) Water supplies and fire hydrants shall be available in accordance with recognized good practices.

(j) Small arms ammunition, small arms primers, and small arms propellants.

(1) **Scope.** This paragraph does not apply to in-process storage and intraplant transportation during manufacture of small arms ammunition, small arms primers, and smokeless propellants.

(2) Small arms ammunition.

(i) No quantity limitations are imposed on the storage of small arms ammunition in warehouses, retail stores, and other general occupancy facilities, except those imposed by limitations of storage facilities.

(ii) Small arms ammunition shall be separated from flammable liquids, flammable solids as classified in 49 CFR Part 172, and from oxidizing materials, by a fire-resistive wall of 1-hour rating or by a distance of 25 feet.

(iii) Small arms ammunition shall not be stored together with Class A or Class B explosives unless the storage facility is adequate for this latter storage.

(3) Smokeless propellants.

(i) All smokeless propellants shall be stored in shipping containers specified in 49 CFR 173.93 for smokeless propellants.

(ii) Revoked

(iii) Commercial stocks of smokeless propellants over 20 pounds and not more than 100 pounds shall be stored in portable wooden boxes having walls of at least 1 inch nominal thickness.

(iv) Commercial stocks in quantities not to exceed 750 pounds shall be stored in nonportable storage cabinets having wooden walls of at least 1 inch nominal thickness. Not more than 400 pounds shall be permitted in any one cabinet.

(v) Quantities in excess of 750 pounds shall be stored in magazines in accordance with paragraph (c) of this section.

(4) Small arms ammunition primers.

(i) Small arms ammunition primers shall not be stored except in the original shipping container in accordance with the requirements of 49 CFR 173.107 for small arms ammunition primers.

(ii) Revoked

(iii) Small arms ammunition primers shall be separated from flammable liquids, flammable solids as classified in 49 CFR

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Part 172, and oxidizing materials by a fire-resistive wall of 1-hour rating or by a distance of 25 feet.

(iv) Not more than 750,000 small arms ammunition primers shall be stored in any one building, except as provided in subdivision (v) of this subparagraph. Not more than 100,000 shall be stored in any one pile. Piles shall be at least 15 feet apart.

(v) Quantities of small arms ammunition primers in excess of 750,000 shall be

stored in magazines in accordance with paragraph (c) of this section.

(k) Scope.

This section applies to the manufacture, keeping, having, storage, sale, transportation, and use of explosives, blasting agents, and pyrotechnics. This section does not apply to the sale and use (public display) of pyrotechnics, commonly known as fireworks, nor to the use of explosives in the form prescribed by the official U.S. Pharmacopeia.

1910.110—STORAGE AND HANDLING OF LIQUEFIED PETROLEUM GASES

(a) Definitions applicable to this section.

As used in this section:

(1) API-ASME container—A container constructed in accordance with the requirements of paragraph (b)(3)(iii) of this section.

(2) ASME container—A container constructed in accordance with the requirements of paragraph (b)(3)(i) of this section.

(3) Container assembly—An assembly consisting essentially of the container and fittings for all container openings, including shutoff valves, excess flow valves, liquid-level gaging devices, safety relief devices, and protective housing.

(4) Containers—All vessels, such as tanks, cylinders, or drums, used for transportation or storing liquefied petroleum gases.

(5) DOT—Department of Transportation.

(6) DOT container—A container constructed in accordance with the applicable requirements of 49 CFR Chapter I.

(7) "Liquefied petroleum gases"—"LPG" and "LP-Gas"—Any material which is composed predominantly of any of the following hydrocarbons, or mixtures of them; propane, propylene, butanes (normal butane or iso-butane), and butylenes.

(8) Movable fuel storage tenders or farm carts—Containers not in excess of 1,200 gallons water capacity, equipped with wheels to be towed from one location of usage to another. They are basically nonhighway vehicles, but may occasionally be moved over public roads or highways. They are used as a fuel supply for farm tractors, construction machinery and similar equipment.

(9) P.S.I.G.—pounds per square inch gauge.

(10) P.S.I.A.—pounds per square inch absolute.

(11) Systems—an assembly of equipment consisting essentially of the container or containers, major devices such as vaporizers, safety relief valves, excess flow valves, regulators, and piping connecting such parts.

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(12) Vaporizer-burner—an integral vaporizer-burner unit, dependent upon the heat generated by the burner as the source of heat to vaporize the liquid used for dehydrators or dryers.

(13) Ventilation, adequate—when specified for the prevention of fire during normal operation, ventilation shall be considered adequate when the concentration of the gas in a gas-air mixture does not exceed 25 percent of the lower flammable limit.

(14) Approved—unless otherwise indicated, listing or approval by the following nationally recognized testing laboratories: Underwriters' Laboratories, Inc.; Factory Mutual Engineering Corp.

(15) Listed—see "approved" in § 1910.110(14).

(16) DOT Specifications—regulations of the Department of Transportation published in 49 CFR Chapter I.

(17) Revoked

(18) Revoked

(19) DOT cylinders—cylinders meeting the requirements of 49 CFR Chapter I.

(b) Basic rules.

(1) Odorizing gases.

(i) All liquefied petroleum gases shall be effectively odorized by an approved agent of such character as to indicate positively, by distinct odor, the presence of gas down to concentration in air of not over one-fifth the lower limit of flammability. Odorization, however, is not required if harmful in the use of further processing of the liquefied petroleum gas, or if odorization will serve no useful purpose as a warning agent in such use or further processing.

(ii) The odorization requirement of subdivision (i) of this subparagraph shall be considered to be met by the use of 1.0

pounds of ethyl mercaptan, 1.0 pounds of thiophane or 1.4 pounds of amyl mercaptan per 10,000 gallons of LP-Gas. However, this listing of odorants and quantities shall not exclude the use of other odorants that meet the odorization requirements of subdivision (i) of this subparagraph.

(2) Approval of equipment and systems.

(i) Each system utilizing DOT containers in accordance with 49 CFR Part 178 shall have its container valves, connectors, manifold valve assemblies, and regulators approved.

(ii) Each system for domestic or commercial use utilizing containers of 2,000 gallons or less water capacity, other than those constructed in accordance with 49 CFR Part 178, shall consist of a container assembly and one or more regulators, and may include other parts. The system as a unit or the container assembly as a unit, and the regulator or regulators, shall be individually listed.

(iii) In systems utilizing containers of over 2,000 gallons water capacity, each regulator, container valve, excess flow valve, gaging device, and relief valve installed on or at the container, shall have its correctness as to design, construction, and performance determined by listing by Underwriters' Laboratories, Inc., or Factory Mutual Engineering Corp.

(3) Requirements for construction and original test of containers.

(i) Containers used with systems embodied in paragraphs (d), (e), (g), and (h) of this section, except as provided in paragraphs (e)(3)(iii) and (g)(2)(i) of this section, shall be designed, constructed, and tested in accordance with the Rules for Construction of Unfired Pressure Vessels, section VIII, Division 1, American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, 1968 edition.

(ii) Containers constructed according to the 1949 and earlier editions of the ASME

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Code do not have to comply with paragraphs U-2 through U-10 and U-19 thereof. Containers constructed according to paragraph U-70 in the 1949 and earlier editions are not authorized.

(iii) Containers designed, constructed, and tested prior to July 1, 1961, according to the Code for Unfired Pressure Vessels for Petroleum Liquids and Gases, 1951 edition with 1954 Addenda, of the American Petroleum Institute and the American Society of Mechanical Engineers shall be considered in conformance. Containers constructed according to API-ASME Code do not have to comply with section I or with appendix to section I. Paragraphs W-601 to W-606 inclusive in the 1943 and earlier editions do not apply.

(iv) The provisions of subdivision (i) of this subparagraph shall not be construed as prohibiting the continued use or reinstallation of containers constructed and maintained in accordance with the standard for the Storage and Handling of Liquefied Petroleum Gases NFPA No. 58 in effect at the time of fabrication.

(v) Containers used with systems embodied in paragraph (b), (d)(3)(iii), and (f) of this section, shall be constructed, tested, and stamped in accordance with DOT specifications effective at the date of their manufacture.

(4) Welding of containers.

(i) Welding to the shell, head, or any other part of the container subject to internal pressure, shall be done in compliance with the code under which the tank was fabricated. Other welding is permitted only on saddle plates, lugs, or brackets attached to the container by the tank manufacturer.

(ii) Where repair or modification involving welding of DOT containers is required, the container shall be returned to a qualified manufacturer making containers of the same type, and the repair or modification made in compliance with DOT regulations.

(5) Markings on containers.

(i) Each container covered in subparagraph (3)(i) of this paragraph, except as provided in subparagraph (3)(iv) of this paragraph shall be marked as specified in the following:

(a) With a marking identifying compliance with, and other markings required by, the rules of the reference under which the container is constructed; or with the stamp and other markings required by the National Board of Boiler and Pressure Vessel Inspectors.

(b) With notation as to whether the container is designed for underground or aboveground installation or both. If intended for both and different style hoods are provided, the marking shall indicate the proper hood for each type of installation.

(c) With the name and address of the supplier of the container, or with the trade name of the container.

(d) With the water capacity of the container in pounds or gallons, U.S. Standard.

(e) With the pressure in p.s.i.g., for which the container is designed.

(f) With the wording "This container shall not contain a product having a vapor pressure in excess of—p.s.i.g. at 100° F.," see subparagraph (14)(viii) of this paragraph.

(g) With the tare weight in pounds or other identified unit of weight for containers with a water capacity of 300 pounds or less.

(h) With marking indicating the maximum level to which the container may be filled with liquid at temperatures between 20° F. and 130° F., except on containers provided with fixed maximum level indicators or which are filled by weighing. Markings shall be increments of not more than 20° F. This

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marking may be located on the liquid level gaging device.

(i) With the outside surface area in square feet.

(ii) Markings specified shall be on a metal nameplate attached to the container and located in such a manner as to remain visible after the container is installed.

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

(6) Location of containers and regulating equipment.

(i) Containers, and first stage regulating equipment if used, shall be located outside of buildings, except under one or more of the following:

(a) In buildings used exclusively for container charging, vaporization pressure reduction, gas mixing, gas manufacturing, or distribution.

(b) When portable use is necessary and in accordance with paragraph (c)(5) of this section.

(c) LP-Gas fueled stationary or portable engines in accordance with paragraph (e)(11) or (12) of this section.

(d) LP-Gas fueled industrial trucks used in accordance with paragraph (e)(13) of this section.

(e) LP-Gas fueled vehicles garaged in accordance with paragraph (e)(14) of this section.

(f) Containers awaiting use or resale when stored in accordance with paragraph (f) of this section.

(ii) Each individual container shall be located with respect to the nearest important building or group of buildings in accordance with Table H-23.

TABLE H-23

Water capacity per container	Minimum distances		
	Containers Under-ground	Above-ground	Between above-ground containers
Less than 125 gals. ¹	10 feet...	None....	None.
125 to 250 gallons.....	10 feet....	10 feet....	None.
251 to 500 gallons.....	10 feet....	10 feet....	3 feet.
501 to 2,000 gallons.....	25 feet ² ...	25 feet ² ...	3 feet.
2,001 to 30,000 gallons....	50 feet....	50 feet....	5 feet.
30,001 to 70,000 gallons...	50 feet....	75 feet....	1/4 of sum of diameters of adjacent containers.
70,001 to 90,000 gallons...	50 feet....	100 feet....	

¹ If the aggregate water capacity of a multi-container installation at a consumer site is 501 gallons or greater, the minimum distance shall comply with the appropriate portion of this table, applying the aggregate capacity rather than the capacity per container. If more than one installation is made, each installation shall be separated from another installation by at least 25 feet. Do not apply the MINIMUM DISTANCES BETWEEN ABOVE-GROUND CONTAINERS to such installations.

² NOTE: The above distance requirements may be reduced to not less than 10 feet for a single container of 1,200 gallons water capacity or less, providing such a container is at least 25 feet from any other LP-Gas container of more than 125 gallons water capacity.

(iii) Containers installed for use shall not be stacked one above the other.

(iv) Revoked

(v) In the case of buildings devoted exclusively to gas manufacturing and distributing operations, the distances required by Table H-23 may be reduced provided that in no case shall containers of water capacity exceeding 500 gallons

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located at least 5 feet from container shutoff valves. Vaporizers having capacity of more than 35 gallons but not exceeding 100 gallons per hour shall be located at least 10 feet from the container shutoff valves. Vaporizers having a capacity greater than 100 gallons per hour shall be located at least 15 feet from container shutoff valves.

(c) Vaporizers may be installed in buildings, rooms, housings, sheds, or lean-tos used exclusively for vaporizing or mixing of liquefied petroleum gas. Vaporizing housing structures shall be of non-combustible construction, well ventilated near the floorline and the highest point of the roof. When vaporizer and/or mixing equipment is located in a structure or room attached to or within a building, such structure or room shall be separated from the remainder of the building by a wall designed to withstand a static pressure of at least 100 pounds per square foot. This wall shall have no openings or pipes or conduit passing through it. Such structure or room shall be provided with adequate ventilation, and shall have a roof or at least one exterior wall of lightweight construction.

(d) Vaporizers shall have at or near the discharge, a safety relief valve providing an effective rate of discharge in accordance with subparagraph (10)(iii) of this paragraph. The relief valve shall be so located as not to be subjected to temperatures in excess of 140° F.

(e) Vaporizers shall be provided with suitable automatic means to prevent liquid passing from the vaporizer to the gas discharge piping of the vaporizer.

(f) Vaporizers shall be provided with means for manually turning off the gas to the main burner and pilot.

(g) Vaporizers shall be equipped with automatic safety devices to shut off the flow of gas to main burners if the pilot light should fail. When the flow through the pilot exceeds 2,000 B.t.u. per hour,

the pilot also shall be equipped with an automatic safety device to shut off the flow of gas to the pilot should the pilot flame be extinguished.

(h) Pressure regulating and pressure reducing equipment if located within 10 feet of a direct fired vaporizer shall be separated from the open flame by a substantially airtight noncombustible partition or partitions.

(i) Except as provided in (c) of this subdivision, the following minimum distances shall be maintained between direct fired vaporizers and the nearest important building or group of buildings.

Ten feet for vaporizers having a capacity of 15 gallons per hour or less vaporizing capacity.

Twenty-five feet for vaporizers having a vaporizing capacity of 16 to 100 gallons per hour.

Fifty feet for vaporizers having a vaporizing capacity exceeding 100 gallons per hour.

(j) Direct fired vaporizers shall not raise the product pressure above the design pressure of the vaporizer equipment nor shall they raise the product pressure within the storage container above the pressure shown in the second column of Table H-31.

(k) Vaporizers shall not be provided with fusible plugs.

(l) Vaporizers shall not have unprotected drains to sewers or sump pits.

(iv) Direct gas-fired tank heaters shall be constructed and installed as follows:

(a) Direct gas-fired tank heaters, and tanks to which they are applied, shall only be installed above ground.

(b) Tank heaters shall be permanently marked with the name of the manufacturer, the rated B.t.u. input to the burner, and the maximum vaporizing capacity in gallons per hour.

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(c) Tank heaters may be an integral part of a fuel storage container directly connected to the container liquid section, or vapor section, or both.

(d) Tank heaters shall be provided with a means for manually turning off the gas to the main burner and pilot.

(e) Tank heaters shall be equipped with an automatic safety device to shut off the flow of gas to main burners, if the pilot light should fail. When flow through pilot exceeds 2,000 B.t.u. per hour, the pilot also shall be equipped with an automatic safety device to shut off the flow of gas to the pilot should the pilot flame be extinguished.

(f) Pressure regulating and pressure reducing equipment if located within 10 feet of a direct fired tank heater shall be separated from the open flame by a substantially airtight noncombustible partition.

(g) The following minimum distances shall be maintained between a storage tank heated by a direct fired tank heater and the nearest important building or group of buildings,

Ten feet for storage containers of less than 500 gallons water capacity.

Twenty-five feet for storage containers of 500 to 1,200 gallons water capacity.

Fifty feet for storage containers of over 1,200 gallons water capacity.

(h) No direct fired tank heater shall raise the product pressure within the storage container over 75 percent of the pressure set out in the second column of Table H-31.

(v) The vaporizer section of vaporizer-burners used for dehydrators or dryers shall be located outside of buildings; they shall be constructed and installed as follows:

(a) Vaporizer-burners shall have a minimum design pressure of 250 p.s.i.g. with a factor of safety of five.

(b) Manually operated positive shutoff valves shall be located at the containers to shut off all flow to the vaporizer-burners.

(c) Minimum distances between storage containers and vaporizer-burners shall be as follows:

Water capacity per container (gallons)	Minimum distances (feet)
Less than 501	10
501 to 2,000	25
Over 2,000	50

(d) The vaporizer section of vaporizer-burners shall be protected by a hydrostatic relief valve. The relief valve shall be located so as not to be subjected to temperatures in excess of 140° F. The start-to-discharge pressure setting shall be such as to protect the components involved, but not less than 250 p.s.i.g. The discharge shall be directed upward and away from component parts of the equipment and away from operating personnel.

(e) Vaporizer-burners shall be provided with means for manually turning off the gas to the main burner and pilot.

(f) Vaporizer-burners shall be equipped with automatic safety devices to shut off the flow of gas to the main burner and pilot in the event the pilot is extinguished.

(g) Pressure regulating and control equipment shall be located or protected so that the temperatures surrounding this equipment shall not exceed 140° F. except that equipment components may be used at higher temperatures if designed to withstand such temperatures.

(h) Pressure regulating and control equipment when located downstream of the vaporizer shall be designed to withstand the maximum discharge temperature of the vapor.

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of energy and venting such gas to the atmosphere at a rate not to exceed that from a No. 31 drill size opening and provided that such venting and liquid transfer shall be located not less than 50 feet from the nearest important building.

(v) Filling of fuel containers for industrial trucks or motor vehicles from industrial bulk storage containers shall be performed not less than 10 feet from the nearest important masonry-walled building or not less than 25 feet from the nearest important building or other construction and, in any event, not less than 25 feet from any building opening.

(vi) Filling of portable containers, containers mounted on skids, fuel containers on farm tractors, or similar applications, from storage containers used in domestic or commercial service, shall be performed not less than 50 feet from the nearest important building.

(vii) The filling connection and the vent from the liquid level gages in containers, filled at point of installation, shall not be less than 10 feet in any direction from air openings into sealed combustion system appliances or mechanical ventilation air intakes.

(viii) Fuel supply containers shall be gaged and charged only in the open air or in buildings especially provided for that purpose.

(ix) The maximum vapor pressure of the product at 100° F. which may be transferred into a container shall be in accordance with paragraphs (d)(2) and (e)(3) of this section. (For DOT containers use DOT requirements.)

(x) Marketers and users shall exercise precaution to assure that only those gases for which the system is designed, examined, and listed, are employed in its operation, particularly with regard to pressures.

(xi) Pumps or compressors shall be designed for use with LP-Gas. When com-

pressors are used they shall normally take suction from the vapor space of the container being filled and discharge to the vapor space of the container being emptied.

(xii) Pumping systems, when equipped with a positive displacement pump, shall include a recirculating device which shall limit the differential pressure on the pump under normal operating conditions to the maximum differential pressure rating of the pump. The discharge of the pumping system shall be protected so that pressure does not exceed 350 p.s.i.g. If a recirculation system discharges into the supply tank and contains a manual shutoff valve, an adequate secondary safety recirculation system shall be incorporated which shall have no means of rendering it inoperative. Manual shutoff valves in recirculation systems shall be kept open except during an emergency or when repairs are being made to the system.

(xiii) When necessary, unloading piping or hoses shall be provided with suitable bleeder valves for relieving pressure before disconnection.

(xiv) Agricultural air moving equipment, including crop dryers, shall be shut down when supply containers are being filled unless the air intakes and sources of ignition on the equipment are located 50 feet or more from the container.

(xv) Agricultural equipment employing open flames or equipment with integral containers, such as flame cultivators, weed burners, and, in addition, tractors, shall be shut down during refueling.

(15) Tank car or transport truck loading or unloading points and operations.

(i) The track of tank car siding shall be relatively level.

(ii) A "Tank Car Connected" sign, as covered by DOT rules, shall be installed

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at the active end or ends of the siding while the tank car is connected.

(iii) While cars are on sidetrack for loading or unloading, the wheels at both ends shall be blocked on the rails.

(iv) The employer shall insure that an employee is in attendance at all times while the tank car, cars, or trucks are being loaded or unloaded.

(v) A backflow check valve, excess-flow valve, or a shutoff valve with means of remote closing, to protect against uncontrolled discharge of LP-Gas from storage tank piping shall be installed close to the point where the liquid piping and hose or swing joint pipe is connected.

(vi) Except as provided in subdivision (vii) of this subparagraph, when the size (diameter) of the loading or unloading hoses and/or piping is reduced below the size of the tank car or transport truck loading or unloading connections, the adaptors to which lines are attached shall be equipped with either a backflow check valve, a properly sized excess flow valve, or shutoff valve with means of remote closing, to protect against uncontrolled discharge from the tank car or transport truck.

(vii) The requirement of subdivision (vi) of this subparagraph shall not apply if the tank car or transport is equipped with a quick-closing internal valve that can be remotely closed.

(viii) The tank car or transport truck loading or unloading point shall be located with due consideration to the following:

(a) Proximity to railroads and highway traffic.

(b) Revoked

(c) With respect to buildings on installer's property.

(d) Nature of occupancy.

(e) Topography.

(f) Type of construction of buildings.

(g) Number of tank cars or transport trucks that may be safely loaded or unloaded at one time.

(h) Frequency of loading or unloading.

(ix) Where practical, the distance of the unloading or loading point shall conform to the distances in subparagraph (6)(ii) of this paragraph.

(16) **Instructions.** Personnel performing installation, removal, operation, and maintenance work shall be properly trained in such function.

(17) **Electrical equipment and other sources of ignition.**

(i) Electrical equipment and wiring shall be of a type specified by and shall be installed in accordance with Subpart S of this part, for ordinary locations except that fixed electrical equipment in classified areas shall comply with subparagraph (18) of this paragraph.

(ii) Open flames or other sources of ignition shall not be permitted in vaporizer rooms (except those housing direct-fired vaporizers), pumphouses, container charging rooms or other similar locations. Direct-fired vaporizers shall not be permitted in pumphouses or container charging rooms.

(iii) Liquefied petroleum gas storage containers do not require lightning protection.

(iv) Since liquefied petroleum gas is contained in a closed system of piping and equipment, the system need not be electrically conductive or electrically bonded for protection against static electricity.

(v) Open flames (except as provided for in subparagraph (11) of this paragraph), cutting or welding, portable electric tools, and extension lights capable of igniting LP-Gas, shall not be permitted within

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- (j) Heat producing equipment shall be located and used so as to minimize the possibility of ignition of combustibles.
- (k) Containers having a water capacity greater than 2½ pounds (nominal 1 pound LP-Gas capacity) connected for use, shall stand on a firm and substantially level surface and, when necessary, shall be secured in an upright position.
- (l) Containers, including the valve protective devices, shall be installed so as to minimize the probability of impingement of discharge of safety relief devices upon containers.
- (ii) Containers having a maximum water capacity of 2½ pounds (nominal 1 pound LP-Gas capacity) are permitted to be used inside of buildings as part of approved self-contained hand torch assemblies or similar appliances.
- (iii) Containers having a maximum water capacity of 12 pounds (nominal 5 pounds LP-Gas capacity) are permitted to be used temporarily inside of buildings for public exhibition or demonstration purposes, including use for classroom demonstrations.
- (iv) Revoked
- (v) Containers are permitted to be used in buildings or structures under construction or undergoing major renovation when such buildings or structures are not occupied by the public, as follows:
- (a) The maximum water capacity of individual containers shall be 245 pounds (nominal 100 pounds LP-Gas capacity).
- (b) For temporary heating such as curing concrete, drying plaster and similar applications, heaters (other than integral heater-container units) shall be located at least 6 feet from any LP-Gas container. This shall not prohibit the use of heaters specifically designed for attachment to the container or to a supporting standard, provided they are designed and installed so as to prevent direct or radiant heat application from the heater onto the container. Blower and radiant type heaters shall not be directed toward any LP-Gas container within 20 feet.
- (c) If two or more heater-container units, of either the integral or nonintegral type, are located in an unpartitioned area on the same floor, the container or containers of each unit shall be separated from the container or containers of any other unit by at least 20 feet.
- (d) When heaters are connected to containers for use in an unpartitioned area on the same floor, the total water capacity of containers manifolded together for connection to a heater or heaters shall not be greater than 735 pounds (nominal 300 pounds LP-Gas capacity).

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Such manifolds shall be separated by at least 20 feet.

(e) On floors on which heaters are not connected for use, containers are permitted to be manifolded together for connection to a heater or heaters on another floor, *Provided:*

(1) The total water capacity of containers connected to any one manifold is not greater than 2,450 pounds (nominal 1,000 pounds LP-Gas capacity) and;

(2) Where more than one manifold having a total water capacity greater than 735 pounds (nominal 300 pounds LP-Gas capacity) are located in the same unpartitioned area, they shall be separated by at least 50 feet.

(f) Storage of containers awaiting use shall be in accordance with paragraph (f) of this section.

(vi) Containers are permitted to be used in industrial occupancies for processing, research, or experimental purposes as follows:

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

(b) Containers connected to a manifold shall have a total water capacity not greater than 735 pounds (nominal 300 pounds LP-Gas capacity) and not more than one such manifold may be located in the same room unless separated at least 20 feet from a similar unit.

(c) The amount of LP-Gas in containers for research and experimental use shall be limited to the smallest practical quantity.

(vii)

(a) Containers are permitted to be used in industrial occupancies with essentially noncombustible contents where

portable equipment for space heating is essential and where a permanent heating installation is not practical, as follows:

(b) Containers and heaters shall comply with and be used in accordance with subdivision (v) of this subparagraph.

(viii) Containers are permitted to be used in buildings for temporary emergency heating purposes, if necessary to prevent damage to the buildings or contents, when the permanent heating system is temporarily out of service, as follows:

(a) Containers and heaters shall comply with and be used in accordance with subdivision (v) of this subparagraph.

(b) The temporary heating equipment shall not be left unattended.

(ix) Containers are permitted to be used temporarily in buildings for training purposes related in installation and use of LP-Gas systems, as follows:

(a) The maximum water capacity of individual containers shall be 245 pounds (nominal 100 pounds LP-Gas capacity), but the maximum quantity of LP-Gas that may be placed in each container shall be 20 pounds.

(b) If more than one such container is located in the same room, the containers shall be separated by at least 20 feet.

(6) Container valves and accessories.

(i) Valves in the assembly of multiple container systems shall be arranged so that replacement of containers can be made without shutting off the flow of gas in the system.

NOTE: This provision is not to be construed as requiring an automatic changeover device.

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less than five times the vapor pressure of the product at 100° F. The use of non-metallic hose is prohibited for permanently interconnecting such containers.

(xi) Container assemblies listed for interchangeable installation above ground or under ground shall conform to the requirements for aboveground installations with respect to safety relief capacity and filling density. For installation above ground all other requirements for aboveground installations shall apply. For installation under ground all other requirements for underground installations shall apply.

(8) Protection of container accessories.

(i) Valves, regulating, gaging, and other container accessory equipment shall be protected against tampering and physical damage. Such accessories shall also be so protected during the transit of containers intended for installation underground.

(ii) On underground or combination aboveground-underground containers, the service valve handwheel, the terminal for connecting the hose, and the opening through which there can be a flow from safety relief valves shall be at least 4 inches above the container and this opening shall be located in the dome or housing. Underground systems shall be so installed that all the above openings, including the regulator vent, are located above the normal maximum water table.

(iii) All connections to underground containers shall be located within a substantial dome, housing, or manhole and with access thereto protected by a substantial cover.

(9) Drips for condensed gas. Where vaporized gas on the low-pressure side of the system may condense to a liquid at normal operating temperatures and pressures, suitable means shall be provided for revaporization of the condensate.

(10) Damage from vehicles. When damage to LP-Gas systems from vehicular traffic is a

possibility, precautions against such damage shall be taken.

(11) Pits and drains. Every effort should be made to avoid the use of pits, except pits fitted with automatic flammable vapor detecting devices. No drains or blowoff lines shall be directed into or in proximity to sewer systems used for other purposes.

(12) General provisions applicable to systems in industrial plants (of 2,000 gallons water capacity and more) and to bulk filling plants.

(i) When standard watch service is provided, it shall be extended to the LP-Gas installation and personnel properly trained

(ii) If loading and unloading are normally done during other than daylight hours, adequate lights shall be provided to illuminate storage containers, control valves, and other equipment.

(iii) Suitable roadways or means of access for extinguishing equipment such as wheeled extinguishers or fire department apparatus shall be provided.

(iv) To minimize trespassing or tampering, the area which includes container appurtenances, pumping equipment, loading and unloading facilities, and cylinder-filling facilities shall be enclosed with at least a 6-foot-high industrial type fence unless otherwise adequately protected. There shall be at least two means of emergency access.

(13) Container-charging plants.

(i) The container-charging room shall be located not less than:

(a) Ten feet from bulk storage containers.

(ii) Tank truck filling station outlets shall be located not less than:

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(a) Revoked

(b) Ten feet from pumps and compressors if housed in one or more separate buildings.

(iii) The pumps or compressors may be located in the container-charging room or building, in a separate building, or outside of buildings. When housed in a separate building, such building (a small noncombustible weather cover is not to be construed as a building) shall be located not less than:

(a) Ten feet from bulk storage tanks.

(b) Revoked

(c) Twenty-five feet from sources of ignition.

(iv) When a part of the container-charging building is to be used for a boiler room or where open flames or similar sources of ignition exist or are employed, the space to be so occupied shall be separated from container charging room by a partition wall or walls of fire-resistant construction continuous from floor to roof or ceiling. 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.

(v) Electrical equipment and installations shall conform with paragraphs (b)(17) and (18) of this section.

(14) Fire protection.

(i) Each bulk plant shall be provided with at least one approved portable fire extinguisher having a minimum rating of 12-B, C.

(ii) In industrial installations involving containers of 150,000 gallons aggregate water capacity or more, provision shall

be made for an adequate supply of water at the container site for fire protection in the container area, unless other adequate means for fire control are provided. Water hydrants shall be readily accessible and so spaced as to provide water protection for all containers. Sufficient lengths of firehose shall be provided at each hydrant location on a hose cart, or other means provided to facilitate easy movement of the hose in the container area. It is desirable to equip the outlet of each hose line with a combination fog nozzle. A shelter shall be provided to protect the hose and its conveyor from the weather.

(15) Painting. Revoked

(16) Lighting. Electrical equipment and installations shall conform to paragraphs (b)(17) and (18) of this section.

(17) Vaporizers for internal combustion engines. The provisions of paragraph (e)(8) of this section shall apply.

(18) Gas regulating and mixing equipment for internal combustion engines. The provisions of paragraph (e)(9) of this section shall apply.

(e) Liquefied petroleum gas as a motor fuel.

(1) Application.

(i) This paragraph applies to internal combustion engines, fuel containers, and pertinent equipment for the use of liquefied petroleum gases as a motor fuel on easily movable, readily portable units including self-propelled vehicles.

(ii) Fuel containers and pertinent equipment for internal combustion engines using liquefied petroleum gas where installation is of the stationary type are covered by paragraph (d) of this section. This paragraph does not apply to containers for transportation of liquefied petroleum gases nor to marine fuel use. All requirements of paragraph (b) of this section apply to this paragraph, unless

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(ii) No more than two LP-Gas containers shall be used on an industrial truck for motor fuel purposes.

(iii) Revoked

(iv) Revoked

(v) Industrial trucks shall not be parked and left unattended in areas of possible excessive heat or sources of ignition.

(14) Garaging LP-Gas-fueled vehicles.

(i) LP-Gas-fueled vehicles may be stored or serviced inside garages provided there are no leaks in the fuel system and the fuel tanks are not filled beyond the maximum filling capacity specified in paragraph (b)(12)(i) of this section.

(ii) LP-Gas-fueled vehicles being repaired in garages shall have the container shutoff valve closed except when fuel is required for engine operation.

(iii) Such vehicles shall not be parked near sources of heat, open flames, or similar sources of ignition or near open pits unless such pits are adequately ventilated.

(f) Storage of containers awaiting use or resale.

(1) **Application.** This paragraph shall apply to the storage of portable containers not in excess of 1,000 pounds water capacity, filled or partially filled, at user location but not connected for use, or in storage for resale by dealers or resellers. This paragraph shall not apply to containers stored at charging plants or at plants devoted primarily to the storage and distribution of LP-Gas or other petroleum products.

(2) General.

(i) Containers in storage shall be located so as to minimize exposure to excessive temperature rise, physical damage, or tampering by unauthorized persons.

(ii) Containers when stored inside shall not be located near exits, stairways, or in areas normally used or intended for the safe exit of people.

(iii) Container valves shall be protected while in storage as follows:

(a) By setting into recess of container to prevent the possibility of their being struck if the container is dropped upon a flat surface, or

(b) By ventilated cap or collar, fastened to container capable of withstanding blow from any direction equivalent to that of a 30-pound weight dropped 4 feet. Construction must be such that a blow will not be transmitted to a valve or other connection.

(iv) The outlet valves of containers in storage shall be closed.

(v) Empty containers which have been in LP-Gas service should preferably be stored in the open. When stored inside, they shall be considered as full containers for the purpose of determining the maximum quantity of LP-Gas permitted by this paragraph.

(3) Storage within buildings frequented by the public. Revoked

STANDARDS AND INTERPRETATIONS

(4) Storage within buildings not frequented by the public (such as industrial buildings).

(i) The quantity of LP-Gas stored shall not exceed 300 pounds (approximately 2,550 cubic feet in vapor form) except as provided in subparagraph (5) of this paragraph.

(ii) Containers carried as a part of service equipment on highway mobile vehicles are not to be considered in the total storage capacity in subdivision (i) of this subparagraph provided such vehicles are stored in private garages, and are limited to one container per vehicle with an LP-Gas capacity of not more than 100 pounds. All container valves shall be closed.

(5) Storage within special buildings or rooms.

(i) The quantity of LP-Gas stored in special buildings or rooms shall not exceed 10,000 pounds.

(ii) The walls, floors, and ceilings of container storage rooms that are within or adjacent to other parts of the building shall be constructed of material having at least a 2-hour fire resistance rating.

(iii) A portion of the exterior walls or roof having an area not less than 10 percent of that of the combined area of the enclosing walls and roof shall be of explosion relieving construction.

[39 F.R. 9957, March 15, 1974.]

(iv) Each opening from such storage rooms to other parts of the building shall be protected by a 1½ hour (B) fire door listed by Underwriters' Laboratories, Inc.

(v) Such rooms shall have no open flames for heating or lighting.

(vi) Such rooms shall be adequately ventilated both top and bottom to the outside only. The openings from such vents shall

be at least 5 feet away from any other opening into any building.

(vii) The floors of such rooms shall not be below ground level. Any space below the floor shall be of solid fill or properly ventilated to the open air.

(viii) Such storage rooms shall not be located adjoining the line of property occupied by schools, churches, hospitals, athletic fields or other points of public gathering.

(ix) Fixed electrical equipment shall be installed in accordance with paragraph (b)(18) of this section.

(6) Storage outside of buildings.

(i) Storage outside of buildings, for containers awaiting use or resale, shall be located in accordance with Table H-33 with respect to:

(a) the nearest important building or group of buildings;

(b) Revoked

(c) busy thoroughfares;

(ii) Containers shall be in a suitable enclosure or otherwise protected against tampering.

TABLE H-33

Quantity of LP-Gas Stored:	Distance
500 pounds or less.....	0
501 to 2,500 pounds.....	0*
2,501 to 6,000 pounds.....	10 feet
6,001 to 10,000 pounds.....	20 feet
Over 10,000 pounds.....	25 feet

*Container or containers shall be at least 10 feet from any building on adjoining property, any sidewalk, or any of the exposures described in § 1910.110(f)(6)(i) (c) or (d) of this paragraph.

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(7) **Fire protection.** Storage locations other than supply depots separated and located apart from dealer, reseller, or user establishments shall be provided with at least one approved portable fire extinguisher having a minimum rating of 8-B, C.

(g) LP-Gas system installations on commercial vehicles.

(1) **Application.** This paragraph applies to LP-Gas-system installations on vehicles (whether self-propelled or of the trailer or semitrailer type) used for commercial, construction, to all exchangeable container systems with container capacities greater than 105 pounds water capacity (approximately 45 pounds LP-Gas capacity) and to systems using containers permanently mounted on vehicles. It does not apply to LP-Gas motor fuel systems covered by paragraph (e) of this section. Paragraph (b) of this section applies to this paragraph unless otherwise noted. When such a vehicle is permanently parked, and LP-Gas is supplied from a system not mounted on and secured to the unit, paragraphs (c) and (d) of this section shall apply.

(2) **Construction and marking of containers.** Containers shall be constructed in accordance with paragraph (b)(3) of this section, and marked in accordance with the applicable requirements of paragraph (b)(5) of this section, and shall also meet the following:

(i) Containers designed for use as portable cylinders shall be constructed in accordance with DOT specifications, and in accordance with paragraph (b)(3)(v) of this section; where applicable.

(ii) All other containers whether designed for permanent mounting, or for portable or semiportable use (such as skid tanks), shall be constructed as provided for by paragraphs (b)(3)(i) and (iv) of this section. Mounting, securing, and protection of such containers shall be as in subdivisions (iii) and (iv) of this subparagraph.

(iii) Permanently installed containers shall meet the requirements of subdivi-

sion (a) of this subdivision with regard to container valves and accessories, and subdivision (b) of this subdivision as to mounting.

(a)

(1) Nonrecessed container fittings and appurtenances shall be protected against damage by either:

(i) Their location.

(ii) The vehicle frame or bumper, or

(iii) A protective housing. The protective housing, if used, shall comply with the requirements under which the tanks are fabricated with respect to design and construction and shall be designed to withstand static loadings in any direction equal to twice the weight of the tank and attachments when filled with the lading using a safety factor of not less than four, based on the ultimate strength of the material to be used. The housing shall be provided with a weather cover if necessary to insure proper operation of valves and safety devices.

(2) Manually operated shutoff valves, except as covered in paragraph (e)(2)(i) of this section, or self-closing internal valves shall be closed except during transfer operations.

(b)

(1) Tank motor vehicles with frames not made integral with the tank, as by welding, shall be provided with turnbuckles or similar positive devices for drawing the tank down tight on the frame. In addition, suitable stops or anchors shall be attached to the frame and/or the tank to prevent relative motion between them due to starting, stopping, and turning. The stops and anchors shall be so installed as to be readily accessible for inspection and maintenance.

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(2) Any tank motor vehicle designed and constructed so that the cargo tank constitutes in whole or in part the stress member used in lieu of a frame shall be supported by external cradles subtending at least 120 degrees of the shell circumference. The design calculations shall include beam stress, shear stress, torsion stress, bending moment, and acceleration stress for the cargo tank as a whole using a factor of safety of four, based on the ultimate tensile strength of the material. Maximum concentrated stresses which might be created at pads and cradles due to shear, bending, and torsion shall also be calculated in accordance with Appendix G of the American Society of Mechanical Engineers, Unfired Pressure Vessel Code, 1968. Fully loaded vehicles shall be assumed to be operating under highway conditions equal to two "g" loading. The effects of fatigue shall be taken into consideration. Cargo tanks mounted on frames may be supported by longitudinal members attached to pads providing the above-stated factors are taken into account.

(3) Where any tank support is attached to any part of a tank head, the stresses imposed upon the head shall be provided for as required in (2) of this subdivision.

(4) Tank supports, stops, anchors, and bumpers shall not be welded directly to the tank but shall be attached by means of pads of the same material as the tank. The pad thickness shall be not less than one-fourth inch, or the thickness of the shell material if less, and no greater than the shell material. Each pad shall extend at least four times its thickness, in each direction, beyond the weld attaching the support, bumper, stop, or anchor. Each pad shall be preformed to an inside radius no greater than the outside radius of the tank at the place of attachment. Each pad corner shall be rounded to a radius at least one-fourth the width

of the pad, and no greater than one-half the width of the pad. Weepholes and telltale holes, if used, shall be drilled or punched before the pads are attached to the tank. Each pad shall be attached to the tank by continuous fillet welding using filler material having properties conforming to the recommendations of the maker of the shell and head material.

(iv) Portable or semiportable containers (skid tanks as covered by paragraph (d)(7)(vii) of this section) shall meet the applicable requirements of (a) to (f) of this subdivision inclusive with regard to container valves and accessories and paragraph (e)(4)(iii) of this section as to mounting. Containers designed for permanent installation as part of systems under paragraph (d) of this section shall not be used.

(a) Nonrecessed container fittings and appurtenances shall be protected against damage by either—

(1) Their location.

(2) The vehicle frame or bumper, or

(3) A protective housing. The protective housing, if used, shall comply with the requirements under which the tanks are fabricated with respect to design and construction and shall be designed to withstand static loadings in any direction equal to twice the weight of the tank and attachments when filled with the lading using a safety factor of not less than four, based on the ultimate strength of the material to be used. The housing shall be provided with a weather cover if necessary to insure proper operation of valves and safety devices.

(b) Filling connections shall be provided with approved automatic back pressure check valves, excess flow check valves or quick closing internal valves to prevent excessive escape of gas in case the filling connection is broken, except that where the filling and dis-

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TABLE H-34

Container type	For gases with vapor pressure not to exceed lb. per sq. in. gage of 100° F. (37.8 C.)	Minimum design pressure of container, lb. per sq. in. gage	
		1949 and earlier editions of ASME Code (Par. U-68, U-69)	1949 edition of ASME Code (Par. U-200, U-201); 1950, 1952, 1956, 1959, 1962, 1965 and 1968 (Division 1) editions of ASME Code, all editions of API-ASME Code ²
1 200	215	200	250

¹ Container type may be increased by increments of 25. The minimum design pressure of containers shall be 100 percent of the container type designation when constructed under 1949 or earlier editions of the ASME Code (Par. U-68 and U-69). The minimum design pressure of containers shall be 125 percent of the container type designation when constructed under: (1) the 1949 ASME Code (Paragraphs U-200 and U-201), (2) 1950, 1952, 1956, 1959, 1962, 1965, and 1968 (Division 1) editions of the ASME Code, and (3) all editions of the API-ASME Code.

² Construction of containers under the API-ASME Code is not authorized after July 1, 1961.

(3) Container valves and accessories.

(i) A filling connection on the container shall be fitted with one of the following:

(a) A combination back-pressure check and excess flow valve.

(b) One double or two single back-pressure valves.

(c) A positive shutoff valve, in conjunction with either.

(1) An internal back-pressure valve, or

(2) An internal excess flow valve. In lieu of an excess flow valve, filling connections may be fitted with a quick-closing internal valve, which shall remain closed except during operating periods. The mechanism for such valves may be provided with a secondary control which will cause it to close automatically in case of fire. When a fusible plug is used its melting point shall not exceed 220° F.

(ii) A filling pipe inlet terminal not on the container shall be fitted with a positive shutoff valve in conjunction with either.

(a) A back pressure check valve, or

(b) An excess flow check valve.

(iii) All openings in the container except those listed below shall be equipped with approved excess flow check valves:

(a) Filling connections as provided in subdivision (i) of this subparagraph.

(b) Safety relief connections as provided in paragraph (b)(7)(ii) of this section.

(c) Liquid-level gaging devices as provided in paragraphs (b)(7)(iv) and (19)(iv) of this section.

(d) Pressure gage connections as provided in paragraph (b)(7)(v) of this section.

(iv) All container inlets and outlets except those listed below shall be labeled to designate whether they connect with vapor or liquid (labels may be on valves):

(a) Safety relief valves.

(b) Liquid-level gaging devices.

(c) Pressure gages.

(v) Each storage container shall be provided with a suitable pressure gage.

(4) Safety-relief valves.

(i) All safety-relief devices shall be installed as follows:

(a) On the container and directly connected with the vapor space.

(b) Safety-relief valves and discharge piping shall be protected against physical damage. The outlet shall be provided with loose-fitting rain caps. There shall

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be no return bends or restrictions in the discharge piping.

(c) The discharge from two or more safety relief valves having the same pressure settings may be run into a common discharge header. The cross-sectional area of such header shall be at least equal to the sum of the cross-sectional areas of the individual discharges.

(d) Discharge from any safety relief device shall not terminate in any building nor beneath any building.

(ii) Aboveground containers shall be provided with safety relief valves as follows:

(a) The rate of discharge, which may be provided by one or more valves, shall be not less than that specified in paragraph (b)(10)(ii) of this section.

(b) The discharge from safety relief valves shall be vented to the open air unobstructed and vertically upwards in such a manner as to prevent any impingement of escaping gas upon the container; loose-fitting rain caps shall be used. On a container having a water capacity greater than 2,000 gallons, the discharge from the safety relief valves shall be vented away from the container vertically upwards to a point at least 7 feet above the container. Suitable provisions shall be made so that any liquid or condensate that may accumulate inside of the relief valve or its discharge pipe will not render the valve inoperative. If a drain is used, a means shall be provided to protect the container, adjacent containers, piping, or equipment against impingement of flame resulting from ignition of the product escaping from the drain.

(iii) Underground containers shall be provided with safety relief valves as follows:

(a) The discharge from safety-relief valves shall be piped vertically upward to a point at least 10 feet above the ground. The discharge lines or pipes

shall be adequately supported and protected against physical damage.

(b) Where there is a probability of the manhole or housing becoming flooded, the discharge from regulator vent lines should be above the highest probable water level.

(c) If no liquid is put into a container until after it is buried and covered, the rate of discharge of the relief valves may be reduced to not less than 30 percent of the rate shown in paragraph (b)(10)(ii) of this section. If liquid fuel is present during installation of containers, the rate of discharge shall be the same as for aboveground containers. Such containers shall not be uncovered until emptied of liquid fuel.

(5) **Capacity of liquid containers.** Individual liquid storage containers shall not exceed 30,000 gallons water capacity.

(6) **Installation of storage containers.**

(i)

(a) Each storage container used exclusively in service station operation shall comply with the following table which specifies minimum distances to a building, groups of buildings.

Water capacity per container (gallons)	Minimum distances	
	Above ground and underground (feet)	Between aboveground containers (feet)
Up to 2,000	25	3
Over 2,000	50	5

NOTE: The above distances may be reduced to not less than 10 feet for service station buildings of other than wood frame construction.

(b) Readily ignitable material including weeds and long dry grass, shall be removed within 10 feet of containers.

(c) The minimum separation between L.P.-Gas containers and flammable

STANDARDS AND INTERPRETATIONS

to the weight of water at 60° F. that the container will hold.

(ix) "Gas"—Anhydrous ammonia in either the gaseous or liquefied state.

(x) "Gas mask"—Gas masks approved by the Bureau of Mines, U.S. Department of the Interior.

(xi) "Capacity"—Total volume of the container in standard U.S. gallons.

(xii) DOT specifications—Regulations of the Department of Transportation published in 49 CFR Chapter I.

(b) Basic rules.

This paragraph applies to all paragraphs of this section unless otherwise noted.

(1) Approval of equipment and systems. Each appurtenance shall be approved in accordance with paragraph (b) (1) (i), (ii), (iii), or (iv) of this section.

(i) It was installed before February 8, 1973, and was approved, tested, and installed in accordance with either the provisions of the American National Standard for the Storage and Handling of Anhydrous Ammonia, K61.1, or the Fertilizer Institute Standards for the Storage and Handling of Agricultural Anhydrous Ammonia, M-1, in effect at the time of installation; or

(ii) It is accepted, or certified, or listed, or labeled, or otherwise determined to be safe by a nationally recognized testing laboratory, such as, but not limited to, Underwriters' Laboratories, Inc. and Factory Mutual Research Corporation; or

(iii) It is a type which no nationally recognized testing laboratory does, or

will undertake to, accept, certify, list, label, or determine to be safe; and such equipment is inspected or tested by any Federal, State, municipal, or other local authority responsible for enforcing occupational safety provisions of a Federal, State, municipal or other local law, code, or regulation pertaining to the storage, handling, transport, and use of anhydrous ammonia, and found to be in compliance with either the provisions of the American National Standard for the Storage and Handling of Anhydrous Ammonia, K61.1, or the Fertilizer Institute Standards for the Storage and Handling of Agricultural Anhydrous Ammonia, M-1, in effect at the time of installation; or

(iv) It is a custom-designed and custom-built unit, which no nationally recognized testing laboratory, or Federal, State, municipal or local authority responsible for the enforcement of a Federal, State, municipal, or local law, code or regulation pertaining to the storage, transportation and use of anhydrous ammonia is willing to undertake to accept, certify, list, label or determine to be safe, and the employer has on file a document attesting to its safe condition following the conduct of appropriate tests. The document shall be signed by a registered professional engineer or other person having special training or experience sufficient to permit him to form an opinion as to safety of the unit involved. The document shall set forth the test bases, test data and results, and also the qualifications of the certifying person.

(v) For the purposes of this paragraph (b)(1), the word "listed" means that equipment is of a kind mentioned in a list which is published by a nationally recognized laboratory which makes periodic inspection of the production of such equipment, and states such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner. "Labeled" means there is attached to it a label, symbol, or other identifying mark of a nationally recognized testing laboratory which, makes periodic inspections of the production of such equipment, and whose

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labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner. "Certified" means it has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner, or is of a kind whose production is periodically inspected by a nationally recognized testing laboratory, and it bears a label, tag, or other record of certification.

[38 F.R. 3598, February 8, 1973.]

(2) Requirements for construction, original test and requalification of nonrefrigerated containers.

(i) Containers used with systems covered in paragraphs (c), (f), (g), and (h) of this section shall be constructed and tested in accordance with the Code except that construction under Table UW12 at a basic joint efficiency of under 80 percent is not authorized.

(ii) Containers built according to the Code do not have to comply with Paragraphs UG125 to UG128 inclusive, and Paragraphs UG132 and UG133 of the Code.

(iii) Containers exceeding 36 inches in diameter or 250 gallons water capacity shall be constructed to comply with one or more of the following:

(a) Containers shall be stress relieved after fabrication in accordance with the Code, or

(b) Cold-formed heads, when used, shall be stress relieved, or

(c) Hot-formed heads shall be used.

(iv) Welding to the shell, head, or any other part of the container subject to internal pressure shall be done in compliance with the Code. Other welding is permitted only on saddle plates, lugs, or brackets attached to the container by the container manufacturer.

(v) Containers used with systems covered in paragraph (e) of this section shall be

constructed and tested in accordance with the DOT specifications.

(vi) The provisions of subdivision (i) of this subparagraph shall not be construed as prohibiting the continued use or reinstallation of containers constructed and maintained in accordance with the 1949, 1950, 1952, 1956, 1959, and 1962 editions of the Code or any revisions thereof in effect at the time of fabrication.

(3) Marking nonrefrigerated containers.

(i) System nameplates, when required, shall be permanently attached to the system so as to be readily accessible for inspection and shall include markings as prescribed in subdivision (ii) of this subparagraph.

(ii) Each container or system covered in paragraphs (c), (f), (g), and (h) of this section shall be marked as specified in the following:

(a) With a notation "Anhydrous Ammonia."

(b) With a marking identifying compliance with the rules of the Code under which the container is constructed.

Under ground: Container and system nameplate.
Above ground: Container.

(c) With a notation whether the system is designed for underground or above-ground installation or both.

(d) With the name and address of the supplier of the system or the trade name of the system and with the date of fabrication.

Under ground and above ground: System nameplate.

(e) With the water capacity of the container in pounds at 60° F. or gallons, U.S. Standard.

Under ground: Container and system nameplate.
Above ground: Container.

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(f) With the design pressure in pounds per square inch.

Under ground: Container and system nameplate.
Above ground: Container.

(g) With the wall thickness of the shell and heads.

Under ground: Container and system nameplate.
Above ground: Container.

(h) With marking indicating the maximum level to which the container may be filled with liquid anhydrous ammonia at temperatures between 20° F. and 130° F. except on containers provided with fixed level indicators, such as fixed length dip tubes, or containers that are filled with weight. Markings shall be in increments of not more than 20° F.

Above ground and under ground: System nameplate or on liquid-level gaging device.

(i) With the total outside surface area of the container in square feet.

Under ground: System nameplate.
Above ground: No requirement.

(j) Marking specified on the container shall be on the container itself or on a nameplate permanently attached to it.

(4) Marking refrigerated containers. Each refrigerated container shall be marked with nameplate on the outer covering in an accessible place as specified in the following:

(i) With the notation, "Anhydrous Ammonia."

(ii) With the name and address of the builder and the date of fabrication.

(iii) With the water capacity of the container in gallons, U.S. Standard.

(iv) With the design pressure.

(v) With the minimum temperature in degrees Fahrenheit for which the container was designed.

(vi) The maximum allowable water level to which the container may be filled for test purposes.

(vii) With the density of the product in pounds per cubic foot for which the container was designed.

(viii) With the maximum level to which the container may be filled with liquid anhydrous ammonia.

(5) Location of containers.

(i) Consideration shall be given to the physiological effects of ammonia as well as to adjacent fire hazards in selecting the location for a storage container. Containers shall be located outside of buildings or in buildings or sections thereof especially provided for this purpose.

(ii) Permanent storage containers shall be located at least 50 feet from a dug well or other sources of potable water supply, unless the container is a part of a water-treatment installation.

(iii) Revoked

(iv) Revoked

(v) Storage areas shall be kept free of readily ignitable materials such as waste, weeds, and long dry grass.

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(6) Container appurtenances.

(i) All appurtenances shall be designed for not less than the maximum working pressure of that portion of the system on which they are installed. All appurtenances shall be fabricated from materials proved suitable for anhydrous ammonia service.

(ii) All connections to containers except safety relief devices, gaging devices, or those fitted with No. 54 drill-size orifice shall have shutoff valves located as close to the container as practicable.

(iii) Excess flow valves where required by these standards shall close automatically at the rated flows of vapor or liquid as specified by the manufacturer. The connections and line including valves and fittings being protected by an excess flow valve shall have a greater capacity than the rated flow of the excess flow valve so that the valve will close in case of failure of the line or fittings.

(iv) Liquid-level gaging devices that require bleeding of the product to the atmosphere and which are so constructed that outward flow will not exceed that passed by a No. 54 drill-size opening need not be equipped with excess flow valves.

(v) Openings from the container or through fittings attached directly on the container to which pressure gage connections are made need not be equipped with excess flow valves if such openings are not larger than No. 54 drill size.

(vi) Excess flow and back pressure check valves where required by the standards in this section shall be located inside of the container or at a point outside as close as practicable to where the line enters the container. In the latter case installation shall be made in such manner that any undue strain beyond the excess flow or back pressure check valve will not cause breakage between the container and the valve.

(vii) Excess flow valves shall be designed with a bypass, not to exceed a No. 60 drill-

size opening to allow equalization of pressures.

(viii) All excess flow valves shall be plainly and permanently marked with the name or trademark of the manufacturer, the catalog number, and the rated capacity.

(7) Piping, tubing, and fittings.

(i) All piping, tubing, and fittings shall be made of material suitable for anhydrous ammonia service.

(ii) All piping, tubing, and fittings shall be designed for a pressure not less than the maximum pressure to which they may be subjected in service.

(iii) All refrigerated piping shall conform to the Refrigeration Piping Code, American National Standards Institute, B31.5-1966 with addenda B31.1a-1968 as it applies to ammonia.

(iv) Piping used on non-refrigerated systems shall be at least American Society for Testing and Materials (ASTM) A-53-69 Grade B Electric Resistance Welded and Electric Flash Welded Pipe or equal. Such pipe shall be at least schedule 40 when joints are welded, or welded and flanged. Such pipe shall be at least schedule 80 when joints are threaded. Threaded connections shall not be back-welded. Brass, copper, or galvanized steel pipe shall not be used.

(v) Tubing made of brass, copper, or other material subject to attack by ammonia shall not be used.

(vi) Cast iron fittings shall not be used but this shall not prohibit the use of fittings made specifically for ammonia service of malleable, nodular, or high strength gray iron meeting American Society for Testing and Materials (ASTM) A47-68, ASTM 395-68, or ASTM A126-66 Class B or C.

(vii) Joint compounds shall be resistant to ammonia.

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graduated to at least one and one-half times the maximum pressure that can be developed.

(e) Adequate means, such as drainable liquid trap, shall be provided on the compressor suction to minimize the entry of liquid into the compressor.

(vii) Loading and unloading systems shall be protected by suitable devices to prevent emptying of the storage container or the container being loaded or unloaded in the event of severance of the hose. Backflow check valves or properly sized excess flow valves shall be installed where necessary to provide such protection. In the event that such valves are not practical, remotely operated shutoff valves may be installed.

(13) Tank car unloading points and operations.

(i) Provisions for unloading tank cars shall conform to the applicable recommendations contained in the DOT regulations.

(ii) The employer shall insure that unloading operations are performed by reliable persons properly instructed and given the authority to monitor careful compliance with all applicable procedures.

(iii) Caution signs shall be so placed on the track or car as to give necessary warning to persons approaching the car from open end or ends of siding and shall be left up until after the car is unloaded and disconnected from discharge connections. Signs shall be of metal or other suitable material, at least 12 by 15 inches in size and bear the words "STOP—Tank Car Connected" or "STOP—Men at Work" the word, "STOP," being in letters at least 4 inches high and the other words in letters at least 2 inches high.

(iv) The track of a tank car siding shall be substantially level.

(v) Brakes shall be set and wheels blocked on all cars being unloaded.

(14) Liquid-level gaging device.

(i) Each container except those filled by weight shall be equipped with an approved liquid-level gaging device. A thermometer well shall be provided in all containers not utilizing a fixed liquid-level gaging device.

(ii) All gaging devices shall be arranged so that the maximum liquid level to which the container is filled is readily determined.

(iii) Gaging devices that require bleeding of the product to the atmosphere such as the rotary tube, fixed tube, and slip tube devices shall be designed so that the maximum opening of the bleed valve is not larger than No. 54 drill size unless provided with an excess flow valve. (This requirement does not apply to farm vehicles used for the application of ammonia as covered in paragraph (h) of this section.)

(iv) Gaging devices shall have a design pressure equal to or greater than the design pressure of the container on which they are installed.

(v) Fixed tube liquid-level gages shall be designed and installed to indicate that level at which the container is filled to 85 percent of its water capacity in gallons.

(vi) Gage glasses of the columnar type shall be restricted to stationary storage installations. They shall be equipped with shutoff valves having metallic handwheels, with excess-flow valves, and with extra heavy glass adequately protected with a metal housing applied by the gage manufacturer. They shall be shielded against the direct rays of the sun.

(15) Painting of containers. Aboveground uninsulated containers should have a reflective surface maintained in good condition.

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(16) Electrical equipment and wiring.

(i) Electrical equipment and wiring for use in ammonia installations shall be general purpose or weather resistant as appropriate.

(ii) Electrical systems shall be installed and maintained in accordance with Subpart S of this part.

(c) Systems utilizing stationary, nonrefrigerated storage containers.

This paragraph applies to stationary, non-refrigerated storage installations utilizing containers other than those covered in paragraph (e) of this section. Paragraph (b) of this section applies to this paragraph unless otherwise noted.

(1) Design pressure and construction of containers.
The minimum design pressure for nonrefrigerated containers shall be 250 p.s.i.g.

(2) Container valves and accessories filling and discharge connections.

(i) Each filling connection shall be provided with combination back-pressure check valve and excess-flow valve; one double or two single back-pressure check valves; or a positive shutoff valve in conjunction with either an internal back-pressure check valve or an internal excess flow valve.

(ii) All liquid and vapor connections to containers except filling pipes, safety relief connections, and liquid-level gaging and pressure gage connections provided with orifices not larger than No. 54 drill size as required in paragraphs (b)(6)(iv) and (v) of this section shall be equipped with excess-flow valves.

(iii) Each storage container shall be provided with a pressure gage graduated from 0 to 400 p.s.i. Gages shall be designated for use in ammonia service.

(iv) All containers shall be equipped with vapor return valves.

(3) Safety-relief devices.

(i) Every container shall be provided with one or more safety-relief valves of the spring-loaded or equivalent type in accordance with paragraph (b)(9) of this section.

(ii) The rate of discharge of spring-loaded safety relief valves installed on underground containers may be reduced to a minimum of 30 percent of the rate of discharge specified in Table H-36. Containers so protected shall not be uncovered after installation until the liquid ammonia has been removed. Containers which may contain liquid ammonia before being installed underground and before being completely covered with earth are to be considered aboveground containers when determining the rate of discharge requirements of the safety-relief valves.

(iii) On underground installations where there is a probability of the manhole or housing becoming flooded, the discharge from vent lines shall be located above the high water level. All manholes or housings shall be provided with ventilated louvers or their equivalent, the area of such openings equalling or exceeding combined discharge areas of safety-relief valves and vent lines which discharge their content into the manhole housing.

(iv) Vent pipes, when used, shall not be restricted or of smaller diameter than the relief-valve outlet connection.

(v) If desired, vent pipes from two or more safety-relief devices located on the same unit, or similar lines from two or more different units may be run into a common discharge header, provided the capacity of such header is at least equal to the sum of the capacities of the individual discharge lines.

(4) Reinstallation of containers.

(i) Containers once installed underground shall not later be reinstalled above ground or under ground, unless

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(ii) Container safety-relief valves shall be set to start-to-discharge as follows, with relation to the design pressure of the container:

Containers	Minimum (percent)	Maximum (percent)
ASME-U-68, U-69	110	125
ASME-U-200, U-201	95	100
ASME 1959, 1956, 1952, or 1962	95	100
API-ASME	95	100
U.S. Coast Guard	95	100

As required by DOT Regulations.

(iii) Safety relief devices used in systems covered by paragraphs (c), (f), (g), and (h) of this section shall be constructed to discharge at not less than the rates required in subdivision (i) of this subparagraph before the pressure is in excess of 120 percent (not including the 10 percent tolerance referred to in subdivision (ii) of this subparagraph) of the maximum permitted start-to-discharge pressure setting of the device.

(iv) Safety-relief valves shall be so arranged that the possibility of tampering will be minimized. If the pressure setting adjustment is external, the relief valves shall be provided with means for sealing the adjustment.

(v) Shutoff valves shall not be installed between the safety-relief valves and the container; except, that a shut-off valve may be used where the arrangement of this valve is such as always to afford full required capacity flow through the relief valves.

(vi) Safety-relief valves shall direct communication with the vapor space of the container.

(vii) Each container safety-relief valve used with systems covered by paragraphs

(c), (f), (g), and (h) of this section shall be plainly and permanently marked with the symbol "NH₃" or "AA"; with the pressure in pounds-per-square-inch gage at which the valve is set to start-to-discharge; with the actual rate of discharge of the valve at its full open position in cubic feet per minute of air at 60° F. and atmospheric pressure; and with the manufacturer's name and catalog number. Example: "NH₃ 250—4050 Air" indicates that the valve is suitable for use on an anhydrous ammonia container, is set to start-to-discharge at a pressure of 250 p.s.i.g., and that its rate of discharge at full open position (subdivisions (ii) and (iii) of this subparagraph) is 4,050 cubic feet per minute of air.

(viii) The flow capacity of the relief valve shall not be restricted by any connection to it on either the upstream or downstream side.

(ix) A hydrostatic relief valve shall be installed between each pair of valves in the liquid ammonia piping or hose where liquid may be trapped so as to relieve into the atmosphere at a safe location.

(10) General.

(i) Personnel required to handle ammonia should be trained in safe operating practices and in the proper action to take in the event of emergencies.

(ii) All stationary storage installations shall have at least two suitable gas masks in readily accessible locations. Full face masks with ammonia canisters as approved by the Bureau of Mines, U.S. Department of the Interior, are suitable for emergency action for most leaks, particularly those that occur outdoors. For protection in concentrated ammonia atmospheres self-contained breathing air apparatus is required.

(iii) Stationary storage installations shall have an easily accessible shower or a 50-gallon drum of water.

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(iv) Each vehicle transporting ammonia in bulk except farm applicator vehicles shall carry a container of at least 5 gallons of water and shall be equipped with a full face mask.

(11) Charging of containers.

(i) The filling densities for containers that are not refrigerated shall not exceed the following:

Type of container	Percent by weight	Percent by volume
Aboveground—Uninsulated	56	82
Aboveground—Uninsulated		87.5
Aboveground—Insulated	57	83.5
Underground—Uninsulated	58	85
DOT—In accord with DOT regulations.		

(ii) Aboveground uninsulated containers may be charged 87.5 percent by volume provided the temperature of the anhydrous ammonia being charged is determined to be not lower than 30° F. or provided the charging of the container is stopped at the first indication of frost or ice formation on its outside surface and is not resumed until such frost or ice has disappeared.

(12) Transfer of liquids.

(i) Anhydrous ammonia shall always be at a temperature suitable for the material of construction and the design of the receiving container.

(ii) The employer shall require the continuous presence of an attendant in the vicinity of the operation during such time as ammonia is being transferred.

(iii) Containers shall be charged or used only upon authorization of the owner.

(iv) Containers shall be gaged and charged only in the open atmosphere or in buildings or areas thereof provided for that purpose.

(v) Pumps used for transferring ammonia shall be those manufactured for that purpose.

(a) Pumps shall be designed for at least 250 p.s.i.g. working pressure.

(b) Positive displacement pumps shall have, installed off the discharged port, a constant differential relief valve discharging into the suction port of the pump through a line of sufficient size to carry the full capacity of the pump at relief valve setting, which setting and installation shall be according to the pump manufacturer's recommendations.

(c) On the discharge side of the pump, before the relief valve line, there shall be installed a pressure gage graduated from 0 to 400 p.s.i.

(d) Plant piping shall contain shut-off valves located as close as practical to pump connections.

(vi) Compressors used for transferring or refrigerating ammonia shall be recommended for ammonia service by the manufacturer.

(a) Compressors shall be designed for at least 250 p.s.i.g. working pressure.

(b) Plant piping shall contain shutoff valves located as close as practical to compressor connections.

(c) A relief valve large enough to discharge the full capacity of the compressor shall be connected to the discharge before any shutoff valve.

(d) Compressors shall have pressure gages at suction and discharge

STANDARDS AND INTERPRETATIONS

they successfully withstand hydrostatic pressure retests at the pressure specified for the original hydrostatic test as required by the code under which constructed and show no evidence of serious corrosion.

(ii) Where containers are reinstalled above ground, safety devices or gaging devices shall comply with paragraph (b)(9) of this section and this subparagraph respectively for aboveground containers.

(5) Installation of storage containers.

(i) Containers installed above ground, except as provided in subdivision (v) of this subparagraph shall be provided with substantial concrete or masonry supports, or structural steel supports on firm concrete or masonry foundations. All foundations shall extend below the frost line.

(ii) Horizontal aboveground containers shall be so mounted on foundations as to permit expansion and contraction. Every container shall be supported to prevent the concentration of excessive loads on the supporting portion of the shell. That portion of the container in contact with foundations or saddles shall be protected against corrosion.

(iii) Containers installed under ground shall be so placed that the top of the container is below the frost line and in no case less than 2 feet below the surface of the ground. Should ground conditions make compliance with these requirements impracticable, installation shall be made otherwise to prevent physical damage. It will not be necessary to cover the portion of the container to which manhole and other connections are affixed. When necessary to prevent floating, containers shall be securely anchored or weighted.

(iv) Underground containers shall be set on a firm foundation (firm earth may be used) and surrounded with earth or sand well tamped in place. The container, prior to being placed under ground, shall be given a corrosion resisting protective coating. The container thus coated shall be so lowered into place as to prevent abrasion or other damage to the coating.

(v) Containers with foundations attached (portable or semiportable tank containers with suitable steel "runners" or "skids" and commonly known in the industry as "skid tanks") shall be designed and constructed in accordance with subparagraph (1) of this paragraph.

(vi) Secure anchorage or adequate pier height shall be provided against container flotation wherever sufficiently high flood water might occur.

(vii) The distance between underground containers of over 2,000 gallons capacity shall be at least 5 feet.

(6) Protection of appurtenances.

(i) Valves, regulating, gaging, and other appurtenances shall be protected against tampering and physical damage. Such appurtenances shall also be protected during transit of containers.

(ii) All connections to underground containers shall be located within a dome, housing, or manhole and with access thereto by means of a substantial cover.

(7) **Damage from vehicles.** Precaution shall be taken against damage to ammonia systems from vehicles.

(d) Refrigerated storage systems.

This paragraph applies to systems utilizing containers with the storage of anhydrous ammonia under refrigerated conditions. All applicable rules of paragraph (b) of this section apply to this paragraph unless otherwise noted.

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(1) Design of containers.

(i) The design temperature shall be the minimum temperature to which the container will be refrigerated.

(ii) Containers with a design pressure exceeding 15 p.s.i.g. shall be constructed in accordance with paragraph (b)(2) of this section, and the materials shall be selected from those listed in API Standard 620, Recommended Rules for Design and Construction of Large, Welded, Low-Pressure Storage Tanks, Fourth Edition, 1970, Tables 2.02, R2.2, R2.2(A), R2.2.1, or R2.3.

(iii) Containers with a design pressure of 15 p.s.i.g. and less shall be constructed in accordance with the applicable requirements of API Standard 620 including its Appendix R.

(iv) When austenitic steels or nonferrous materials are used, the Code shall be used as a guide in the selection of materials for use at the design temperature.

(v) The filling density for refrigerated storage containers shall be such that the container will not be liquid full at a liquid temperature corresponding to the vapor pressure at the start-to-discharge pressure setting of the safety-relief valve.

(2) Installation of refrigerated storage containers.

(i) Containers shall be supported on suitable noncombustible foundations designed to accommodate the type of container being used.

(ii) Adequate protection against flotation or other water damage shall be provided wherever high flood water might occur.

(iii) Containers for product storage at less than 32° F. shall be supported in such a way, or heat shall be supplied, to prevent the effects of freezing and consequent frost heaving.

(3) Shutoff valves. When operating conditions make it advisable, a check valve shall be installed on the fill connection and a remotely operated shutoff valve on other

connections located below the maximum liquid level.

(4) Safety relief devices.

(i) Safety relief valves shall be set to start-to-discharge at a pressure not in excess of the design pressure of the container and shall have a total relieving capacity sufficient to prevent a maximum pressure in the container of more than 120 percent of the design pressure. Relief valves for refrigerated storage containers shall be self-contained spring-loaded, weight-loaded, or self-contained pilot-operated type.

(ii) The total relieving capacity shall be the larger of:

(a) Possible refrigeration system upset such as

(1) Cooling water failure.

(2) Power failure.

(3) Instrument air or instrument failure.

(4) Mechanical failure of any equipment.

(5) Excessive pumping rates.

(b) Fire exposure determined in accordance with Compressed Gas Association (CGA) S-1, Part 3, Safety Relief Device Standards for Compressed Gas Storage Containers, 1959, except that "A" shall be the total exposed surface area in square feet up to 25 foot above grade or to the equator of the storage container if it is a sphere, whichever is greater. If the relieving capacity required for fire exposure is greater than that required by (a) of this subdivision, the additional capacity may be provided by weak roof to shell seams in containers operating at essentially atmospheric pressure and having an inherently weak roof-to-shell seam. The weak roof-to-shell seam is not to be considered as providing any of the capacity required in (a) of this subdivision.

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(iii) If vent lines are installed to conduct the vapors from the relief valve, the back pressure under full relieving conditions shall not exceed 50 percent of the start-to-discharge pressure for pressure balanced valves or 10 percent of the start-to-discharge pressure for conventional valves. The vent lines shall be installed to prevent accumulation of liquid in the lines.

(iv) The valve or valve installation shall provide weather protection.

(v) Atmospheric storage shall be provided with vacuum breakers. Ammonia gas, nitrogen, methane, or other inert gases can be used to provide a pad.

(5) **Protection of container appurtenances.** Appurtenances shall be protected against tampering and physical damage.

(6) **Reinstallation of refrigerated storage containers.** Containers of such size as to require field fabrication shall, when moved and reinstalled, be reconstructed and reinspected in complete accordance with the requirements under which they were constructed. The containers shall be subjected to a pressure retest and if rerating is necessary, rerating shall be in accordance with applicable requirements.

(7) **Damage from vehicles.** Precaution shall be taken against damage from vehicles.

(8) **Refrigeration load and equipment.**

(i) The total refrigeration load shall be computed as the sum of the following:

(a) Load imposed by heat flow into the container caused by the temperature differential between design ambient temperature and storage temperature.

(b) Load imposed by heat flow into the container caused by maximum sun radiation.

(c) Maximum load imposed by filling the container with ammonia warmer than the design storage temperature.

(ii) More than one storage container may be handled by the same refrigeration system.

(9) **Compressors.**

(i) A minimum of two compressors shall be provided either of which shall be of sufficient size to handle the loads listed in subparagraphs (8)(i)(a) and (b) of this paragraph. Where more than two compressors are provided minimum standby equipment equal to the largest normally operating equipment shall be installed. Filling compressors may be used as standby equipment for holding compressors.

(ii) Compressors shall be sized to operate with a suction pressure at least 10 percent below the minimum setting of the safety valve(s) on the storage container and shall withstand a suction pressure at least equal to 120 percent of the design pressure of the container.

(10) **Compressor drives.**

(i) Each compressor shall have its individual driving unit.

(ii) An emergency source of power of sufficient capacity to handle the loads listed in subparagraphs (8)(i)(a) and (b) of this paragraph shall be provided unless facilities are available to safely dispose of vented vapors while the refrigeration system is not operating.

(11) **Automatic control equipment.**

(i) The refrigeration system shall be arranged with suitable controls to govern the compressor operation in accordance with the load as evidenced by the pressure in the container(s).

(ii) An emergency alarm system shall be installed to function in the event the pressure in the container(s) rises to the maximum allowable operating pressure.

(iii) An emergency alarm and shutoff shall be located in the condenser system to respond to excess discharge pressure caused by failure of the cooling medium.

STANDARDS AND INTERPRETATIONS

(iv) All automatic controls shall be installed in a manner to preclude operation of alternate compressors unless the controls will function with the alternate compressors.

(12) Separators for compressors.

(i) An entrainment separator of suitable size and design pressure shall be installed in the compressor suction line of lubricated compression. The separator shall be equipped with a drain and gaging device.

(13) Condensers. The condenser system may be cooled by air or water or both. The condenser shall be designed for at least 250 p.s.i.g. Provision shall be made for purging noncondensibles either manually or automatically.

(14) Receiver and liquid drain. A receiver shall be provided with a liquid-level control to discharge the liquid ammonia to storage. The receiver shall be designed for at least 250 p.s.i.g. and be equipped with the necessary connections, safety valves, and gaging device.

(15) Insulation. Refrigerated containers and pipelines which are insulated shall be covered with a material of suitable quality and thickness for the temperatures encountered. Insulation shall be suitably supported and protected against the weather. Weatherproofing shall be of a type which will not support flame propagation.

(e) Systems utilizing portable DOT containers.

(1) **Conformance.** Cylinders shall comply with DOT specifications and shall be maintained, filled, packaged, marked, labeled, and shipped to comply with 49 CFR Chapter I and Marking Portable Compressed Gas Containers to Identify the Material Contained, ANSI Z48.1-1954 (R1970).

(2) Storage. Cylinders shall be stored in an area free from ignitable debris and in such manner as to prevent external corrosion. Storage may be indoors or outdoors.

(3) Heat protection. Cylinders filled in accordance with DOT regulations will become liquid full at 145° F. Cylinders shall be protected from heat sources such as radiant flame and steam pipes. Heat shall not be applied directly to cylinders to raise the pressure.

(4) Protection. Cylinders shall be stored in such manner as to protect them from moving vehicles or external damage.

(5) Valve cap. Any cylinder which is designed to have a valve protection cap shall have the cap securely in place when the cylinder is not in service.

(f) Tank motor vehicles for the transportation of ammonia.

(1) This paragraph applies to containers and pertinent equipment mounted on tank motor vehicles including semitrailers and full trailers used for the transportation of ammonia. This paragraph does not apply to farm vehicles. For requirements covering farm vehicles, refer to paragraphs (g) and (h) of this section.

Paragraph (b) of this section applies to this paragraph unless otherwise noted. Containers and pertinent equipment for tank motor vehicles for the transportation of anhydrous ammonia, in addition to complying with the requirements of this section, shall also comply with the requirements of DOT.

(2) Design pressure and construction of containers.

(i) The minimum design pressure for containers shall be that specified in the regulations of the DOT.

(ii) The shell or head thickness of any container shall not be less than three-sixteenth inch.

(iii) All container openings, except safety relief valves, liquid-level gaging devices,

STANDARDS AND INTERPRETATIONS

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

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

(g) Identification of gas mask canisters.

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

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

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

(i)

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

(ii) In addition, essentially the following wording shall appear beneath the appropriate phase on the canister label: "For

respiratory protection in atmospheres containing not more than percent by volume of "

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

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

(6) Each gas mask canister shall be painted a distinctive color or combination of colors indicated in Table I-1. All colors used shall be such that they are clearly identifiable by the user and clearly distinguishable from one another. The color coating used shall offer a high degree of resistance to chipping, scaling, peeling, blistering, fading, and the effects of the ordinary atmospheres to which they may be exposed under normal conditions of storage and use. Appropriately colored pressure sensitive tape may be used for the stripes.

STANDARDS AND INTERPRETATIONS

TABLE I-1

<i>Atmospheric contaminants to be protected against</i>	<i>Colors assigned*</i>
Acid gases.....	White.
Hydrocyanic acid gas.....	White with ½-inch green stripe completely around the canister near the bottom.
Chlorine gas.....	White with ½-inch yellow stripe completely around the canister near the bottom.
Organic vapors.....	Black.
Ammonia gas.....	Green.
Acid gases and ammonia gas.....	Green with ½-inch white stripe completely around the canister near the bottom.
Carbon monoxide.....	Blue.
Acid gases and organic vapors.....	Yellow.
Hydrocyanic acid gas and chloropicrin vapor..	Yellow with ½-inch blue stripe completely around the canister near the bottom.
Acid gases, organic vapors, and ammonia gases.	Brown.
Radioactive materials, excepting tritium and noble gases.	Purple (Magenta).
Particulates (dusts, fumes, mists, fogs, or smokes) in combination with any of the above gases or vapors.	Canister color for contaminant, as designated above, with ½-inch gray stripe completely around the canister near the top.
All of the above atmospheric contaminants..	Red with ½-inch gray stripe completely around the canister near the top.

*Gray shall not be assigned as the main color for a canister designed to remove acids or vapors.

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

1910.135—OCCUPATIONAL HEAD PROTECTION

Helmets for the protection of heads of occupational workers from impact and penetration from falling and flying objects and from limited electric shock and burn shall meet the

requirements and specifications established in American National Standard Safety Requirements for Industrial Head Protection, Z89.1-1969.

1910.136—OCCUPATIONAL FOOT PROTECTION

Safety-toe footwear for employees shall meet the requirements and specifications in

American National Standard for Men's Safety-Toe Footwear, Z41.1-1967.

STANDARDS AND INTERPRETATIONS

tained in a sanitary condition. Such a receptacle shall be equipped with a solid tight-fitting cover, unless it can be maintained in a sanitary condition without a cover. This requirement does not prohibit the use of receptacles which are designed to permit the maintenance of a sanitary condition without regard to the aforementioned requirements.

(ii) All sweepings, solid or liquid wastes, refuse, and garbage shall be removed in such a manner as to avoid creating a menace to health and as often as necessary or appropriate to maintain the place of employment in a sanitary condition.

(5) **Vermin control.** Every enclosed workplace shall be so constructed, equipped, and maintained, so far as reasonably practicable, as to prevent the entrance or harborage of rodents, insects, and other vermin. A continuing and effective extermination program shall be instituted where their presence is detected.

(b) Water supply.

(1) Potable water.

(i) Potable water shall be provided in all places of employment, for drinking, washing of the person, cooking, washing of foods, washing of cooking or eating utensils, washing of food preparation or processing premises, and personal service rooms.

(ii) Revoked

(iii) Portable drinking water dispensers shall be designed, constructed, and serv-

iced so that sanitary conditions are maintained, shall be capable of being closed, and shall be equipped with a tap.

(iv) Revoked

(v) Open containers such as barrels, pails, or tanks for drinking water from which the water must be dipped or poured, whether or not they are fitted with a cover, are prohibited.

(vi) A common drinking cup and other common utensils are prohibited.

(2) Nonpotable water.

(i) Outlets for nonpotable water, such as water for industrial or firefighting purposes, shall be posted or otherwise marked in a manner that will indicate clearly that the water is unsafe and is not to be used for drinking, washing of the person, cooking, washing of food, washing of cooking or eating utensils, washing of food preparation or processing premises, or personal service rooms, or for washing clothes.

(ii) Construction of nonpotable water systems or systems carrying any other nonpotable substance shall be such as to prevent backflow or backsiphonage into a potable water system.

(iii) Nonpotable water shall not be used for washing any portion of the person, cooking or eating utensils, or clothing. Nonpotable water may be used for cleaning work premises, other than food processing and preparation premises and personal service rooms: *Provided*, That this nonpotable water does not contain concentrations of chemicals, fecal coliform, or other substances which could create insanitary conditions or be harmful to employees.

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(c) Toilet facilities.

(1) General.

(i) Except as otherwise indicated in this subdivision (i), toilet facilities, in toilet rooms separate for each sex, shall be provided in all places of employment in accordance with table J-1 of this section. The number of facilities to be provided for each sex shall be based on the number of employees of that sex for whom the facilities are furnished. Where toilet rooms will be occupied by no more than one person at a time, can be locked from the inside, and contain at least one water closet, separate toilet rooms for each sex need not be provided. Where such single-occupancy rooms have more than one toilet facility, only one such facility in each toilet room shall be counted for the purpose of table J-1.

TABLE J-1

Number of employees:	Minimum number of water closets ¹
1 to 15	1.
16 to 35	2.
36 to 55	3.
56 to 80	4.
81 to 110	5.
111 to 150	6.
Over 150	1 additional fixture for each additional 40 employees.

¹ Where toilet facilities will not be used by women, urinals may be provided instead of water closets, except that the number of water closets in such cases shall not be reduced to less than $\frac{2}{3}$ of the minimum specified.

(ii) The requirements of subdivision (i) of this subparagraph do not apply to mobile crews or to normally unattended work locations so long as employees working at these locations have transportation immediately available to nearby toilet facilities which meet the other requirements of this subparagraph.

(iii) The sewage disposal method shall not endanger the health of employees.

(2) Construction of toilet rooms.

(i) Each water closet shall occupy a separate compartment with a door and walls or partitions between fixtures sufficiently high to assure privacy.

(3) Construction and installation of toilet facilities. Revoked

STANDARDS AND INTERPRETATIONS

(d) Washing facilities.

(1) General. Washing facilities shall be maintained in a sanitary condition.

(2) Lavatories.

(i) Lavatories shall be made available in all places of employment

The requirements of this subdivision do not apply to mobile crews or to normally unattended work locations if employees working at these locations have transportation readily available to nearby washing facilities which meet the other requirements of this paragraph.

(ii) Each lavatory shall be provided with hot and cold running water, or tepid running water.

(iii) Hand soap or similar cleansing agents shall be provided.

(iv) Individual hand towels or sections thereof, of cloth or paper, warm air blowers or clean individual sections of continuous cloth toweling, convenient to the lavatories, shall be provided.

(3) Showers.

(i) Whenever showers are required by a particular standard, the showers shall be provided in accordance with subdivisions (ii) through (v) of this subparagraph.

(ii) One shower shall be provided for each 10 employees of each sex, or numerical fraction thereof, who are required to shower during the same shift.

(iii) Body soap or other appropriate cleansing agents convenient to the showers shall be provided as specified in paragraph (d)(2)(iii) of this section.

(iv) Showers shall be provided with hot and cold water feeding a common discharge line.

(v) Employees who use showers shall be provided with individual clean towels.

(e) Change rooms.

Whenever employees are required by a particular standard to wear protective clothing because of the possibility of contamination with toxic materials, change rooms equipped with storage facilities for street clothes and separate storage facilities for the protective clothing shall be provided.

(f) Clothes drying facilities.

Where working clothes are provided by the employer and become wet or are washed between shifts, provision shall be made to insure that such clothing, is dry before reuse.

(g) Consumption of food and beverages on the premises.

(1) **Application.** This paragraph shall apply only where employees are permitted to consume food or beverages, or both, on the premises.

STANDARDS AND INTERPRETATIONS

(2) **Eating and drinking areas.** No employee shall be allowed to consume food or beverages in a toilet room nor in any area exposed to a toxic material.

(3) **Waste disposal containers.** Receptacles constructed of smooth, corrosion resistant, easily cleanable, or disposable materials, shall be provided and used for the disposal of waste food. The number, size, and location of such receptacles shall encourage their use and not result in overfilling. They shall be emptied not less frequently than once each working day, unless unused, and shall be maintained in a clean and sanitary condition. Receptacles shall be provided with a solid tight-fitting cover unless sanitary conditions can be maintained without use of a cover.

(4) **Sanitary storage.** No food or beverages shall be stored in toilet rooms or in an area exposed to a toxic material.

(h) **Food handling.**

All employee food service facilities and operations shall be carried out in accordance with sound hygienic principles. In all places of employment where all or part of the food service is provided, the food dispensed shall be wholesome, free from spoilage, and shall be processed, prepared, handled, and stored in such a manner as to be protected against contamination.

[38 F.R. 10930, May 3, 1973.]

1910.142—TEMPORARY LABOR CAMPS

(a) **Site.**

(1) All sites used for camps shall be adequately drained. They shall not be subject to periodic flooding, nor located within 200 feet of swamps, pools, sink holes, or other surface collections of water unless such quiescent water surfaces can be subjected to mosquito control measures. The camp shall be located so the drainage from and through the camp will not endanger any domestic or public water supply. All sites shall be graded, ditched, and rendered free from depressions in which water may become a nuisance.

(2) All sites shall be adequate in size to prevent overcrowding of necessary structures. The principal camp area in which food is prepared and served and where sleeping quarters are located shall be at least 500 feet from any area in which livestock is kept.

(3) The grounds and open areas surrounding the shelters shall be maintained in a clean and sanitary condition free from rubbish,

debris, waste paper, garbage, or other refuse.

(4) Whenever the camp is closed for the season or permanently, all garbage, manure, and other refuse shall be collected and so disposed of as to prevent nuisance. All abandoned privy pits shall be filled with earth and the grounds and buildings left in a clean and sanitary condition. If privy buildings remain, they shall be locked or otherwise secured to prevent entrance.

(b) **Shelter.**

(1) Every shelter in the camp shall be constructed in a manner which will provide protection against the elements.

(2) Each room used for sleeping purposes shall contain at least 50 square feet of floor space for each occupant. At least a 7-foot ceiling shall be provided.

(3) Beds, cots, or bunks, and suitable storage facilities such as wall lockers for clothing

STANDARDS AND INTERPRETATIONS

(5) Facilities for drying clothes shall be provided.

(6) All service buildings shall be kept clean.

(g) Lighting.

Where electric service is available, each habitable room in a camp shall be provided with at least one ceiling-type light fixture and at least one separate floor- or wall-type convenience outlet. Laundry and toilet rooms and rooms where people congregate shall contain at least one ceiling- or wall-type fixture. Light levels in toilet and storage rooms shall be at least 20 foot-candles 30 inches from the floor. Other rooms, including kitchens and living quarters, shall be at least 30 foot-candles 30 inches from the floor.

(h) Refuse disposal.

(1) Fly-tight, rodent-tight, impervious, cleanable or single service containers, approved by the appropriate health authority shall be provided for the storage of garbage. At least one such container shall be provided for each family shelter and shall be located within 100 feet of each shelter on a wooden, metal, or concrete stand.

(2) Garbage containers shall be kept clean.

(3) Garbage containers shall be emptied when full, but not less than twice a week.

(i) Construction and operation of kitchens, dining hall, and feeding facilities.

(1) In all camps where central dining or multiple family feeding operations are permitted or provided, the food handling facilities shall comply with the requirements of the "Food Service Sanitation Ordinance and Code," Part V of the "Food Service Sanitation Manual," U.S. Public Health Service Publication 934 (1965).

(2) A properly constructed kitchen and dining hall adequate in size, separate from the sleeping quarters of any of the workers

or their families, shall be provided in connection with all food handling facilities. There shall be no direct opening from living or sleeping quarters into a kitchen or dining hall.

(3) No person with any communicable disease shall be employed or permitted to work in the preparation, cooking, serving, or other handling of food, foodstuffs, or materials used therein, in any kitchen or dining room operated in connection with a camp or regularly used by persons living in a camp.

(j) Insect and rodent control.

Effective measures shall be taken to prevent infestation by and harborage of animal or insect vectors or pests.

(k) First aid.

(1) Adequate first aid facilities approved by a health authority shall be maintained and made available in every labor camp for the emergency treatment of injured persons.

(2) Such facilities shall be in charge of a person trained to administer first aid and shall be readily accessible for use at all times.

(l) Reporting communicable disease.

(1) It shall be the duty of the camp superintendent to report immediately to the local health officer the name and address of any individual in the camp known to have or suspected of having a communicable disease.

(2) Whenever there shall occur in any camp a case of suspected food poisoning or an unusual prevalence of any illness in which fever, diarrhea, sore throat, vomiting, or jaundice is a prominent symptom, it shall be the duty of the camp superintendent to report immediately the existence of the outbreak to the health authority by telegram or telephone.

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1910.143—NONWATER CARRIAGE DISPOSAL SYSTEMS

Revoked

1910.144—SAFETY COLOR CODE FOR MARKING PHYSICAL HAZARDS

(a) Color identification.

(1) **Red.** Red shall be the basic color for the identification of:

(i) Fire protection equipment and apparatus.

(ii) **Danger.** Safety cans or other portable containers of flammable liquids having a flashpoint at or below 80° F. table containers of flammable liquids (open cup tester), excluding shipping containers, shall be painted red with some additional clearly visible identification either in the form of a yellow band around the can or the name of the contents conspicuously stenciled or painted on the can in yellow. Red lights shall be provided at barricades and at temporary obstructions, as specified in ANSI Safety Code for Build-

ing Construction, A10.2-1944. Danger signs shall be painted red.

(iii) **Stop.** Emergency stop bars on hazardous machines such as rubber mills, wire blocks, flat work ironers, etc., shall be red. Stop buttons or electrical switches used for emergency stopping of machinery shall be red.

(2) Orange. Revoked

(3) **Yellow.** Yellow shall be the basic color for designating caution and for marking physical hazards such as: Striking against, stumbling, falling, tripping, and "caught in between." Solid yellow, yellow and black stripes, yellow and black checkers (or yellow with suitable contrasting background) should be used interchangeably, using the combination which will attract the most attention in the particular environment.

1910.145—SPECIFICATIONS FOR ACCIDENT PREVENTION SIGNS AND TAGS

(a) Scope.

(1) These specifications apply to the design, application, and use of signs or symbols (as included in paragraphs (c) through (e) of this section) intended to indicate and, insofar as possible, to define specific hazards of a nature such that failure to designate them may lead to accidental injury to workers or the public, or both, or to property damage.

These specifications are intended to cover all safety signs except those designed for streets, highways, railroads, and marine regulations. These specifications do not apply to plant bulletin boards or to safety posters.

(2) All new signs and replacements of old signs on or after August 31, 1971, shall be in accordance with these specifications.

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(b) Definitions.

As used in this section, the word "sign" refers to a surface on which letters or other markings appear, prepared for the warning of, or safety instructions of, industrial workers or members of the public who may be exposed to hazards. Excluded from this definition, however, are news releases, displays commonly known as safety posters, and bulletins used for employee education.

(c) Classification of signs according to use.**(1) Danger signs.**

(i) Danger signs should be used only where an immediate hazard exists. There shall be no variation in the type of design of signs posted to warn of specific dangers and radiation hazards.

(ii) All employees shall be instructed that danger signs indicate immediate danger and that special precautions are necessary.

(2) Caution signs.

(i) Caution signs shall be used only to warn against potential hazards or to caution against unsafe practices.

(ii) All employees shall be instructed that caution signs indicate a possible hazard against which proper precaution should be taken.

(3) Safety instruction signs. Safety instruction signs shall be used where there is a need for general instructions and suggestions relative to safety measures.

(d) Sign design

(1) Design features. All signs shall be furnished with rounded or blunt corners and shall be free from sharp edges, burrs, splinters, or other sharp projections. The ends or heads of bolts or other fastening devices shall be located in such a way that they do not constitute a hazard.

(2) Danger signs.

(i) The colors red, black, and white shall be those of opaque glossy samples as specified in Table 1 of Fundamental Specification of Safety Colors for CIE Standard Source "C", American National Standard Z53.1-1967.

(ii) Standard proportions shall be as indicated in Table J-1, and format shall be as in Fig. J-1.

(3) Radiation warning signs. Revoked**(4) Caution signs.**

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

(5) Exit signs. Revoked**(6) Safety instruction signs.**

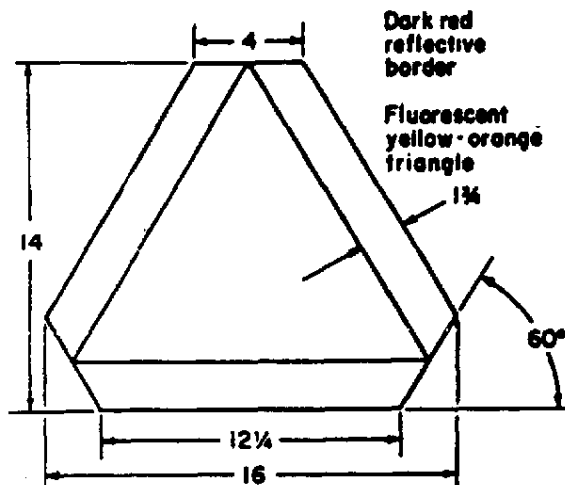
(i) Standard color of the background shall be white; and the panel, green with white letters. Any letters used against the white background shall be black. The colors shall be those of opaque glossy samples as specified in Table 1 of American National Standard, Z53.1-1967.

(7) Directional signs. Revoked**(8) In-Plant traffic signs.** Revoked**(9) Informational signs.** Revoked

(10) Slow-moving vehicle emblem. This emblem (see Fig. J-7) consists of a fluorescent yellow-orange triangle with a dark red reflective border. The yellow-orange fluorescent triangle is a highly visible color for daylight exposure. The reflective border defines the shape of the fluorescent color in daylight and creates a hollow red triangle in the path of motor vehicle headlights at night. The

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emblem is intended as a unique identification for, and it shall be used only on, vehicles which by design move slowly (25 m.p.h. or less) on the public roads. The emblem is not a clearance marker for wide machinery nor is it intended to replace required lighting or marking of slow-moving vehicles. Neither the color film pattern and its dimensions nor the backing shall be altered to permit use of advertising or other markings. The material, location, mounting, etc., of the emblem shall be in accordance with the American Society of Agricultural Engineers Emblem for Identifying Slow-Moving Vehicles, ASAE R276, 1967, or ASAE S276.2 (ANSI B114.1-1971).



NOTE: All dimensions are in inches.

Fig. J-7
Slow-Moving Vehicle Emblem

(e) Sign wordings.

(1) Examples of wordings. Revoked

(2) Nature of wording. The wording of any sign should be easily read and concise. The sign should contain sufficient information to be easily understood. The wording should make a positive, rather than negative suggestion and should be accurate in fact.

(3) Danger signs. Revoked

(4) Biological hazard signs. The biological hazard warning shall be used to signify the actual or potential presence of a biohazard and to identify equipment, containers, rooms, materials, experimental animals, or combinations thereof, which contain, or are contaminated with, viable hazardous agents. For the purpose of this subparagraph the term "biological hazard," or "biohazard," shall include only those infectious agents presenting a risk or potential risk to the well-being of man.

The symbol design shall be a fluorescent orange or orange-red color. Background color is optional as long as there is sufficient contrast for the symbol to be clearly defined. Appropriate wording may be used in association with the symbol to indicate the nature or identity of the hazard, name of individual responsible for its control, precautionary information, etc., but never should this information be superimposed on the symbol.

(f) Accident prevention tags.

(1) Scope and purpose.

(i) The tags are a temporary means of warning all concerned of a hazardous condition, defective equipment, radiation hazards, etc. The tags are not to be considered as a complete warning method, but should be used until a positive means can be employed to eliminate the hazard; for example, a "Do Not Start" tag on power equipment shall be used for a few moments or a very short time until the switch in the system can be locked out; a "Defective Equipment" tag shall be placed on a damaged ladder and immediate arrangements made for the ladder to be taken out of service and sent to the repair shop.

(ii) The purpose of this paragraph is to establish a set of specifications for tags based on experience and previous use. The tags are to be used in industry, mercantile establishments, or wherever such tags can be utilized to help prevent accidental injury to personnel.

STANDARDS AND INTERPRETATIONS

(2) **Definitions.** The word "tag" as used in this paragraph refers to a surface (usually card, paper, pasteboard, or some temporary or nonpermanent material) on which letters or markings, or both, appear. These letters or markings, or both, are for warning (cautioning) or safety instruction of employees who may be exposed to hazards. They are to be affixed to the device in question by string, wire, or adhesive.

(3) **Do not start tags.**

(i) The standard background color for Do Not Start tags shall be red. (See Fig. J-10.)

(ii) Letters shall be white or grey or etched, provided that a long lasting and sharp contrast results.

(iii) Do Not Start tags shall be placed in a conspicuous location or shall be placed in such a manner that they effectively block the starting mechanism which would cause hazardous conditions should the equipment be energized.

(4) **Danger tags.**

(i) Danger tags should be used only where an immediate hazard exists. There should be no variation in the type of design of tags posted or hung to warn of specific dangers.

(ii) All employees should be instructed that Danger tags indicate immediate danger and that special precautions are necessary.

(5) **Caution tags.**

(i) Caution tags should be used only to warn against potential hazards or to caution against unsafe practices.

(ii) All employees should be instructed that Caution tags indicate a possible hazard against which proper precautions should be taken.

(6) **Out of order tags.** Out of Order tags should be used only for the specific purpose of indicating that a piece of equipment, machinery, etc., is out of order and to attempt to use it might present a hazard.

(7) **Radiation tags.** Revoked

(8) **Biological hazard tags.**

(i) Revoked

(ii) The Biological Hazard tag shall be used to signify the actual or potential presence of a biohazard, to identify equipment, containers, rooms, materials, experimental animals, or combinations thereof, which contain or are contaminated with viable hazardous agents.

(iii) For the purpose of this subparagraph the term "biological hazard" shall include only those infectious agents presenting a risk or potential risk to the well-being of man.

1910.146—[RESERVED]

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Pages 355 thru 362 deleted

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any flow of water from a sprinkler system equal to or greater than that from a single automatic sprinkler will result in an audible alarm signal on the premises.

(k) Class of service—standpipe systems: "Standpipe systems" are grouped into three general classes of service for the intended use in the extinguishment of fire.

(1) Class I: For use by fire departments and those trained in handling heavy fire streams (2½-inch hose).

(2) Class II: For use primarily by the building occupants until the arrival of the fire department (small hose).

(3) Class III: For use by either fire departments and those trained in handling heavy hose streams or by the building occupants.

(l) Class I service: "Class I service" is a standpipe system capable of furnishing the effective fire streams required during the more advanced stages of fire on the inside of buildings or for exposure fire.

(m) Class II service: "Class II service" is a standpipe system which affords a ready means for the control of incipient fires by the occupants of buildings during working hours and by watchmen and those present during the night time and holidays.

(n) Class III service: "Class III service" is a standpipe system capable of furnishing the effective fire streams required during the more advanced stages of fire on the inside of buildings as well as providing a ready means for the control of fires by the occupants of the building.

(o) Standpipe systems: "Standpipe systems" are usually of the following types:

(1) A wet standpipe system having a supply valve open and water pressure maintained at all times.

(2) A standpipe system so arranged through the use of approved devices as to admit water to the system automatically by opening a hose valve.

(3) A standpipe system arranged to admit water to the system through manual operation of approved remote control devices located at each hose station.

(4) Dry standpipe having no permanent water supply. See also paragraph (k) of this section.

(p) Type I storage: "Type I storage" is that in which combustible commodities or noncombustible commodities involving combustible packaging or storage aids are stored over 15 feet but not more than 21 feet high in solid piles or over 12 feet but not more than 21 feet high in piles that contain horizontal channels. Minor quantities of commodities of hazard greater than ordinary combustibles may be included without affecting this general classification.

(q) Type II storage: "Type II storage" is that in which combustible commodities or noncombustible commodities involving combustible packaging or storage aids are stored not over 15 feet high in solid piles or not over 12 feet high in piles that contain horizontal channels. Minor quantities of commodities of hazard greater than ordinary combustibles may be included without affecting this general classification.

(r) Type III storage: "Type III storage" is that in which the stored commodities, packaging, and storage aids are noncombustible or contain only a small concentration of combustibles which are incapable of producing a fire that would cause appreciable damage to the commodities stored or to noncombustible wall, floor or roof construction. Ordinary combustible commodities in completely sealed noncombustible containers may qualify in this classification. General commodity storage that is subject to frequent changing and storage of combustible packaging and storage aids is excluded from this category.

(s) "Approved": "Approved" means listed or approved by: (1) At least one of the following nationally recognized testing laboratories: Factory Mutual Engineering Corp.; Underwriters' Laboratories, Inc., or (2) Federal agencies such as Bureau of Mines, Department of the Interior; Department of Transportation; or U.S. Coast Guard, which issue approvals for such equipment.

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PORTABLE FIRE SUPPRESSION EQUIPMENT

1910.157—PORTABLE FIRE EXTINGUISHERS

(a) General requirements.

(1) **Operable condition.** Portable extinguishers shall be maintained in a fully charged and operable condition, and kept in their designated places at all times when they are not being used.

(2) **Location.** Extinguishers shall be conspicuously located where they will be readily accessible and immediately available in the event of fire. They shall be located along normal paths of travel.

(3) **Marking of location.** Extinguishers shall not be obstructed or obscured from view. In large rooms, and in certain locations where visual obstruction cannot be completely avoided, means shall be provided to indicate the location and intended use of extinguishers conspicuously.

(4) **Marking of extinguishers.** If extinguishers intended for different classes of fire are grouped, their intended use shall be marked conspicuously to insure choice of the proper extinguisher at the time of a fire.

(5) **Mounting of extinguishers.** Revoked

(6) **Height of mounting.** Revoked

(7) **Cabinet mounting.** Revoked

(8) **Vibrating locations.** Revoked

(9) **Temperature range.** Extinguishers shall be suitable for use within a temperature range of at least plus 40° to 120° Fahrenheit.

(10) **Extreme temperature exposure.** When extinguishers are installed in locations subjected to temperatures outside the range prescribed in this subparagraph, they shall be of a type approved or listed for the temperature to which they will be exposed, or placed in an enclosure capable of maintaining the temperature within the range prescribed in this subparagraph.

(b) Selection of extinguishers.

(1) **General.** The selection of extinguishers for a given situation will depend upon the character of the fires anticipated, the construction and occupancy of the individual property, the vehicle or hazard to be protected, ambient-temperature conditions, and other factors. The number of extinguishers required shall be determined by reference to paragraph (c) of this section. Approved fire extinguishers shall be used to meet the requirements of this section.

[38 F.R. 19030, July 17, 1973.]

(2) Selection by hazard.

(i) Extinguishers shall be selected for the specific class or classes of hazards to be protected in accordance with the following paragraphs.

(ii) Extinguishers for protecting Class A hazards shall be selected from among the

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following: foam, loaded stream, multipurpose dry chemical, and water types. Certain smaller extinguishers which are charged with multipurpose dry chemical are rated on Class B and Class C fires, but have insufficient effectiveness to earn the minimum 1-A rating even though they have value in extinguishing smaller Class A fires.

Such smaller extinguishers shall not be used to meet the requirements of paragraph (c)(2)(i) of this section.

(iii) Extinguishers for protection of Class B hazards shall be selected from the following: bromotrifluoromethane, carbon dioxide, dry chemical, foam, loaded stream, and multipurpose dry chemical. Extinguishers with ratings less than 1-B shall not be considered in determining suitability.

(iv) Extinguishers for protection of Class C hazards shall be selected from the following: bromotrifluoromethane, carbon dioxide, dry chemical, and multipurpose dry chemical.

NOTE: Carbon dioxide extinguishers equipped with metal horns are not considered safe for use on fires in energized electrical equipment and, therefore, are not classified for use on Class C hazards.

(v) Extinguishers and extinguishing agents for the protection of Class D hazards shall be of types approved for use on the specific combustible-metal hazard.

tained therein.

(iii) Revoked

(iv) Occupancy hazard protection shall be provided by fire extinguishers suitable for such Class A, B, C, or D fire potentials as may be present.

(v) Revoked

(vi) Combustible buildings having an occupancy hazard subject to Class B, and/or Class C fires, shall have a standard complement of Class A fire extinguishers as required by Table L-1 for building protection, plus additional Class B and/or Class C extinguishers. Where fire extinguishers have more than one letter classification (such as 2-A: 20-B:C), they may be considered to satisfy the requirements of each letter class.

(vii) Rooms or areas shall be graded generally as light hazard, ordinary hazard, or extra hazard. Limited areas of greater or lesser hazard shall be protected as required.

(c) Distribution of portable fire extinguishers.

(1) General.

(i) The number of fire extinguishers needed to protect a property shall be determined as prescribed herein, considering the area and arrangement of the building or occupancy, the severity of the hazard, the anticipated classes of fires, and the distances to be traveled to reach extinguishers.

(ii) Fire extinguishers shall be provided for the protection of the occupancy hazards con-

TABLE L-1

Basic minimum extinguisher rating for area specified	Maximum travel distances to extinguishers (feet)	Areas to be protected per extinguisher		
		Light hazard occupancy (square feet)	Ordinary hazard occupancy (square feet)	Extra hazard occupancy (square feet)
1A.....	75	3,000	Note 1	Note 1
2A.....	75	6,000	3,000	Note 1
3A.....	75	9,000	4,500	3,000
4A.....	75	11,250	6,000	4,000
6A.....	75	11,250	9,000	6,000

NOTE 1: Not permitted except as specified in subdivision (ii) of this subparagraph.

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(2) Fire extinguisher size and placement for Class A hazards.

(i) Minimal sizes of fire extinguishers for the listed grades of hazard shall be provided on the basis of Table L-1. Extinguishers shall be located so that the maximum travel distances shall not exceed those specified in Table L-1.

(ii) The protection requirements specified in Table L-1 may be fulfilled by several extinguishers of lower ratings for ordinary or extrahazard occupancies.

(iii) Where the floor area of a building is less than that specified in Table L-1, at least one extinguisher of the minimum size recommended shall be provided.

(iv) The protection requirements may be fulfilled with extinguishers of higher rating provided the travel distance to such larger extinguishers shall not exceed 75 feet.

(3) Fire extinguisher size and placement for Class B fires other than for fires in flammable liquids of appreciable depth.

(i) Minimal sizes of fire extinguishers for the listed grades of hazard shall be provided on the basis of Table L-2. Extinguishers shall be located so that the maximum travel distances shall not exceed those specified in Table L-2.

TABLE L-2

Type of hazard	Basic minimum extinguisher rating	Maximum travel distance to extinguishers (feet)
Light	4B	50
Ordinary	8B	50
Extra	12B	50

NOTE: Where this section calls for minimum extinguisher ratings of 4-B, 8-B, or 12-B, the requirements may be met by existing extinguishers of multiple foam extinguishers as allowed by paragraph (c)(3)(ii) of this section. However, if a single extinguisher must be purchased to fulfill such requirements, the next higher rating shall be used.

(ii) Two or more extinguishers of lower rating, except for foam extinguishers, shall not be used to fulfill the protection requirements of Table L-2. Up to three foam extinguishers may be used to fulfill these requirements.

(iii) The protection requirements may be fulfilled with extinguishers of higher ratings provided the travel distance to such larger extinguishers shall not exceed 50 feet.

(4) Fire extinguisher size and placement for Class B fires in flammable liquids of appreciable depth.

(i) For flammable liquid hazards of appreciable depth (Class B), such as in dip or quench tanks, Class B fire extinguishers shall be provided on the basis of one numerical unit of Class B extinguishing potential per square foot of flammable liquid surface of the largest tank hazard within the area.

NOTE: Appreciable depth is defined as a depth of a liquid greater than one-quarter inch.

(ii) Two or more extinguishers of lower ratings except for foam extinguishers, shall not be used in lieu of the extinguisher required for the largest tank. Up to three foam extinguishers may be used to fulfill these requirements.

(iii) Scattered or widely separated hazards shall be individually protected if the specified travel distances in subdivisions (i) and (ii) of subparagraph (3) of this paragraph (c) are exceeded. Likewise, extinguishers in the proximity of a hazard shall be carefully located so as to be accessible in the presence of a fire without undue danger to the operator.

(5) Fire extinguisher size and placement for Class C hazards.

(i) Extinguishers with Class C ratings shall be required where energized electrical equipment may be encountered which would require a nonconducting extinguishing media. This will include fire either directly involving or surrounding

1910.158—STANDPIPE AND HOSE SYSTEMS

(a) General requirements.

(1) **Application.** Where standpipe and hose systems are provided they shall meet the design requirements of the National Fire Protection Association's Standard for the Installation of Standpipe and Hose Systems NFPA 14-1970 and the requirements of this section.

(2) **Closets and cabinets.** Closets and cabinets used to contain fire hose shall be of sufficient size to permit the installation of the necessary equipment at hose stations, and so designed as not to interfere with the prompt handling of the hose and equipment at time of fire. They shall be used for fire equipment only.

(3) **Protection of standpipes.** Standpipes shall be so located that they are protected against mechanical and fire damage.

(b) Hose outlets.

(1) Location of hose.

(i) Hose outlets shall be within easy reach of a person standing on the floor and in no case shall be over 6 feet from the floor. Hose stations shall be located conspicuously within the immediate area and where not likely to be obstructed. Hose may be located at one side of the standpipe and supplied by short lateral connections to the standpipe where necessary to avoid obstructions.

(ii) For Class III service, the outlets for large hose shall be located in a stairway enclosure, and for small hose the outlets shall be located in the corridor or space adjacent to the stairway enclosure.

(2) Hose connections.

(i) Revoked

(ii) Standpipes for Class II service shall be provided with 1½-inch hose connections on each floor.

(iii) Standpipes for Class III service shall be provided with both a 2½-inch and 1½-inch hose connection on each floor. The hose connections may be through one 2½-inch hose valve and an easily removable 2½-inch by 1½-inch adapter.

(3) **Hose.** Each hose outlet provided for the use of building occupants (Class II and III services) shall be equipped with approved small fire hose attached and ready for use. The maximum total length of unlined hose shall be 75 feet. The maximum total length of lined hose shall be 100 feet.

(4) **Hose racks or reels.** Each station provided with small hose shall be equipped with an approved rack, or an approved reel securely fastened in position; provided, that an employer may continue to use a reel acquired prior to May 20, 1974, even though it is not approved, so long as it is in good working condition.

[39 F.R. 6109, February 19, 1974.]

(5) Hose valves.

(i) An approved hose valve shall be provided at each outlet for attachment of hose.

(ii) Where the static pressure at any standpipe outlet for small hose exceeds 100 pounds per square inch, an approved device shall be installed at the outlet to reduce the pressure so that the nozzle pressure will be approximately 80 pounds per square inch.

NOTE: Pressure reducers are not required on standpipe outlets for 2½-inch hose because it is assumed 2½-inch hose will be attached only when the persons likely to use it are trained in handling large streams.

(iii) National (American) Standard Fire Hose Coupling Screw Threads shall be used whenever they will fit existing equipment; see Standard for Screw

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Threads Gaskets for Fire Hose Couplings,
NFPA No. 194-1968.

(6) **Nozzles.** Nozzles shall be of an approved type. Size of nozzles for small hose shall be not larger than one-half inch.

(7) **Dry standpipe identification.** Each hose connection on dry standpipes shall be provided with a conspicuous, durable, and permanently legible sign reading "Dry Standpipe for Fire Department Use Only."

(c) Water supplies.

(1) **Minimum supply for Class I service.** Revoked

(2) **Minimum supply for Class II service.** The minimum supply for Class II service shall be sufficient to provide 100 gallons per minute for a period of at least thirty (30) minutes. The supply shall be sufficient to maintain a residual pressure of 65 pounds per square inch at the topmost outlet of each standpipe (including the roof outlet) with 100 gallons per minute flowing.

(3) **Minimum supply for Class III service.** The minimum supply for Class III service shall be the same as for Class I service.

(4) **Fire department connections.** Revoked

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(d) Tests and maintenance.

(1) **Tests.** All new systems including yard piping shall be tested hydrostatically at not less than 200 pounds per square inch pressure for 2 hours, or at 50 pounds per square inch in excess of the normal pressure when the normal pressure is in excess of 150 pounds per square inch.

(2) Periodic inspection.

(i) The tanks shall be kept properly filled, and where pressure tanks are employed,

a pressure of at least 75 pounds per square inch shall be maintained at all times.

NOTE: For further details, see Standard for Water Tanks for Private Fire Protection, NFPA No. 22-1970.

(ii) The valves in the main connection to the automatic sources of water supply shall be open at all times. The hose valves should be frequently examined to see that they are tight.

NOTE: For further details, see Care of Fire Hose, NFPA No. 19H-1969.

FIXED FIRE SUPPRESSION EQUIPMENT

1910.159—AUTOMATIC SPRINKLER SYSTEMS**(a) General requirements.**

(1) **Design.** When automatic sprinkler systems are provided they shall meet design requirements of the National Fire Protection Association's Standard for the Installation of Sprinkler Systems NFPA No. 13-1969 and the requirements of this section.

(2) **Water supply.** Every automatic sprinkler system shall have at least one automatic water supply of adequate pressure, capacity and reliability.

(3) **Fire department connection.** A connection through which a fire department can pump water into the sprinkler system makes a desirable auxiliary supply. For this purpose, one or more fire department connections shall be provided in all cases.

(b) Fire department connections. Revoked

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detecting alarm device with the necessary attachments required to give an alarm.

(ii) The alarm apparatus for a dry-pipe system shall consist of approved alarm attachments to the dry-pipe valve. When a dry-pipe valve is located on the system side of an alarm valve, the actuating device of the alarms for the dry-pipe valve may be connected to the alarms on the wet-pipe system.

(iii) The alarm apparatus for preaction and deluge systems shall consist of approved electric alarm attachments, actuated by a thermostatic system independently of flow of water in the system.

(c) Sprinkler alarms.**(1) General.**

(i) Waterflow alarms shall be provided on all sprinkler installations.

(ii) An alarm unit shall include an approved mechanical alarm, horn, or siren, or an approved weatherproof electric gong, bell, horn, or siren on the outside of the building or approved electric gongs, bells, horns, or sirens inside the building, or a combination of such devices.

(iii) All alarm apparatus shall be so located and installed that all parts are readily accessible for inspection, removal, and repair, and shall be substantially supported. Outdoor mechanical or electrically operated bells shall be of weatherproof and guarded type. On each alarm check valve used under conditions of variable water pressure, a retarding device shall be installed. Suitable valves shall be provided in the connections to retarding chambers, to permit repair or removal without shutting off sprinklers; these valves shall be so arranged that they may be locked or sealed in the open position.

(2) Waterflow detecting devices.

(i) The alarm apparatus for a wet-pipe system shall consist of an approved alarm check valve or other approved water flow

(3) **Drains.** Drains from alarm devices shall be so arranged that there will be no danger of freezing, and so that there will be no overflowing at the alarm apparatus, at domestic connections or elsewhere with the sprinkler drains wide open and under pressure.

(d) Maintenance of sprinkler system.

A sprinkler system installed under this Standard must be properly maintained for efficient service. The employer is responsible for the condition of his sprinkler system and must use due diligence in keeping the system in good operating condition.

(e) Sprinkler head clearance.

(1) **Type I storage.** Clearance of at least 36 inches shall be maintained between sprinkler deflectors and top of storage to reduce the possibility of obstruction to the distribution of water.

(2) **Type II storage.** Clearance of at least 18 inches shall be maintained between sprinkler deflectors and top of storage to reduce the possibility of obstruction to the distribution of water.

(3) **Type III storage.** In sprinklered buildings, at least 18 inches clearance between sprinkler deflectors and top of storage shall be maintained.

STANDARDS AND INTERPRETATIONS

1910.160—FIXED DRY CHEMICAL EXTINGUISHING SYSTEMS**(a) General requirements.**

(1) **Design.** When dry chemical extinguishing systems are provided they shall meet the design requirements of the National Fire Protection Association's "Standard For Dry Chemical Extinguishing Systems" NFPA No. 17-1969 and the requirements of this section.

(2) **Safety requirements.** Where there is a possibility that personnel may be exposed to a dry chemical discharge, suitable safeguards shall be provided to insure prompt evacuation of such locations, and also to provide means for prompt rescue of any trapped personnel.

(b) Alarms and indicators.

(1) **General.** Alarms and/or indicators are used to indicate the operation of the system, hazard to personnel, or failure of any supervised device or equipment. The devices may be audible or visual. The type, number, and location of the devices shall be such that their purpose is satisfactorily accomplished.

[38 F.R. 19030, July 17, 1973.]

(2) Operation alarm.

(i) An alarm or indicator shall be provided to show that the system has operated, that personnel response may be needed, and that the system should be charged.

(ii) Alarms indicating failure of supervised devices or equipment shall give prompt and positive indication of any failure and shall be distinctive from alarms indicating operation or hazardous conditions.

(c) Inspection and maintenance.**(1) Inspection and tests.**

(i) At least annually, all dry chemical systems including alarms, shutdowns, and

other associated equipment, shall be thoroughly inspected and checked for proper operation by a competent inspector.

(ii) The purpose of the inspection and testing prescribed by paragraph (c) of this section shall be not only to insure that the system is in full operating condition but also to indicate the probable continuance of that condition until the next inspection. Attention at this inspection shall be given to any extension of the hazard protected by the system.

(iii) Revoked

(iv) Between the regular annual inspection or tests, the system shall be inspected visually or otherwise by competent personnel, following a predetermined schedule.

[38 F.R. 19030, July 17, 1973.]

(v) At least semiannually, all expellant gas containers shall be checked by pressure or weight against the required minimums.

(vi) At least semiannually, all stored pressure dry chemical containers shall be checked by pressure and weight against the required minimums.

(vii) Except for stored pressure systems, at least annually the dry chemical in the system storage container shall be sampled from the top center and also near the wall to determine the existence of lumps harder than will be friable when dropped from a height of 4 inches.

(2) Maintenance.

(i) These fixed dry chemical systems shall be maintained in full operating condition

STANDARDS AND INTERPRETATIONS

at all times. Use, impairment, and restoration of this protection shall be reported promptly to the employer.

(ii) Any troubles or impairments shall be corrected at once by competent personnel.

1910.161—CARBON DIOXIDE EXTINGUISHING SYSTEMS

(a) General requirements.

(1) **Design.** When carbon dioxide extinguishing systems are provided they shall meet the design requirements of the National Fire Protection Association's "Standard on Carbon Dioxide Extinguishing Systems" NFPA No. 12-1968 and the requirements of this section.

(2) **Safety requirements.** In any use of carbon dioxide where there is a possibility that employees may be trapped in, or enter into atmospheres made hazardous by a carbon dioxide discharge, suitable safeguards shall be provided to insure prompt evacuation of and to prevent entry into such atmospheres and also to provide means for prompt rescue of any trapped personnel. Such safety items as personnel training, warning signs, discharge alarms, predischARGE alarms, and breathing apparatus shall be considered.

(b) Inspection and maintenance.

(1) Inspection and tests.

(i) At least annually, all carbon dioxide systems shall be thoroughly inspected and tested for proper operation by a competent engineer or inspector.

(ii) The goal of this inspection and testing shall be not only to insure that the system is in full operating condition but shall

indicate the probable continuance of that condition until the next inspection.

(iii) Suitable discharge tests shall be made when any inspection indicates their advisability.

(iv) Between the regular service contract inspection or tests, the system shall be inspected visually or otherwise by competent personnel, following a schedule.

(v) At least semiannually, all high pressure cylinders shall be weighed. If, at any time, a container shows a loss in net content of more than 10 percent, it shall be refilled or replaced.

(vi) If, at any time, a low pressure container shows a loss of more than 10 percent, it shall be refilled, unless the minimum gas requirements are still provided.

(2) Maintenance.

(i) These carbon dioxide systems shall be maintained in full operating condition at all times.

(ii) Any troubles or impairments shall be corrected at once by competent personnel.

1910.162—OTHER SPECIAL FIXED EXTINGUISHING SYSTEMS. [RESERVED]

PART 1910**OCCUPATIONAL SAFETY AND HEALTH STANDARDS****SUBPART N—MATERIALS HANDLING AND STORAGE**

- 1910.176 Handling materials—general.
- 1910.177 Indoor general storage.
- 1910.178 Powered industrial trucks.
- 1910.179 Overhead and gantry cranes.
- 1910.180 Crawler, locomotive, and truck cranes.
- 1910.181 Derricks.
- 1910.182 Additional delay in effective date.
- 1910.183 Sources of standards.
- 1910.184 Standards organizations.

STANDARDS AND INTERPRETATIONS

SUBPART N—MATERIALS HANDLING AND STORAGE**1910.176—HANDLING MATERIALS—GENERAL****(a) Use of mechanical equipment.**

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

(b) Secure storage.

Storage of material shall not create a hazard. Bags, containers, bundles, etc., stored in tiers shall be stacked, blocked, interlocked and limited in height so that they are stable and secure against sliding or collapse.

(c) Housekeeping.

Storage areas shall be kept free from accumulation of materials that constitute

hazards from tripping, fire, explosion, or pest harborage. Vegetation control will be exercised when necessary.

(d) Drainage. Revoked**(e) Clearance limits.**

Clearance signs to warn of clearance limits shall be provided.

(f) Rolling railroad cars.

Derail and/or bumper blocks shall be provided on spur railroad tracks where a rolling car could contact other cars being worked, enter a building, work or traffic area.

(g) Guarding.

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

1910.177—INDOOR GENERAL STORAGE**1910.177 REVOKED**

[38 F.R. 14371, June 1, 1973.]

1910.178—POWERED INDUSTRIAL TRUCKS**(a) General requirements.**

(1) This section contains safety requirements relating to fire protection, design,

maintenance, and use of fork trucks, tractors, platform lift trucks, motorized hand trucks, and other specialized industrial trucks powered by electric motors or inter-

STANDARDS AND INTERPRETATIONS

(6) Industrial trucks shall not be altered so that the relative positions of the various parts are different from what they were when originally received from the manufacturer, nor shall they be altered either by the addition of extra parts not provided by the manufacturer or by the elimination of any parts, except as provided in subparagraph (12) of this paragraph. Additional counter-weighting of fork trucks shall not be done unless approved by the truck manufacturer.

(7) Industrial trucks shall be examined before being placed in service, and shall not be placed in service if the examination shows any condition adversely affecting the safety of the vehicle. Such examination shall be made at least daily.

Where industrial trucks are used on a round-the-clock basis, they shall be examined after each shift. Defects when found shall be immediately reported and corrected.

(8) Water mufflers shall be filled daily or as frequently as is necessary to prevent depletion of the supply of water below 75 percent of the filled capacity. Vehicles with mufflers having screens or other parts that may become clogged shall not be operated while such screens or parts are clogged. Any vehicle that emits hazardous sparks or flames from the exhaust system shall immediately be removed from service, and

not returned to service until the cause for the emission of such sparks and flames has been eliminated.

(9) When the temperature of any part of any truck is found to be in excess of its normal operating temperature, thus creating a hazardous condition, the vehicle shall be removed from service and not returned to service until the cause for such overheating has been eliminated.

(10) Industrial trucks shall be kept in a clean condition, free of lint, excess oil, and grease. Noncombustible agents should be used for cleaning trucks. Low flash point (below 100° F.) solvents shall not be used. High flash point (at or above 100° F.) solvents may be used. Precautions regarding toxicity, ventilation, and fire hazard shall be consonant with the agent or solvent used.

(11) Revoked

(12) Industrial trucks originally approved for the use of gasoline for fuel may be converted to liquefied petroleum gas fuel provided the complete conversion results in a truck which embodies the features specified for LP or LPS designated trucks. Such conversion equipment shall be approved. The description of the component parts of this conversion system and the recommended method of installation on specific trucks are contained in the "Listed by Report."

1910.179—OVERHEAD AND GANTRY CRANES

(a) Definitions applicable to this section.

(1) A "crane" is a machine for lifting and lowering a load and moving it horizontally, with the hoisting mechanism an integral part of the machine. Cranes whether fixed or mobile are driven manually or by power.

(2) An "automatic crane" is a crane which when activated operates through a preset cycle or cycles.

(3) A "cab-operated crane" is a crane controlled by an operator in a cab located on the bridge or trolley.

(4) "Cantilever gantry crane" means a gantry or semigantry crane in which the bridge girders or trusses extend transversely beyond the crane runway on one or both sides.

(5) "Floor-operated crane" means a crane which is pendant or nonconductive rope con-

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trolled by an operator on the floor or an independent platform.

(6) "Gantry crane" means a crane similar to an overhead crane except that the bridge for carrying the trolley or trolleys is rigidly supported on two or more legs running on fixed rails or other runway.

(7) "Hot metal handling crane" means an overhead crane used for transporting or pouring molten material.

(8) "Overhead crane" means a crane with a movable bridge carrying a movable or fixed hoisting mechanism and traveling on an overhead fixed runway structure.

(9) "Power-operated crane" means a crane whose mechanism is driven by electric, air, hydraulic, or internal combustion means.

(10) A "pulpit-operated crane" is a crane operated from a fixed operator station not attached to the crane.

(11) A "remote-operated crane" is a crane controlled by an operator not in a pulpit or in the cab attached to the crane, by any method other than pendant or rope control.

(12) A "semigantry crane" is a gantry crane with one end of the bridge rigidly supported on one or more legs that run on a fixed rail or runway, the other end of the bridge being supported by a truck running on an elevated rail or runway.

(13) "Storage bridge crane" means a gantry type crane of long span usually used for bulk storage of material; the bridge girders or trusses are rigidly or nonrigidly supported on one or more legs. It may have one or more fixed or hinged cantilever ends.

(14) "Wall crane" means a crane having a jib with or without trolley and supported from a side wall or line of columns of a building. It is a traveling type and operates on a runway attached to the side wall or columns.

(15) "Appointed" means assigned specific responsibilities by the employer or the employer's representative.

(16) "ANSI" means the American National Standards Institute.

(17) An "auxiliary hoist" is a supplemental hoisting unit of lighter capacity and usually higher speed than provided for the main hoist.

(18) A "brake" is a device used for retarding or stopping motion by friction or power means.

(19) A "drag brake" is a brake which provides retarding force without external control.

(20) A "holding brake" is a brake that automatically prevents motion when power is off.

(21) "Bridge" means that part of a crane consisting of girders, trucks, end ties, foot-walks, and drive mechanism which carries the trolley or trolleys.

(22) "Bridge travel" means the crane movement in a direction parallel to the crane runway.

(23) A "bumper" (buffer) is an energy absorbing device for reducing impact when a moving crane or trolley reaches the end of its permitted travel; or when two moving cranes or trolleys come in contact.

(24) The "cab" is the operator's compartment on a crane.

(25) "Clearance" means the distance from any part of the crane to a point of the nearest obstruction.

(26) "Collectors current" are contacting devices for collecting current from runway or bridge conductors.

(27) "Conductors, bridge" are the electrical conductors located along the bridge structure of a crane to provide power to the trolley.

(28) "Conductors, runway" (main) are the electrical conductors located along a crane runway to provide power to the crane.

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(a) The derrick to be repaired shall be arranged so it will cause the least interference with other equipment and operations in the area.

(b) All hoist drum dogs shall be engaged.

(c) The main or emergency switch shall be locked in the open position, if an electric hoist is used.

(d) Warning or out of order signs shall be placed on the derrick and hoist.

(e) The repairs of booms of derricks shall either be made when the booms are lowered and adequately supported or safely tied off.

(f) A good communication system shall be set up between the hoist operator and the appointed individual in charge of derrick operations before any work on the equipment is started.

(ii) After adjustments and repairs have been made the derrick shall not be operated until all guards have been reinstalled, safety devices reactivated, and maintenance equipment removed.

(3) Adjustments and repairs.

(i) Any unsafe conditions disclosed by inspection shall be corrected before operation of the derrick is resumed.

(ii) Adjustments shall be maintained to assure correct functioning of components.

(iii) Repairs or replacements shall be provided promptly as needed for safe operation. The following are examples of conditions requiring prompt repair or replacement:

(a) Hooks showing defects described in paragraph (d)(2)(vi) of this section shall be discarded.

(b) All critical parts which are cracked, broken, bent, or excessively worn.

(c) Revoked

(d) All replacement and repaired parts shall have at least the original safety factor.

(g) Rope inspection.

(1) **Running ropes.** A thorough inspection of all ropes in use shall be made at least once a month and a full written, dated, and signed report of rope condition kept on file where readily available. Any deterioration, resulting in appreciable loss of original strength, such as described below, shall be carefully noted and determination made as to whether further use of the rope would constitute a safety hazard:

(i) Reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires.

(ii) A number of broken outside wires and the degree of distribution or concentration of such broken wires.

(iii) Worn outside wires.

(iv) Corroded or broken wires at end connections.

(v) Corroded, cracked, bent, worn, or improperly applied end connections.

(vi) Severe kinking, crushing, cutting, or unstranding.

(2) **Limited travel ropes.** Heavy wear and/or broken wires may occur in sections in contact with equalizer sheaves or other sheaves where rope travel is limited, or with saddles. Particular care shall be taken to inspect ropes at these locations.

(3) **Idle ropes.** All rope which has been idle for a period of a month or more due to shut-

STANDARDS AND INTERPRETATIONS

down or storage of a derrick on which it is installed shall be given a thorough inspection before it is placed in service. This inspection shall be for all types of deterioration. A written and dated report of the rope condition shall be available.

(4) **Nonrotating ropes.** Particular care shall be taken in the inspection of nonrotating rope.

(h) **Operations of derricks.**

Derrick operations shall be directed only by the individual specifically designated for that purpose.

(i) **Handling the load.**

(1) **Size of load.**

(i) No derrick shall be loaded beyond the rated load.

(ii) When loads approach the maximum rating of the derrick, it shall be ascertained that the weight of the load has been determined within plus or minus 10 percent before it is lifted.

(2) **Attaching the load.**

(i) The hoist rope shall not be wrapped around the load.

(ii) The load shall be attached to the hook by means of slings or other suitable devices.

(3) **Moving the load.**

(i) The load shall be well secured and properly balanced in the sling or lifting device before it is lifted more than a few inches.

(ii) Before starting to hoist, the following conditions shall be noted:

(a) Hoist rope shall not be kinked.

(b) Multiple part lines shall not be twisted around each other.

(c) The hook shall be brought over the load in such a manner as to prevent swinging.

(d) If there is a slack rope condition, it should be determined that the rope is properly seated on the drum and in the sheaves.

(iii) During hoisting, care shall be taken that:

(a) There is no sudden acceleration or deceleration of the moving load.

(b) Load does not contact any obstructions.

(iv) A derrick shall not be used for side loading except when specifically authorized by a responsible person who has determined that the various structural components will not be overstressed.

(v) No hoisting, lowering, or swinging shall be done while anyone is on the load or hook.

(vi) The operator should avoid carrying loads over people.

(vii) The operator shall test the brakes each time a load approaching the rated load is handled by raising it a few inches and applying the brakes.

(viii) Neither the load nor boom shall be lowered below the point where less than two full wraps of rope remain on their respective drums.

(ix) When rotating a derrick, sudden starts and stops shall be avoided. Rotational speed shall be such that the load does not swing out beyond the radius at which it can be controlled.

(x) Boom and hoisting rope systems shall not be twisted.

(4) **Holding the load.**

(i) The operator shall not be allowed to leave his position at the controls while the load is suspended.

(ii) People should not be permitted to stand or pass under a load on the hook.

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high ram velocities resulting from the sudden release of a compressed gas against a free piston impart impact to the workpiece.

(8) "Forging rolls" mean a class of auxiliary forging equipment wherein stock is shaped between power driven rolls bearing contoured dies. Usually used for preforming, roll forging is often employed to reduce thickness and increase length of stock.

(9) "Ring rolls" mean a class for forging equipment used for shaping weldless rings from pierced discs or thick-walled, ring-shaped blanks between rolls which control wall thickness, ring diameter, height and contour.

(10) "Bolt-headers" mean the same as an upsetter or forging machine except that the diameter of stock fed into the machine is much smaller, i.e., commonly three-fourths inch or less.

(11) Rivet making machines mean the same as upsetters and boltheaders when producing rivets with stock diameter of 1-inch or more. Rivet making with less than 1-inch diameter is usually a cold forging operation, and therefore not included in this subpart.

(12) Upsetters (or forging machines, or headers) type of forging equipment, related to the mechanical press, in which the main forming energy is applied horizontally to the workpiece which is gripped and held by prior action of the dies.

(f) As used in § 1910.219, unless, the context clearly requires otherwise, the following mechanical power-transmission guarding terms shall have the meaning prescribed in this paragraph.

(1) "Belts" include all power transmission belts, such as flat belts, round belts, V-belts, etc., unless otherwise specified.

(2) "Belt shifter" means a device for mechanically shifting belts from tight to

loose pulleys or vice versa, or for shifting belts on cones of speed pulleys.

(3) "Belt pole" (sometimes called a "belt shipper" or "shipper pole,") means a device used in shifting belts on and off fixed pulleys on line or countershaft where there are no loose pulleys.

(4) "Exposed to contact" means that the location of an object is such that a person is likely to come into contact with it and be injured.

(5) "Flywheels" include flywheels, balance wheels, and flywheel pulleys mounted and revolving on crankshaft of engine or other shafting.

(6) "Maintenance runway" means any permanent runway or platform used for oiling, maintenance, running adjustment, or repair work, but not for passageway.

(7) "Nip-point belt and pulley guard" means a device which encloses the pulley and is provided with rounded or rolled edge slots through which the belt passes.

(8) "Point of operation" means that point at which cutting, shaping, or forming is accomplished upon the stock and shall include such other points as may offer a hazard to the operator in inserting or manipulating the stock in the operation of the machine.

(9) "Prime movers" include steam, gas, oil, and air engines, motors, steam and hydraulic turbines, and other equipment used as a source of power.

(10) "Sheaves" mean grooved pulleys, and shall be so classified unless used as flywheels.

1910.212—GENERAL REQUIREMENTS FOR ALL MACHINES

(a) Machine guarding.

(1) **Types of guarding.** One or more methods of machine guarding shall be provided to

protect the operator and other employees in the machine area from hazards such as those created by point of operation, ingoing nip points, rotating parts, flying chips and

STANDARDS AND INTERPRETATIONS

sparks. Examples of guarding methods are—barrier guards, two-hand tripping devices, electronic safety devices, etc.

(2) **General requirements for machine guards.** Guards shall be affixed to the machine where possible and secured elsewhere if for any reason attachment to the machine is not possible. The guard shall be such that it does not offer an accident hazard in itself.

(3) **Point of operation guarding.**

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

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

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

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

(a) Guillotine cutters.

(b) Shears.

(c) Alligator shears.

(d) Power presses.

(e) Milling machines.

(f) Power saws.

(g) Jointers.

(h) Portable power tools.

(i) Forming rolls and calenders.

(4) **Barrels, containers, and drums.** Revolving drums, barrels, and containers shall be guarded by an enclosure which is interlocked with the drive mechanism, so that the barrel, drum, or container cannot revolve unless the guard enclosure is in place.

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

(b) **Anchoring fixed machinery.**

Machines designed for a fixed location shall be securely anchored to prevent walking or moving.

1910.213—WOODWORKING MACHINERY REQUIREMENTS

(a) **Machine construction general.**

(1) Each machine shall be so constructed as to be free from sensible vibration when the largest size tool is mounted and run idle at full speed.

(2) Arbors and mandrels shall be constructed so as to have firm and secure bearing and be free from play.

(3) Revoked

STANDARDS AND INTERPRETATIONS

(3) Sprockets on chain or slat-belt conveyors shall be enclosed.

(4) Where practicable, hand and foot-power guillotine veneer cutters shall be provided with rods or plates or other satisfactory means, so arranged on the feeding side that the hands cannot reach the cutting edge of the knife while feeding or holding the stock in place.

(5) Power-driven guillotine veneer cutters, except continuous feed trimmers, shall be equipped with:

(i) Starting devices which require the simultaneous action of both hands to start the cutting motion and of at least one hand on a control during the complete stroke of the knife; or

(ii) An automatic guard which will remove the hands of the operator from the danger zone at every descent of the blade, used in conjunction with one-hand starting devices which require two distinct movements of the device to start the cutting motion, and so designed as to return positively to the nonstarting position after each complete cycle of the knife.

(6) Where two or more workers are employed at the same time on the same power-driven guillotine veneer cutter equipped with two-hand control, the device shall be so arranged that each worker shall be required to use both hands simultaneously on the controls to start the cutting motion, and at least one hand on a control to complete the cut.

(7) Power-driven guillotine veneer cutters, other than continuous trimmers, shall be provided, in addition to the brake or other stopping mechanism, with an emergency device which will prevent the machine from operating in the event of failure of the brake when the starting mechanism is in the nonstarting position.

(r) Miscellaneous woodworking machines.

(1) The feed rolls of roll type glue spreaders shall be guarded by a semicylindrical guard.

The bottom of the guard shall come to within three-eighths inch of a plane formed by bottom or contact face of the feed roll where it touches the stock.

(2) Drag saws shall be so located as to give at least a 4-foot clearance for passage when the saw is at the extreme end of the stroke; or if such clearance is not obtainable, the saw and its driving mechanism shall be provided with a standard enclosure.

(3) For combination or universal woodworking machines each point of operation of any tool shall be guarded as required for such a tool in a separate machine.

(4) The mention of specific machines in paragraphs (a) thru (q) and this paragraph (r) of this section, inclusive, is not intended to exclude other woodworking machines from the requirement that suitable guards and exhaust hoods be provided to reduce to a minimum the hazard due to the point of operation of such machines.

(s) Inspection and maintenance of woodworking machinery.

(1) Dull, badly set, improperly filed, or improperly tensioned saws shall be immediately removed from service, before they begin to cause the material to stick, jam, or kick back when it is fed to the saw at normal speed. Saws to which gum has adhered on the sides shall be immediately cleaned.

(2) All knives and cutting heads of woodworking machines shall be kept sharp, properly adjusted, and firmly secured. Where two or more knives are used in one head, they shall be properly balanced.

(3) Bearings shall be kept free from lost motion and shall be well lubricated.

(4) Arbors of all circular saws shall be free from play.

(5) Sharpening or tensioning of saw blades or cutters shall be done only by persons of demonstrated skill in this kind of work.

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(6) Emphasis is placed upon the importance of maintaining cleanliness around wood-working machinery, particularly as regards the effective functioning of guards and the prevention of fire hazards in switch enclosures, bearings, and motors.

(7) All cracked saws shall be removed from service.

(8) The practice of inserting wedges between the saw disk and the collar to form what is commonly known as a "wobble saw" shall not be permitted.

(9) Push sticks or push blocks shall be provided at the work place in the several sizes and types suitable for the work to be done.

(10) Revoked

(11) Revoked

(12) The knife blade of jointers shall be so installed and adjusted that it does not protrude more than one-eighth inch beyond the cylindrical body of the head. Push sticks or push blocks shall be provided at the work place in the several sizes and types suitable for the work to be done.

(13) Whenever veneer slicers or rotary veneer-cutting machines have been shut-down for the purpose of inserting logs or to make adjustments, operators shall make sure that machine is clear and other workmen are not in a hazardous position before starting the machine.

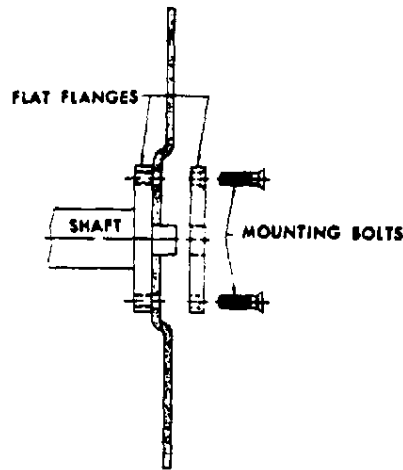
(14) Operators shall not ride the carriage of a veneer slicer.

1910.214—COOPERAGE MACHINERY

Revoked

Pages 495 and 496 deleted

STANDARDS AND INTERPRETATIONS

**FIGURE NO. O-24**

The Type 27A Wheel is mounted between flat non-relieved flanges of equal bearing surfaces.

(b) straight unrelieved flanges (see Figure O-30);

(c) adaptor flanges (see Figures O-33 and O-34);

(v) Regardless of flange type used, the wheel shall always be guarded. Blotters shall be used in accordance with subparagraph (6) of this paragraph.

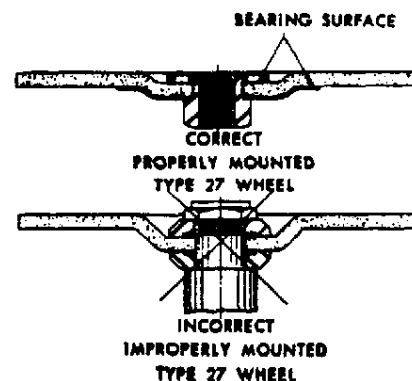
(2) Design and material. Revoked

(3) Finish and balance. Flanges shall be dimensionally accurate and in good balance. There shall be no rough surfaces or sharp edges.

(4) Uniformity of diameter.

(i) Both flanges, of any type, between which a wheel is mounted, shall be of the same diameter and have equal bearing surface. Exceptions are set forth in the remaining subdivisions of this subparagraph.

(ii) Type 27 and Type 28 wheels, because of their shape and usage, require specially designed adaptors. The back flange shall extend beyond the central hub or raised portion and contact the wheel to counteract the side pressure on the wheel in use. The adaptor nut which is less than the minimum one-third diameter of wheel fits in the depressed side of wheel to prevent interference in side grinding and serves to drive the wheel by its clamping force against the depressed portion of the back flange. The variance in flange diameters, the adaptor nut being less than one-third wheel diameter, and the use of side pressure in wheel operation limits the use to reinforced organic bonded wheels. Mounts which are affixed to the wheel by the manufacturer shall not be reused. Type 27 and Type 28 wheels shall be used only with a safety guard located between wheel and operator during use. (See Figure O-24-A.)

FIGURE NO. O-24-A

Types 27 and 28 wheels, because of their shape, require specially designed adaptors.

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(iii) Modified Types 6 and 11 wheels (terrazzo) with tapered K dimension.

(5) Recess and undercut.

(i) Straight relieved flanges made according to Table O-6 and Figure O-32 shall be recessed at least one-sixteenth inch on the side next to the wheel for a distance as specified in Table O-6.

(ii) Straight flanges of the adaptor or sleeve type (Table O-7 and Figures O-33 and O-34) shall be undercut so that there will be no bearing on the sides of the wheel within one-eighth inch of the arbor hole.

(6) Blotters.

(i) Blotters (compressible washers) shall always be used between flanges and abrasive wheel surfaces to insure uniform distribution of flange pressure. (See paragraph (d)(5) of this section.)

(ii) Exception:

(a) Mounted wheels.

(b) Abrasive discs (inserted nut, inserted washer, and projecting stud type).

(c) Plate mounted wheels.

(d) Cylinders, cups, or segmental wheels that are mounted in chucks.

(e) Types 27 and 28 wheels.

(f) Certain Type 1 and Type 27A cutting-off wheels.

(g) Certain internal wheels.

(h) Type 4 tapered wheels.

(i) Diamond wheels, except certain vitrified diamond wheels.

(j) Modified Types 6 and 11 wheel (terrazzo)—blotters applied flat side of wheel only.

(7) Driving flange. The driving flange shall be securely fastened to the spindle and the bearing surface shall run true. When more than one wheel is mounted between a single set of flanges, wheels may be cemented together or separated by specially designed spacers. Spacers shall be equal in diameter to the mounting flanges and have equal bearing surfaces. (See paragraph (d)(6) of this section.)

(8) Dimensions.

(i) Tables O-4 and O-6 and Figures O-30 and O-32 show minimum dimensions for straight relieved and unrelieved flanges for use with wheels with small holes that fit directly on the machine spindle. Dimensions of such flanges shall never be less than indicated and should be greater where practicable.

(ii) Table O-5, and Table O-7 and Figures O-31, O-33, O-34 show minimum dimensions for straight adaptor flanges for use with wheels having holes larger than the spindle. Dimensions of such adaptor flanges shall never be less than indicated and should be greater where practicable.

(iii) Table O-8 and Figure O-35 show minimum dimensions for straight flanges that are an integral part of wheel sleeves which are frequently used on precision grinding machines. Dimensions of such flanges shall never be less than indicated and should be greater where practicable.

(9) Repairs and maintenance. All flanges shall be maintained in good condition. When the bearing surfaces become worn, warped, sprung, or damaged they should be trued or refaced. When refacing or truing, care shall be exercised to make sure that proper relief and rigidity is maintained as specified in subparagraphs (2) and (5) of this paragraph and they shall be replaced when they do not conform to these subparagraphs and Table O-4, Figure O-30, Table O-5, Figure O-31, Table O-6, Figure O-32, and Table O-8, Figure O-35.

Failure to observe these rules might cause excessive flange pressure around the

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maximum operating speed. Stopping distances shall be expressed in inches of surface travel of the roll from the instant the emergency stopping device is actuated.

(2) **Stopping limits for mills.** All mills irrespective of the size of the rolls or their arrangement (individually or group-driven) shall be stopped within a distance, as measured in inches of surface travel, not greater than $1\frac{1}{2}$ percent of the peripheral no-load surface speeds of the respective rolls as determined in feet per minute.

(3) **Stopping limits for calenders.**

(i) All calenders, irrespective of size of the rolls or their configuration, shall be stopped within a distance, as measured in inches of surface travel, not greater

than $1\frac{3}{4}$ percent of the peripheral no-load surface speeds of the respective calender rolls as determined in feet per minute.

(ii) Where speeds above 250 feet per minute as measured on the surface of the drive roll are used, stopping distances of more than $1\frac{3}{4}$ percent are permissible. Such stopping distances shall be subject to engineering determination.

(g) **Alarm.**

Where an exposure is created by the operation, and the operators are not within sight or hearing of other employees, a suitable alarm device should be provided so that assistance will be available in case of accidents.

1910.217—MECHANICAL POWER PRESSES

(a) **General requirements.**

(1) **New installations.** Revoked

(2) **Former installations.** Revoked

(3) **All installations.** Revoked

(4) **Reconstruction and modification.** It shall be the responsibility of any person reconstructing, or modifying a mechanical power press to do so in accordance with paragraph (b) of this section.

(5) **Excluded machines.** Press brakes, hydraulic and pneumatic power presses, bulldozers, hot bending and hot metal presses, forging presses and hammers, riveting machines and similar types of fastener applicators are excluded from the requirements of this section.

(b) **Mechanical power press guarding and construction, general.**

(1) **Hazards to personnel associated with broken or falling machine components.** Machine components shall be designed, secured, or covered to minimize hazards caused by breakage, or loosening and falling or release of mechanical energy (i.e. broken springs).

(2) **Brakes.** Friction brakes provided for stopping or holding a slide movement shall be inherently self-engaging by requiring power or force from an external source to cause disengagement. Brake capacity shall be sufficient to stop the motion of the slide quickly and capable of holding the slide and its attachments at any point in its travel.

[38 F.R. 16223, June 21, 1973.]

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(3) Machines using full revolution positive clutches.

(i) Machines using full revolution clutches shall incorporate a single-stroke mechanism.

(ii) If the single-stroke mechanism is dependent upon spring action, the spring(s) shall be of the compression type, operating on a rod or guided within a hole or tube, and designed to prevent interleaving of the spring coils in event of breakage.

(4) Foot pedals (treadle).

(i) The pedal mechanism shall be protected to prevent unintended operation from falling or moving objects or by accidental stepping onto the pedal.

(ii) A pad with a nonslip contact area shall be firmly attached to the pedal.

(iii) The pedal return spring(s) shall be of the compression type, operating on a rod or guided within a hole or tube, or designed to prevent interleaving of spring coils in event of breakage.

(iv) If pedal counterweights are provided, the path of the travel of the weight shall be enclosed.

(5) Hand operated levers.

(i) Hand-lever-operated power presses shall be equipped with a spring latch on the operating lever to prevent premature or accidental tripping.

(ii) The operating levers on handtripped presses having more than one operating station shall be interlocked to prevent the tripping of the press except by the "concurrent" use of all levers.

(6) Two-hand trip.

(i) A two-hand trip shall have the individual operator's hand controls protected against unintentional operation and have the individual operator's hand controls arranged by design and construction and/or separation to require the use of both hands to trip the press and

use a control arrangement requiring concurrent operation of the individual operator's hand controls.

(ii) Two-hand trip systems on full revolution clutch machines shall incorporate an antirepeat feature.

(iii) If two-hand trip systems are used on multiple operator presses, each operator shall have a separate set of controls.

(7) Machines using part revolution clutches.

(i) The clutch shall release and the brake shall be applied when the external clutch engaging means is removed, deactivated, or deenergized.

(ii) A red color stop control shall be provided with the clutch/brake control system. Momentary operation of the stop control shall immediately deactivate the clutch and apply the brake. The stop control shall override any other control, and reactivation of the clutch shall require use of the operating (tripping) means which has been selected.

(iii) A means of selecting Off, "Inch," Single Stroke, and Continuous (when the continuous function is furnished) shall be supplied with the clutch/brake control to select type of operation of the press. Fixing of selection shall be by means capable of supervision by the employer.

(iv) The "Inch" operating means shall be designed to prevent exposure of the workers hands within the point of operation by:

(a) Requiring the concurrent use of both hands to actuate the clutch, or

(b) Being a single control protected against accidental actuation and so located that the worker cannot reach into the point of operation while operating the single control.

(v) Two-hand controls for single stroke shall conform to the following requirements:

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(iv) The pull-out device shall protect the operator as specified in paragraph (c)(3)(i)(b) of this section and shall include attachments for each of the operator's hands.

(a) Attachments shall be connected to and operated only by the press slide or upper die.

(b) Attachment shall be adjusted to prevent the operator from reaching into the point of operation or to withdraw the operator's hands from the point of operation before the dies close.

(c) A separate pull-out device shall be provided for each operator if more than one operator is used on a press.

(d) Each pull-out device in use shall be visually inspected and checked for proper adjustment at the start of each operator shift, following a new die set-up, and when operators are changed. Necessary maintenance or repair or both shall be performed and completed before the press is operated. Records of inspections and maintenance shall be kept in accordance with paragraph (e) of this section.

(v) The sweep device may not be used for point of operation safeguarding after December 31, 1976.

(vi) A holdout or a restraint device shall protect the operator as specified in subdivision (i)(c) of this subparagraph and shall include attachments for each of the operator's hands. Such attachments shall be securely anchored and adjusted in such a way that the operator is restrained from reaching into the point of operation. A separate set of restraints shall be provided for each operator if more than one operator is required on a press.

(vii) The two hand control device shall protect the operator as specified in paragraph (c)(3)(i)(e) of this section.

(a) When used in press operations requiring more than one operator, separate two hand controls shall be provided for each operator, and shall be designed to require concurrent application of all operators' controls to activate the slide. The removal of a hand from any control button shall cause the slide to stop.

(b) Each two hand control shall meet the construction requirements of paragraph (b)(7)(v) of this section.

(c) The safety distance (D_s) between each two hand control device and the point of operation shall be greater than the distance determined by the following formula:

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$D_s = 63 \text{ inches/second} \times T_s$; where:
 D_s = minimum safety distance (inches);
 63 inches/second = hand speed constant; and
 T_s = stopping time of the press measured at approximately 90° position of crankshaft rotation (seconds).

(d) Two hand control shall be fixed in position so that only a supervisor or safety engineer is capable of relocating the controls.

(viii) The two hand trip device shall protect the operator as specified in paragraph (c)(3)(i)(e) of this section.

(a) When used in press operations requiring more than one operator, separate two hand trips shall be provided for each operator, and shall be designed to require

concurrent application of all operators' controls to activate the slide.

[40 F.R. 3982, January 27, 1975.]

(b) Each two hand trip shall meet the construction requirements of paragraph (b)(6) of this section.

(c) The safety distance (D_m) between the two hand trip and the point of operation shall be greater than the distance determined by the following formula:

$D_m = 63 \text{ inches/second} \times T_m$; where:
 D_m = minimum safety distance (inches);
 63 inches/second = hand speed constant; and
 T_m = the maximum time the press takes for the die closure after it has been tripped (seconds). For full revolution clutch presses with only one engaging point T_m is equal to the time necessary for one and one-half revolutions of the crankshaft. For full revolution clutch presses with more than one engaging point, T_m shall be calculated as follows:

$$T_m = \left\{ \frac{1}{2} + \frac{1}{\text{Number of engaging points per revolution}} \right\} \times \text{time necessary to complete one revolution of the crankshaft (seconds)}$$

(d) Two hand trips shall be fixed in position so that only a supervisor or safety engineer is capable of relocating the controls.

(ix) [Revoked]

[39 F.R. 41841, December 3, 1974]

(4) **Hand feeding tools.** Hand feeding tools are intended for placing and removing materials in and from the press. Hand feeding tools are not a point of operation guard or protection device and shall not be used in lieu of the "guards" or devices required in this section.

(5) **Additional requirements for safeguarding.** Where the operator feeds or removes parts by placing one or both hands in the point of operation, and a two hand control, presence sensing device of Type B gate or movable barrier (on a part revolution clutch) is used for safeguarding:

(i) the employer shall use a control system and a brake monitor which comply with paragraphs (b)(13) and (14) of this section. This requirement shall be complied with by November 1, 1975;

(ii) the exception in paragraph (b)(7)(v)(d) of this section for two hand controls manufactured and installed before August 31, 1971 is not applicable under this paragraph (c)(5);

(iii) the control of air clutch machines shall be designed to prevent a significant increase in the normal stopping time due to a failure within the operating valve mechanism, and to inhibit further operation if such failure does occur, where a part revolution clutch is employed. The exception in paragraph (b)(7)(xi) of this section for controls manufactured and installed before August 31, 1971, is not applicable under this paragraph (c)(5).

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(d) Design, construction, setting and feeding of dies.

(1) **General requirements.** Effective February 1, 1975, the employer shall:

(i) use dies and operating methods designed to control or eliminate hazards to operating personnel, and

(ii) furnish and enforce the use of hand tools for freeing and removing stuck work or scrap pieces from the die, so that no employee need reach into the point of operation for such purposes.

(2) [Revoked]

[39 F.R. 41841, December 3, 1974.]

(3) **Scrap handling.** The employer shall provide means for handling scrap from roll feed or random length stock operations. Scrap cutters used in conjunction with scrap handling systems shall be safeguarded in accordance with paragraph (b) of this section and with § 1910.219.

(4) **Guide post hazard.** The hazard created by a guide post (when it is located in the immediate vicinity of the operator) when separated from its bushing by more than one-fourth inch shall be considered as a point of operation hazard and be protected in accordance with paragraph (c) of this section.

(5) **Unitized tooling.** If unitized tooling is used, the opening between the top of the punch holder and the face of the slide, or striking pad, shall be safeguarded in accordance with the requirements of paragraph (b) of this section.

(6) **Tonnage, stroke, and weight designation.** All dies shall be:

(i) Stamped with the tonnage and stroke requirements, or have these characteristics recorded if these records are readily available to the die setter;

(ii) Stamped to indicate upper die weight when necessary for air counterbalance pressure adjustment; and

(iii) Stamped to indicate complete die weight when handling equipment may become overloaded.

(7) **Die fastening.** Provision shall be made in both the upper and lower shoes for securely mounting the die to the bolster and slide. Where clamp caps or setscrews are used in conjunction with punch stems, additional means of securing the upper shoe to the slide shall be used.

(8) **Die handling.** Handling equipment attach points shall be provided on all dies requiring mechanical handling.

(9) **Diesetting.**

(i) The employer shall establish a die-setting procedure that will insure compliance with paragraph (b) of this section.

(ii) The employer shall provide spring loaded turnover bars, for presses designed to accept such turnover bars.

(iii) The employer shall provide die stops or other means to prevent losing control of the die while setting or removing dies in presses which are inclined.

(iv) The employer shall provide and enforce the use of safety blocks for use whenever dies are being adjusted or repaired in the press.

(v) The employer shall provide brushes, swabs, lubricating rolls, and automatic or manual pressure guns so that operators and diesetters shall not be required to reach into the point of operation or other hazard areas to lubricate material, punches or dies.

(e) Inspection, maintenance, and modification of presses.

(1) **Inspection and maintenance records.**

(i) It shall be the responsibility of the employer to establish and follow a program of periodic and regular inspections of his power presses to insure that all their parts, auxiliary equipment, and safeguards are in a

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safe operating condition and adjustment. The employer shall maintain records of these inspections and the maintenance work performed.

(ii) Each press shall be inspected and tested no less than weekly to determine the condition of the clutch/brake mechanism, anti-repeat feature and single stroke mechanism. Necessary maintenance or repair or both shall be performed and completed before the press is operated. The employer shall maintain records of these inspections and the maintenance work performed. These requirements do not apply to those presses which comply with paragraph (b)(13) and (14) of this section.

[39 F.R. 41841, December 3, 1974.]

(2) **Modification.** It shall be the responsibility of any person modifying a power press to furnish instructions with the modification to establish new or changed guidelines for use and care of the power press so modified.

(3) **Training of maintenance personnel.** It shall be the responsibility of the employer to insure the original and continuing competence of personnel caring for, inspecting, and maintaining power presses.

(f) Operation of power presses.

(1) **Employment of miners.** Revoked

(2) **Instruction to operators.** The employer shall train and instruct the operator in the safe method of work before starting work on any operation covered by this section. The employer shall insure by adequate supervi-

sion that correct operating procedures are being followed.

(3) **Work area.** The employer shall provide clearance between machines so that movement of one operator will not interfere with the work of another. Ample room for cleaning machines, handling material, work pieces, and scrap shall also be provided. All surrounding floors shall be kept in good condition and free from obstructions, grease, oil, and water.

(4) **Overloading.** The employer shall operate his presses within the tonnage and attachment weight ratings specified by the manufacturer.

This table shows the distances that guards shall be positioned from the danger line in accordance with the required openings.

TABLE O-10

Distance of opening from point of opera- tion hazard (inches)	Maximum width of opening (inches)
$\frac{1}{2}$ to $1\frac{1}{2}$ -----	$\frac{1}{4}$
$1\frac{1}{2}$ to $2\frac{1}{2}$ -----	$\frac{3}{8}$
$2\frac{1}{2}$ to $3\frac{1}{2}$ -----	$\frac{1}{2}$
$3\frac{1}{2}$ to $5\frac{1}{2}$ -----	$\frac{3}{4}$
$5\frac{1}{2}$ to $6\frac{1}{2}$ -----	$\frac{7}{8}$
$6\frac{1}{2}$ to $7\frac{1}{2}$ -----	$1\frac{1}{8}$
$7\frac{1}{2}$ to $12\frac{1}{2}$ -----	$1\frac{1}{4}$
$12\frac{1}{2}$ to $15\frac{1}{2}$ -----	$1\frac{3}{8}$
$15\frac{1}{2}$ to $17\frac{1}{2}$ -----	$1\frac{7}{8}$
$17\frac{1}{2}$ to $31\frac{1}{2}$ -----	$2\frac{1}{4}$

(g) Reports of injuries to employees operating mechanical power presses.

The employer shall, within 30 days of the occurrence, report to either the Director of the Office of Standards Development, OSHA, U.S. Department of Labor, Washington, D.C. 20210, or the State agency administering a plan approved by the Assistant Secretary of Labor for Occupational Safety and Health, all point of operation injuries to operators or other employees. The following information shall be included in the report:

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(3) **Conveyors.** Conveyor power transmission equipment shall be guarded in accordance with ANSI B20.1-1957, Safety Code for Conveyors, Cableways, and Related Equipment.

(4) **Shot blast.** The cleaning chamber shall have doors or guards to protect operators.

(5) **Grinding.** Personal protective equipment shall be used in grinding operations, and equipment shall be used and maintained in accordance with ANSI B7.1-1970, Safety Code for the Use, Care, and Protection of Abrasive Wheels, and with § 1910.215.

1910.219—MECHANICAL POWER-TRANSMISSION APPARATUS

(a) General requirements.

(1) This section covers all types and shapes of power-transmission belts, except the following when operating at two hundred and fifty (250) feet per minute or less:

(i) Flat belts one (1) inch or less in width,

(ii) Flat belts two (2) inches or less in width which are free from metal lacings or fasteners,

(iii) Round belts one-half ($\frac{1}{2}$) inch or less in diameter; and

(iv) Single strand V-belts, the width of which is thirteen thirty-seconds ($\frac{13}{32}$) inch or less.

(2) Vertical and inclined belts (paragraphs (e) (3) and (4) of this section) if not more than two and one-half ($2\frac{1}{2}$) inches wide and running at a speed of less than one thousand (1,000) feet per minute, and if free from metal lacings or fastenings may be guarded with a nip-point belt and pulley guard.

(3) For the Textile Industry, because of the presence of excessive deposits of lint, which constitute a serious fire hazard, the sides and face sections only of nip-point belt and pulley guards are required, provided the guard shall extend at least six (6) inches beyond the rim of the pulley on the in-running and off-running sides of the belt and at least two (2) inches away from the

rim and face of the pulley in all other directions.

(4) This section covers the principal features with which power transmission safeguards shall comply.

(b) Prime-mover guards.

(1) **Flywheels.** Flywheels located so that any part is seven (7) feet or less above floor or platform shall be guarded in accordance with the requirements of this subparagraph:

(i) With an enclosure of sheet, perforated, or expanded metal, or woven wire;

(ii) With guard rails placed not less than fifteen (15) inches nor more than twenty (20) inches from rim. When flywheel extends into pit or is within 12 inches of floor, a standard toeboard shall also be provided;

(iii) When the upper rim of flywheel protrudes through a working floor, it shall be entirely enclosed or surrounded by a guardrail and toeboard.

(iv) For flywheels with smooth rims five (5) feet or less in diameter, where the preceding methods cannot be applied, the following may be used: A disk attached to the flywheel in such manner as to cover the spokes of the wheel on the exposed side and present a smooth surface and edge, at the same time providing means

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for periodic inspection. An open space, not exceeding four (4) inches in width, may be left between the outside edge of the disk and the rim of the wheel if desired, to facilitate turning the wheel over. Where a disk is used, the keys or other dangerous projections not covered by disk shall be cut off or covered. This subdivision does not apply to flywheels with solid web centers.

(v) Adjustable guard to be used for starting engine or for running adjustment may be provided at the flywheel of gas or oil engines. A slot opening for jack bar will be permitted.

(vi) Wherever flywheels are above working areas, guards shall be installed having sufficient strength to hold the weight of the flywheel in the event of a shaft or wheel mounting failure.

(2) Cranks and connecting rods. Cranks and connecting rods, when exposed to contact shall be guarded in accordance with paragraphs (m) and (n) of this section, or by a guardrail as described in paragraph (o) (5) of this section.

(3) Tail rods or extension piston rods. Tail rods or extension piston rods shall be guarded in accordance with paragraphs (m) and (o) of this section, or by a guardrail on sides and end, with a clearance of not less than fifteen (15) nor more than twenty (20) inches when rod is fully extended.

(c) Shafting**(1) Installation.**

(i) Each continuous line of shafting shall be secured in position against excessive endwise movement.

(ii) Inclined and vertical shafts, particularly inclined idler shafts, shall be securely held in position against endwise thrust.

(2) Guarding horizontal shafting.

(i) All exposed parts of horizontal shafting seven (7) feet or less from floor or working platform, excepting runways used exclusively for oiling, or running adjustments, shall be protected by a stationary casing enclosing shafting completely or by a trough enclosing sides and top or sides and bottom of shafting as location requires.

(ii) Shafting under bench machines shall be enclosed by a stationary casing, or by a trough at sides and top or sides and bottom, as location requires. The sides of the trough shall come within at least six (6) inches of the underside of table, or if shafting is located near floor within six (6) inches of floor. In every case the sides of trough shall extend at least two (2) inches beyond the shafting or protuberance.

(3) Guarding vertical and inclined shafting. Vertical and inclined shafting seven (7) feet or less from floor or working platform, excepting maintenance runways, shall be enclosed with a stationary casing in accordance with requirements of paragraphs (m) and (o) of this section.

(4) Projecting shaft ends.

(i) Projecting shaft ends shall present a smooth edge and end and shall not project more than one-half the diameter of the shaft unless guarded by nonrotating caps or safety sleeves.

(ii) Unused keyways shall be filled up or covered.

(5) Power-transmission apparatus located in basements. All mechanical power transmission apparatus located in basements, towers, and rooms used exclusively for power trans-

STANDARDS AND INTERPRETATIONS

mission equipment shall be guarded in accordance with this section, except that the requirements for safeguarding belts, pulleys, and shafting need not be complied with when the following requirements are met:

(i) The basement, tower, or room occupied by transmission equipment is locked against unauthorized entrance.

(ii) The vertical clearance in passageways between the floor and power transmission beams, ceiling, or any other objects, is not less than five feet six inches (5 ft. 6 in.).

(iii) The intensity of illumination conforms to the requirements of ANSI A11.1-1965 (R-1970).

(iv) Revoked

(v) The route followed by the oiler is protected in such manner as to prevent accident.

(d) Pulleys.

(1) **Guarding.** Pulleys, any parts of which are seven (7) feet or less from the floor or working platform, shall be guarded in accordance with the standards specified in paragraphs (m) and (o) of this section. Pulleys serving as balance wheels (e.g., punch presses) on which the point of contact between belt and pulley is more than six feet six inches (6 ft. 6 in.) from the floor or platform may be guarded with a disk covering the spokes.

(2) Location of pulleys.

(i) Unless the distance to the nearest fixed pulley, clutch, or hanger exceeds the width of the belt used, a guide shall be provided to prevent the belt from leaving the pulley on the side where insufficient clearance exists.

(ii) Where there are overhanging pulleys on line, jack, or countershafts with no bearing between the pulley and the outer end of the shaft, a guide to prevent the belt from running off the pulley should be provided.

(3) **Broken pulleys.** Pulleys with cracks, or pieces broken out of rims, shall not be used.

(4) **Pulley speeds.** Pulleys intended to operate at rim speed in excess of manufacturers normal recommendations shall be specially designed and carefully balanced for the speed at which they are to operate.

(e) Belt, rope, and chain drives.

(1) Horizontal belts and ropes.

(i) Where both runs of horizontal belts are seven (7) feet or less from the floor level, the guard shall extend to at least fifteen (15) inches above the belt or to a standard height (see Table O-12), except that where both runs of a horizontal belt are 42 inches or less from the floor, the belt shall be fully enclosed in accordance with paragraphs (m) and (o) of this section.

(ii) In powerplants or power-development rooms, a guardrail may be used in lieu of the guard required by subdivision (i) of this subparagraph.

(2) Overhead horizontal belts.

(i) Overhead horizontal belts, with lower parts seven (7) feet or less from the floor or platform, shall be guarded on sides and bottom in accordance with paragraph (o)(3) of this section.

(ii) Horizontal overhead belts more than seven (7) feet above floor or platform shall be guarded for their entire length under the following conditions:

(a) If located over passageways or work places and traveling 1,800 feet or more per minute.

(b) If center to center distance between pulleys is ten (10) feet or more.

(c) If belt is eight (8) inches or more in width.

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(iii) Where the upper and lower runs of horizontal belts are so located that passage of persons between them would be possible, the passage shall be either:

(a) Completely barred by a guardrail or other barrier in accordance with paragraphs (m) and (o) of this section; or

(b) Where passage is regarded as necessary, there shall be a platform over the lower run guarded on either side by a railing completely filled in with wire mesh or other filler, or by a solid barrier. The upper run shall be so guarded as to prevent contact therewith either by the worker or by objects carried by him. In powerplants only the lower run of the belt need be guarded.

(iv) Overhead chain and link belt drives are governed by the same rules as overhead horizontal belts and shall be guarded in the same manner as belts.

(3) Vertical and inclined belts.

(i) Vertical and inclined belts shall be enclosed by a guard conforming to standards in paragraphs (m) and (o) of this section.

(ii) All guards for inclined belts shall be arranged in such a manner that a minimum clearance of seven (7) feet is maintained between belt and floor at any point outside of guard.

(4) Vertical belts. Vertical belts running over a lower pulley more than seven (7) feet above floor or platform shall be guarded at the bottom in the same manner as horizontal overhead belts, if conditions are as stated in subparagraphs (2)(ii)(a) and (c) of this paragraph.

(5) Cone-pulley belts.

(i) The cone belt and pulley shall be equipped with a belt shifter so constructed as to adequately guard the nip point of the belt and pulley. If the frame of the belt shifter does not adequately guard the nip point of the belt and pulley, the nip point shall be further protected by means of a vertical guard placed in front of the pulley and extending at least to the top of the largest step of the cone.

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(ii) If the belt is of the endless type or laced with rawhide laces, and belt shifter is not desired, the belt will be considered guarded if the nip point of the belt and pulley is protected by a nip point guard located in front of the cone extending at least to the top of the largest step of the cone, and formed to show the contour of the cone in order to give the nip point of the belt and pulley the maximum protection.

(iii) If the cone is located less than 3 feet from the floor or working platform, the cone pulley and belt shall be guarded to a height of 3 feet regardless of whether the belt is endless or laced with rawhide.

(6) Belt tighteners.

(i) Suspended counterbalanced tighteners and all parts thereof shall be of substantial construction and securely fastened; the bearings shall be securely capped. Means must be provided to prevent tightener from falling, in case the belt breaks.

(ii) Where suspended counterweights are used and not guarded by location, they shall be so encased as to prevent accident.

(f) Gears, sprockets, and chains.

(1) **Gears.** Gears shall be guarded in accordance with one of the following methods:

(i) By a complete enclosure; or

(ii) By a standard guard as described in paragraph (c) of this section, at least seven (7) feet high extending six (6) inches above the mesh point of the gears; or

(iii) By a band guard covering the face of gear and having flanges extended inward beyond the root of the teeth on the exposed side or sides. Where any portion of the train of gears guarded by a band guard is less than six (6) feet from the floor a disk guard or a complete enclosure to the height of six (6) feet shall be required.

(2) **Hand-operated gears.** Subparagraph (1) of this paragraph does not apply to hand-operated gears used only to adjust machine parts and which do not continue to move after hand power is removed. However, the guarding of these gears is highly recommended.

(3) **Sprockets and chains.** All sprocket wheels and chains shall be enclosed unless they are more than seven (7) feet above the floor or platform. Where the drive extends over other machine or working areas, protection against falling shall be provided. This subparagraph does not apply to manually operated sprockets.

(4) **Openings for oiling.** When frequent oiling must be done, openings with hinged or sliding self-closing covers shall be provided. All points not readily accessible shall have oil feed tubes if lubricant is to be added while machinery is in motion.

(g) Guarding friction drives.

The driving point of all friction drives when exposed to contact shall be guarded, all arm or spoke friction drives and all web friction drives with holes in the web shall be entirely enclosed, and all projecting belts on friction drives where exposed to contact shall be guarded.

(h) Keys, setscrews, and other projections.

(1) All projecting keys, setscrews, and other projections in revolving parts shall be removed or made flush or guarded by metal cover. This subparagraph does not apply to keys or setscrews within gear or sprocket casings or other enclosures, nor to keys, setscrews, or oilcups in hubs of pulleys less than twenty (20) inches in diameter where they are within the plane of the rim of the pulley.

(2) It is recommended, however, that no projecting setscrews or oilcups be used in any revolving pulley or part of machinery.

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(i) Collars and couplings.

(1) **Collars.** All revolving collars, including split collars, shall be cylindrical, and screws or bolts used in collars shall not project beyond the largest periphery of the collar.

(2) **Couplings.** Shaft couplings shall be so constructed as to present no hazard from bolts, nuts, setscrews, or revolving surfaces. Bolts, nuts, and setscrews will, however, be permitted where they are covered with safety sleeves or where they are used parallel with the shafting and are countersunk or else do not extend beyond the flange of the coupling.

(j) Bearings and facilities for oiling.

All drip cups and pans shall be securely fastened.

(k) Guarding of clutches, cutoff couplings, and clutch pulleys.

(1) **Guards.** Clutches, cutoff couplings, or clutch pulleys having projecting parts, where such clutches are located seven (7) feet or less above the floor or working platform, shall be enclosed by a stationary guard constructed in accordance with this section. A "U" type guard is permissible.

(2) **Engine rooms.** In engine rooms a guardrail, preferably with toeboard, may be used instead of the guard required by subparagraph (1) of this paragraph, provided such a room is occupied only by engineroom attendants.

(l) Belt shifters, clutches, shippers, poles, perches, and fasteners.**(1) Belt shifters.**

(i) Tight and loose pulleys on all new installations made on or after August 31, 1971, shall be equipped with a permanent

belt shifter provided with mechanical means to prevent belt from creeping from loose to tight pulley. It is recommended that old installations be changed to conform to this rule.

(ii) Belt shifter and clutch handles shall be rounded and be located as far as possible from danger of accidental contact, but within easy reach of the operator. Where belt shifters are not directly located over a machine or bench, the handles shall be cut off six feet six inches (6 ft. 6 in.) above floor level.

(iii) All belt and clutch shifters of the same type in each shop should move in the same direction to stop machines, i.e., either all right or all left. This does not apply to friction clutch on countershaft carrying two clutch pulleys with open and crossed belts, respectively. In this case the shifter handle has three positions and the machine is at a standstill when clutch handle is in the neutral or center position.

(2) **Belt shippers and shipper poles.** The use of belt poles as substitutes for mechanical shifters is not recommended.

(3) **Belt perches.** Where loose pulleys or idlers are not practicable, belt perches in form of brackets, rollers, etc., shall be used to keep idle belts away from the shafts. Perches should be substantial and designed for the safe shifting of belts.

(4) **Belt fasteners.** Belts which of necessity must be shifted by hand and belts within seven (7) feet of the floor or working platform which are not guarded in accordance with this section shall not be fastened with metal in any case, nor with any other fastening which by construction or wear will constitute an accident hazard.

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(m) Standard guards—general requirements.**(1) Materials.**

(i) Standard conditions shall be secured by the use of the following materials. Expanded metal, perforated or solid sheet metal, wire mesh on a frame of angle iron, or iron pipe securely fastened to floor or to frame of machine.

(ii) All metal should be free from burrs and sharp edges.

(2) Methods of manufacture.

(i) Expanded metal, sheet or perforated metal, and wire mesh shall be securely fastened to frame

(n) Disk, shield, and "U" guards. Revoked**(o) Approved materials.**

(1) **Minimum requirements.** The materials and dimensions specified in this paragraph shall apply to all guards, except horizontal overhead belts, rope, cable, or chain guards more than seven (7) feet above floor, or platform.

(i) Revoked

(a) All guards shall be rigidly braced every three (3) feet or fractional part of their height to some fixed part of machinery or building structure. Where guard is exposed to contact with moving equipment additional strength may be necessary.

(2) Wood guards.

(i) Wood guards may be used in the wood-working and chemical industries, in industries where the presence of fumes or where manufacturing conditions would cause the rapid deterioration of metal guards; also in construction work and in locations outdoors where extreme cold or extreme heat make metal guards and railings undesirable. In all other industries, wood guards shall not be used.

(3) Guards for horizontal overhead belts.

(i) Guards for horizontal overhead belts shall run the entire length of the belt and follow the line of the pulley to the ceiling or be carried to the nearest wall, thus enclosing the belt effectively. Where belts are so located as to make it impracticable to carry the guard to wall or ceiling, construction of guard shall be such as to enclose completely the top and bottom runs of belt and the face of pulleys.

(ii) Revoked

(iii) Suitable reinforcement shall be provided for the ceiling rafters or overhead floor beams, where such is necessary, to sustain safely the weight and stress likely to be imposed by the guard. The interior surface of all guards, by which is meant the surface of the guard with which a belt will come in contact, shall be smooth and free from all projections of any character, except where construction demands it; protruding shallow roundhead rivets may be used. Overhead belt guards shall be at least one-quarter wider than belt which they protect, except that this clearance need not in any case exceed six (6) inches on each side. Overhead rope drive and block and roller-chain-drive guards shall be not less than six (6) inches wider than the drive on each side. In overhead silent chain-drive guards where the chain is held from lateral displacement on the sprockets, the side clearances required on drives of twenty (20) inch centers or under shall be not less than one-fourth inch from the nearest moving chain part, and on drives of over twenty (20) inch centers a minimum of one-half inch from the nearest moving chain part.

(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

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(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 ($1\frac{1}{4}$) 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 ($1\frac{1}{2}$) by one and one-half ($1\frac{1}{2}$) by three-sixteenths ($\frac{3}{16}$) 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 one 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

Pages 533 and 534 deleted

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grill not exceeding one (1) inch mesh. Toeboards at flywheel pits should preferably be placed as close to edge of the pit as possible.

(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 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) Revoked

(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 oilers 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:

§ 1910.212(a).

§ 1910.213 (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

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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. 13, 1971]

1910.221—SOURCES OF STANDARDS

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

<i>Standard</i>	<i>Source</i>	<i>Standard</i>	<i>Source</i>
§ 1910.212	41 CFR 50-204.5.	§ 1910.216	ANSI B 28.1-1967, Safety Code for Mills Calendars in the Rubber and Plastic Industries.
§ 1910.213	ANSI O1.1-1964-(R 1971), Safety Code for Code for Woodworking Machinery.	§ 191.217	ANSI B 11.1-1971, Safety Standard for Construction, Care, and Use of Mechanical Power Presses.
§ 1910.214	ANSI O1.1-1964-(R 1961), Safety Code for Woodworking Machinery.	§ 1910.218	ANSI B 24.1, 1971 Safety Standard for Forging.
§ 1910.215	ANSI B 7.1-1970, Safety Code for Abrasive Wels.	§ 1910.219	ANSI B 15.1-1953-(R-1958) 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.

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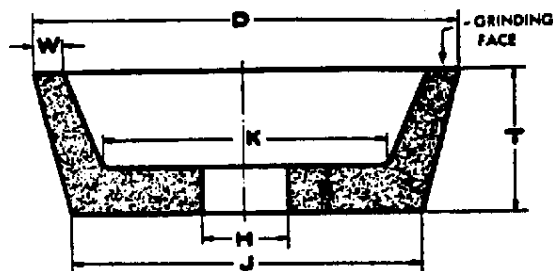
(5) **Organic bonded wheels.** Organic wheels are wheels which are bonded by means of an organic material such as resin, rubber, shellac, or other similar bonding agent.

(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 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.

TYPE 11 FLARING CUP WHEELS



Figure

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).

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.

(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.

TYPE 6 STRAIGHT CUP WHEELS

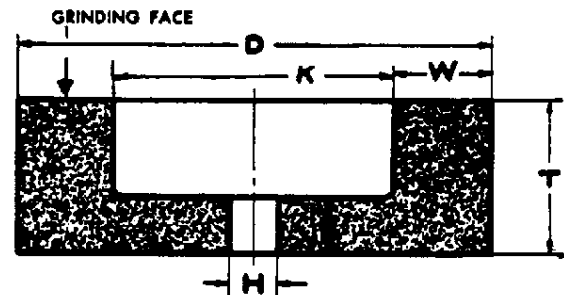


Figure P-2

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 abrasive created by the difference between the diameter of the recess and the outside diameter of the wheel. Therefore, the wall dimension "W" takes precedence over the diameter of the recess as an essential intermediate dimension to describe this shape type.

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.

(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.

TYPE 1 STRAIGHT WHEELS

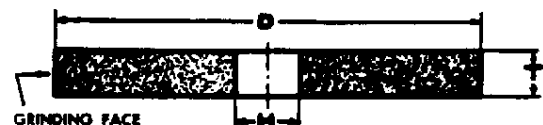


Figure P-3

Type 1 — Straight Wheel
Peripheral grinding wheel having a diameter, thickness and hole.

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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.

(c) Power lawnmower terms. Revoked

(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.

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(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.)

(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.)

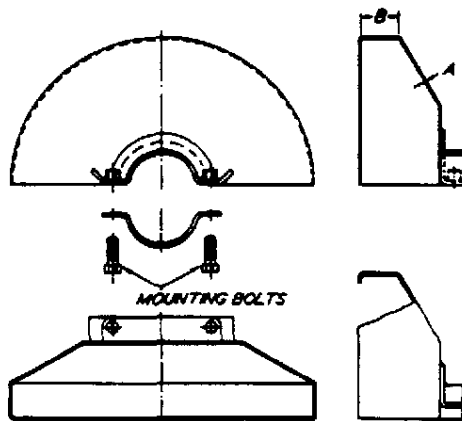


FIGURE NO. P-4

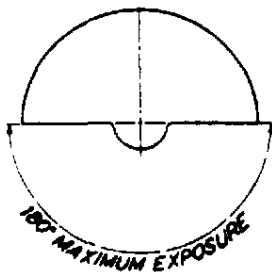


FIGURE NO. P-5

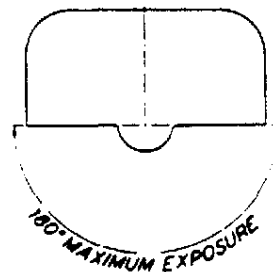


FIGURE NO. P-6

(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 adaptors) 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).

(6) **Excluded machinery.** Natural sandstone wheels and metal, wooden, cloth, or paper

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discs, having a layer of abrasive on the surface are not covered by this paragraph.

[38 F.R. 14371, June 1, 1973.]

(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

(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)

(1) 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 breeching parts will be reasonably visible to allow a check for any foreign matter that may be present.

STANDARDS AND INTERPRETATIONS

(ii) Tools of the low-velocity-piston type shall have the characteristics outlined in (a) through (e) of this subdivision

characteristics outlined in (a) through (e) of this subdivision

(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.

(a) The muzzle end of the tool shall be so designed 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)

(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.

(1) 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) 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.

(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.

(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.

(iii) Tools of the hammer-operated piston tools—low-velocity type shall have the

STANDARDS AND INTERPRETATIONS

(ii) Revoked

(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.)

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

(ii) Piping joints.

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

(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) All piping shall be run as directly as practicable, protected against physical damage, proper allowance being made for expansion and contraction, jarring and vibration. Pipe laid underground in earth shall be located below the frost line and protected against corrosion. After assembly, piping shall be thoroughly 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 end 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

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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 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 gas tight 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. Flames 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.

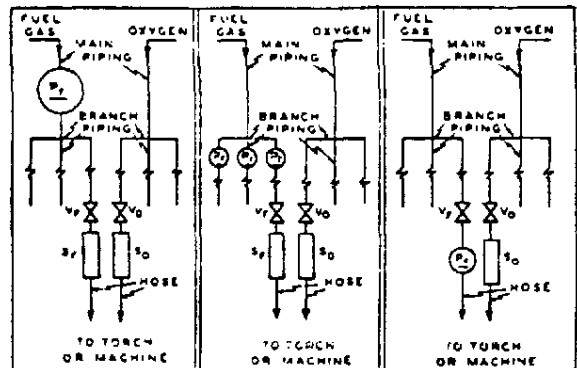


Fig. Q-1 Fig. Q-2 Fig. Q-3
LEGEND:
P_F — Protective equipment in fuel gas piping
V_F — Fuel gas station outlet valve
V_O — Oxygen station outlet valve
S_F — Backflow prevention device(s) at fuel gas station outlet
S_O — Backflow prevention device(s) at oxygen station outlet

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_F 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

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(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_F) 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 S_F , 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 S_F and S_O .

(b) When approved pipeline protective equipment (designated P_F) 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 V_F and V_O) 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 se-

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cured 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.

(v) **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) Revoked

(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.

(6) **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 carbide required for a single complete charge.

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(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.

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

(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)(a)(4) of this subparagraph, sources of ignition shall be prohibited in outside generator houses or inside 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 overfilling 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)

(1) Each generator shall be provided with a vent pipe

(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 buildings 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.

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(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 P_r) 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.

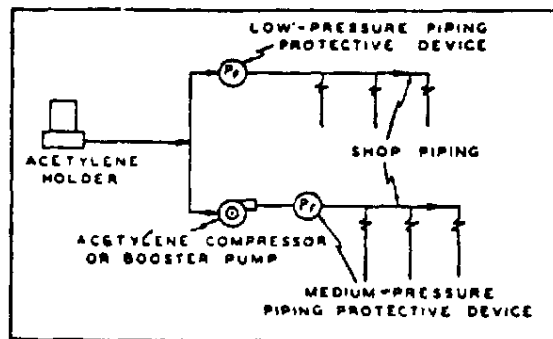


Figure Q-4

(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

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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 manifold 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,

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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

(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 S of this part for Class I, Division 2 locations.

(vii) 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.

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(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:

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(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. If the storage building is of noncombustible construction, it may adjoin other one-story buildings if separated therefrom by unpierced 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.

(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) Revoked

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

(8) Public exhibitions and demonstrations.

Revoked

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(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.

(i) **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 3,300 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.

(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.

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(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.

(b) 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 return of voltage.

(b) On all types of arc welding machines, control apparatus shall be enclosed except for the operating wheels, levers, or handles.

(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 nonremovable 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.

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(ii) **Capacitor welding.** Stored energy or capacitor discharge type of resistance welding equipment and control panels involving high voltage (over 550 volts) shall be suitably insulated and protected by complete enclosures, all doors of which shall be provided with suitable interlocks and contacts wired into the control circuit (similar to elevator interlocks). Such interlocks or contacts shall be so designed as to effectively interrupt power and short circuit all capacitors when the door or panel is open. A manually operated switch or suitable positive device shall be installed, in addition to the mechanical interlocks or contacts, as an added safety measure assuring absolute discharge of all capacitors.

(iii) **Interlocks.** All doors and access panels of all resistance welding machines and control panels shall be kept locked and interlocked to prevent access, by unauthorized persons, to live portions of the equipment.

(iv) **Guarding.** All press welding machine operations, where there is a possibility of the operator's fingers being under the point of operation, shall be effectively guarded by the use of a device such as an electronic eye safety circuit, two hand controls or protection similar to that prescribed for punch press operation, § 1910.217. All chains, gears, operating bus linkage, and belts shall be protected by adequate guards, in accordance with § 1910.219.

(v) **Shields.** The hazard of flying sparks shall be, wherever practical, eliminated by installing a shield guard of safety glass or suitable fire-resistant plastic at the point of operation. Additional shields or curtains shall be installed as necessary to protect passing persons from flying sparks. (See paragraph (c)(2)(i)(c) of this section.)

(vi) **Foot switches.** All foot switches shall be guarded to prevent accidental operation of the machine.

(vii) **Stop buttons.** Two or more safety emergency stop buttons shall be provided on

all special multispot welding machines, including 2-post and 4-post weld presses.

(viii) **Safety pins.** On large machines, four safety pins with plugs and receptacles (one in each corner) shall be provided so that when safety pins are removed and inserted in the ram or platen, the press becomes inoperative.

(ix) **Grounding.** Where technically practical, the secondary of all welding transformers used in multispot, projection and seam welding machines shall be grounded. This may be done by permanently grounding one side of the welding secondary current circuit. Where not technically practical, a center tapped grounding reactor connected across the secondary or the use of a safety disconnect switch in conjunction with the welding control are acceptable alternates. Safety disconnect shall be arranged to open both sides of the line when welding current is not present.

(3) Portable welding machines.

(i) **Counterbalances.** All portable welding guns shall have suitable counterbalanced devices for supporting the guns, including cables, unless the design of the gun or fixture makes counterbalancing impractical or unnecessary.

(ii) **Safety chains.** All portable welding guns, transformers and related equipment that is suspended from overhead structures, eye beams, trolleys, etc. shall be equipped with safety chains or cables. Safety chains or cables shall be capable of supporting the total shock load in the event of failure of any component of the supporting system.

(iii) **Clevis.** Each clevis shall be capable of supporting the total shock load of the suspended equipment in the event of trolley failure.

(iv) **Switch guards.** All initiating switches, including retraction and dual schedule switches, located on the portable welding gun shall be equipped with suitable

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guards capable of preventing accidental initiation through contact with fixturing, operator's clothing, etc. Initiating switch voltage shall not exceed 24 volts.

(v) **Moving holder.** The movable holder, where it enters the gun frame, shall have sufficient clearance to prevent the shearing of fingers carelessly placed on the operating movable holder.

(vi) **Grounding.** The secondary and case of all portable welding transformers shall be grounded. Secondary grounding may be by center tapped secondary or by a center tapped grounding reactor connected across the secondary.

(4) Flash welding equipment.

(i) **Ventilation and flash guard.** Flash welding machines shall be equipped with a hood to control flying flash. In cases of high production, where materials may contain a film of oil and where toxic elements and metal fumes are given off, ventilation shall be provided in accordance with paragraph (f) of this section.

(ii) **Fire curtains.** For the protection of the operators of nearby equipment, fire-resistant curtains or suitable shields shall be set up around the machine and in such a manner that the operators' movements are not hampered.

(5) Hazards and precautions. Revoked

(6) **Maintenance.** Periodic inspection shall be made by qualified maintenance personnel, and records of the same maintained. The operator shall be instructed to report any equipment defects to his supervisor and the use of the equipment shall be discontinued until safety repairs have been completed.

(d) Fire prevention and protection.

(1) **Basic precautions.** For elaboration of these basic precautions and of the special precau-

tions of subparagraph (2) of this paragraph as well as a delineation of the fire protection and prevention responsibilities of welders and cutters, their supervisors (including outside contractors) and those in management on whose property cutting and welding is to be performed, see Standard for Fire Prevention in Use of Cutting and Welding Processes, NFPA Standard 51B, 1962. The basic precautions for fire prevention in welding or cutting work are:

(i) **Fire hazards.** If the object to be welded or cut cannot readily be moved, all movable fire hazards in the vicinity shall be taken to a safe place.

(ii) **Guards.** If the object to be welded or cut cannot be moved and if all the fire hazards cannot be removed, then guards shall be used to confine the heat, sparks, and slag, and to protect the immovable fire hazards.

(iii) **Restrictions.** If the requirements stated in subdivision (i) and (ii) of this subdivision cannot be followed then welding and cutting shall not be performed.

(2) **Special precautions.** When the nature of the work to be performed falls within the scope of subdivision (ii) of this subdivision certain additional precautions may be necessary:

(i) **Combustible material.** Wherever there are floor openings or cracks in the flooring that cannot be closed, precautions shall be taken so that no readily combustible materials on the floor below will be exposed to sparks which might drop through the floor. The same precautions shall be observed with regard to cracks or holes in walls, open doorways and open or broken windows.

(ii) **Fire extinguishers.** Suitable fire extinguishing equipment shall be maintained in a state of readiness for instant use. Such equipment may consist of pails of water, buckets of sand, hose or portable extinguishers depending upon the nature and quantity of the combustible material exposed.

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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.

(4) Confined spaces.

(i) **Accidental contact.** 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 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 shutoff 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.

(e) Protection of personnel.**(1) General.**

(i) **Railing.** 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 protection 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,

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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.

<i>Welding operation</i>	<i>Shade No.</i>
Shielded metal-arc welding— $\frac{1}{16}$ -, $\frac{3}{32}$ -, $\frac{1}{8}$ -, $\frac{5}{32}$ -inch electrodes	10
Gas-shielded arc welding (nonferrous)— $\frac{1}{16}$ -, $\frac{3}{32}$ -, $\frac{1}{8}$ -, $\frac{5}{32}$ -inch electrodes	11
Gas-shielded arc welding (ferrous)— $\frac{1}{16}$ -, $\frac{3}{32}$ -, $\frac{1}{8}$ -, $\frac{5}{32}$ -inch electrodes	12
Shielded metal-arc welding: $\frac{1}{16}$ -, $\frac{3}{32}$ -, $\frac{1}{8}$ -inch electrodes	12
$\frac{5}{32}$ -, $\frac{3}{16}$ -inch electrodes	14
Atomic hydrogen welding	10-14
Carbon arc welding	14
Soldering	2

<i>Welding operation</i>	<i>Shade No.</i>
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.

(j) 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 non-combustible 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 non-combustible 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. Revoked

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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 pre-planned 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 shutoff.** 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.

(4) Work in confined spaces.

(i) **General.** As used herein confined space is intended to mean a relatively small or

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(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.**(1) **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 § 1910.1000.

[40 F.R. 23072, May 28, 2975.]

(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.

(a) 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.

(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:

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be controlled at the source, in accordance with American National Standard Z9.2—1960. 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 unpling 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 unpiled.

(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.

(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 (c)(15)(iv) of this section shall apply.

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(7) **Circular saws (not slasher saws).** Saws shall be provided with standard guards, in accordance with American National Standard B1.1—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 barker 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.

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(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 calender 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 calender 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. Revoked

(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.

(l) Finishing room.

(1) Cleaning rolls. Rolls shall be cleaned only on the outrunning side.

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(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 (re-affirmed 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 nonrepeat 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 rewriter 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

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.

(b) Definitions applicable to this section.

Revoked

(c) General machine guarding.

(1) **Electrical grounding.** Revoked

(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.** Revoked

(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.** Revoked

(7) **Ventilation through machine guards.**

Revoked

(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) Revoked

(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) Revoked

(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.

(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, there shall be an upturn at the lower end of the chute to slow down the bags.

(ii) Bag-arm elevators with manual takeoff 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.

(iii) Revoked

STANDARDS AND INTERPRETATIONS

(iv) Man lifts shall be prohibited in bakeries. Bag or barrel lifts shall not be used as man lifts.

(3) Dumpbin and blender.

(i) Revoked

(ii) Revoked

(iii) Revoked

(iv) Revoked

(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.

(4) Flour elevators. Revoked**(5) Bolting reels. Revoked****(6) Storage bins.**

(i) Revoked

(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) Revoked

(v) Revoked

(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) Revoked

(ii) Revoked

(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) Revoked

(9) Flour scales.

(i) Revoked

(ii) Revoked

(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.

(e) Mixers.

(1) Horizontal dough mixers.

STANDARDS AND INTERPRETATIONS

(i) Mixers with external power application shall have all belts, chains, gears, pulleys, sprockets, clutches, and other moving parts completely enclosed.

(ii) Revoked

(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;

(vi) Revoked

(vii) Revoked

(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) Revoked

(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) thru (xvii) Revoked

(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 paragraphs (e)(1)(i), (iii), (ix), and (x) of this section."

(ii) Revoked

(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.

(f) Dividers.

(1) *Pinch and shear points.* Revoked

(2) *Front guards.* Revoked

(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.

(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.

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(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.

(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, and so located that the body of the operator will press against the bar if the operator slips and falls toward the rolls, or if the operator gets his hand caught in the rolls. The bar shall apply the body pressure to open positively a circuit that will deenergize the drive motor. In addition, a brake which is inherently self-engaging by requiring power or force from an external source to cause disengagement shall be activated at the same time causing the rolls to stop instantly. The emergency stop bar shall be checked for proper operation every 30 days.

[38 F.R. 16223, June 21, 1973.]

(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) Revoked

(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.

(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.

REGULATIONS AND PROCEDURES

(8) Overhead rail systems. Revoked

(9) Dough chutes. Revoked

(10) Skids. Revoked

(11) Ingredient premixers, emulsifiers, etc.

(i) All top openings shall be provided with covers attached to the machines. These covers should be so arranged and interlocked that power will be shutoff whenever the cover is opened to a point where the operator's fingers might come in contact with the beaters.

(12) Chain tackle.

(i) All chain tackle shall be marked prominently, permanently, and legibly with maximum load capacity.

(ii) All chain tackle shall be marked permanently, and legibly with minimum support specification.

(iii) Safety hooks shall be used.

(13) Trough hoists, etc.

(i) All hoists shall be marked prominently, permanently, and legibly with maximum load capacity.

(ii) All hoists shall be marked permanently and legibly with minimum support specifications.

(iii) Safety catches shall be provided for the chain so that the chain will hold the load in any position.

(iv) Safety hooks shall be used.

(14) Air-conditioning units.

(i) Revoked

(ii) On large units with doors to chambers large enough to be entered, all door locks shall be operable from both inside and outside.

(15) Pan washing tanks.

(i) Revoked

(ii) The surface of the floor of the working platform shall be maintained in nonslip condition.

(iii) Revoked

(iv) Revoked

(v) Power ventilated exhaust hoods shall be provided over the tanks.

(16) Pan washing machines. Revoked

(17) Cake depositors. Revoked

(18) Icing machines. Revoked

(19) Bread coolers, conveyor type. Revoked

(20) Bread coolers, rack type.

(i) Revoked

(ii) All door locks shall be operable from both within and outside the cooler.

(21) Bread and cake boxes, trays, etc. Revoked

(22) Doughnut machines. Separate flues shall be provided,

(i) For venting vapors from the frying section, and

(ii) For venting products of combustion from the combustion chamber used to heat the fat.

(23) Open fat kettles.

(i) The floor around kettles shall be maintained in nonslip condition.

(ii) Revoked

(iii) Revoked

(iv) The top of the kettle shall be not less than 36 inches above floor or working level.

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(24) Steam kettles.

- (i) Positive locking devices shall be provided to hold kettles in the desired position.
- (ii) Kettles with steam jackets shall be provided with safety valves in accordance with the ASME Pressure Vessel Code, Section VIII, Unfired Pressure Vessels, 1968.

(j) Slicers and wrappers.**(1) Slicers.**

- (i) Revoked
- (ii) Revoked
- (iii) The cover over the knife head of reciprocating-blade slicers shall be provided with an interlocking arrangement so that the machine cannot operate unless the cover is in place.
- (iv) On slicers with endless band knives, each motor shall be equipped with a magnet brake which operates whenever the motor is not energized. Each door, panel, or other point of access to the cutting blades shall be arranged by means of mechanical or electric interlocks so that the motor will be deenergized if all such access doors, panels, or access points are not closed.
- (v) When it is necessary to sharpen slicer blades on the machine, a barrier shall be provided leaving only sufficient opening for the sharpening stone to reach the knife blades.

(vi) Revoked

(vii) Slicer wrapper conditions.

- (a) Revoked
- (b) Revoked
- (c) Mechanical control levers for starting and stopping both slicing machine conveyors and wrapping machines shall be extended or so located that an

operator in one location can control both machines. Such levers should be provided wherever necessary, but these should be so arranged that there is only one station capable of starting the wrapping machine and conveyor assembly, and this starting station should be so arranged or guarded as to prevent accidental starting. The electric control station for starting and stopping the electric motor driving the wrapping machine and conveyor should be located near the clutch starting lever.

(2) Wrappers.

- (i) Revoked
- (ii) Revoked
- (iii) Electrical heaters on wrappers shall be protected by a cover plate properly separated or insulated from the heaters in order that accidental contact with this cover plate will not cause a burn to the operator.

(k) Biscuit and cracker equipment.**(1) Meal, peanut, and fig grinders.**

- (i) If the hopper is removable it shall be provided with an electric interlock so that the machine cannot be put in operation when the hopper is removed.

(ii) Where grid guards cannot be used, feed conveyors to hoppers, or baffle-type hoppers, shall be provided. Hoppers in such cases shall be enclosed and provided with hinged covers, and equipped with electric interlock to prevent operation of the machine with the cover open.

(2) Sugar and spice pulverizers.

- (i) All drive belts used in connection with sugar and spice pulverizers shall be grounded by means of metal combs or other effective means of removing static electricity. All pulverizing of sugar or spice grinding shall be done in accordance with NFPA 62—1967 (Standard for Dust

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Hazards of Sugar and Cocoa), NFPA 656—1959 (Standard for Dust Hazards in Spice Grinding Plants).

(ii) Magnetic separators shall be provided to reduce fire and explosion hazards.

(3) **Cheese, fruit, and food cutters.** These machines shall be protected in accordance with the requirements of subparagraph (1) of this paragraph.

(4) **Jam, icing, and marshmallow beaters of horizontal tub type.** Revoked

(5) **Reversible dough brakes.** Reversible brakes shall be provided with a guard or tripping mechanism on each side of the rolls. These guards shall be so arranged as to stop the machine or reverse the direction of the rolls so that they are outrunning if the guard is moved by contact of the operator.

(6) **Cross-roll brakes.** Cross-roll brakes shall be provided with guards that are similar in number and equal in effectiveness to guards on hand-fed brakes.

(7) **Box- and roll-type dough sheeters.**

(i) Revoked

(ii) Hoppers for sheeters shall have an automatic stop bar or automatic stopping device along the back edge of the hopper. If construction does not permit location at the back edge, the automatic stop bar or automatic stopping device shall be located where it will be most effective to accomplish the desired protection.

(8) **Cutting and panning, embossing, peeling, bar, and fruit machines.** Revoked

(9) **Rotary, die machines, pretzel rolling, and pretzel-stick extruding machines.** Dough hoppers shall have the entire opening protected with substantial grid-type guards to prevent the employee from getting his hands caught in moving parts, or the hopper shall be extended high enough so that the operator's hands cannot get into moving parts.

(10) **Band ovens.** Revoked

(11) **Wafer-cutting machines.** Revoked

(12) **Pan cooling towers.**

(i) Where pan cooling towers extend to two or more floors, a lockout switch shall be provided on each floor in order that mechanics working on the tower may positively lock the mechanism against starting. Only one start switch shall be used in the motor control circuit.

(13) **Chocolate melting, refining, and mixing kettles.** Each kettle shall be provided with a cover to enclose the top of the kettle. The bottom outlet of each kettle shall be of such size and shape that the operator cannot reach in to touch the revolving paddle or come in contact with the shear point between the paddle and the side of the kettle.

(14) **Caddie, cover, and box stitchers**
Revoked

(15) **Carton-wrapping and bundling machines.**
Revoked

(16) **Carton and lining feeding machines.** Revoked

(17) **Peanut cooling trucks.** Mechanically operated peanut cooling trucks shall have a grid-type cover over the entire top.

(I) **Ovens.**

(1) **General location.**

(i) thru (vi) Revoked

(vii) Ovens shall be located so that possible fire or explosion will not expose groups of persons to possible injury. For this reason ovens shall not adjoin lockers, lunch or sales rooms, main passageways, or exits.

(2) **Recommended construction.** Revoked

(3) **Safeguards of mechanical parts.**

(i) Emergency stop buttons shall be provided on mechanical ovens near the point where operators are stationed.

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(ii) All piping at ovens shall be tested to be gastight.

(iii) Main shutoff valves, operable separately from any automatic valve, shall be provided to permit turning off the fuel or steam in case of an emergency.

(a) Main shutoff valves shall be located so that explosions, fires, etc. will not prevent access to these valves.

(b) Main shutoff valves shall be locked in the closed position when men must enter the oven or when the oven is not in service.

(4) Gas-burning systems. Revoked

(5) Gas mixing machines. Revoked

(6) Oil-burning equipment. Revoked

(7) Solid-fuel firing equipment. Revoked

(8) Electrical heating equipment.

(i) Revoked

(ii) Revoked

(iii) A main disconnect switch or circuit breaker shall be provided. This switch or circuit breaker shall be so located that it can be reached quickly and safely. The main switch or circuit breaker shall have provisions for locking it in the open position if any work on the electrical equipment or inside the oven must be performed.

(9) General requirements.

(i) Protecting devices shall be properly maintained and kept in working order.

(ii) All safety devices on ovens shall be inspected at intervals of not less than twice a month by an especially appointed, properly instructed bakery employee, and not less than once a year by representatives of the oven manufacturers.

(iii)

(a) Protection of gas pilot lights shall be provided when it is impracticable to protect the main flame of the burner and where the pilot flame cannot contact the flame electrode without being in the path of the main flame of the burner. Failure of any gas pilot shall automatically shut off the fuel supply to the burner.

(b) Ovens with multiple burners shall be equipped with individual atmospheric pilot lights where there is sufficient secondary air in the baking chamber and where gas is available; or else each burner shall be equipped with an electric spark type ignition device.

(iv) Burners of a capacity exceeding 150,000 B.t.u. per hour equipped with electric ignition shall be protected in addition by quick-acting combustion safeguards.

(a) The high-tension current for any electric spark-type ignition device shall originate in a power supply line which is interlocked with the fuel supply for the oven in such a way that in case of current failure both the source of electricity to the high-tension circuits and the fuel supply shall be turned off simultaneously.

(v) When fuel is supplied and used at line pressure, safety shutoff valves shall be provided in the fuel line leading to the burner.

(a) When fuel is supplied in excess of line pressure, safety shutoff valves shall be provided in the fuel line leading to the burners, unless the fuel supply lines are equipped with other automatic valves which will prevent the flow of fuel when the compressing equipment is stopped.

(b) The safety shutoff valve shall be positively tight and shall be tested at least twice monthly.

(c) Packing glands shall be designed so

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that the valve will not be made inoperative by excessive tightening of the packing gland.

(d) Revoked

(e) A safety shutoff valve shall require manual operation for reopening after it has closed, or the electric circuit shall be so arranged that it will require a manual operation for reopening the safety shutoff valve.

(f) Manual reset-type safety shutoff valves shall be so arranged that they cannot be locked in an open position by external means.

(g) Where blowers are used for supplying the air for combustion the safety shutoff valve shall be interlocked so that it will close in case of air failure.

(h) Where gas or electric ignition is used, the safety shutoff valve shall close in case of ignition failure. On burners equipped with combustion safeguards, the valve shall close in case of burner flame failure.

(vi) One main, manually operated, fuel shutoff valve shall be provided on each oven, and shall be located ahead of all other valves in the system.

(vii) All individual gas or oil burners with a heating capacity over 150,000 B.t.u. per hour shall be protected by a safeguard which is actuated by the flame and which will react to flame failure in a time interval not to exceed 2 seconds. All safeguards, once having shut down a gas or oil burner, shall require manual resetting and starting of the burner or burners.

(viii) Any space in an oven (except direct fired ovens) which could be filled with an explosive mixture shall be protected by explosion vents. Explosion vents shall be made of minimum weight consistent with adequate insulation.

(a) Explosion doors which have a substantial weight shall be attached by chains or similar means to prevent flying parts from injuring the personnel in case of an explosion.

(b) Where explosion vents are so located that flying parts or gases might endanger the personnel working on or near the oven, internal or external protecting means shall be provided in the form of heavily constructed shields or deflectors made from noncombustible material.

(c) Specifically exempted from the provisions of subdivision (viii) of this subparagraph are heating systems on ovens in which the fuel is admitted only to enclosed spaces which shall have been tested to prove that their construction will resist repeated explosions without deformation are exempt from the requirements of subdivisions (viii) (a) and (b) of this paragraph.

(ix) Flues and dampers. Revoked

(x) Revoked

(xi) Where the gas supply pressure is substantially higher than that at which the burners of an oven are designed to operate, a gas pressure regulator shall be employed.

(a) Revoked

(b) Revoked

(c) Revoked

(d) A relief valve shall be placed on the outlet side of gas pressure regulators where gas is supplied at high pressure. The discharge from this valve shall be piped to the outside of the building.

(10) Direct-fired ovens.

(i) Direct-fired ovens shall be safeguarded against failure of fuel, air, or ignition.

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(ii) To prevent the possible accumulation of explosive gases from being ignited after a shutdown, all direct-fired ovens with a heating capacity over 150,000 B.t.u. per hour shall be ventilated before the ignition system, combustion air blower, and the fuel can be turned on. The prevention shall insure at least four complete changes of atmosphere in the baking chamber by discharging the oven atmosphere to the outside of the building and entraining fresh air into it. The prevention shall be repeated whenever the heating equipment is shut down by a safety device.

(11) Direct recirculating ovens.

(i) Each circulating fan in direct recirculating ovens shall be interconnected with the burner in such a manner that the fuel is shut off by a safety valve when the fan is not running.

(ii) The flame of the burner or burners

in direct recirculating ovens shall be protected by a quick-acting flame-sensitive safeguard which will automatically shut off the fuel supply in case of burner failure.

(12) Flue-type ovens. Revoked

(13) Indirect-fired multiple burner ovens. Revoked

(14) Steam-tube ovens. Revoked

(15) Indirect recirculating ovens.

(i) Revoked

(ii) Revoked

(iii) Duct systems (in ovens) operating under pressure shall be tested for tightness in the initial starting of the oven and also at intervals not farther apart than 6 months.

1910.264—LAUNDRY MACHINERY AND OPERATIONS

(a) Definitions applicable to this section.

Revoked

(b) General requirements.

This section applies to moving parts of equipment used in laundries and to conditions peculiar to this industry, with special reference to the point of operation of laundry machines. This section does not apply to dry-cleaning operations.

(c) Point-of-operation guards.

(1) Washroom machines.

(i) Marking machine. Revoked

(ii) Washing machine.

(a) Revoked

(b) Each washing machine shall be provided with means for holding open the doors or covers of inner and outer cylinders or shells while being loaded or unloaded.

(iii) Extractor. Revoked

(2) Starching and drying machines.

(i) Starching machine (cylinder or box type). Revoked

(ii) Drying-room fan. Revoked.

(iii) Drying tumbler.

(a) Revoked

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(b) Each drying tumbler shall be provided with means for holding open the doors or covers of inner and outer cylinders or shells while being loaded or unloaded.

(iv) **Shaker (clothes tumbler).**

(a) Revoked

(b)

(1) Revoked

(2) Each shaker or clothes tumbler of the double-cylinder type shall be provided with means for holding open the doors or covers of inner and outer cylinders or shells while being loaded or unloaded.

(v) **Exception.** Provisions of subdivision (iii), (iv)(a)(1), and (iv)(b) of this subparagraph shall not apply to shakeout or conditioning tumblers where the clothes are loaded into the open end of the revolving cylinder and are automatically discharged out of the opposite end.

(3) **Finishing machines.** Revoked

(4) **Miscellaneous machines and equipment.**

(i) **Sewing machine.** Revoked

(ii) **Exhaust or ventilating fans.** Revoked

(iii) **Steam pipes.**

(a) All steam pipes that are within 7 feet of the floor or working platform, and with which the worker may come into contact, shall be insulated or covered with a heat-resistive material or shall be otherwise properly guarded.

(b) Where pressure-reducing valves are used, one or more relief or safety valves shall be provided on the low-pressure side of the reducing valve, in case the piping or equipment on the low-pressure side does not meet the requirements for full initial pressure. The relief or safety valve shall be located adjacent to, or as close as possible to, the reducing valve. Proper protection shall be provided to

prevent injury or damage caused by fluid escaping from relief or safety valves if vented to the atmosphere. The vents shall be of ample size and as short and direct as possible. The combined discharge capacity of the relief valves shall be such that the pressure rating of the lower-pressure piping and equipment will not be exceeded if the reducing valve sticks or fails to open.

(d) **Operating rules.**

(1) **General.**

(i) **Floors.** Revoked

(ii) **Table tops, shelves, and machine woodwork.**
Revoked

(iii) **Markers.** Markers and others handling soiled clothes shall be warned against touching the eyes, mouth, or any part of the body on which the skin has been broken by a scratch or abrasion; and they shall be cautioned not to touch or eat food until their hands have been thoroughly washed.

(iv) **Ventilation.** Revoked

(v) **Instruction of employees.** Employees shall be properly instructed as to the hazards of their work and be instructed in safe practices, by bulletins, printed rules, and verbal instructions.

(2) **Mechanical.**

(i) **Safety guards.**

(a) No safeguard, safety appliance, or device attached to, or forming an integral part of any machinery shall be removed or made ineffective except for the purpose of making immediate repairs or adjustments. Any such safeguard, safety appliance, or device removed or made ineffective during the repair or adjustment of such machinery shall be replaced immediately upon the completion of such repairs or adjustments.

STANDARDS AND INTERPRETATIONS

Pages 627 thru 640 deleted

1910.265—SAWMILLS

(a) General requirements.

(1) Application. This section includes safety requirements for sawmill operations includ-

ing, but not limited to, log and lumber handling, sawing, trimming, and planing; waste disposal; operation of dry kilns; finishing; shipping; storage; yard and yard

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(viii) **Passageways to panels.** Passageways to switch centers or panels shall at all times be kept free from obstruction. Not less than 3 feet of clear space shall be maintained in front of switch centers or panels at all times.

(ix) **Bridging fuses.** Doubling or bridging fuses shall be prohibited.

(13) **Hydraulic systems.** Means shall be provided to block, chain, or otherwise secure equipment normally supported by hydraulic pressure so as to provide for safe maintenance.

(14) **Liquefied petroleum gas storage and handling.** Storage and handling of liquified petroleum gas shall be in accordance with the requirements of § 1910.110.

(15) **Gas piping and appliances.** All gas piping and appliances shall be installed in accordance with the American National Standard Requirements for Gas Appliances and Gas Piping Z21.30—1964.

(16) **Flammable liquids.** Flammable liquids shall be stored and handled in accordance with § 1910.106.

(17) **Storage, handling, and use of chemicals.**

(i) **Threshold limits.** Employees shall not be exposed to airborne concentration of toxic dusts, fumes, vapors, mists or gases that exceed the threshold limit values set forth by § 1910.1000.

[40 F.R. 23072, May 28, 1975.]

(ii) **Protective equipment.** The use of chemicals shall be controlled so as to protect employees from harmful exposure to toxic materials. Where necessary, employees shall be provided with and required to wear such protective equipment as will afford adequate protection against harmful exposure as required by Subpart I of this part.

(iii) **Open surface tank operations.** Open surface tank operations shall conform to the requirements of § 1910.94(d).

(18) **Conveyors.**

(i) **Standards.** Construction, operation, and maintenance of conveyors shall be in accordance with American National Standard B20.1—1957.

(ii) **Guarding.** Spiked live rolls shall be guarded.

(19) **Stationary tramways and trestles.**

(i) **Foundations and walkways.** Tramways and trestles shall have substantial mud sills or foundations which shall be frequently inspected and kept in repair. When vehicles are operated on tramways and trestles which are used for foot passage, traffic shall be controlled or a walkway with standard handrails at the outer edge and shear timber on the inner edge shall be provided. This walkway shall be wide enough to allow adequate clearance to vehicles. When walkways cross over other thoroughfares, they shall be solidly fenced at the outer edge to a height of 42 inches over such thoroughfares.

(ii) **Clearance.** Stationary tramways and trestles shall have a vertical clearance of 22 feet over railroad rails. When constructed over carrier docks or roads, they shall have a clearance of 6 feet above the driver's foot rest on the carrier, and in no event shall this clearance be less than 12 feet from the roadway. In existing operations where it is impractical to obtain such clearance, telltales, electric signals, signs or other precautionary measures shall be installed.

(20) **Blower, collecting, and exhaust systems.**

(i) **Design, construction, and maintenance.** Blower, collecting, and exhaust systems should be designed, constructed, and maintained in accordance with American National Standards Z33.1—1961 (For the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying) and Z12.2—1962 (R1969) (Code for the Prevention of Dust Explosion in Woodworking and Wood Flour Manufacturing Plants).

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(ii) **Collecting systems.** All mills containing one or more machines that create dust, shavings, chips, or slivers during a period of time equal to or greater than one-fourth of the working day, shall be equipped with a collecting system. It may be either continuous or automatic, and shall be of sufficient strength and capacity to enable it to remove such refuse from points of operation and immediate vicinities of machines and work areas.

(iii) **Exhaust or conveyor systems.** Each wood-working machine that creates dust, shavings, chips, or slivers shall be equipped with an exhaust or conveyor system located and adjusted to remove the maximum amount of refuse from the point of operation and immediate vicinity.

(iv) **Exhaust pipes.** Revoked

(v) **Dust chambers.** Exhaust pipes shall not discharge into an unconfined outside pile if uncontrolled fire or explosion hazards are created. They may empty into settling or dust chambers, designed to prevent the dust or refuse from entering any work area. Such chambers shall be constructed and operated to minimize the danger of fire or dust explosion.

(vi) **Hand removal of refuse.** Provision for the daily removal of refuse shall be made in all operations not required to have an exhaust system or having refuse too heavy, bulky, or otherwise unsuitable to be handled by the exhaust system.

(21) **Chippers.**

(i) **Whole-log chippers.** The feed system to the chipper shall be arranged so the operator does not stand in direct line with the chipper spout (hopper). The chipper spout shall be enclosed to a height of not less than 36 inches from the floor or the operator's platform. A safety belt and lifeline shall be worn by workmen when working at or near the spout unless the spout is guarded. The lifeline shall be

short enough to prevent workers from falling into the chipper.

(ii) **Hogs.**

(a) Hog mills shall be so designed and arranged that from no position on the rim of the chute shall the distance to the cutter knives be less than 40 inches.

(b) Hog feed chutes shall be provided with suitable and approved baffles, which shall minimize material from being thrown from the mill.

(c) Employees feeding hog mills shall be provided with safety belts and lines unless guarded.

(22) **Mechanical power-transmission apparatus.** The construction, operation, and maintenance of all mechanical power-transmission apparatus shall be in accordance with the requirements of § 1910.219.

(23) **Bins, bunkers, hoppers, and fuel houses.**

(i) **Guarding.** Open bins, bunkers, and hoppers whose upper edges extend less than 3 feet above working level shall be equipped with standard handrails and toe boards, or have their tops covered by a substantial grill or grating with openings small enough to prevent a man from falling through.

(ii) **Use of wheeled equipment to load bins.** Where automotive or other wheeled equipment is used to move materials into bins, bunkers, and hoppers, adequate guard rails shall be installed along each side of the runway, and a substantial bumper stop provided when necessary.

(iii) **Exits, lighting, and safety devices.** Fuel houses and bins shall have adequate exits and lighting, and all necessary safety devices shall be provided and shall be used by persons entering these structures.

(iv) **Walkways.** Where needed, fuel houses and bins shall have a standard railed platform or walkway near the top.

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ing vehicles and equipment and at a safe distance from all fire hazards.

(5) Chain saw operations.

(i) Chain saw operators shall be instructed to daily inspect the saws daily to assure that all handles and guards are in place and tight, that all controls function properly, and that the muffler is operative.

(ii) Chain saw operators shall be instructed to follow manufacturer's instructions as to operation and adjustment.

(iii) Chain saw operators shall be instructed to fuel the saw only in safe areas and not under conditions conducive to fire such as near men smoking, hot engine, etc.

(iv) Chain saw operators shall be instructed to hold the saw with both hands during operation.

(v) Chain saw operators shall be instructed to start the saw at least 10 feet away from fueling area.

(vi) Chain saw operators shall be instructed to start the saw only on the ground or when otherwise firmly supported.

(vii) Chain saw operators shall be instructed to be certain of footing and to clear away brush which might interfere before starting to cut.

(viii) Chain saw operators shall be instructed not to use engine fuel for starting fires or as a cleaning solvent.

(ix) Chain saw operators shall be instructed to shut off the saw when carrying it for a distance greater than from tree to tree or in hazardous conditions such as slippery surfaces or heavy underbrush. The saw shall be at idle speed when carried short distances.

(x) Chain saw operators shall be instructed to carry the saw in a manner to prevent contact with the chain and muffler.

(xi) Chain saw operators shall be instructed not to use the saw to cut directly overhead or at a distance that would require the operator to relinquish a safe grip on the saw.

(6) Stationary and mobile equipment operation.

(i) Equipment operators shall be instructed as to the manufacturers recommendations for equipment operation, maintenance, safe practices, and site operating procedures.

(ii) Equipment shall be kept free of flammable material.

(iii) Equipment shall be kept free of any material which might contribute to slipping and falling.

(iv) Engine of equipment shall be shut down during fueling, servicing, and repairs except where operation is required for adjustment.

(v) Equipment shall be inspected for evidence of failure or incipient failure.

(vi) The equipment operator shall be instructed to walk completely around machine and assure that no obstacles or personnel are in the area before startup.

(vii) The equipment operator shall be instructed to start and operate equipment only from the operator's station or from safe area recommended by the manufacturer.

(viii) Seat belt shall be provided on mobile equipment.

(ix) The equipment operator shall be instructed to check all controls for proper function and response before starting working cycle.

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(x) The equipment operator shall be instructed to ground or secure all movable elements when not in use.

(xi) The equipment operator shall be advised of the load capacity and operating speed of the equipment.

(xii) The equipment operator shall be advised of the stability limitations of the equipment.

(xiii) The equipment operator shall be instructed to maintain adequate distance from other equipment and personnel.

(xiv) Where signalmen are used, the equipment operator shall be instructed to operate the equipment only on signal from the designated signalman and only when signal is distinct and clearly understood.

(xv) The equipment operator shall be instructed not to operate movable elements (boom, grapple, load, etc.) close to or over personnel.

(xvi) The equipment operator shall be instructed to signal his intention before operation when personnel are in or near the working area.

(xvii) The equipment operator shall be instructed to dismount and stand clear for all loading and unloading of his mobile vehicle by other mobile equipment. The dismounted operator shall be visible to loader operator.

(xviii) The equipment operator shall be instructed to operate equipment in a manner that will not place undue shock loads on wire rope.

(xix) The equipment operator shall be instructed not to permit riders or observers on the machine unless approved seating and protection is provided.

(xx) The equipment operator shall be instructed to shut down the engine when the equipment is stopped, apply brake locks and ground moving elements before he dismounts.

(xxi) The equipment operator shall be instructed, when any equipment is transported from one job location to another, to transport it on a vehicle of sufficient rated capacity and the equipment shall be properly secured during transit.

(xxii) When any equipment is being moved or operated in the vicinity of an electric distribution line a minimum clearance of ten feet shall be maintained between the electric distribution line and all elements of the machine.

(7) **Explosives.** Only trained and experienced personnel shall handle or use explosives. Usage shall comply with the requirements of § 1910.109.

(d) Equipment protective devices—stationary and mobile equipment.

(1) **Operator's manual.** There shall be an operator's manual or operating instructions with each machine. It will describe operation, maintenance, and safe practices.

(2) **Protective canopy.** A protective canopy shall be provided for the operator of mobile equipment. It shall be so constructed as to protect the operator from injury due to falling trees or limbs, saplings or branches which might enter the compartment side areas, and snapping winch lines or other objects.

(i) The canopy shall be of adequate size so as not to impair the operator's movements.

(ii) **Revoked**

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(iii) The overhead covering shall be of solid material and extend the full width of the canopy.

(iv) The lower portion of cab shall be completely enclosed with solid material, except at entrances, to prevent the operator from being injured from obstacles entering the cab.

(v) The upper rear portion of cab shall be fully enclosed with open mesh material with openings of such a size as to reject the entrance of an object larger than 1¾ inch in diameter. It shall provide maximum rearward visibility.

(vi) Open mesh shall be extended forward as far as possible from the rear corners of the cab sides so as to give the maximum protection against obstacles, branches, etc., entering the cab area.

(vii) Deflectors shall also be installed ahead of the operator to deflect whipping saplings and branches. These shall be located so as to not impede ingress or egress from the compartment.

(viii) The entrance opening of the canopy shall be not less than 52 inches in vertical height.

(ix) Where glass is used it shall be safety glass. An approved substitute may be used.

(a) An additional metal screen shall be used where glass alone is not adequate operator protection.

(b) Provision shall be made to clean glass to assure adequate visibility.

(3) **Guards.** Guards shall be provided for exposed moving elements such as shafts,

pulleys, belts, conveyors, and gears in accordance with § 1910.219 and American National Standard Safety Code for Conveyors, Cableways, and Related Equipment, B20.1—1957. Guards shall be in place at all times machine is in operation.

(4) **Mufflers.** Mufflers provided by the manufacturer or their equivalent shall be in place at all times the machine is in operation.

(5) **Guylines.** Guylines shall be arranged in such manner that stresses will be imposed on not less than two guylines. Stumps used for anchoring guylines shall be carefully chosen as to position and strength. They shall be tied back if necessary. Standing trees shall not be used for this purpose.

(6) **Stability and reliability.** Crane and loader stability and boom reliability shall be in accordance with American National Standard Safety Code for Cranes, Derricks and Hoists Overhead and Gantry Cranes, B30.2.0—1967, and American National Standard Safety Code for Cranes, Derricks and Hoists—Crawler, Locomotive, and Truck Cranes, B30.5—1968.

(e) **Pulpwood harvesting.**

(1) **Felling, general.**

(i) Work areas shall be assigned such that a tree cannot fall into an adjacent work area. The recommended distance between workers is twice the height of trees being felled.

(ii) **Revoked**

(iii) Workers shall be instructed not to approach a feller closer than twice the height of trees being felled until the feller has acknowledged the signal of approach.

(iv) Lodged trees shall be pulled to the ground at first opportunity with mechanical equipment or animal.

(v) Workers shall be instructed not to work under a lodged tree.

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(vi) Special precautions shall be taken to prevent felling trees into powerlines.

(vii) If a tree does make contact with a powerline the power company shall be notified immediately and all personnel shall remain clear of the area until power company personnel advises that conditions are safe.

(2) Manual felling.

(i) The feller shall be instructed to plan retreat path and clear path as necessary before cut is started.

(ii) The feller shall be instructed to appraise situation for dead limbs, the lean of tree to be cut, wind conditions, location of other trees and other hazards and exercise proper precautions before cut is started.

(iii) Undercuts shall be about one-third the diameter of the tree to guide tree and reduce possibility of splitting. (Local practice where small diameter trees are felled without being undercut is acceptable if the direction of fall is controlled by the practice.)

(iv) Back or felling cut shall be parallel to the inner edge of the undercut and approximately two inches higher than the undercut.

(v) The saw shall be shut off before feller starts his retreat.

(vi) On terrain where trees are likely to slide or roll fellers shall be instructed to fell trees from the uphill side and arrange to keep uphill from previously felled trees.

(3) Bucking.

(i) Bucking on slopes shall be from the uphill side unless the log has been securely blocked to prevent rolling or swinging.

(ii) Spring poles and trees under stress shall be cut so that employee is clear when the tension is released. (This is accomplished by cutting under the bend.)

(iii) Trees piled for bucking shall be piled in an orderly parallel manner that minimizes hazard to employees.

(4) Limbing. Spring poles and limbs under stress shall be cut in such a manner that the employee is clear when tension is released.

(5) Mechanical debarking and delimbing. Guarding shall be provided so as to protect employees from flying chunks, logs, chips, bark, limbs, and other material and to prevent the worker from contacting moving parts.

(6) Skidding and prehauling, general.

(i) Only a designated, trained operator shall operate a skid or prehaul machine.

(ii) Choker setters shall work on uphill side of log.

(iii) No passenger personnel shall ride on a prehaul vehicle, logs, pallets, skid pans or other load unless adequate seating and protection is provided except on animal powered wagons.

(iv) Chokers shall be positioned near the end of the log or tree length to allow turning of the prehaul vehicle, to prevent the penetration of the operator station and to reduce possibility of striking the wheel or track.

(v) During winching, the equipment shall be positioned so that the winch line is in alignment with the long axis of the prehaul machine.

(vi) A stuck or inoperative vehicle shall be towed. A loaded pallet shall not be pushed.

(vii) Stakes shall not be added to permit a load beyond the rated capacity of pallets and trailers.

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(viii) The operator shall be instructed to be observant and cautious of height of load and vehicle when traveling under trees, limbs, and other overhead obstructions.

(7) Skidding and prehauling equipment requirements.

(i) Arches, fairleads, drawbars, hitches and bumpers or fenders shall be designed and constructed to allow a minimum radius vehicle turn without the load contacting a rear tire or the rear of a track assembly.

(ii) Towed equipment such as skid pans, pallets and trailers shall be attached in such a manner as to allow a full 90° turn, prevent overrunning of the towed vehicle, and assure control of the towed equipment.

(iii) Animal towed equipment shall be equipped with a hand brake within reach of the driver.

(iv) Prehaulers shall have a means for securely retaining pallets or pulpwood.

(v) Prehaulers shall have a means of securely retaining loader for transport when so equipped.

(vi) Provision shall be made to securely fasten and to protect all tools and material on the carrier.

(8) Personnel transport.

(i) The driver shall be properly licensed.

(ii) Flammable liquids shall not be transported on personnel carriers unless a safe and adequate compartment is provided.

(iii) Seats shall be securely fastened.

(9) Off highway truck transport. Revoked

(10) Manual loading.

(i) The carrier shall be positioned to provide safe working clearance between carrier and pile.

(ii) Proper lifting techniques shall be used, i.e., straight back and bend knees.

(iii) The stick shall be placed in the carrier in such manner that it is or will be properly secured.

(iv) Manual handling shall be limited to a weight consistent with safe practices.

(11) Machine loading.

(i) Piles shall be located to provide a safe work area.

(ii) Only the machine operator and slingman, where used, shall be in the work area.

(iii) The load shall be positioned for balance and to prevent slippage or loss. Slings shall be placed to secure and balance the load.

(12) Storage. Piles shall be located and constructed in a manner to provide safe working area around them.

(13) Banding and piling bundles.

(i) Steel bands in good condition shall be used.

(ii) Bands shall be placed when bundle is close to ground.

(iii) No part of the body shall be under the bundle at any time. Bundles shall be placed on runners. Bundles may be double stacked with top end bundle one half or more back from the lower rank end bundle.

(14) Chipping (in-woods locations).

(i) Access covers or doors shall not be opened until the drum or disk is at a complete stop.

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(ii) Infeed and discharge ports shall be designed to prevent contact by personnel with disc, knives, or blower blades.

(15) Roads and trails, general.

(i) Roads shall be maintained and hazardous conditions corrected.

(ii) Where vision is limited warnings shall be posted.

(iii) Curve radii shall be the maximum consistent with terrain.

(iv) When nightwork is necessary adequate lighting shall be provided.

(v) Local road standards and maximum weight of traffic expected shall be used as guides for materials, construction features and drainage.

(16) Road and trail pioneering and earthwork.

(i) Banks at the borrow area shall be sloped to prevent slides.

(ii) Backfill shall be adequately compacted.

(iii) Roadside banks shall be sloped or stabilized to prevent slides.

(iv) Overhanging banks, large rocks and debris shall be removed or secured.

(v) Where riprap is used the material and design shall assure safe containment of material.

(vi) Trees or snags which may fall into the road shall be felled.

(17) Road and trail drainage.

(i) Drainage shall be provided to prevent washouts and landslides.

(ii) Culverts shall be of adequate strength and of a size to handle maximum runoff.

(iii) Where necessary, ditches and banks shall be stabilized by vegetation, riprap or other adequate means.

(18) Road and trail surfacing. Road surface shall be properly compacted, graded and crowned.

(19) Bridges.

(i) Construction shall provide for maximum anticipated loads and side thrust with a substantial safety factor.

(ii) Bridges shall be decked and curbed.

(f) Effective dates.

(1) The provisions of this § 1910.266 shall become effective on August 27, 1971, except as provided in the remaining subparagraphs of this paragraph.

(2) Paragraph (d)(2) of this section shall become effective on February 15, 1972.

(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 anything in 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 § 1910.266 which is derived from 41 CFR Part 40-204 shall also become effective, and shall be applicable to such employment and place of employment, on the same date.

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TABLE R-2—Approach Distances to Exposed Energized Overhead Power Lines and Parts

<i>Voltage range (phase to phase, RMS)</i>	<i>Approach distance (inches)</i>
300 V and less	(¹)
Over 300V, not over 750V	12
Over 750V not over 2kV	18
Over 2kV, not over 15kV	24
Over 15kV, not over 37kV	36
Over 37kV, not over 87.5kV	42
Over 87.5kV, not over 121kV	48
Over 121kV, not over 140kV	54

¹Avoid contact.

(8) **Illumination of field work.** Whenever natural light is insufficient to adequately illuminate the worksite, artificial illumination shall be provided to enable the employee to perform the work safely.

(c) Training

Employers shall provide training in the various precautions and safe practices described in this section and shall insure that employees do not engage in the activities to which this section applies until such employees have received proper training in the various precautions and safe practices required by this section. However, where the employer can demonstrate that an employee is already trained in the precautions and safe practices required by this section prior to his employment, training need not be provided to that employee in accordance with this section. Where training is required, it shall consist of on-the-job training or classroom-type training or a combination of both. The training program shall include a list of the subject courses and the types of personnel required to receive such instruction. A written description of the training program and a record of employees who have received such training shall be maintained for the duration of the employee's employment and shall be made available upon request to the Assistant Secretary for Occupational Safety and Health. Such training shall, where appropriate, include the following subjects:

(1) Recognition and avoidance of dangers relating to encounters with harmful substances, and animal, insect, or plant life.

(2) Procedures to be followed in emergency situations, and

(3) First aid training, including instruction in artificial respiration.

(d) Employee protection in public work areas.

(1) Before work is begun in the vicinity of vehicular or pedestrian traffic which may endanger employees, warning signs and/or flags or other traffic control devices shall be placed conspicuously to alert and channel approaching traffic. Where further protection is needed, barriers shall be utilized. At night, warning lights shall be prominently displayed, and excavated areas shall be enclosed with protective barricades.

(2) If work exposes energized or moving parts that are normally protected, danger signs shall be displayed and barricades erected, as necessary, to warn other personnel in the area.

(3) The employer shall insure that an employee finding any crossed or fallen wires which create or may create a hazardous situation at the work area: (i) Remains on guard or adopts other adequate means to warn other employees of the danger and (ii) has the proper authority notified at the earliest practical moment.

(e) Tools and personal protective equipment—Generally.

Personal protective equipment, protective devices and special tools needed for the work of employees shall be provided and the employer shall ensure that they are used by employees. Before each day's use the employer shall ensure that these personal protective devices, tools, and equipment are carefully inspected by a competent person to ascertain that they are in good condition.

(f) Rubber insulating equipment.

(1) Rubber insulating equipment designed for the voltage levels to be encountered shall be provided and the employer shall ensure that they are used by employees as required by this section. This equipment shall meet the electrical and physical requirements contained in ANSI J6.6-1971 "Standard Specifications for Rubber Insulating Gloves," and ANSI J6.4-1971 "Standard Specifications for Rubber Insulating Blankets," with the exception that

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the maximum proof test current for a 14 inch Class I glove shall be no more than 14 mA, and with the further exception that existing 14 inch Class I rubber gloves that meet a maximum proof test current of 16 mA and a minimum breakdown voltage of 17,000 volts (RMS) acquired prior to July 1, 1975 may be used as long as these gloves comply with the retest requirements of paragraph (f) (5) of this section.

(2) When these gloves are used on jobs where they may be torn, they shall be protected with heavy outer canvas or leather gloves.

(3) Revoked

(4) Protective equipment fabricated of material other than rubber shall provide electrical and mechanical protection at least equal to that of the rubber equipment.

(5) The employer is responsible for the periodic retesting of all insulating gloves, blankets, and other rubber insulating equipment. This retesting shall be electrical, visual and mechanical. The following maximum retesting intervals shall apply:

Gloves, blankets, and other insulating equipment	Natural rubber	Synthetic rubber
	<i>Months</i>	<i>Months</i>
New	12	18
Re-issued	9	15

(6) Gloves and blankets shall be marked to indicate compliance with the retest schedule, and shall be marked with the date the next test is due. Gloves found to be defective in the field or by the tests set forth in paragraph (f) (5) of this section shall be destroyed by cutting them open from the finger to the gauntlet.

(7) When not being used, insulating gloves shall be stored in glove bags or in their original containers. Insulating blankets shall be stored in a canister or other device which offers equivalent protection.

(8) Insulating gloves and blankets shall be stored away from direct sunlight, steampipes, radiators and other sources of excessive heat. Gloves and blankets shall not be folded while in storage; however, blankets may be rolled for storage.

(9) Rubber gloves shall be visually inspected and air tested prior to each day's use.

(g) Personal climbing equipment

(1) **General.** Safety belts and straps shall be provided and the employer shall ensure their use when work is performed at positions more than 4 feet above ground, on poles, and on towers, except as provided in paragraphs (n) (7) and (n) (8) of this section. No safety belts, safety straps or lanyards acquired after July 1, 1975 may be used unless they meet the tests set forth in paragraph (g) (2) of this section. The employer shall ensure that all safety belts and straps are inspected by a competent person prior to each day's use to determine that they are in safe working condition.

(2) **Telecommunication lineman's body belts, safety straps, and lanyards.**

(i) General requirements.

(a) Hardware for lineman's body belts, safety straps, and lanyards shall be drop forged or pressed steel and shall have a corrosion resistant finish tested to meet the requirements of the American Society for Testing and Materials B117-64 (50-hour test). Surfaces shall be smooth and free of sharp edges. Production samples of lineman's safety straps, body belts and lanyards shall be approved by a nationally recognized testing laboratory, as having been tested in accordance with and as meeting the requirements of this paragraph.

(b) All buckles shall withstand a 2,000-pound tensile test with a maximum permanent deformation no greater than one sixty-fourth inch.

(c) D rings shall withstand a 5,000-pound tensile test without cracking or breaking.

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(d) Snaphooks shall withstand a 5,000-pound tensile test, or shall withstand a 3,000-pound tensile test and a 180° bend test. Tensile failure is indicated by distortion of the snaphook sufficient to release the keeper; bend test failure is indicated by cracking of the snaphook.

(ii) Specific requirements.

(a)

(1) All fabric used for safety straps shall be capable of withstanding an A.C. dielectric test of not less than 25,000 volts per foot "dry" for 3 minutes, without visible deterioration.

(2) All fabric and leather used shall be tested for leakage current. Fabric or leather may not be used if the leakage current exceeds 1 milliamperes when a potential of 3,000 volts is applied to the electrodes positioned 12 inches apart.

(3) In lieu of alternating current tests, equivalent direct current tests may be performed.

(b) The cushion part of the body belt shall:

(1) Contain no exposed rivets on the inside. This provision does not apply to belts used by craftsmen not engaged in line work.

(2) Be at least three inches in width;

(3) Be at least five thirty-seconds ($\frac{5}{32}$) inch thick, if made of leather; and

(c) Revoked

(d) Suitable copper, steel, or equivalent liners shall be used around the bars of D-rings to prevent wear between these members and the leather or fabric enclosing them.

(e) All stitching shall be done with a minimum 42-pound weight nylon or equivalent thread and shall be lock stitched. Stitching parallel to an edge may not be less than three-sixteenths ($\frac{3}{16}$) inch from the edge of the narrowest member caught by the thread. The use of cross stitching on leather is prohibited.

(f) The keepers of snaphooks shall have a spring tension that will not allow the keeper to begin to open when a weight of 2½ pounds or less is applied, but the keepers shall begin to open when a weight of four pounds is applied. In making this determination, the weight shall be supported on the keeper against the end of the nose.

(g) Safety straps, lanyards, and body belts shall be tested in accordance with the following procedure:

(1) Attach one end of the safety strap and lanyard to a rigid support, and the other end to a 250-pound canvas bag of sand;

(2) Allow the 250-pound canvas bag of sand to free fall 4 feet when testing safety straps and 6 feet when testing lanyards. In each case, the strap or lanyard shall stop the fall of the 250-pound bag;

(3) Failure of the strap or lanyard shall be indicated by any breakage or slippage sufficient to permit the bag to fall free from the strap or lanyard.

(4) The entire "body belt assembly" shall be tested using one D-ring. A safety strap or lanyard shall be used that is capable of passing the "impact loading test" described in paragraph (g)

(2) (ii) (G) (2) of this section and attached as required in paragraph (g) (2)

(ii) (G) (1) of this section. The body belt

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shall be secured to the 250-pound bag of sand at a point which simulates the waist of a man and shall be dropped as stated in paragraph (g) (2) (ii) (G) (2) of this section. Failure of the body belt shall be indicated by any breakage or slippage sufficient to permit the bag to fall free from the body belt.

(3) Pole climbers.

(i) Pole climbers may not be used if the gaffs are less than 1¼ inches in length as measured on the underside of the gaff. The gaffs of pole climbers shall be covered with safety caps when not being used for their intended use.

(ii) The employer shall ensure that pole climbers are inspected by a competent person for the following conditions: Fractured or cracked gaffs or leg irons, loose or dull gaffs, broken straps or buckles. If any of these conditions exist, the defect shall be corrected before the climbers are used.

(iii) Pole climbers shall be inspected as required in this paragraph (g) (3) before each day's use and a gaff cut-out test performed at least weekly when in use.

(iv) Pole climbers may not be worn when:

(a) Working in trees (specifically designed tree climbers shall be used for tree climbing),

(b) Working on ladders,

(c) Working in an aerial lift,

(d) Driving a vehicle, nor

(e) Walking on rocky, hard, frozen, brushy or hilly terrain.

(h) Ladders.

(1) The employer shall ensure that no employee nor any material or equipment may be supported or permitted to be supported on any portion of a ladder unless it is first determined, by inspections and checks conducted by a competent person that such ladder is ade-

quately strong, in good condition, and properly secured in place, as required in Subpart D of this part and as required in this section.

(2) The spacing between steps or rungs permanently installed on poles and towers shall be no more than 18 inches (36 inches on any one side). This requirement also applies to fixed ladders on towers, when towers are so equipped. Spacing between steps shall be uniform above the initial unstepped section, except where working, standing, or access steps are required. Fixed ladder rungs and step rungs for poles and towers shall have a minimum diameter of ¾". Fixed ladder rungs shall have a minimum clear width of 12 inches. Steps for poles and towers shall have a minimum clear width of 4½ inches. The spacing between detachable steps may not exceed 30 inches on any one side, and these steps shall be properly secured when in use.

(3) After April 30, 1975, portable wood ladders intended for general use may not be painted but may be coated with a translucent nonconductive coating. Portable wood ladders may not be longitudinally reinforced with metal.

(4) Portable wood ladders that are not being carried on vehicles and are not in active use shall be stored where they will not be exposed to the elements and where there is good ventilation.

(5) The provisions of § 1910.25(c) (5) shall apply to rolling ladders used in telecommunications centers, except that such ladders shall have a minimum inside width, between the side rails, of at least eight inches.

(6) Climbing ladders or stairways on scaffolds used for access and egress shall be affixed or built into the scaffold by proper design and engineering, and shall be so located that their use will not disturb the stability of the scaffold. The rungs of the climbing device shall be equally spaced, but may not be less than 12 inches nominal nor more than 16 inches nominal apart. Horizontal end rungs used for platform support may also be utilized as a climbing device if such rungs meet the spacing requirement of this paragraph (h) (6), and if there is sufficient clearance between the rung

PART 1910

OCCUPATIONAL SAFETY AND HEALTH STANDARDS

SUBPART S—ELECTRICAL

- 1910.308 Application (NFPA 70-1968 Article 90).
- 1910.309 National Electrical Code NFPA 70-1971.

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SUBPART S—ELECTRICAL

1910.308—APPLICATION

(a) General.

Section 1910.309 adopts as a national consensus standard the National Electrical Code NFPA No. 70-1971; ANSI C1-1971 (Rev. of C1-1968), which is incorporated by reference in this subpart.

(b) Purpose of the National Electrical Code.

(1) The purpose of the National Electrical Code is the practical safeguarding of any persons and of buildings and their contents from hazards arising from the use of electricity for light, heat, power, radio, signaling, and for other purposes. The standards contained therein are occupational safety and health standards to the extent that they safeguard any person who is an employee of an employer.

(2) The National Electrical Code contains basic minimum provisions considered necessary for safety.

(c) Scope.

(1) **Covered.** The provisions of this Subpart S cover electrical installations and utilization equipment installed or used within or on buildings, structures and other premises including:

- (i) Yards,
- (ii) Carnivals,
- (iii) Parking lots,
- (iv) Mobile homes,
- (v) Recreational vehicles,
- (vi) Conductors that connect an installation to a supply of electricity, and

(vii) Other outside conductors adjacent to the premises.

(2) **Not covered.** The provisions of this subpart do not cover:

(i) Installations in ships, watercraft, railway rolling stock, aircraft or automotive vehicles.

(ii) Installations underground in mines.

(iii) Installations of railways for generation, transformation, transmission, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communication purposes.

(iv) Installations of communication equipment under exclusive control of communication utilities, located outdoors or in building spaces used exclusively for such installation, or

(v) Installations under the exclusive control of electric utilities for the purpose of communication, metering or for the generation, control, transformation, transmission, and distribution of electric energy, located in buildings used exclusively by the utilities for such purposes or located outdoors on property owned or leased by the utilities or on public highways, streets, roads, etc., or outdoors by established rights on private property.

(d) Definitions applicable to this Subpart S.

(1) **Approved.** Some provisions of the National Electrical Code, NFPA No. 70-1971; ANSI C1-1971 (Rev. of C1-1968), which is adopted

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areas, nonregulated areas, or the external environment.

(14) "Protective clothing" means clothing designed to protect an employee against contact with or exposure to 4-Nitrobiphenyl.

(15) "Regulated area" means an area where entry and exit is restricted and controlled.

(c) Requirements for areas containing 4-Nitrobiphenyl.

A regulated area shall be established by an employer where 4-Nitrobiphenyl is manufactured, processed, used, repackaged, released, handled or stored. All such areas shall be controlled in accordance with the requirements for the following category or categories describing the operation involved:

(1) **Isolated systems.** Employees working with 4-Nitrobiphenyl within an isolated system, such as a "glove box" shall wash their hands and arms upon completion of the assigned task and before engaging in other activities not associated with the isolated system.

(2) **Closed system operation.** Within regulated areas where 4-Nitrobiphenyl is stored in sealed containers, or contained in a closed system, including piping systems, with any sample ports or openings closed while 4-Nitrobiphenyl is contained within:

(i) Access shall be restricted to authorized employees only;

(ii) Employees shall be required to wash hands, forearms, face and neck upon each exit from the regulated areas, close to the point of exit and before engaging in other activities.

(3) **Open vessel system operations.** Open vessel system operations as defined in paragraph (b)(13) of this section are prohibited.

(4) **Transfer from a closed system, charging or discharging point operations, or otherwise opening a closed system.** In operations in-

volving "laboratory type hoods," or in locations where 4-Nitrobiphenyl is contained in an otherwise "closed system," but is transferred, charged, or discharged into other normally closed containers, the provisions of this subparagraph shall apply.

(i) Access shall be restricted to authorized employees only.

(ii) Each operation shall be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated. Clean makeup air shall be introduced in sufficient volume to maintain the correct operation of the local exhaust system.

(iii) Employees shall be provided with, and required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area.

(iv) Employees engaged in 4-Nitrobiphenyl handling operations shall be provided with and required to wear and use a half-face, filter-type respirator for dusts, mists, and fumes, in accordance with §1910.134. A respirator affording higher levels of protection may be substituted.

(v) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under paragraphs (e)(2), (3), and (4) of this section.

(vi) Employees shall be required to wash hands, forearms, face and neck on each exit from the regulated area, close to the point of exit, and before engaging in other activities.

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(vii) Employees shall be required to shower after the last exit of the day.

(viii) Drinking fountains are prohibited in the regulated area.

(5) Maintenance and decontamination activities. In cleanup of leaks or spills, maintenance or repair operations on contaminated systems or equipment, or any operations involving work in an area where direct contact with 4-Nitrobiphenyl could result, each authorized employee entering that area shall:

(i) Be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with §1910.134.

(ii) Be decontaminated before removing the protective garments and hood.

(iii) Be required to shower upon removing the protective garments and hood.

(6) Laboratory activities.

(Deleted)

(41 F.R. 35184, August 20, 1976.)

(d) General regulated area requirements.

(1) Employee identification. Revoked oster of

(2) Emergencies. In an emergency, immediate measures including, but not limited to, the requirements of subdivisions (i), (ii), (iii), (iv), and (v) of this paragraph shall be implemented.

(i) The potentially affected area shall be evacuated as soon as the emergency has been determined.

(ii) Hazardous conditions created by the emergency shall be eliminated and the potentially affected area shall be decontaminated prior to the resumption of normal operations.

(iii) Special medical surveillance by a physician shall be instituted with 24 hours for employees present in the potentially affected area at the time of the emergency. A report of the medical surveillance and any treatment shall be included in the incident report, in accordance with paragraph (f)(2) of this section.

(iv) Where an employee has a known contact with 4-Nitrobiphenyl such employee shall be required to shower as soon as possible, unless contraindicated by physical injuries.

(v) An incident report on the emergency shall be reported as provided in paragraph (f)(2) of this section.

(3) Hygiene facilities and practices.

(i) Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smoking, storage of smoking materials, tobacco products or other products for chewing, or the chewing of such products, are prohibited in regulated areas.

(ii) Where employees are required by this section to wash, washing facilities shall be provided in accordance with §1910.141(d)(1) and (2)(ii) through (vii).

(iii) Where employees are required by this section to shower, shower facilities shall be provided in accordance with §1910.141(d)(3).

(iv) Where employees wear protective clothing and equipment clean change rooms shall be provided, in accordance

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contact with or exposure to alpha-Naphthylamine.

(15) "Regulated area" means an area where entry and exit is restricted and controlled.

(c) Requirements for areas containing alpha-Naphthylamine.

A regulated area shall be established by an employer where alpha-Naphthylamine is manufactured, processed, used, repackaged, released, handled or stored. All such areas shall be controlled in accordance with the requirements for the following category or categories describing the operation involved:

(1) **Isolated systems.** Employees working with alpha-Naphthylamine within an isolated system, such as a "glove box" shall wash their hands and arms upon completion of the assigned task and before engaging in other activities not associated with the isolated system.

(2) **Closed system operation.** Within regulated areas where alpha-Naphthylamine is stored in sealed containers, or contained in a closed system, including piping systems, with any sample ports or openings closed while alpha-Naphthylamine is contained within:

(i) Access shall be restricted to authorized employees only;

(ii) Employees shall be required to wash hands, forearms, face and neck upon each exit from the regulated areas, close to the point of exit and before engaging in other activities.

(3) **Open vessel system operations.** Open vessel system operations as defined in paragraph (b)(13) of this section are prohibited.

(4) **Transfer from a closed system, charging or discharging point operations, or otherwise opening a closed system.** In operations involving "laboratory type hoods," or in locations where alpha-Naphthylamine is contained in an otherwise "closed system," but is transferred, charged, or discharged into

other normally closed containers, the provisions of this subparagraph shall apply.

(i) Access shall be restricted to authorized employees only;

(ii) Each operation shall be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated. Clean makeup air shall be introduced in sufficient volume to maintain the correct operation of the local exhaust system.

(iii) Employees shall be provided with, and required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), and shoe covers and gloves prior to entering a regulated area.

(iv) Employees engaged in alpha-Naphthylamine handling operations shall be provided with and required to wear and use a half-face, filter-type respirator for dusts, mists, and fumes, in accordance with §1910.134. A respirator affording higher levels of protection may be substituted.

(v) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under paragraphs (e)(2), (3), and (4) of this section.

(vi) Employees shall be required to wash hands, forearms, face and neck on each exit from the regulated area, close to the point of exit, and before engaging in other activities.

(vii) Employees shall be required to shower after the last exit of the day.

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(viii) Drinking fountains are prohibited in the regulated area.

(5) Maintenance and decontamination activities. In cleanup of leaks or spills, maintenance or repair operations on contaminated systems or equipment, or any operations involving work in an area where direct contact with alpha-Naphthylamine could result, each authorized employee entering that area shall:

(i) Be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with §1910.134.

(ii) Be decontaminated before removing the protective garments and hood.

(iii) Be required to shower upon removing the protective garments and hood.

(6) Laboratory activities.

(Deleted)

141 F.R. 35184, August 20, 1976.]

(d) General regulated area requirements.

(1) Employee identification. Revoked

(2) Emergencies. In an emergency, immediate measures including, but not limited to, the requirements of subdivisions (i), (ii), (iii), (iv), and (v) of this paragraph shall be implemented.

(i) The potentially affected area shall be evacuated as soon as the emergency has been determined.

(ii) Hazardous conditions created by the emergency shall be eliminated and the potentially affected area shall be decontaminated prior to the resumption of normal operations.

(iii) Special medical surveillance by a physician shall be instituted within 24 hours for employees present in the potentially affected area at the time of the emergency. A report of the medical surveillance and any treatment shall be included in the incident report, in accordance with paragraph (f)(2) of this section.

(iv) Where an employee has a known contact with alpha-Naphthylamine, such employee shall be required to shower as soon as possible, unless contraindicated by physical injuries.

(v) An incident report on the emergency shall be reported as provided in paragraph (f)(2) of this section.

(3) Hygiene facilities and practices.

(i) Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smoking, storage of smoking materials, tobacco products or other products for chewing, or the chewing of such products, are prohibited in regulated areas.

(ii) Where employees are required by this section to wash, washing facilities shall be provided in accordance with §1910.141(d)(1) and (2)(ii) through (vii).

(iii) Where employees are required by this section to shower, shower facilities shall be provided in accordance with §1910.141(d)(3).

(iv) Where employees wear protective clothing and equipment clean change rooms shall be provided, in accordance with §1910.141(e), for the number of such employees required to change clothes.

(v) Where toilets are in regulated areas, such toilets shall be in a separate room.

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an open vessel, which is not in an isolated system, a laboratory type hood, nor in any other system affording equivalent protection against the entry of methyl chloromethyl ether into regulated areas, nonregulated areas, or the external environment.

(14) "Protective clothing" means clothing designed to protect an employee against contact with or exposure to methyl chloromethyl ether.

(15) "Regulated area" means an area where entry and exit is restricted and controlled.

(c) Requirements for areas containing methyl chloromethyl ether.

A regulated area shall be established by an employer where methyl chloromethyl ether is manufactured, processed, used, repackaged, released, handled or stored. All such areas shall be controlled in accordance with the requirements for the following category or categories describing the operation involved:

(1) **Isolated systems.** Employees working with methyl chloromethyl ether within an isolated system, such as a "glove box" shall wash their hands and arms upon completion of the assigned task and before engaging in other activities not associated with the isolated system.

(2) **Closed system operation.** Within regulated areas where methyl chloromethyl ether is stored in sealed containers, or contained in a closed system, including piping systems, with any sample ports or openings closed while methyl chloromethyl ether is contained within. Access shall be restricted to authorized employees only.

(3) **Open vessel system operations.** Open vessel system operations as defined in paragraph (b)(13) of this section are prohibited.

(4) **Transfer from a closed system, charging or discharging point operations, or otherwise opening a closed system.** In operations involving "laboratory type hoods," or in locations where methyl chloromethyl ether is contained in an otherwise "closed system,"

but is transferred, charged, or discharged into other normally closed containers, the provisions of this subparagraph shall apply.

(i) Access shall be restricted to authorized employees only;

(ii) Each operation shall be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated. Clean makeup air shall be introduced in sufficient volume to maintain the correct operation of the local exhaust system.

(iii) Employees shall be provided with, and required to wear clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), and gloves prior to entering the regulated area.

(iv) Employees engaged in methyl chloromethyl ether handling operations shall be provided with the required to wear and use a full-face, supplied air respirator, of the continuous flow or pressure-demand type, in accordance with §1910.124.

(v) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under paragraphs (e)(2), (3), and (4) of this section.

(vi) Drinking fountains are prohibited in the regulated area.

(5) **Maintenance and decontamination activities.** In cleanup of leaks or spills, maintenance or repair operations on contaminated systems or equipment, or any operations involving work in an area where direct contact with methyl chloromethyl

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other could result, each authorized employee entering that area shall:

(i) Be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with §1910.134.

(ii) Be decontaminated before removing the protective garments and hood.

(iii) Be required to shower upon removing the protective garments and hood.

(6) Laboratory activities.

(Deleted)

[41 F.R. 35184, August 20, 1976.]

(d) General regulated area requirements.

(1) Employee identification. Revoked

(2) Emergencies. In an emergency, immediate measures including, but not limited to, the requirements of subdivisions (i), (ii), (iii), (iv), and (v) of this paragraph shall be implemented.

(i) The potentially affected area shall be evacuated as soon as the emergency has been determined.

(ii) Hazardous conditions created by the emergency shall be eliminated and the potentially affected area shall be decontaminated prior to the resumption of normal operations.

(iii) Special medical surveillance by a physician shall be instituted within 24 hours for employees present in the potentially affected area at the time of the

emergency. A report of the medical surveillance and any treatment shall be included in the incident report, in accordance with paragraph (f)(2) of this section.

(iv) Where an employee has a known contact with methyl chloromethyl ether, such employee shall be required to shower as soon as possible, unless contraindicated by physical injuries.

(v) An incident report on the emergency shall be reported as provided in paragraph (f)(2) of this section.

(3) Hygiene facilities and practices.

(i) Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smoking, storage of smoking materials, tobacco products or other products for chewing, or the chewing of such products, are prohibited in regulated areas.

(ii) Where employees wear protective clothing and equipment clean change rooms shall be provided, in accordance with §1910.141(e), for the number of such employees required to change clothes.

(iii) Where toilets are in regulated areas, such toilets shall be in a separate room.

(iv) Where employees are required by this section to wash, washing facilities shall be provided in accordance with §1910.141(d)(1) and (2)(ii) through (vii).

(v) Where employees are required by this section to shower, shower facilities shall be provided in accordance with §1910.141(d)(3).

(4) Contamination control.

(i) Regulated areas, except for outdoor systems, shall be maintained under pressure negative with respect to nonregulated areas. Local exhaust ventilation may be used to satisfy this requirement. Clean makeup air in equal volume shall replace air removed.

(ii) Any equipment, material, or other item taken into or removed from a regu-

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(2) **Closed system operation.** Within regulated areas where 3,3'-Dichlorobenzidine (or its salts) is stored in sealed containers, or contained in a closed system, including piping systems, with any sample ports or openings closed while 3,3'-Dichlorobenzidine (or its salts) is contained within:

(i) Access shall be restricted to authorized employees only;

(ii) Employees shall be required to wash hands, forearms, face and neck upon each exit from the regulated areas, close to the point of exit and before engaging in other activities.

(3) **Open vessel system operations.** Open vessel system operations as defined in paragraph (b)(13) of this section are prohibited.

(4) **Transfer from a closed system, charging or discharging point operations, or otherwise opening a closed system.** In operations involving "laboratory type hoods," or in locations where 3,3'-Dichlorobenzidine (or its salts) is contained in an otherwise "closed system," but is transferred, charged, or discharged into other normally closed containers, the provisions of this subparagraph shall apply.

(i) Access shall be restricted to authorized employees only.

(ii) Each operation shall be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated. Clean makeup air shall be introduced in sufficient volume to maintain the correct operation of the local exhaust system.

(iii) Employees shall be provided with, and required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area.

(iv) Employees engaged in 3,3'-Dichlorobenzidine (or its salts) handling operations shall be provided with and required to wear and use a half-face, filter-type respirator for dusts, mists, and fumes, in accordance with §1910.134. A respirator affording higher levels of protection may be substituted.

(v) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under paragraphs (e)(2), (3), and (4) of this section.

(vi) Employees shall be required to wash hands, forearms, face and neck on each exit from the regulated area, close to the point of exit, and before engaging in other activities.

(vii) Employees shall be required to shower after the last exit of the day.

(viii) Drinking fountains are prohibited in the regulated area.

(5) **Maintenance and decontamination activities.** In cleanup of leaks or spills, maintenance or repair operations on contaminated systems or equipment, or any operations involving work in an area where direct contact with 3,3'-Dichlorobenzidine (or its salts) could result, each authorized employee entering that area shall:

(i) Be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with §1910.134.

(ii) Be decontaminated before removing the protective garments and hood.

(iii) Be required to shower upon removing the protective garments and hood.

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(6) Laboratory activities.**(Deleted)**

[41 F.R. 35184, August 20, 1976.]

(d) General regulated area requirements.**(1) Employee identification. .Revoked**

(2) Emergencies. In an emergency, immediate measures including, but not limited to, the requirements of subdivisions (i), (ii), (iii), (iv), and (v) of this paragraph shall be implemented.

(i) The potentially affected area shall be evacuated as soon as the emergency has been determined.

(ii) Hazardous conditions created by the emergency shall be eliminated and the potentially affected area shall be decontaminated prior to the resumption of normal operations.

(iii) Special medical surveillance by a physician shall be instituted with 24 hours for employees present in the potentially affected area at the time of the emergency. A report of the medical surveillance and any treatment shall be included in the incident report, in accordance with paragraph (f)(2) of this section.

(iv) Where an employee has a known contact with 3,3'-Dichlorobenzidine (or its salts), such employee shall be required to shower as soon as possible, unless contraindicated by physical injuries.

(v) An incident report on the emergency shall be reported as provided in paragraph (f)(2) of this section.

(3) Hygiene facilities and practices.

(i) Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smoking, storage of smoking materials, tobacco products or other products for chewing, or the chewing of such products, are prohibited in regulated areas.

(ii) Where employees are required by this section to wash, washing facilities shall be provided in accordance with §1910.141(d)(1) and (2)(ii) through (vii).

(iii) Where employees are required by this section to shower, shower facilities shall be provided in accordance with §1910.141(d)(3).

(iv) Where employees wear protective clothing and equipment clean change rooms shall be provided, in accordance with §1910.141(e), for the number of such employees required to change clothes.

(v) Where toilets are in regulated areas, such toilets shall be in a separate room.

(4) Contamination control.

(i) Regulated areas, except for outdoor systems, shall be maintained under pressure negative with respect to nonregulated areas. Local exhaust ventilation may be used to satisfy this requirement. Clean makeup air in equal volume shall replace air removed.

(ii) Any equipment, materials, or other item taken into or removed from a regulated area shall be done so in a manner that does not cause contamination in nonregulated areas or the external environment.

(iii) Decontamination procedures shall be established and implemented to remove 3,3'-Dichlorobenzidine (or its salts) from the surfaces of materials, equipment and the decontamination facility.

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stored in sealed containers, or contained in a closed system, including piping systems, with any sample ports or openings closed while bis-Chloromethyl ether is contained within. Access shall be restricted to authorized employees only.

(3) Open vessel system operations. Open vessel system operations as defined in paragraph (b)(13) of this section are prohibited.

(4) Transfer from a closed system, charging or discharging point operations, or otherwise opening a closed system. In operations involving "laboratory type hoods," or in locations where bis-Chloromethyl ether is contained in an otherwise "closed system," but is transferred, charged, or discharged into other normally closed containers, the provisions of this subparagraph shall apply.

(i) Access shall be restricted to authorized employees only.

(ii) Each operation shall be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated. Clean makeup air shall be introduced in sufficient volume to maintain the correct operation of the local exhaust system.

(iii) Employees shall be provided with, and required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), and gloves prior to entering the regulated area.

(iv) Employees engaged in bis-Chloromethyl ether handling operations shall be provided with and required to wear and use a full-face, supplied air respirator, of the continuous flow or pressure-demand type, in accordance with §1910.134.

(v) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the

last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under paragraphs (e)(2), (3), and (4) of this section.

(vi) Drinking fountains are prohibited in the regulated area.

(5) Maintenance and decontamination activities. In cleanup of leaks or spills, maintenance or repair operations on contaminated systems or equipment, or any operations involving work in an area where direct contact with bis-Chloromethyl ether could result, each authorized employee entering that area shall:

(i) Be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with §1910.134.

(ii) Be decontaminated before removing the protective garments and hood.

(iii) Be required to shower upon removing the protective garments and hood.

(6) Laboratory activities.

(Deleted)

[41 F.R. 35184, August 20, 1976.]

(d) General regulated area requirements.

(1) Employee identification. Revoked

(2) Emergencies. In an emergency, immediate measures including, but not limited

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to, the requirements of subdivisions (i), (ii), (iii), (iv), and (v) of this paragraph shall be implemented.

(i) The potentially affected area shall be evacuated as soon as the emergency has been determined.

(ii) Hazardous conditions created by the emergency shall be eliminated and the potentially affected area shall be decontaminated prior to the resumption of normal operations.

(iii) Special medical surveillance by a physician shall be instituted within 24 hours for employees present in the potentially affected area at the time of the emergency. A report of the medical surveillance and any treatment shall be included in the incident report, in accordance with paragraph (f)(2) of this section.

(iv) Where an employee has a known contact with bis-Chloromethyl ether, such employee shall be required to shower as soon as possible, unless contraindicated by physical injuries.

(v) An incident report on the emergency shall be reported as provided in paragraph (f)(2) of this section.

(3) Hygiene facilities and practices.

(i) Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smoking, storage of smoking materials, tobacco products or other products for chewing, or the chewing of such products, are prohibited in regulated areas.

(ii) Where employees wear protective clothing and equipment clean change rooms shall be provided, in accordance with §1910.141(e), for the number of such employees required to change clothes.

(iii) Where toilets are in regulated areas, such toilets shall be in a separate room.

(iv) Where employees are required by this section to wash, washing facilities shall be

provided in accordance with §1910.141(d)(1) and (2) (ii) through (vii).

(v) Where employees are required by this section to shower, shower facilities shall be provided in accordance with §1910.141(d)(3).

(4) Contamination control.

(i) Regulated areas, except for outdoor systems, shall be maintained under pressure negative with respect to nonregulated areas. Local exhaust ventilation may be used to satisfy this requirement. Clean makeup air in equal volume shall replace air removed.

(ii) Any equipment, material, or other item taken into or removed from a regulated area shall be done so in a manner that does not cause contamination in nonregulated areas or the external environment.

(iii) Decontamination procedures shall be established and implemented to remove bis-Chloromethyl ether from the surfaces of materials, equipment and the decontamination facility.

(e) Signs, information and training.**(1) Signs.**

(i) Entrances to regulated areas shall be posted with signs bearing the legend:

**CANCER-SUSPECT AGENT
AUTHORIZED PERSONNEL ONLY**

(ii) Entrances to regulated areas containing operations covered in paragraph (c)(5) of this section shall be posted with signs bearing the legend:

**CANCER-SUSPECT AGENT
EXPOSED IN THIS AREA
IMPERVIOUS SUIT INCLUDING
GLOVES, BOOTS, AND AIR-
SUPPLIED HOOD REQUIRED
AT ALL TIMES
AUTHORIZED PERSONNEL ONLY**

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(ii) Each operation shall be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated. Clean makeup air shall be introduced in sufficient volume to maintain the correct operation of the local exhaust system.

(iii) Employees shall be provided with, and required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering a regulated area.

(iv) Employees engaged in beta-Naphthylamine handling operations shall be provided with and required to wear and use a half-face, filter-type respirator for dusts, mists, and fumes, in accordance with §1910.134. A respirator affording higher levels of protection may be substituted.

(v) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under paragraphs (e)(2), (3), and (4) of this section.

(vi) Employees shall be required to wash hands, forearms, face and neck on each exit from the regulated area, close to the point of exit, and before engaging in other activities.

(vii) Employees shall be required to shower after the last exit of the day.

(viii) Drinking fountains are prohibited in the regulated area.

(5) **Maintenance and decontamination activities.** In cleanup of leaks or spills,

maintenance or repair operations on contaminated systems or equipment, or any operations involving work in an area where direct contact with beta-Naphthylamine could result, each authorized employee entering that area shall:

(i) Be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with §1910.134.

(ii) Be decontaminated before removing the protective garments and hood.

(iii) Be required to shower upon removing the protective garments and hood.

(6) **Laboratory activities.**

(Deleted)

[41 F.R. 35184, August 20, 1976.]

(d) **General regulated area requirements.**

(1) **Employee identification.** Revoked

(2) **Emergencies.** In an emergency, immediate measures including, but not limited to, the requirements of subdivisions (i), (ii), (iii), (iv), and (v) of this paragraph shall be implemented.

(i) The potentially affected area shall be evacuated as soon as the emergency has been determined.

(ii) Hazardous conditions created by the emergency shall be eliminated and the po-

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tentially affected area shall be decontaminated prior to the resumption of normal operations.

(iii) Special medical surveillance by a physician shall be instituted within 24 hours for employees present in the potentially affected area at the time of the emergency. A report of the medical surveillance and any treatment shall be included in the incident report, in accordance with paragraph (f)(2) of this section.

(iv) Where an employee has a known contact with beta-Naphthylamine, such employee shall be required to shower as soon as possible, unless contraindicated by physical injuries.

(v) An incident report on the emergency shall be reported as provided in paragraph (f)(2) of this section.

(3) Hygiene facilities and practices.

(i) Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smoking, storage of smoking materials, tobacco products or other products for chewing, or the chewing of such products, are prohibited in regulated areas.

(ii) Where employees are required by this section to wash, washing facilities shall be provided in accordance with §1910.141(d)(1) and (2)(ii) through (vii).

(iii) Where employees are required by this section to shower, shower facilities shall be provided in accordance with §1910.141(d)(3).

(iv) Where employees wear protective clothing and equipment clean change rooms shall be provided, in accordance with §1910.141(e), for the number of such employees required to change clothes.

(v) Where toilets are in regulated areas, such toilets shall be in a separate room.

(4) Contamination control.

(i) Regulated areas, except for outdoor systems, shall be maintained under pressure negative with respect to nonregulated areas. Local exhaust ventilation may be used to satisfy this requirement. Clean makeup air in equal volume shall replace air removed.

(ii) Any equipment, material, or other item taken into or removed from a regulated area shall be done so in a manner that does not cause contamination in nonregulated areas or the external environment.

(iii) Decontamination procedures shall be established and implemented to remove beta-Naphthylamine from the surfaces of materials, equipment and the decontamination facility.

(iv) Dry sweeping and dry mopping are prohibited.

(e) Signs, information and training.**(1) Signs.**

(i) Entrances to regulated areas shall be posted with signs bearing the legend:

**CANCER-SUSPECT AGENT
AUTHORIZED PERSONNEL ONLY**

(ii) Entrances to regulated areas containing operations covered in paragraph (c)(5) of this section shall be posted with signs bearing the legend:

**CANCER-SUSPECT AGENT
EXPOSED IN THIS AREA
IMPERVIOUS SUIT INCLUDING
GLOVES, BOOTS, AND AIR-
SUPPLIED HOOD REQUIRED
AT ALL TIMES
AUTHORIZED PERSONNEL ONLY**

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volving "laboratory type hoods," or in locations where Benzidine is contained in an otherwise "closed system," but is transferred, charged, or discharged into other normally closed containers, the provisions of this subparagraph shall apply.

(i) Access shall be restricted to authorized employees only;

(ii) Each operation shall be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated. Clean makeup air shall be introduced in sufficient volume to maintain the correct operation of the local exhaust system.

(iii) Employees shall be provided with, and required to wear clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), and shoe covers and gloves prior to entering the regulated area.

(iv) Employees engaged in Benzidine handling operations shall be provided with and required to wear and use a half-face, filter-type respirator for dusts, mists, and fumes, in accordance with §1910.134. A respirator affording higher levels of protection may be substituted.

(v) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under paragraphs (c)(2), (3), and (4) of this section.

(vi) Employees shall be required to wash hands, forearms, face and neck on each exit from the regulated area, close to the point of exit, and before engaging in other activities.

(vii) Employees shall be required to shower after the last exit of the day.

(viii) Drinking fountains are prohibited in the regulated area.

(5) Maintenance and decontamination activities. In cleanup of leaks or spills, maintenance or repair operations on contaminated systems or equipment where direct contact with Benzidine could result, each authorized employee entering that area shall:

(i) Be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with §1910.134.

(ii) Be decontaminated before removing the protective garments and hood;

(iii) Be required to shower upon removing the protective garments and hood.

(6) Laboratory activities.

(Deleted)

[41 F.R. 35184, August 20, 1976.]

(d) General regulated area requirements.

(1) Employee identification. Revoked

(2) Emergencies. In an emergency, immediate measures including, but not limited to, the requirements of subdivisions (i), (ii), (iii), (iv), and (v) of this paragraph shall be implemented.

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(i) The potentially affected area shall be evacuated as soon as the emergency has been determined.

(ii) Hazardous conditions created by the emergency shall be eliminated and the potentially affected area shall be decontaminated prior to the resumption of normal operations.

(iii) Special medical surveillance by a physician shall be instituted within 24 hours for employees present in the potentially affected area at the time of the emergency. A report of the medical surveillance and any treatment shall be included in the incident report, in accordance with paragraph (f)(2) of this section.

(iv) Where an employee has a known contact with Benzidine, such employee shall be required to shower as soon as possible, unless contraindicated by physical injuries.

(v) An incident report on the emergency shall be reported as provided in paragraph (f)(2) of this section.

(3) Hygiene facilities and practices.

(i) Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smoking, storage of smoking materials, tobacco products or other products for chewing, or the chewing of such products, are prohibited in regulated areas.

(ii) Where employees are required by this section to wash, washing facilities shall be provided in accordance with §1910.141(d)(1) and (2)(ii) through (vii).

(iii) Where employees are required by this section to shower, shower facilities shall be provided in accordance with §1910.141(d)(3).

(iv) Where employees wear protective clothing and equipment clean change rooms shall be provided, in accordance with §1910.141(e), for the number of such employees required to change clothes.

(v) Where toilets are in regulated areas, such toilets shall be in a separate room.

(4) Contamination control.

(i) Regulated areas, except for outdoor systems, shall be maintained under pressure negative with respect to nonregulated areas. Local exhaust ventilation may be used to satisfy this requirement. Clean makeup air in equal volume shall replace air removed.

(ii) Any equipment, material, or other item taken into or removed from a regulated area shall be done so in a manner that does not cause contamination in nonregulated areas or the external environment.

(iii) Decontamination procedures shall be established and implemented to remove Benzidine from the surfaces of materials, equipment and the decontamination facility.

(iv) Dry sweeping and dry mopping are prohibited.

(e) Signs, information and training.**(1) Signs.**

(i) Entrances to regulated areas shall be posted with signs bearing the legend:

**CANCER-SUSPECT AGENT
AUTHORIZED PERSONNEL ONLY**

(ii) Entrances to regulated areas containing operations covered in paragraph (c)(5) of this section shall be posted with signs bearing the legend:

**CANCER-SUSPECT AGENT
EXPOSED IN THIS AREA
IMPERVIOUS SUIT INCLUDING
GLOVES, BOOTS, AND AIR-
SUPPLIED HOOD REQUIRED
AT ALL TIMES
AUTHORIZED PERSONNEL ONLY**

(iii) Appropriate signs and instructions shall be posted at the entrance to, and

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(iii) Employees shall be provided with, and required to wear clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area.

(iv) Employees engaged in 4-Aminodiphenyl handling operations shall be provided with and required to wear and use a half-face, filter-type respirator for dusts, mists, and fumes, in accordance with §1910.134. A respirator affording higher levels of protection may be substituted.

(v) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under paragraphs (e)(2), (3), and (4) of this section.

(vi) Employees shall be required to wash hands, forearms, face and neck on each exit from the regulated area, close to the point of exit, and before engaging in other activities.

(vii) Employees shall be required to shower after the last exit of the day.

(viii) Drinking fountains are prohibited in the regulated area.

(5) Maintenance and decontamination activities. In cleanup of leaks or spills, maintenance or repair operations on contaminated systems or equipment, where direct contact with 4-Aminodiphenyl could result, each authorized employee entering that area shall:

(i) Be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with §1910.134.

(ii) Be decontaminated before removing the protective garments and hood.

(iii) Be required to shower upon removing the protective garments and hood.

(6) Laboratory activities.

(Deleted)

[41 F.R. 35184, August 20, 1976.]

(d) General regulated area requirements.

(1) Employee identification. Revoked

(2) Emergencies. In an emergency, immediate measures including, but not limited to, the requirements of subdivisions (i), (ii), (iii), (iv), and (v) of this paragraph shall be implemented.

(i) The potentially affected area shall be evacuated as soon as the emergency has been determined.

(ii) Hazardous conditions created by the emergency shall be eliminated and the potentially affected area shall be decontaminated prior to the resumption of normal operations.

(iii) Special medical surveillance by a physician shall be instituted within 24 hours for employees present in the potentially affected area at the time of the emergency. A report of the medical surveillance and any treatment shall be included in the incident report, in accordance with paragraph (f)(2) of this section.

(iv) Where an employee has a known contact with 4-Aminodiphenyl such employee shall be required to shower as soon as possible, unless contraindicated by physical injuries.

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(v) An incident report on the emergency shall be reported as provided in paragraph (f)(2) of this section.

(3) Hygiene facilities and practices.

(i) Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smoking, storage of smoking materials, tobacco products or other products for chewing, or the chewing of such products, are prohibited in regulated areas.

(ii) Where employees are required by this section to wash, washing facilities shall be provided in accordance with §1910.141(d)(1) and (2)(ii) through (vii).

(iii) Where employees are required by this section to shower, shower facilities shall be provided in accordance with §1910.141(d)(3).

(iv) Where employees wear protective clothing and equipment clean change rooms shall be provided, in accordance with §1910.141(e), for the number of such employees required to change clothes.

(v) Where toilets are in regulated areas, such toilets shall be in a separate room.

(4) Contamination control.

(i) Regulated areas, except for outdoor systems, shall be maintained under pressure negative with respect to nonregulated areas. Local exhaust ventilation may be used to satisfy this requirement. Clean makeup air in equal volume shall replace air removed.

(ii) Any equipment, materials, or other item taken into or removed from a regulated area shall be done so in a manner that does not cause contamination in nonregulated areas or the external environment.

(iii) Decontamination procedures shall be established and implemented to remove 4-Aminodiphenyl from the surfaces of materials, equipment and the decontamination facility.

(iv) Dry sweeping and dry mopping are prohibited.

(e) Signs, information and training.**(1) Signs.**

(i) Entrances to regulated areas shall be posted with signs bearing the legend:

**CANCER-SUSPECT AGENT
AUTHORIZED PERSONNEL ONLY**

(ii) Entrances to regulated areas containing operations covered in paragraph (c)(5) of this section shall be posted with signs bearing the legend:

**CANCER-SUSPECT AGENT
EXPOSED IN THIS AREA
IMPERVIOUS SUIT INCLUDING
GLOVES, BOOTS, AND AIR-
SUPPLIED HOOD REQUIRED
AT ALL TIMES
AUTHORIZED PERSONNEL ONLY**

(iii) Appropriate signs and instructions shall be posted at the entrance to, and exit from, regulated areas, informing employees of the procedures that must be followed in entering and leaving a regulated area.

(2) Container contents identification.

(i) Containers of 4-Aminodiphenyl and containers required under paragraphs (c)(4)(v) and (c)(6)(vii)(b), and (c)(6)(viii)(b) of this section which are accessible only to, and handled only by, authorized employees, or by other employees trained in accordance with subparagraph (5) of this paragraph, may have contents identification limited to a generic or proprietary name, or other proprietary identification, of the carcinogen and percent.

(ii) Containers of 4-Aminodiphenyl and containers required under paragraphs (c)(4)(v), (c)(6)(vii)(b), and (c)(6)(viii)(b) of this section which are accessible to, or

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sult, each authorized employee entering that area shall:

(i) Be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with §1910.134.

(ii) Be decontaminated before removing the protective garments and hood.

(iii) Be required to shower upon removing the protective garments and hood.

(6) Laboratory activities.

(Deleted)

[41 F.R. 35184, August 20, 1976.]

(d) General regulated area requirements.

(1) Employee identification. Revoked

(2) Emergencies. In an emergency, immediate measures including, but not limited to, the requirements of subdivisions (i), (ii), (iii), (iv), and (v) of this paragraph shall be implemented.

(i) The potentially affected area shall be evacuated as soon as the emergency has been determined.

(ii) Hazardous conditions created by the emergency shall be eliminated and the potentially affected area shall be decontaminated prior to the resumption of normal operations.

(iii) Special medical surveillance by a physician shall be instituted with 24 hours for employees present in the potentially affected area at the time of the emergency. A report of the medical surveillance and any treatment shall be in-

cluded in the incident report, in accordance with paragraph (f)(2) of this section.

(iv) Where an employee has a known contact with Ethyleneimine such employee shall be required to shower as soon as possible, unless contraindicated by physical injuries.

(v) An incident report on the emergency shall be reported as provided in paragraph (f)(2) of this section.

(vi) Emergency deluge showers and eye-wash fountains supplied with running potable water shall be located near, within sight of, and on the same level with locations where a direct exposure of Ethyleneimine would be most likely as a result of equipment failure, or improper work practices.

(3) Hygiene facilities and practices.

(i) Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smoking, storage of smoking materials, tobacco products or other products for chewing, or the chewing of such products, are prohibited in regulated areas.

(ii) Where employees wear protective clothing and equipment clean change rooms shall be provided, in accordance with §1910.141(e), for the number of such employees required to change clothes.

(iii) Where toilets are in regulated areas, such toilets shall be in a separate room.

(iv) Where employees are required by this section to wash, washing facilities shall be provided in accordance with §1910.141(d)(1) and (2)(ii) through (vii).

(v) Where employees are required by this section to shower, shower facilities shall be provided in accordance with §1910.141(d)(3).

(4) Contamination control.

(i) Regulated areas, except for outdoor systems, shall be maintained under pressure negative with respect to nonregulated areas. Local exhaust ventilation may

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be used to satisfy this requirement. Clean makeup air in equal volume shall replace air removed.

(ii) Any equipment, material, or other item taken into or removed from a regulated area shall be done so in a manner that does not cause contamination in non-regulated areas or the external environment.

(iii) Decontamination procedures shall be established and implemented to remove Ethyleneimine from the surfaces of materials, equipment and the decontamination facility.

(e) Signs, information and training.

(1) Signs.

(i) Entrances to regulated areas shall be posted with signs bearing the legend:

**CANCER-SUSPECT AGENT
AUTHORIZED PERSONNEL ONLY**

(ii) Entrances to regulated areas containing operations covered in paragraph (c)(5) of this section shall be posted with signs bearing the legend:

**CANCER-SUSPECT AGENT
EXPOSED IN THIS AREA
IMPERVIOUS SUIT INCLUDING
GLOVES, BOOTS, AND AIR-
SUPPLIED HOOD REQUIRED
AT ALL TIMES
AUTHORIZED PERSONNEL ONLY**

(iii) Appropriate signs and instructions shall be posted at the entrance to, and exit from, regulated areas, informing employees of the procedures that must be followed in entering and leaving a regulated area.

(2) Container contents identification.

(i) Containers of Ethyleneimine and containers required under paragraphs (c)(4)(v) and (c)(6)(vii)(b), and (c)(6)(viii)(b) of this section which are accessible only to, and handled only by, authorized employees, or by other employees trained

in accordance with subparagraph (5) of this paragraph, may have contents identification limited to a generic or proprietary name, or other proprietary identification, of the carcinogen and percent.

(ii) Containers of Ethyleneimine and containers required under paragraphs (c)(4)(v), (c)(6)(vii)(b), and (c)(6)(viii)(b) of this section which are accessible to, or handled by employees other than authorized employees or employees trained in accordance with subparagraph (5) of this paragraph shall have contents identification which includes the full chemical name and Chemical Abstracts Service Registry Number as listed in paragraph (a)(1) of this section.

(iii) Containers shall have the warning words "CANCER-SUSPECT AGENT" displayed immediately under or adjacent to the contents identification.

(iv) Containers which have Ethyleneimine contents with corrosive or irritating properties shall have label statements warning of such hazards, noting, if appropriate, particularly sensitive or affected portions of the body.

(3) **Lettering.** Lettering on signs and instructions required by subparagraph (1) shall be a minimum letter height of 2 inches. Labels on containers required under this section shall not be less than 1/4 the size of the largest lettering on the package, and not less than 8 point type in any instance; provided that no such required lettering need be more than 1 inch in height.

(4) **Prohibited statements.** No statement shall appear on or near any required sign, label, or instruction which contradicts or detracts from the effect of any required warning, information or instruction.

(5) Training and indoctrination.

(i) Each employee prior to being authorized to enter a regulated area, shall receive a training and indoctrination program including, but not necessarily limited to:

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and/or protective equipment in an environment free of beta-Propiolactone. The clean change room shall be contiguous to and have an entry from a shower room, when the shower room facilities are otherwise required in this section.

(4) "Closed system" means an operation involving beta-Propiolactone where containment prevents the release of beta-Propiolactone into regulated areas, nonregulated areas, or the external environment.

(5) "Decontamination" means the inactivation of beta-Propiolactone or its safe disposal.

(6) "Director" means the Director, National Institute for Occupational Safety and Health, or any person directed by him or the Secretary of Health, Education, and Welfare to act for the Director.

(7) "Disposal" means the safe removal of beta-Propiolactone from the work environment.

(8) "Emergency" means an unforeseen circumstance or set of circumstances resulting in the release of beta-Propiolactone which may result in exposure to or contact with beta-Propiolactone.

(9) "External environment" means any environment external to regulated and non-regulated areas.

(10) "Isolated system" means a fully enclosed structure other than the vessel of containment of beta-Propiolactone, which is impervious to the passage of beta-Propiolactone, and which would prevent the entry of beta-Propiolactone into regulated areas, nonregulated areas, or the external environment, should leakage or spillage from the vessel of containment occur.

(11) "Laboratory type hood" is a device enclosed on three sides and the top and bottom, designed and maintained so as to draw air inward at an average linear face velocity of 150 feet per minute with a minimum of 125 feet per minute; designed, constructed,

and maintained in such a way that an operation involving beta-Propiolactone within the hood does not require the insertion of any portion of any employee's body other than his hands and arms.

(12) "Nonregulated area" means any area under the control of the employer where entry and exit is neither restricted nor controlled.

(13) "Open-vessel system" means an operation involving beta-Propiolactone in an open vessel, which is not in an isolated system, a laboratory type hood, nor in any other system affording equivalent protection against the entry of beta-Propiolactone into regulated areas, nonregulated areas, or the external environment.

(14) "Protective clothing" means clothing designed to protect an employee against contact with or exposure to beta-Propiolactone.

(15) "Regulated area" means an area where entry and exit is restricted and controlled.

(c) Requirements for areas containing beta-Propiolactone.

A regulated area shall be established by an employer where beta-Propiolactone is manufactured, processed, used, repackaged, released, handled or stored. All such areas shall be controlled in accordance with the requirements for the following category or categories describing the operation involved:

(1) **Isolated systems.** Employees working with beta-Propiolactone within an isolated system, such as a "glove box" shall wash their hands and arms upon completion of the assigned task and before engaging in other activities not associated with the isolated system.

(2) **Closed system operation.** Within regulated areas where beta-Propiolactone is stored in sealed containers, or contained in a closed system, including piping systems, with any sample ports or openings closed while beta-Propiolactone is contained within. Access shall be restricted to authorized employees only.

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(3) **Open vessel system operations.** Open vessel system operations as defined in paragraph (b)(13) of this section are prohibited.

(4) **Transfer from a closed system, charging or discharging point operations, or otherwise opening a closed system.** In operations involving "laboratory type hoods," or in locations where beta-Propiolactone is contained in an otherwise "closed system," but is transferred, charged, or discharged into other normally closed containers, the provisions of this subparagraph shall apply.

(i) Access shall be restricted to authorized employees only.

(ii) Each operation shall be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated. Clean makeup air shall be introduced in sufficient volume to maintain the correct operation of the local exhaust system.

(iii) Employees shall be provided with, and required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area.

(iv) Employees engaged in beta-Propiolactone handling operations shall be provided with and required to wear and use a full-face, supplied air respirator, of the continuous flow or pressure-demand type, in accordance with §1910.134.

(v) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under paragraphs (e)(2), (3), and (4) of this section.

(vi) Drinking fountains are prohibited in the regulated area.

(5) **Maintenance and decontamination activities.** In cleanup of leaks or spills, maintenance or repair operations on contaminated systems or equipment, where direct contact with beta-Propiolactone could result, each authorized employee entering that area shall:

(i) Be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with §1910.134.

(ii) Be decontaminated before removing the protective garments and hood;

(iii) Be required to shower upon removing the protective garments and hood.

(6) **Laboratory activities.**

(Deleted)

[41 F.R. 35184, August 20, 1976.]

(d) **General regulated area requirements.**

(1) **Employee identification.** Revoked

(2) **Emergencies.** In an emergency, immediate measures including, but not limited to, the requirements of subdivision (i), (ii), (iii), (iv), and (v) of this paragraph shall be implemented.

(i) The potentially affected area shall be evacuated as soon as the emergency has been determined.

(ii) Hazardous conditions created by the emergency shall be eliminated and the po-

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regulated areas, nonregulated areas, or the external environment, should leakage or spillage from the vessel of containment occur.

(11) "Laboratory type hood" is a device enclosed on three sides and the top and bottom, designed and maintained so as to draw air inward at an average linear face velocity of 150 feet per minute with a minimum of 125 feet per minute; designed, constructed, and maintained in such a way that an operation involving 2-Acetylaminofluorene within the hood does not require the insertion of any portion of any employee's body other than his hands and arms.

(12) "Nonregulated area" means any area under the control of the employer where entry and exit is neither restricted nor controlled.

(13) "Open-vessel system" means an operation involving 2-Acetylaminofluorene in an open vessel, which is not in an isolated system, a laboratory type hood, nor in any other system affording equivalent protection against the entry of 2-Acetylaminofluorene into areas, nonregulated areas, or the external environment.

(14) "Protective clothing" means clothing designed to protect an employee against contact with or exposure to 2-Acetylaminofluorene.

(15) "Regulated area" means an area where entry and exit is restricted and controlled.

(c) Requirements for areas containing 2-Acetylaminofluorene.

A regulated area shall be established by an employer where 2-Acetylaminofluorene is manufactured, processed, used, repackaged, released, handled or stored. All such areas shall be controlled in accordance with the requirements for the following category or categories describing the operation involved:

(i) **Isolated systems.** Employees working with 2-Acetylaminofluorene within an isolated system, such as a "glove box" shall wash their hands and arms upon completion

of the assigned task and before engaging in other activities not associated with the isolated system.

(2) **Closed system operation.** Within regulated areas where 2-Acetylaminofluorene is stored in sealed containers, or contained in a closed system, including piping systems, with any sample ports or openings closed while 2-Acetylaminofluorene is contained within:

(i) Access shall be restricted to authorized employees only;

(ii) Employees shall be required to wash hands, forearms, face and neck upon each exit from the regulated areas, close to the point of exit and before engaging in other activities.

(3) **Open vessel system operations.** Open vessel system operations as defined in paragraph (b)(13) of this section are prohibited.

(4) **Transfer from a closed system, charging or discharging point operations, or otherwise opening a closed system.** In operations involving "laboratory type hoods," or in locations where 2-Acetylaminofluorene is contained in an otherwise "closed system," but is transferred, charged, or discharged into other normally closed containers, the provisions of this subparagraph shall apply.

(i) Access shall be restricted to authorized employees only.

(ii) Each operation shall be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated. Clean makeup air shall be introduced in sufficient volume to maintain the correct operation of the local exhaust system.

(iii) Employees shall be provided with, and required to wear, clean, full body protective clothing (smocks, coveralls, or

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long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area.

(iv) Employees engaged in 2-Acetylaminofluorene handling operations shall be provided with and required to wear and use a half-face, filter-type respirator for dusts, mists, and fumes, in accordance with §1910.134. A respirator affording higher levels of protection may be substituted.

(v) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under paragraphs (e)(2), (3), and (4) of this section.

(vi) Employees shall be required to wash hands, forearms, face and neck on each exit from the regulated area, close to the point of exit, and before engaging in other activities.

(vii) Employees shall be required to shower after the last exit of the day.

(viii) Drinking fountains are prohibited in the regulated area.

(5) Maintenance and decontamination activities. In cleanup of leaks or spills, maintenance or repair operations on contaminated systems or equipment, where direct contact with 2-Acetylaminofluorene could result, each authorized employee entering that area shall:

(i) Be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with §1910.134.

(ii) Be decontaminated before removing the protective garments and hood.

(iii) Be required to shower upon removing the protective garments and hood.

(6) Laboratory activities.

(Deleted)

[41 F.R. 35184, August 20, 1976.]

(d) General regulated area requirements.

(1) Employee identification. Revoked roster of

(2) Emergencies. In an emergency, immediate measures including, but not limited to, the requirements of subdivisions (i), (ii), (iii), (iv), and (v) of this paragraph shall be implemented.

(i) The potentially affected area shall be evacuated as soon as the emergency has been determined.

(ii) Hazardous conditions created by the emergency shall be eliminated and the potentially affected area shall be decontaminated prior to the resumption of normal operations.

(iii) Special medical surveillance by a physician shall be instituted within 24 hours for employees present in the potentially affected area at the time of the emergency. A report of the medical surveillance and any treatment shall be included in the incident report, in accordance with paragraph (f)(2) of this section.

(iv) Where an employee has a known contact with 2-Acetylaminofluorene, such employee shall be required to shower as soon as possible, unless contraindicated by physical injuries.

(v) An incident report on the emergency shall be reported as provided in paragraph (f)(2) of this section.

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in an open vessel, which is not in an isolated system, a laboratory type hood, nor in any other system affording equivalent protection against the entry of 4-Dimethylaminoazobenzene into regulated areas, nonregulated areas, or the external environment.

(14) "Protective clothing" means clothing designed to protect an employee against contact with or exposure to 4-Dimethylaminoazobenzene.

(15) "Regulated area" means an area where entry and exit is restricted and controlled.

(c) Requirements for areas containing 4-Dimethylaminoazobenzene.

A regulated area shall be established by an employer where 4-Dimethylaminoazobenzene is manufactured, processed, used, repackaged, released, handled or stored. All such areas shall be controlled in accordance with the requirements for the following category or categories describing the operation involved:

(1) **Isolated systems.** Employees working with 4-Dimethylaminoazobenzene within an isolated system, such as a "glove box" shall wash their hands and arms upon completion of the assigned task and before engaging in other activities not associated with the isolated system.

(2) **Closed system operation.** Within regulated areas where 4-Dimethylaminoazobenzene is stored in sealed containers, or contained in a closed system, including piping systems, with any sample ports or openings closed while 4-Dimethylaminoazobenzene is contained within:

(i) Access shall be restricted to authorized employees only;

(ii) Employees shall be required to wash hands, forearms, face and neck upon each exit from the regulated areas, close to the point of exit and before engaging in other activities.

(3) **Open vessel system operations.** Open vessel system operations as defined in paragraph (b)(13) of this section, are prohibited.

(4) **Transfer from a closed system, charging or discharging point operations, or otherwise opening a closed system.** In operations involving "laboratory type hoods," or in locations where 4-Dimethylaminoazobenzene is contained in an otherwise "closed system," but is transferred, charged, or discharged into other normally closed containers, the provisions of this subparagraph shall apply.

(i) Access shall be restricted to authorized employees only.

(ii) Each operation shall be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated. Clean makeup air shall be introduced in sufficient volume to maintain the correct operation of the local exhaust system.

(iii) Employees shall be provided with, and required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area.

(iv) Employees engaged in 4-Dimethylaminoazobenzene handling operations shall be provided with and required to wear and use a half-face, filter-type respirator for dusts, mists, and fumes, in accordance with §1910.134. A respirator affording higher levels of protection may be substituted.

(v) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under paragraphs (e)(2), (3), and (4) of this section.

(vi) Employees shall be required to wash hands, forearms, face and neck on each exit from the regulated area, close to the

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point of exit, and before engaging in other activities.

(vii) Employees shall be required to shower after the last exit of the day.

(viii) Drinking fountains are prohibited in the regulated area.

(5) Maintenance and decontamination activities. In cleanup of leaks or spills, maintenance or repair operations on contaminated systems or equipment, where direct contact with 4-Dimethylaminoazobenzene could result, each authorized employee entering that area shall:

(i) Be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with §1910.134.

(ii) Be decontaminated before removing the protective garments and hood.

(iii) Be required to shower upon removing the protective garments and hood.

(6) Laboratory activities.

(Deleted)

[41 F.R. 35184, August 20, 1976.]

(d) General regulated area requirements.

(1) Employee identification. Revoked

(2) Emergencies. In an emergency, immediate measures including, but not limited to, the requirements of subdivisions (i), (ii), (iii), (iv), and (v) of this paragraph shall be implemented.

(i) The potentially affected area shall be evacuated as soon as the emergency has been determined.

(ii) Hazardous conditions created by the emergency shall be eliminated and the potentially affected area shall be decontaminated prior to the resumption of normal operations.

(iii) Special medical surveillance by a physician shall be instituted with 24 hours for employees present in the potentially affected area at the time of the emergency. A report of the medical surveillance and any treatment shall be included in the incident report, in accordance with paragraph (f)(2) of this section.

(iv) Where an employee has a known contact with 4-Dimethylaminoazobenzene, such employee shall be required to shower as soon as possible, unless contraindicated by physical injuries.

(v) An incident report on the emergency shall be reported as provided in paragraph (f)(2) of this section.

(3) Hygiene facilities and practices.

(i) Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smoking, storage of smoking materials, tobacco products or other products for chewing, or the chewing of such products, are prohibited in regulated areas.

(ii) Where employees are required by this section to wash, washing facilities shall be provided in accordance with §1910.141(d)(1) and (2)(ii) through (vii).

(iii) Where employees are required by this section to shower, shower facilities shall be provided in accordance with §1910.141(d)(3).

(iv) Where employees wear protective clothing and equipment clean change rooms shall be provided, in accordance with §1910.141(e), for the number of such employees required to change clothes.

(v) Where toilets are in regulated areas, such toilets shall be in a separate room.

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is stored in sealed containers, or contained in a closed system, including piping systems, with any sample ports or openings closed while N-Nitrosodimethylamine is contained within:

(i) Access shall be restricted to authorized employees only;

(ii) Employees shall be required to wash hands, forearms, face and neck upon each exit from the regulated areas, close to the point of exit and before engaging in other activities.

(3) Open vessel system operations. Open vessel system operations as defined in paragraph (b)(13) of this section are prohibited.

(4) Transfer from a closed system, charging or discharging point operations, or otherwise opening a closed system. In operations involving "laboratory type hoods," or in locations where N-Nitrosodimethylamine is contained in an otherwise "closed system," but is transferred, charged, or discharged into other normally closed containers, the provisions of this subparagraph shall apply.

(i) Access shall be restricted to authorized employees only.

(ii) Each operation shall be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated. Clean makeup air shall be introduced in sufficient volume to maintain the correct operation of the local exhaust system.

(iii) Employees shall be provided with, and required to wear, clean, full body protective clothing (smocks, coveralls, or long sleeved shirt and pants), shoe covers, and gloves prior to entering the regulated area.

(iv) Employees engaged in N-Nitrosodimethylamine handling operations shall be provided with and required to wear and

use a half-face, filter-type respirator for dusts, mists, and fumes, in accordance with §1910.134. A respirator affording higher levels of protection may be substituted.

(v) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under paragraphs (c)(2), (3), and (4) of this section.

(vi) Employees shall be required to wash hands, forearms, face and neck on each exit from the regulated area, close to the point of exit, and before engaging in other activities.

(vii) Employees shall be required to shower after the last exit of the day.

(viii) Drinking fountains are prohibited in the regulated area.

(5) Maintenance and decontamination activities. In cleanup of leaks or spills, maintenance or repair operations on contaminated systems or equipment, where direct contact with N-Nitrosodimethylamine could result, each authorized employee entering that area shall:

(i) Be provided with and required to wear clean, impervious garments, including gloves, boots and continuous air supplied hood in accordance with §1910.134.

(ii) Be decontaminated before removing the protective garments and hood.

(iii) Be required to shower upon removing the protective garments and hood.

(6) Laboratory activities.

(Deleted)

[41 F.R. 35184, August 20, 1976.]

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(d) General regulated area requirements.**(1) Employee identification. Revoked**

(2) Emergencies. In an emergency, immediate measures including, but not limited to, the requirements of subdivisions (i), (ii), (iii), (iv), and (v) of this paragraph shall be implemented.

(i) The potentially affected area shall be evacuated as soon as the emergency has been determined.

(ii) Hazardous conditions created by the emergency shall be eliminated and the potentially affected area shall be decontaminated prior to the resumption of normal operations.

(iii) Special medical surveillance by a physician shall be instituted within 24 hours for employees present in the potentially affected area at the time of the emergency. A report of the medical surveillance and any treatment shall be included in the incident report, in accordance with paragraph (f)(2) of this section.

(iv) Where an employee has a known contact with N-Nitrosodimethylamine, such employee shall be required to shower as soon as possible, unless contraindicated by physical injuries.

(v) An incident report on the emergency shall be reported as provided in paragraph (f)(2) of this section.

(3) Hygiene facilities and practices.

(i) Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smok-

ing, storage of smoking materials, tobacco products or other products for chewing, or the chewing of such products, are prohibited in regulated areas.

(ii) Where employees are required by this section to wash, washing facilities shall be provided in accordance with §1910.141(d)(1) and (2)(ii) through (vii).

(iii) Where employees are required by this section to shower, shower facilities shall be provided in accordance with §1910.141(d)(3).

(iv) Where employees wear protective clothing and equipment clean change rooms shall be provided, in accordance with §1910.141(e), for the number of such employees required to change clothes.

(v) Where toilets are in regulated areas, such toilets shall be in a separate room.

(4) Contamination control.

(i) Regulated areas, except for outdoor systems, shall be maintained under pressure negative with respect to nonregulated areas. Local exhaust ventilation may be used to satisfy this requirement. Clean makeup air in equal volume shall replace air removed.

(ii) Any equipment, material, or other item taken into or removed from a regulated area shall be done so in a manner that does not cause contamination in nonregulated areas or the external environment.

(iii) Decontamination procedures shall be established and implemented to remove N-Nitrosodimethylamine from the surfaces of materials, equipment and the decontamination facility.

(iv) Dry sweeping and dry mopping are prohibited.

(e) Signs, information and training.**(1) Signs.**

(i) Entrances to regulated areas shall be posted with signs bearing the legend:

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(ii) Vinyl chloride concentrations are in excess of the permissible exposure limit.

(2) Access to regulated areas shall be limited to authorized persons.

(f) Methods of compliance.

Employee exposures to vinyl chloride shall be controlled to at or below the permissible exposure limit provided in paragraph (c) of this section by engineering, work practice, and personal protective controls as follows:

(1) Feasible engineering and work practice controls shall immediately be used to reduce exposures to at or below the permissible exposure limit.

(2) Wherever feasible engineering and work practice controls which can be instituted immediately are not sufficient to reduce exposures to at or below the permissible exposure limit, they shall nonetheless be used to reduce exposures to the lowest practicable level, and shall be supplemented by respiratory protection in accordance with paragraph (g) of this section. A program shall be established and implemented to reduce exposures to at or below the permissible exposure limit, or to the greatest extent feasible, solely by means of engineering and work practice controls, as soon as feasible.

(3) Written plans for such a program shall be developed and furnished upon request for examination and copying to authorized rep-

resentatives of the Assistant Secretary and the Director. Such plans shall be updated at least every six months.

(g) Respiratory protection.

Where respiratory protection is required under this section:

(1) The employer shall provide a respirator which meets the requirements of this paragraph and shall assure that the employee uses such respirator, except that until April 1, 1976, wearing of respirators shall be at the discretion of each employee for exposures not in excess of 25 ppm, measured over any 15-minute period. Until April 1, 1976, each employee who chooses not to wear an appropriate respirator shall be informed at least quarterly of the hazards of vinyl chloride and the purpose, proper use, and limitations of respiratory devices.

[40 F.R. 13211, March 25, 1975.]

(2) Respirators shall be selected from among those jointly approved by the Mining Enforcement and Safety Administration, Department of the Interior, and the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.

(3) A respiratory protection program meeting the requirements of § 1910.134 shall be established and maintained.

(4) Selection of respirators for vinyl chloride shall be as follows:

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<i>Atmospheric concentration of vinyl chloride</i>	<i>Required apparatus</i>
(i) Unknown, or above 3,600 ppm	Open-circuit, self-contained breathing apparatus, pressure demand type, with full facepiece.
(ii) Not over 3,600 ppm	(a) Combination type C supplied air respirator, pressure demand type, with full or half facepiece, and auxiliary self-contained air supply; or (b) Combination type C, supplied air respirator continuous flow type, with full or half facepiece and auxiliary self-contained air supply.
(iii) Not over 1,000 ppm	Type C, supplied air respirator continuous flow type, with full or half facepiece, helmet or hood.
(iv) Not over 100 ppm	(a) Combination type C supplied air respirator demand type, with full facepiece, and aux- iliary self-contained air supply; or (b) Open-circuit self-contained breathing ap- paratus with full facepiece, in demand mode; or (c) Type C supplied air respirator, demand type, with full facepiece.
(v) Not over 25 ppm	(a) A powered air-purifying respirator with hood, helmet, full or half facepiece, and a canister which provides a service life of at least 4 hours for concentrations of vinyl chloride up to 25 ppm, or (b) Gas mask, front- or back-mounted canister which provides a service life of at least 4 hours for concentrations of vinyl chloride up to 25 ppm.
(vi) Not over 10 ppm	(a) Combination type C supplied-air respirator, demand type, with half facepiece, and aux- iliary self-contained air supply; or (b) Type C supplied-air respirator, demand type, with half facepiece; or (c) Any chemical cartridge respirator with an organic vapor cartridge which provides a service life of at least 1 hour for concentra- tions of vinyl chloride up to 10 ppm.

[39 F.R. 4148, December 3, 1974.]

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(7) If the examining physician determines that alternative medical examinations to those required by paragraph (k) (1) of this section will provide at least equal assurance of detecting medical conditions pertinent to the exposure to vinyl chloride, the employer may accept such alternative examinations as meeting the requirements of paragraph (k) (1) of this section, if the employer obtains a statement from the examining physician setting forth the alternative examinations and the rationale for substitution. This statement shall be available upon request for examination and copying to authorized representatives of the Assistant Secretary and the Director.

(1) Signs and labels.

(1) Entrances to regulated areas shall be posted with legible signs bearing the legend:

**CANCER-SUSPECT AGENT AREA
AUTHORIZED PERSONNEL ONLY**

[39 F. R. 41848, December 3, 1974.]

(2) Areas containing hazardous operations or where an emergency currently exists shall be posted with legible signs bearing the legend:

**CANCER-SUSPECT AGENT IN THIS AREA
PROTECTIVE EQUIPMENT REQUIRED
AUTHORIZED PERSONNEL ONLY**

[39 F.R. 41848, December 3, 1974.]

(3) Containers of polyvinyl chloride resin waste from reactors or other waste contaminated with vinyl chloride shall be legibly labeled:

**CONTAMINATED WITH
VINYL CHLORIDE
CANCER-SUSPECT AGENT**

[39 F.R. 41848, December 3, 1974.]

(4) Containers of polyvinyl chloride shall be legibly labeled:

**POLYVINYL CHLORIDE (OR TRADE
NAME)
Contains
VINYL CHLORIDE
VINYL CHLORIDE IS A CANCER-
SUSPECT AGENT**

(5) Containers of vinyl chloride shall be legibly labeled either:

(i)
**VINYL CHLORIDE
EXTREMELY FLAMMABLE GAS
UNDER PRESSURE
CANCER-SUSPECT AGENT**

or

(ii) In accordance with 49 CFR Parts 170-189, with the additional legend:

CANCER-SUSPECT AGENT

applied near the label or placard.

[39 F.R. 41848, December 3, 1974.]

(6) No statement shall appear on or near any required sign, label or instruction which contradicts or detracts from the effect of, any required warning, information or instruction.

(m) Records.

(1) All records maintained in accordance with this section shall include the name and social security number of each employee where relevant.

(2) Records of required monitoring and measuring, medical records, and authorized personnel rosters, shall be made and shall be available upon request for examination and copying to authorized representatives of the Assistant Secretary and the Director.

(i) Monitoring and measuring records shall:

(a) State the date of such monitoring and measuring and the concentrations determined and identify the instruments and methods used;

(b) Include any additional information necessary to determine individual employee exposures where such exposures are determined by means other than individual monitoring of employees; and

(c) Be maintained for not less than 30 years.

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(ii) Revoked

(iii) Medical records shall be maintained for the duration of the employment of each employee plus 20 years, or 30 years, whichever is longer.

(3) In the event that the employer ceases to do business and there is no successor to receive and retain his records for the prescribed period, these records shall be transmitted by registered mail to the Director, and each employee individually notified in writing of this transfer.

(4) Employees or their designated representatives shall be provided access to examine and copy records of required monitoring and measuring.

(5) Former employees shall be provided access to examine and copy required monitoring and measuring records reflecting their own exposures.

(6) Upon written request of any employee, a copy of the medical record of that employee shall be furnished to any physician designated by the employee.

(n) Reports.

(1) Not later than 1 month after the establishment of a regulated area, the following information shall be reported to the OSHA Area Director. Any changes to such information shall be reported within 15 days.

(i) The address and location of each establishment which has one or more regulated areas; and

(ii) The number of employees in each regulated area during normal operations, including maintenance.

(2) Emergencies, and the facts obtainable at that time, shall be reported within 24 hours to

the OSHA Area Director. Upon request of the Area Director, the employer shall submit additional information in writing relevant to the nature and extent of employee exposures and measures taken to prevent future emergencies of similar nature.

(3) Within 10 working days following any monitoring and measuring which discloses that any employee has been exposed, without regard to the use of respirators, in excess of the permissible exposure limit, each such employee shall be notified in writing of the results of the exposure measurement and the steps being taken to reduce the exposure to within the permissible exposure limit.

[39 F.R. 41848, December 3, 1974.]

(o) Effective dates.

(1) Until April 1, 1975, the provisions currently set forth in § 1910.93q of this Part shall apply.

(2) Effective April 1, 1975, the provisions set forth in § 1910.93q of this Part shall apply.

[40 F.R. 13211, March 25, 1975.]

APPENDIX A—SUPPLEMENTARY MEDICAL INFORMATION

When required tests under paragraph (k) (1) of this section show abnormalities, the tests should be repeated as soon as practicable, preferably within 3 to 4 weeks. If tests remain abnormal, consideration should be given to withdrawal of the employee from contact with vinyl chloride, while a more comprehensive examination is made.

Additional tests which may be useful:

A. For kidney dysfunction: urine examination for albumin, red blood cells, and exfoliative abnormal cells.

B. Pulmonary system: Forced vital capacity, Forced expiratory volume at 1 second, and chest roentgenogram (posterior-anterior, 14 x 17 inches).

C. Additional serum tests: Lactic acid dehydrogenase, lactic acid dehydrogenase isoenzyme, protein determination, and protein electrophoresis.

D. For a more comprehensive examination on repeated abnormal serum tests: Hepatitis B antigen, and liver scanning.

[39 F.R. 35889, October 4, 1974.]

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