S. D'Armond's copy.

Confidential

ETHYL CORPORATION

Inter-Office

with issue 1/4/72

TO: Mr. J. J. Bergin - I requested his comments -
Mr. H. O. Bourque " " info. from him by 2/1/72
Mr. L. G. Cliver - - - - - - - - - Need memo. from H.O.Smith 2/10/72
Mr. W. B. Heck " " he put S.H. items in books by 2/1/72
Mr. B. E. Hodge
Mr. J. C. Klock With request to Hoss & G. - - - Have not seen - S.Rogers 2/10/72
Mr. T. M. Mixon ——
Mr. W. C. Strader
Mr. D. C. Townsend With request to Hoss & G.C. - - - Need memo. 2/10/72.

FROM: S. A. D'Armond

SUBJECT: DISTRIBUTION NO. 2 - Study of Occupational Safety and Health Standards

DATE: January 4, 1972

Comments herein are relative to Occupational Safety and Health standards covered in Subparts G, H, I, J, K, L, M and N code of Federal Regulations, Title 29, Chapter XVII, Part 1910. The comments are derived from a study made by key people in Operations, Maintenance, Engineering, R&D and Safety.

Subparts A-B-C do not presently require study. Comments on Subparts D-E-F were issued as Distribution No. 1, dated August 31, 1971. Later distributions will be issued for revisions and/or to cover the remaining subparts which go through Subpart S.

The Baton Rouge plant is not, or may not be, in compliance with the following Federal Occupational Safety and Health Standards. (The study shows compliance with all other such standards in subparts included in this study applicable to the Baton Rouge plant.)

For training and recordkeeping Requirements See memo. attached from SAD to HOB, JEG, JCK 8/14/73.

SUBPART G - OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL

Standard

Par.1910.93 "Air Contaminants." See Exhibit "A" attached for details of the standard.

Remarks: Lead Area

At the present time, lead-in-air is monitored by air sampling equipment at various locations in the TEL-TML Areas. Samples are a composite for a 24-hour period. The OSHA standard regarding TEL and TML requires

C.W.O. APPROVED.
$1500 - 2/9/72 - Per. monitoring Equip.
$ 650 - 3/20/72 - Pumps.

E-02467

2057
ESTIMK

that "An employee's exposure in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average of 0.075 mg/M^3." A special task force has been established to make detailed studies regarding TLV compliance in the lead areas of the Baton Rouge and Houston plants. The first meeting of the task force was held 11/17/71.

Sodium Area

Vent imp. made - see letter from Causey to Brown 1/31/74

The Operating Superintendent says further study is needed in the use of barium chloride, calcium oxide (lime dissolving) sulfuric acid, scrubber gunk (carbon tetrachloride, chloroform, hexachloroethane, methalene chloride), and asbestos. By means of this memorandum, the Operating Superintendent is requested to spearhead studies with R&D and Dr. Rinehart, as needed, to determine if a problem exists and, if so, what is recommended.

4/4/72 Dale said he would work with Taylor on TLV's other than Asbestos.

SUP. OPER. INVESTIGATING THE PROB. SEE LETTER FROM J.A.M. 4/5/72.
Letter from Taylor 10/18/72 SAYS Respiratory Protection for operators not needed for Asbestos.

PVC Area See Taylors report on BaCl in Back of this Section & Montsinger's report.

Info. From H. Smith 4/5/72

The Operating Superintendent has indicated the following questionable areas of compliance:

OK. → 1. Adequacy of dust masks worn by operators in the blending area. Efficiency of dust removed by the masks should be checked if possible. The Superintendent plans to continue work on dust control to eliminate remaining dust sources as much as possible.

Checked OK → 2. Concentrations that might develop from vaporization of materials when heated in the FCM and on the Mill. These concentrations should be determined if feasible.

Will discuss with Taylor 4/10/73 - - - → 3. Autoclave Additives - - ammonia, hydrogen peroxide, sodium hydroxide and copper sulfate. These are handled in well ventilated areas. Concentrations should not be at TLV's but no actual measurements have been made. Suggest measurements be made if reasonably possible.

Respirators are presently used as needed. Proj. 0917 Budgeted for 1974 Should improve dust control → 4. Concentrations that might develop in the air in the Compound Room.

This said under normal Conditions CPRS Should we Review Allowable T-V.

See Letter runnings to CWH 3/29/72 EX. FOR TEST ED. APP FOR 9/1925

The writer adds the possible need for monitoring VCM vapors in the Reactor Area. By means of this memorandum, the Operating Superintendent is requested to spearhead studies with R&D and Dr. Rinehart, as needed, to determine if a problem exists and, if so, what is recommended.

H-C Area ETC 14661 E-02468

The writer recommends monitoring VCM vapors at the tank car loading spots. By means of this memorandum, the Operating Superintendent is requested to spearhead studies with R&D and Dr. Rinehart, as needed, to determine if a problem exists and, if so, what is recommended. SEE LETTER FROM H.G.O. 3/20/72. T. SER.

ACTIVELY WORKING ON PROB. 4/10/73 - d/scn said R&D working out analytical Anl. for control Lab — plan to check up in 10th. as want as loading spots. FOR VCL SEE LETTER FROM LENTZ 7/31/73.

AS OF 4/11/72 Have Spent $4,075 for test equip. - for this std.

When studies are complete in TEL-SOD-PVC-H.C., the oper. Supt's are requested to furnish the writer with reports.

Par.1910.94(a)(2)(ii) "The concentration of respirable dust or fume in the breathing zone of the abrasive-blasting operator or any other worker shall be kept below the levels specified in Par.1910.93."

Done 10/9/72

Remarks: This standard will be put in the Safety-How book and supervision will be responsible for following it. Your attention is called to other workers noted in the standard. Other workers near Drum Sandblasting Shed could be a case-in point. 4/11/73, Sterenson will work with Taylor to determine what needs to be done, if anything, at Drum Sandblasting area.

Par.1910.94(a)(5)(v) "Operators shall be equipped with heavy canvas or leather gloves and aprons or equivalent protection to protect them from the impact of abrasives. Safety shoes shall be worn to protect against foot injury where heavy pieces of work are handled."

Remarks: This standard applies to abrasive blasting -- such as sandblast area near Central Shops and Drum blasting area. We do not require (and therefore do not furnish) safety shoes as called for in the standard. By means of this memorandum, comments on safety shoes are requested from Messrs. Strader and Bourque. Rec states not enough foot injuries to justify Safety Shoes; writer's note: Many jobs are as subject to foot Inj. as blast operators and OSHA is silent on their G.S. requirements. Recommendation is Status Quo.

Par.1910.94(a)(6) "Air supply and air compressors. The air for abrasive-blasting respirators shall be free of harmful quantities of dusts, mists, or noxious gases, and shall meet the requirements for air purity set forth in ANSI Z9.2-1960. (Note by Bill Heck - ANSI requirement - air must have less than 20 ppm CO, 1000 ppm CO_2) The air from the regular compressed air line of the plant may be used for the abrasive-blasting respirator if (i) a trap and carbon filter are installed and regularly maintained, to remove oil, water, scale, and odor, (ii) a pressure reducing diaphragm or valve is installed to reduce the pressure down to requirements of the particular type of abrasive-blasting respirator, and (iii) an automatic control is provided to either sound an alarm or shut down the compressor in case of over-heating."

Remarks: The Power Superintendent is requested to provide the writer with compliance data regarding air purity, and requirement (iii). It is our understanding that we are in known compliance with all other requirements in article (a)(6). O.K. See HOE INFO.

I.H.O.E. recommends Sampling once/shift. Cap. Cost Less than $1000 ea. SEE HOE INFO.
W.A.S. Letter 4/9/73 says start collecting Data Cert DFC

Par.1910.94(b)(2) "Application. (i) Every establishment performing dry grinding, dry polishing, or buffing shall provide suitable hood or enclosures that are connected to exhaust systems." #1303

E-02469

* HAVE 12 GRINDERS WITH EXHAUST SYSTEMS, 11 ARE IN CENTRAL SHOPS AND ONE IN TE-IRON W. SHOP. ALL 12 COMPLY WITH O.S.H.A. & THIS IS WHERE MOST GRINDING IS DONE. HAVE 26 GRIN WITH NO EXHAUST, MOST ARE NOT USED MUCH. ROBT. NIMS LETTER SAYS ON SINGLE GRINDERS, EX. SYSTEM NOT NEEDE IF DUST DOES NOT EXCEED TLVS. ASK DR. RINEHART TO CHK. 100 OF 26 WHERE TLV MAY BE QUESTIONABLE. EX. SY. FOR 26 COST $18,00

Remarks: O.K. As is - See H.M. Taylor Letter 2/9/73

Maintenance is requested to list all specific locations where such work is done and send a copy of the list to Mr. Don Townsend in Engineering. Engineering is requested to analyze for compliance in reference to Exhibit "B" attached and advise the writer of findings and/or recommendations.

*

Par.1910.94(c) "Spray-Finishing Operations"-- See requirements in Exhibit "C" attached.

Remarks: This standard would apply to such spray painting operations as those in the Drumming Plant and Central Shops. By means of this memorandum, Engineering is requested to check compliance versus requirements called for in (6)(i) and (6)(ii) and advise the writer of findings, including recommendations if needed. Nothing needed See Letter from Bugas. 3/14/72. EX need to clean D.P. booth fan blades & check V-Belt drive for wear & Tensio

Par.1910.95 "Occupational Noise Exposure"

Remarks: A plantwide study has been made and reports issued. 4/19/72 IN COMP. IN PRC & H.C.

** Cost to date $13,000 of which: $5000 Base study, 4000 subsequent Eng. Work, 4000 Investment for changes. See Letter from WALTMAN 4/19/72

SUBPART H - HAZARDOUS MATERIALS

Standard

Par.1910.101 Compressed Gases (a) Inspection of Compressed Gas Cylinders. "Each employer shall determine that compressed gas cylinders under his control are in a safe condition to the extent that this can be determined by visual inspection."

Remarks: There is no visual inspection system in the H-C Area. Implemented 4/1/72 SEE LETTER FROM H.C Operations are now taking steps to set up the required system. Operations is requested to advise the writer when this is put into effect. See Letters from H&S & M.J. Benaventure. IN COMPLIANCE.

Par.1910.104(b)(8)(viii) Oxygen - Placarding. "The bulk oxygen storage location shall be permanently placarded to indicate: OXYGEN - NO SMOKING - NO OPEN FLAMES, or any equivalent warning."

Remarks: This standard applies to bulk storage at Central Shops & Sod Sh By means of this memorandum, Shops supervision is requested to have a suitable sign mounted. It is also suggested (by Mr. W. B. Heck - not required in standard) that the sign denote; "Hot Work Permit Required Within 50 Feet" and "Obtain Supervision Permission Before Unloading Oxygen." Shops supervision is requested to advise the writer on final action taken. H.O.B. says this not needed. H.O.B. IS PUTTING UP SIGNS; OXYGEN-NO OPEN FLAMES. 3/72. SEE HOB. INFO. COMPLETE.

Par.1910.106(b) "(i) Design and Construction of Tanks, (iii) Atmospheric Tanks, (iv) Low Pressure Tanks, and (v) Pressure Vessels."

** Par. 1910.106 (m)(1) IN COMPLIANCE "Every employer shall maintain records of the radiation exposure of all employees for whom personnel monitoring is required under par.(d) of this section and advise each of his employees of his individual exposure on at least an annual basis."

Remarks: OSHA ALSO SAYS OK to follow state laws already by AEC, Dr. Robinson says have such state law and he says recommends only if asked. — therefore this is very mild will enforce

E-02470

ETC 14663

Remarks:

OSHA standards call for design and construction to be in accordance with definitive codes of a specific year such as 1968. We find two things wrong with such dates. First, we have tanks built many years prior to 1968. Second, flexibility is not provided to use standards revised and republished subsequent to 1968.

The incorrectness in the use of specific dates should be pointed out to OSHA so that the permanent standards that will be promulgated in 1973 will be correct. By means of this memorandum, Mr. Bergin is asked for advice on how to get the changes made. 1/17/72 JTB SAID HE IS CONFIDENT ADEQUATE CORRECTIONS WILL BE MADE WITHOUT US NOTIFYING OSHA

Par.1910.106(b)(2)(v)(h)

Flammable and Combustible Liquids - "Each commercial tank venting device shall have stamped on it the opening pressure, the pressure at which the valve reaches the full open position, and the flow capacity at the latter pressure expressed in cubic feet per hour of air at 60°F and at a pressure of 14.7 PSIA. (i)The flow capacity of tank venting devices 12 inches and smaller in nominal pipe size shall be determined by actual test of each type and size of vent. These flow tests may be conducted by the manufacturer if certified by a qualified impartial observer, or may be conducted by an outside agency."

Remarks:

H-C, TEL and PVC Areas

The safety valves on flammable and combustible liquids in these areas have the opening pressure stamped on a tag, but not the pressure at which the valve reaches full open position, nor the flow capacity as required.

4/11/73. Eng. is developing this info. which in turn will be given to the inspectors to put on valve Cards and Valves if practable. 11/8/73 Letter from L R. Parker outlines Procedures that Should be Satisfactory.

By means of this memorandum, Mr. Bourque and Mr. Townsend are asked to furnish the writer recommendations on a system that will provide the necessary information. See Letter from Dugas 2/29/72. Eng. is working w/ valve suppliers. See 5/11/72 Letter from Du

Par.1910.106(b)(2)(vii)

Flammable and Combustible Liquids - "Drainage, Dikes, and Walls for Above-ground Tanks. (b)Drainage. Where protection of adjoining property or waterways is by means of a natural or man-made drainage system, such systems shall comply with the following:

(3)The drainage, including automatic drainage pumps, shall not discharge to adjoining property, natural water courses, public sewers, or public drains unless the discharge of flammable or combustible liquids would not constitute a hazard, or the system is so designed that it will not permit flammable or combustible liquids to be released."

Remarks:

TEL, PVC and H-C Areas

The drainage on the storage tank dikes is routed to the surface drain.

* 9/27/72. McGEE CHECKED TEC-SER. AND ADVISED ME THAT PRESENT BASIN PROT. NEAR FENCE WOULD CONTAIN SPILLS & THEREFORE THIS PROB. IS ADEQUATELY HANDLED.

The Operations Manager suggests further study on this problem in conjunction with the provision of an oil skimmer. The Operations Manager is requested to keep the writer advised of work on this problem.

(b) * SEE ABOVE, OSHA Dir. 100-11 said this std. does not apply where it does not have substantial relationship to Safety & Health of Employees.

Par.1910.106(2)(vii)(c) Diked Areas for Above-ground Tanks. Subparagraph (4) "The walls of the diked area shall be restricted to an average height of 6 feet above interior grade."

Remarks: The walls around our TEL fluid tanks are much higher than 6 feet. We feel this standard should be changed and request advice from Mr. Bergin similar to the second paragraph on page 5. 1/17/72. T.T.B thinks we are OK. Suggests doing nothing except rerouting certain drain lines now underway. I AGree since this std. regards protecting adjoining property or waterways. J.E.D.

Par.1910.106(c)(6) Flammable and Combustible Liquids - Valves. "Piping systems shall contain a sufficient number of valves to operate the system properly and to protect the plant. Piping systems in connection with pumps shall contain a sufficient number of valves to control properly the flow of liquid in normal operation and in the event of physical damage. Each connection to pipelines, by which equipment such as tankcars or tank vehicles discharge liquids by means of pumps into storage tanks, shall be provided with a check valve for automatic protection against backflow if the piping arrangement is such that backflow from the system is possible."

Remarks: <u>TEL, PVC and H-C Areas</u>

Existing arrangement has adequate check valve. See Letter from Dugas 3/14/1 & Prgm W.G.9-3130/72 - in Compliance

There are several systems that may be in violation of this standard; i.e., <u>MeOH unloading in the H-C Area,</u> (1) TML catalyst unloading in the TEL Area and raw material unloading at PVC. Engineering is requested to check and advise on findings

See Letter 3/8/72 H.G.S. to G.C. W.O. issued to install check valve between Filter & Tank on Plasticizer unloading system. (1) not require of see letter from Dugas 3/14/72.

Par.1910.106(e)(6)(ii) "Grounding. Class I liquids shall not be dispersed into containers unless the nozzle and container are electrically interconnected. Where the metallic floor plate 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."

"Class I liquids shall include those having flashpoints below 100°F and may be subdivided as follows:

"Class IA shall include those having flashpoints below 73°F and having a boiling point below 100°F.

"Class IB shall include those having flashpoints below 73°F and having a boiling point at or above 100°F.

"Class IC shall include those having flashpoints at or above 73°F and below 100°F."

The above identification of Class I liquids is from Par. 1910.106(a)(19).

Done 10/9/72 Par. 103.02 (b)(2)

Remarks: This standard will be added to the Safety-How book. Supervision will be responsible for following the standard. W.O. issued for Area Lab. See Letter from M.T.R. 2/11/72.

Par.1910.106(f)(iii) "Piling Containers. Containers of flammable or combustible liquids when piled one upon the other shall be separated by dunnage sufficient to provide stability and to prevent excessive stress on container walls. The height of the pile shall be consistent with the stability and strength of containers."

Done 10/9/72 Par. 103.02(c)(2)

Remarks: This standard will be added to the Safety-How book. Supervision will be responsible for following the standard.

Par.1910.106(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 process but shall not apply to chemical plants, refineries or distilleries."
(3) "Process buildings."
(3)(iv) "Explosion relief. Areas where Class IA or unstable liquids are processed shall have explosive venting through one or more of the following methods:
(a) open air construction,
(b) lightweight walls and roof,
(c) lightweight wall panels and roof hatches,
(d) windows of explosion venting type."

Remarks: TEL and TML buildings contain alkylation operations with Class IA liquids, Ethyl Chloride and Methyl Chloride. However, we feel that this standard does not apply to us since the Ethyl plant is a chemical plant and chemical plants are exempt. See Rohm & Haas items in front of this book which supports our feelings.

Par.1910.106(4)(ii)(c) "Piping containing flammable or combustible liquids shall be identified."

Remarks: Ben Hodge attended an OSHA workshop in New Orleans 9/21/71. He said that identification requirements were under development by OSHA and more information would be forthcoming. The writer recommends status quo until more details are received from OSHA.

Par.1910.107(d)(1) "Spray Finishing using Flammable and Combustible Materials. (d) Ventilation - (1) Conformance. Ventilating and exhaust systems shall be in accordance with the standard for Blower and Exhaust Systems for Vapor Removal, NFPA No. 91-1961 where applicable and shall also conform to the provisions of this section."

Remarks: By means of this memorandum, Engineering is requested to check the drum painting system in the TEL Area and advise the writer of findings. OK. See letter from Dugas 2/29/72. IN COMPLIANCE

1910.107(a)(2) Need to chk Spray painting in Tank Car Rep. Shop. See 9/7/73 Letter from Conrad.

Par.1910.110(b)(1)(i) Storage and Handling of Liquified Petroleum Gases - Odorizing Gases. "All liquified 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-fifty the lower limit of flammability. Odorization, however, is not required if harmful in the use of further processing of the liquified petroleum gas, or if odorization will serve no useful purpose as a warning agent in such use or further processing."

Remarks: Propane used in the refrigeration system in the H-C Area is not odorized. Engineering and Tech Service are requested to recommend method of odorizing and costs. Tech Service is requested to check process.
SEE LETTER FROM H.G.O. 3/30/72 - HE SAYS COST TO odorize is $2000 & would PROVIDE NO USEFUL PURPOSE AS WARNING AGENT BECAUSE OF THE CHARACTERISTIC ODOR OF PROPANE. SAME INFO. IN LETTER FROM DUG AS 5/16/72.

SUBPART I - PERSONAL PROTECTIVE EQUIPMENT

Standard

Par.1910.134(e)(3) "Written procedures shall be prepared covering safe use of respirators in dangerous atmospheres that might be encountered in normal operations or in emergencies. Personnel shall be familiar with these procedures and the available respirators."

Remarks: Written procedures were sent to each Superintendent 12/10/71. These procedures will also be put in the Safety-How book. See attachment. Also see letter H.G.S. to L.G.C 2/8/72.
└ Done 10/9/72

1910.134(e)(5)(ii) "Wearing of contact lenses in contaminated atmospheres with a respirator shall not be allowed."

Remarks: This will be put in the Safety-How book and is to be followed. └ was - 10/9/72

Par.1910.134(f)(2)(iv) "A record shall be kept of inspection dates and findings for respirators maintained for emergency use."

Remarks: TEL, PVC, Sodium, H-C Operations (Fire Inspection and any other group with such responsibilities) are requested to keep such records and advise the writer the date this procedure is implemented. Sod. effective 3/17/72 see Letter in this sect. from S.D. PVC effective 3/8/72. See Letter H.G.S. to L.G.C. H.C. effective 4/1/72 SEE LETTER FROM H.G.O. 3/30/72. TEL RECORDS FILED BY SECURITY - SEE LETTER FROM T.A.M. 5/3/72.

SUBPART J - GENERAL ENVIRONMENTAL CONTROLS Occ. Saf. & H. Reporter 1/27/72. Interpretations pg. 792 (1) Proposed revocation of specific requirements for lights and locks.

Standard (1) He is director of OSHA office of Stds.

Par.1910.141(b)(2)(i) Nonpotable Water. "Outlets for nonpotable water, such as water for industrial or firefighting purposes only, shall be posted to indicate clearly that the water is unsafe and is not to be used for drinking, washing, or cooking purposes."

Remarks:

By means of this memorandum, the department managers are requested to have such postings made and advise the writer when complete. *postings up in H.C. & SOD But not in TEL & ... According to W.A.S. Letter of 11/7/73.*

Par.1910.141(c)(2)(i)

Toilet Facilities. "Each toilet facility (closet) shall occupy a separate compartment, which should be equipped with a door, latch, and clothes hanger."

Remarks:

Some of the toilets in the PVC and TEL areas do not have doors. By means of this memorandum, it is suggested that the Operations Manager authorize the PVC and TEL operating superintendents to have the necessary doors (equipped with latches and clothes hangers) installed and advise the writer when complete. *W.O. in PVC issued 3/72 — See Letter HGS to LGC.* *W.O. issued for Area Lab. 8/72.* *BNA 11/20/72. Am. Airlines Maint. & Eng. Center cited for men's toilet Facilities without doors. See J.A.M. Letter of 4/15/72 which says All areas have issued necessary W.O. to Comply with this regulation.*

Par.1910.141(b)(2)(ii) (iii)(iv)

Sanitation - Water Supply. "There shall be no cross-connection, open or potential, between a system furnishing potable water and a system furnishing non-potable water." *OK says H.O.B. - in compliance*

"Construction shall be such as to prevent backflow of contaminated water into a potable water system." *H.O.B. says we are in compliance.*

U.S. ... in this section ... [illegible]

"Nonpotable water shall not be used for bathing or for washing any portion of the person, clothing, dishes, or premises." *Removed in 1973 when std. was changed.*

Remarks: *Water has been tested and is OK. However have put Signs up in these Locations advising not to Drink. 2/23/73*

We are in ~~violation~~ *Questionable Compliance* of this standard in several areas, such as the safety showers and lavatories in the TEL Buildings, the old safety showers in the Sodium area, etc. Also, ~~nonpotable~~ *non-drinking* water is used to wash down *premises* in all areas. Engineering is now preparing an estimate to convert the safety showers and lavatories in the TEL and Sodium areas. The operations superintendents are requested to advise the writer on action or nonaction taken after the estimate is available. By means of this memorandum, Mr. Bergin is asked for advice regarding our use of non-potable water for wash down of premises. *OSHA now OK's. June '73.* *OK - due to OSHA chg. First 1/2 of 7* *$90,000 Attached*

Par.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.

(a)Fire alarm boxes (pull boxes).

(b)Fire blanket boxes.

(c)Fire buckets or pails.

(d)Fire exit signs.

(e)Fire extinguishers (if painting the extinguisher is impractical or undesirable, color should be used on the housing wall, or support to identify the location).

(f)Fire hose locations (color should be used on reel, supports, or housing but not on the hose).

(g)Fire hydrants (industrial).

(h)Fire pumps.

(i)Fire sirens.

[illegible handwritten margin notes]

(j)Post indicator valves for sprinkler system (it is suggested that if a traffic hazard is involved, the top should be colored red, and the barrel or post yellow and black stripes).

(k)Sprinkler piping. (See ANSI Standard Scheme for the Identification of Piping Systems A13.1-1956.)

(ii)Danger. Safety cans or other portable containers of flammable liquids having a flashpoint at of 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 Building 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. Orange shall be used as the basic color for designating dangerous parts of machines or energized equipment which may cut, crush, shock, or otherwise injure and to emphasize such hazards when enclosure doors are open or when gear belt, other guards around moving equipment are open or removed, exposing unguarded hazards.

(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.

Green not for Safety — Showers. See Letter from Olson 4/19/72

(4)Green. Green shall be used as the basic color for designating "Safety" and the location of first aid equipment (other than firefighting equipment).

(5)Blue. Blue shall be the basic color for designating caution, limited to warning against the starting, the use of, or the movement of equipment under repair, or being worked upon.

(6)Purple. Purple shall be the basic color for designating radiation hazards. "Radiation" as used in this subparagraph refers to radiation types as X-ray, alpha, beta, gamma, neutron, proton, deutron, and meson. Yellow should be used in combination with purple for markers such as tags, labels, signs, and floor markers.

(7)Black, white, or combinations of black and white. Black, white, or a combination of these two, shall be the basic colors for the designation of traffic and housekeeping markings. Solid white, solid black, single color striping, alternate stripes of black and white, or black and white checkers should be used in accordance with local conditions.

(b)Color specifications. Colors shall meet the tests specified in section 3, Color Definitions, of ANSI Z53.1-1967, Safety Color Code for Marking Physical Hazards."

Remarks: The plant is in compliance in many instances. It is suggested that the Resident Manager request the section managers have the safety color code system implemented plant wide and that the writer be advised when it is fully implemented. 5/31/72. Key plt People from Eng. & Maint. working on Problem of Color stds, WAIT FOR OSHA TO CH. STD.

Par.1910.145(a)(2) "Specification for Accident Prevention Signs and Tags. All new signs and replacment of old signs on or after August 31, 1971 shall be in accordance with these specifications."

Remarks: OSHA specifications will be put in the Safety-How book and supervision will be responsible for following them. See Exhibit "D" for OSHA specifications. OSHA Schedule shows plan to revoke Section on color Code [illegible] Physical Hazard, & size of signs. Recommend status [illegible] cleared up. 5/31/72.

SUBPART K - MEDICAL AND FIRST AID

IN COMPLIANCE

SUBPART L - FIRE PROTECTION

Standard

Par. 1910.157 — — — — — — — (1) Portable Fire Extinguishers - General Requirements - See Letter from [illegible]

Par.1910.157(b)(2)(4) Portable Fire Extinguishers. "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."

Remarks: Superintendents whose people use this equipment are requested to work with Fire Inspection Supervision to (1) get cost of converting horns to plastic, (2) get approval or non-approval from management for expenditure, and (3) advise writer of ultimate action. HOB says can be done for under $100 & do on W.O. See HOB info. Letter from Dixon 4/28/72 SAYS NOW ALL HAVE PLASTIC HORNS.

Par.1910.157(d)(4)(iii) Hydrostatic Test Intervals for Extinguishers. "Dry chemical extinguisers with brased-brass shells or mild steel shell - 12 year test interval."

Remarks: We have about ~~200~~ 500 such extinguishers. None have been given a periodic test. It is my understanding that a company named Arthur Dooley and Sons, Beaumont, Texas, with a branch in Baton Rouge will do the required test work for $6.00 per extinguisher. It is recommended that Fire Inspection Superintendent get approval for necessary expenditure, including purchase of spares if necessary during testing, and get the necessary testing done. Please notify the writer when action is complete. Testing started wk. of 2/7/72.

TEST Total Cost $3000
See [illegible] Letter 4/26/72

ETC 14670

SUBPART M - COMPRESSED GAS AND COMPRESSED AIR EQUIPMENT

IN COMPLIANCE

1910.157(d)(4)(iii) in compliance regarding [illegible] in [illegible]

(1) To get in Compliance 2 Extinguishers were relocated in TEL & 1 in PVC, one additional Extinguisher was installed in PVC, completed in 1972.

E-02477

SUBPART N - MATERIALS HANDLING AND STORAGE

Standard

Par.1910.176(e) Materials Handling. Clearance Limits. "Clearance signs to warn of clearance limits shall be provided."

Remarks: There are several doors in the PVC area that should be marked. The PVC Operating Superintendent is requested to notify the writer when this is done. DONE - See Letter HGS to LGC 2/8/72 See Letter from MJB 2/11/72.

Par.1910.176(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."

Remarks: TEL Area - There is no derail on the spur used for unloading lead. By means of this memorandum, Mr. Bourque is requested to provide the Resident Manager with cost to install a derail and advise the writer when and if installed. #250 - See HOB info. Complete 10/24/73 #250

Par.1910.178(a)(2) "New Powered Industrial Trucks."

Remarks: Requisitions for new trucks should state that they are to be built in accordance with OSHA standards. See my letter to W. Mitchell, dated 2/10/72.

Par.1910.178(k) Trucks and Railroad Cars. "(1) The brakes of highway trucks shall be set and wheel chocks placed under the rear wheels to prevent the trucks from rolling while they are boarded with powered industrial trucks. (2) Wheel stops or other recognized positive protection shall be provided to prevent railroad cars from moving during loading or unloading operations."

Remarks: By means of this memorandum, all superintendents are requested to adhere to this standard and the standard will be put in the Safety-How book. Done 10/9/72 par. 504.1 & 2.

Par. 1910.178 (K)(4) See my letter to McGee & Stevenson & their response. (Rack Ext. on #20 Towmotor For Less than #200/mo.)

Par.1910.178(m)(5) "When leaving a powered industrial truck unattended, load engaging means shall be fully lowered, controls shall be neutralized, power shut off, brakes set, key or connector plug removed. Wheels shall be blocked if the truck is parked on an incline."

OSHA REMOVED FROM STD. EARLY 1973

Remarks: Keys are not removed on such trucks in the Baton Rouge plant. Other companies have been given OSHA citations for such omissions. By means of this memorandum, section managers are requested to arrive at a decision on how to handle the problem and advise the writer.

OSHA EXCHANGE VOIDS THIS

Par.1910.178(m)(12)(ii) Powered Industrial Trucks. "Means shall be provided whereby personnel on the platform (elevated) can shut off power to truck."

Remarks: PVC Area has an elevated platform without this shut-off. The PVC Operating Superintendent is requested to determine means and cost of such shut-off, discuss with Resident Manager and advise the writer when and if installed. Such shut off not needed because a second man is always on the truck at controls. See letter WGS to LGC 3/8/72. Rome & Haas Letter shows we are ok with second man.

Par.1910.179(b)(2) Overhead and Gantry Cranes. "New and existing equipment. All new overhead and gantry cranes constructed and installed after August 31, 1971, shall meet the design specifications of the American National Standard Safety Code for Overhead and Gantry Cranes, ANSI B30.2.0-1967. Overhead and gantry cranes constructed before August 31, 1971 should be modified to conform to those design specifications by February 15, 1972, unless it can be shown that the crane cannot feasibly or economically be altered and that the crane substantially complies with the requirements of this Section."

Remarks: Requisitions for any new cranes should state that they are to be built in accordance with OSHA regulations.

The Maintenance Manager is requested to get a copy of the ANSI standard and make modification determination regarding existing cranes. Notify the writer of final disposition of this problem. SEE LETTER FROM W.A.S. 4/18/72 will cost abt. $5000 to put bumpers on 16 cranes. ? We question getting any safety imp. from this. In 1973 std. changed to eliminate our need for bumpers as I see the stds. SAB

Par.1910.179(b)(5) Overhead and Gantry Cranes. "The rated load of the crane shall be plainly marked on each side of the crane, and if the crane has more than one hoisting unit, each hoist shall have its rated load marked on it or its load block and this marking shall be clearly legible from the ground or floor."

Remarks: Most of the cranes on the plant do not have this rated load marking. By means of this memorandum, supervision responsible are requested to provide the requested markings and advise the writer when completed. SEE HOC info. of 3/29/72 which says markings will be put on all maint. cranes in near future, not on sludge cranes, ALSO LETTER FROM W.A.S. 4/18/72. Stevenson Letter 2/19/73 Says Complete.

Par.1910.180(b)(2) Crawler, Locomotive and Truck Cranes. "New and existing equipment. All new crawler, locomotive, and truck crane constructed and utilized on or after August 31, 1971 shall meet the design specifications of the American National Standard Code for Crawler, Locomotive, and Truck Cranes, ANSI B30.5-1968. Crawler, locomotive, and truck cranes constructed prior to August 31, 1971 should be modified to conform to those design specifications by February 15, 1972, unless it can be shown that the crane cannot feasibly or economically be altered and that the crane substantially complies with the requirements of this Section." See completion Notice from Overmeyer 6/28/7?

Remarks: Requisitions for any new crawler, locomotive and truck cranes should state that they are to be built in accordance with OSHA regulations.

1910.184 Slings – See Letter in this section Fleischer [illegible] 73. [illegible]

The Maintenance Manager is requested to get a copy of the ANSI standard and make modification determination regarding existing equipment. Notify the writer of final disposition of this problem. HOB obtained ANSI stds. & he says we are in compliance. See HOB info. 3/29/72 and W.F.S. letter 4/14/72

S. A. D'Armond

SAD:mmj

Attachments

ETC 14673

E-02480

OCCUPATIONAL SAFETY AND HEALTH STANDARDS
SUBPART G – OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL

(Code of Federal Regulations, Title 29, Chapter XVII, Part 1910)

Subpart G—Occupational Health and Environmental Control

§ 1910.93 Air contaminants.

An employee's exposure to any material listed in table G–1, G–2, or G–3 of this section shall be limited in accordance with the requirements of the following paragraphs of this section.

(a) Table G–1:

(1) *Materials with names preceded by "C"—Ceiling Values.* An employee's exposure to any material in table G–1, the name of which is preceded by a "C" (e.g., C Boron trifluoride), shall at no time exceed the ceiling value given for that material in the table.

(2) *Other materials—8-hour time weighted averages.* An employee's exposure to any material in table G–1, the name of which is not preceded by "C", in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average given for that material in the table.

(b) Table G–2:

(1) *8-hour time weighted averages.* An employee's exposure to any material listed in table G–2, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that material in the table.

(2) *Acceptable ceiling concentrations.* An employee's exposure to a material listed in table G–2 shall not exceed at any time during an 8-hour shift the acceptable ceiling concentration limit given for the material in the table, except for a time period, and up to a concentration not exceeding the maximum duration and concentration allowed in the column under "acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift".

(3) *Example.* During an 8-hour work shift, an employee may be exposed to a concentration of Benzene above 25 p.p.m. (but never above 50 p.p.m.) only for a maximum period of 10 minutes. Such exposure must be compensated by exposures to concentrations less than 10 p.p.m. so that the cumulative exposure for the entire 8-hour work shift does not exceed a weighted average of 10 p.p.m.

(c) Table G–3: An employee's exposure to any material listed in table G–3, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that material in the table.

(d) Computation formulae:

(1) (i) The cumulative exposure for an 8-hour work shift shall be computed as follows:

$$E=\frac{C_1T_1+C_2T_2+\ \ldots\ C_nT_n}{8}$$

where:

E is the equivalent exposure for the working shift.

C is the concentration during any period of time *T* where the concentration remains constant.

T is the duration in hours of the exposure at the concentration C.

The value of *E* shall not exceed the 8-hour time weighted average limit in table G–1, G–2, or G–3 for the material involved.

(ii) To illustrate the formula prescribed in subdivision (i) of this subparagraph, note that isomyl acetate has an 8-hour time weighted average limit of 100 p.p.m. (table G–1). Assume that an employee is subject to the following exposure:

Two hours exposure at 150 p.p.m.
Two hours exposure at 75 p.p.m.
Four hours exposure at 50 p.p.m.

Substituting this information in the formula, we have

$$\frac{2\times150+2\times75+4\times50}{8}=81\text{ p.p.m.}$$

100

Since 81 p.p.m. is less than eight, the 8-hour time weighted average limit, the exposure is acceptable.

(2) (i) In case of a mixture of air contaminants an employer shall compute the equivalent exposure as follows:

$$E_m=\frac{C_1}{L_1}+\frac{C_2}{L_2}+\ \ldots\ \frac{C_n}{L_n}$$

Where:

E_m is the equivalent exposure for the mixture.

C is the concentration of a particular contaminant.

L is the exposure limit for that contaminant, from table G–1, G–2, or G–3.

The value of E_m shall not exceed unity (1).

(ii) To illustrate the formula prescribed in subdivision (i) of this subparagraph, consider the following exposures:

Material	Actual concentration of 8-hour exposure	8-hour time weighted average exposure limit
Acetone (Table G-1)	500 p.p.m.	1,000 p.p.m.
2-Butanone (Table G-1)	45 p.p.m.	200 p.p.m.
Toluene (Table G-2)	40 p.p.m.	200 p.p.m.

Substituting in the formula, we have:

$$E_m=\frac{500}{1,000}+\frac{45}{200}+\frac{40}{200}$$

$E_m=0500+0225+0200$

$E_m=0925$

Since E_m is less than unity (1), the exposure combination is within acceptable limits.

(e) To achieve compliance with paragraph (a) through (d) of this section administrative or engineering controls must first be determined and implemented whenever feasible. When such controls are not feasible to achieve full compliance, protective equipment or any other protective measures shall be used to keep the exposure of employees to air contaminants within the limits prescribed in this section. Any equipment and technical measure use for this purpose must be approved for each particular use by a competent industrial hygienist or other technically qualified person. Whenever respirators are used, their use shall comply with § 1913.134 of this chapter.

TABLE G-1

Substance	p.p.m.[a]	mg./m³[a]
Acetaldehyde	200	360
Acetic acid	10	25
Acetic anhydride	5	20
Acetone	1,000	2,400
Acetonitrile	40	70
Acetylene dichloride, see 1, 2-Dichloroethylene		
Acetylene tetrabromide	1	14
Acrolein	0.1	0.25
Acrylamide—Skin		0.3
Acrylonitrile—Skin	20	45
Aldrin—Skin		0.25
Allyl alcohol—Skin	2	5
Allyl chloride	1	3
**C Allyl glycidyl ether (AGE)	10	45
Allyl propyl disulfide	2	12
2-Aminoethanol, see Ethanolamine		
2-Aminopyridine	0.5	2
**Ammonia	50	35
Ammonium sulfamate (Ammate)		15
n-Amyl acetate	100	525
sec-Amyl acetate	125	650
Aniline—Skin	5	19
Anisidine (o, p-isomers)—Skin		0.5
Antimony and compounds (as Sb)		0.5
ANTU (alpha naphthyl thiourea)		0.3
Arsenic and compounds (as As)		0.5
Arsine	0.05	0.2
Azinphos-methyl—Skin		0.2
Barium (soluble compounds)		0.5
p-Benzoquinone, see Quinone		
Benzoyl peroxide		5
Benzyl chloride	1	5
Biphenyl, see Diphenyl		
Bisphenol A, see Diglycidyl ether		
Boron oxide		15
C Boron trifluoride	1	3
Bromine	0.1	0.7
Bromoform—Skin	0.5	5
Butadiene (1, 3-butadiene)	1,000	2,200
Butanethiol, see Butyl mercaptan		
2-Butanone	200	590

E-02481

This par. was revised as shown herein Aug. 13, 1971

ETC 14674

TABLE G-I—Continued

Substance	p.p.m.[a]	mg./M³ [b]
2-Butoxy ethanol (Butyl Cellosolve)—Skin	50	240
Butyl acetate (n-butyl acetate)	150	710
sec-Butyl acetate	200	950
tert-Butyl acetate	200	950
Butyl alcohol	100	300
sec-Butyl alcohol	150	450
tert-Butyl alcohol	100	300
C Butylamine—Skin	5	15
C tert-Butyl chromate (as CrO_3)—Skin		0.1
n-Butyl glycidyl ether (BGE)	50	270
*Butyl mercaptan	10	35
p-tert-Butyltoluene	10	60
Calcium arsenate		1
Calcium oxide		5
**Camphor	2	
Carbaryl (Sevin®)		5
Carbon black		3.5
Carbon dioxide	5,000	9,000
Carbon monoxide	50	55
Chlordane—Skin		0.5
Chlorinated camphene—Skin		0.5
Chlorinated diphenyl oxide		0.5
*Chlorine	1	3
Chlorine dioxide	0.1	0.3
C Chlorine trifluoride	0.1	0.4
C Chloroacetaldehyde	1	3
α-Chloroacetophenone (phenacylchloride)	0.05	0.3
Chlorobenzene (monochlorobenzene)	75	350
o-Chlorobenzylidene malononitrile (OCBM)	0.05	0.4
Chlorobromomethane	200	1,050
2-Chloro-1,3-butadiene, see Chloroprene		
Chlorodiphenyl (42 percent Chlorine)—Skin		1
Chlorodiphenyl (54 percent Chlorine)—Skin		0.5
1-Chloro,2,3-epoxypropane, see Epichlorhydrin		
2-Chloroethanol, see Ethylene chlorohydrin		
Chloroethylene, see Vinyl choride		
C Chloroform (trichloromethane)	50	240
1-Chloro-1-nitropropane	20	100
Chloropicrin	0.1	0.7
Chloroprene (2-chloro-1,3-butadiene)—Skin	25	90
Chromium, sol. chromic, chromous salts as Cr		0.5
Metal and insol. salts		1
Coal tar pitch volatiles (benzene soluble fraction) anthracene, BaP, phenanthrene, acridine, chrysene, pyrene		0.2
Cobalt, metal fume and dust		0.1
Copper fume		0.1
Dusts and Mists		1
Cotton dust (raw)		1
Crag® herbicide		15
Cresol (all isomers)—Skin	5	22
Crotonaldehyde	2	6
Cumene—Skin	50	245
Cyanide (as CN)—Skin		5
Cyclohexane	300	1,050
Cyclohexanol	50	200
Cyclohexanone	50	200
Cyclohexene	300	1,015
Cyclopentadiene	75	200
2,4-D		10
DDT—Skin		1
DDVP, see Dichlorvos		
Decaborane—Skin	0.05	0.3
Demeton®—Skin		0.1
Diacetone alcohol (4-hydroxy-4-methyl-2-pentanone)	50	240
1,2-diaminoethane, see Ethylenediamine		
Diazomethane	0.2	0.4
Diborane	0.1	0.1
Dibutylphthalate		5
C o-Dichlorobenzene	50	300
p-Dichlorobenzene	75	450
Dichlorodifluoromethane	1,000	4,950
1,3-Dichloro-5,5-dimethyl hydantoin		0.2
1,1-Dichloroethane	100	400
1,2-Dichloroethylene	200	790
C Dichloroethyl ether—Skin	15	90
Dichloromethane, see Methylenechloride		
Dichloromonofluoromethane	1,000	4,200
1,1-Dichloro-1-nitroethane	10	60
1,2-Dichloropropane, see Propylenedichloride		
Dichlorotetrafluoroethane	1,000	7,000
Dichlorvos (DDVP)—Skin		1
Dieldrin—Skin		0.25
Diethylamine	25	75
Diethylamino ethanol—Skin	10	60
Diethylether, see Ethyl ether		
Difluorodibromomethane	100	860
C Diglycidyl ether (DGE)	0.5	2.8

TABLE G-I—Continued

Substance	p.p.m.[a]	mg./M³ [b]
Dihydroxybenzene, see Hydroquinone		
Diisobutyl ketone	50	290
Diisopropylamine—Skin	5	20
Dimethoxymethane, see Methylal		
Dimethyl acetamide—Skin	10	35
Dimethylamine	10	18
Dimethylaminobenzene, see Xylidene		
Dimethylaniline(N-dimethylaniline)—Skin	5	25
Dimethylbenzene, see Xylene		
Dimethyl 1,2-dibromo-2,2-dichloroethyl phosphate, (Dibrom)		3
Dimethylformamide—Skin	10	30
2,6-Dimethylheptanone, see Diisobutyl ketone		
1,1-Dimethylhydrazine—Skin	0.5	1
Dimethylphthalate		5
Dimethylsulfate—Skin	1	5
Dinitrobenzene (all isomers)—Skin		1
Dinitro-o-cresol—Skin		0.2
Dinitrotoluene—Skin		1.5
Dioxane (Diethylene dioxide)—Skin	100	360
Diphenyl	0.2	1
Diphenylmethane diisocyanate (see Methylene bisphenyl isocyanate (MDI)		
Dipropylene glycol methyl ether—Skin	100	600
Di-sec. octyl phthalate (Di-2-ethylhexylphthalate)		5
Endrin—Skin		0.1
Epichlorhydrin—Skin	5	19
EPN—Skin		0.5
1,2-Epoxypropane, see Propyleneoxide		
2,3-Epoxy-1-propanol, see Glycidol		
Ethanethiol, see Ethylmercaptan		
Ethanolamine	3	6
2-Ethoxyethanol—Skin	200	740
2-Ethoxyethylacetate (Cellosolve acetate)—Skin	100	540
Ethyl acetate	400	1,400
Ethyl acrylate—Skin	25	100
Ethyl alcohol (ethanol)	1,000	1,900
Ethylamine	10	18
Ethyl sec-amyl ketone (5-methyl-3-heptanone)	25	130
Ethyl benzene	100	435
Ethyl bromide	200	890
Ethyl butyl ketone (3-Heptanone)	50	230
Ethyl chloride	1,000	2,600
Ethyl ether	400	1,200
Ethyl formate	100	300
C Ethyl mercaptan	10	25
Ethyl silicate	100	850
Ethylene chlorohydrin—Skin	5	16
Ethylenediamine	10	25
Ethylene dibromide, see 1,2-Dibromoethane		
Ethylene dichloride, see 1,2-Dichloroethane		
C Ethylene glycol dinitrate and/or Nitroglycerin—Skin	◊0.2	1
Ethylene glycol monomethyl ether acetate, see Methyl cellosolve acetate		
Ethylene imine—Skin	0.5	1
Ethylene oxide	50	90
Ethylidine chloride, see 1,1-Dichloroethane		
N-Ethylmorpholine—Skin	20	94
Ferbam		15
Ferrovanadium dust		1
Fluoride (as F)		2.5
Fluorine	0.1	0.2
Fluorotrichloromethane	1,000	5,600
Formic acid	5	9
Furfural—Skin	5	20
Furfuryl alcohol	50	200
Glycidol (2,3-Epoxy-1-propanol)	50	150
Glycol moncethyl ether, see 2-Ethoxyethanol		
Guthion, ® see Azinphosmethyl		
Hafnium		0.5
Heptachlor—Skin		0.5
Heptane (n-heptane)	500	2,000
Hexachloroethane—Skin	1	10
Hexachloronaphthalene—Skin		0.2
Hexane (n-hexane)	500	1,800
2-Hexanone	100	410
Hexone (Methyl isobutyl ketone)	100	410
sec-Hexyl acetate	50	300
Hydrazine—Skin	1	1.3
Hydrogen bromide	3	10
C Hydrogen chloride	5	7
Hydrogen cyanide—Skin	10	11
Hydrogen peroxide (90%)	1	1.4

TABLE G-I—Continued

Substance	p.p.m.[a]	mg./M³ [b]
Hydrogen selenide	0.05	0.2
Hydroquinone		2
C Iodine	0.1	1
Iron oxide fume		10
Isoamyl acetate	100	525
Isoamyl alcohol	100	360
Isobutyl acetate	150	700
Isobutyl alcohol	100	300
Isophorone	25	140
Isopropyl acetate	250	950
Isopropyl alcohol	400	980
Isopropylamine	5	12
Isopropylether	500	2,100
Isopropyl glycidyl ether (IGE)	50	240
Ketene	0.5	0.9
Lead arsenate		0.15
Lindane—Skin		0.5
Lithium hydride		0.025
L.P.G. (liquified petroleum gas)	1,000	1,800
Magnesium oxide fume		15
Malathion—Skin		15
Maleic anhydride	0.25	1
C Manganese		5
Mesityl oxide	25	100
Methanethiol, see Methyl mercaptan		
Methoxychlor		15
2-Methoxyethanol, see Methyl cellosolve		
Methyl acetate	200	610
Methyl acetylene (propyne)	1,000	1,650
Methyl acetylene-propadiene mixture (MAPP)	1,000	1,800
Methyl acrylate—Skin	10	35
Methylal (dimethoxymethane)	1,000	3,100
Methyl alcohol (methanol)	200	260
Methylamine	10	12
Methyl amyl alcohol, see Methyl isobutyl carbinol		
Methyl (n-amyl) ketone (2-Heptanone)	100	465
C Methyl bromide—Skin	20	80
Methyl butyl ketone, see 2-Hexanone		
Methyl cellosolve—Skin	25	80
Methyl cellosolve acetate—Skin	25	120
Methyl chloroform	350	1,900
Methylcyclohexane	500	2,000
Methylcyclohexanol	100	470
o-Methylcyclohexanone—Skin	100	460
Methyl ethyl ketone (MEK), see 2-Butanone		
Methyl formate	100	250
Methyl iodide—Skin	5	28
Methyl isobutyl carbinol—Skin	25	100
Methyl isobutyl ketone, see Hexone		
Methyl isocyanate—Skin	0.02	0.05
C Methyl mercaptan	10	20
Methyl methacrylate	100	410
Methyl propyl ketone, see 2-Pentanone		
C α Methyl styrene	100	480
C Methylene bisphenyl isocyanate (MDI)	0.02	0.2
Molybdenum:		
Soluble compounds		5
Insoluble compounds		15
Monomethyl aniline—Skin	2	9
C Monomethyl hydrazine—Skin	0.2	0.35
Morpholine—Skin	20	70
Naphtha (coaltar)	100	400
Naphthalene	10	50
Nickel carbonyl	0.001	0.007
Nickel, metal and soluble cmpds, as Ni		1
Nicotine—Skin		0.5
Nitric acid	2	5
Nitric oxide	25	30
p-Nitroaniline—Skin	1	6
Nitrobenzene—Skin	1	5
p-Nitrochlorobenzene—Skin		1
Nitroethane	100	310
Nitrogen dioxide	5	9
Nitrogen trifluoride	10	29
Nitroglycerin—Skin	0.2	2
Nitromethane	100	250
1-Nitropropane	25	90
2-Nitropropane	25	90
Nitrotoluene—Skin	5	30
Nitrotrichloromethane, see Chloropicrin		
Octachloronaphthalene—Skin		0.1
*Octane	500	2,350
*Oil mist, mineral		*5
Osmium tetroxide		0.002
Oxalic acid		1
Oxygen difluoride	0.05	0.1
Ozone	0.1	0.2
Paraquat—Skin		0.5
Petroleum distillates (naptha)	500	2,000
Propane	1,000	1,800
Silver, metal and soluble compounds		0.01

See footnotes at end of table.

TABLE G-1—Continued

Substance	p.p.m.[a]	mg./M³ [b]
Sodium fluoroacetate (1080)—Skin		0.05
Sodium hydroxide		2
Stibine	0.1	0.5
*Stoddard solvent	500	2,950
Strychnine		0.15
Sulfur dioxide	5	13
Sulfur hexafluoride	1,000	6,000
Sulfuric acid		1
Sulfur monochloride	1	6
Sulfur pentafluoride	0.025	0.25
Sulfuryl fluoride	5	20
Systox, see Demeton ®		
2,4,5T		10
Tantalum		5
TEDP—Skin		0.2
Tellurium		0.1
Tellurium hexafluoride	0.02	0.2
TEPP—Skin		0.05
C Terphenyls	1	9
1,1,1,2-Tetrachloro-2,2-difluoroethane	500	4,170
1,1,2,2-Tetrachloro-1,2-difluoroethane	500	4,170
1,1,2,2-Tetrachloroethane—Skin	5	35
Tetrachloroethylene, see Perchloroethylene		
Tetrachloromethane, see Carbon tetrachloride		
Tetrachloronaphthalene—Skin		2
Tetraethyl lead (as Pb)—Skin		0.075
Tetrahydrofuran	200	590
Tetramethyl lead (as Pb)—Skin		0.075
Tetramethyl succinonitrile—Skin	0.5	3
Tetranitromethane	1	8
Tetryl (2,4,6-trinitrophenylmethylnitramine)—Skin		1.5
Thallium (soluble compounds)—Skin as Tl		0.1
Thiram		5
Tin (inorganic cmpds, except oxides		2
Tin (organic cmpds)		0.1
C Toluene-2,4-diisocyanate	0.02	0.14
o-Toluidine—Skin	5	22
Toxaphene, see Chlorinated camphene		
Tributyl phosphate		5
1,1,1-Trichloroethane see Methyl chloroform		

TABLE G-1—Continued

Substance	p.p.m.[a]	mg./M³ [b]
1,1,2-Trichloroethane—Skin	10	45
Parathion—Skin		0.1 [f]
Pentaborane	0.005	0.0
Pentachloronaphthalene—Skin		0.5
Pentachlorophenol—Skin		0.5
*Pentane	1,000	2,950
2-Pentanone	200	700
Perchloromethyl mercaptan	0.1	0.8
Perchloryl fluoride	3	13.5
Phenol—Skin	5	19
p-Phenylene diamine—Skin		0.1
Phenyl ether (vapor)	1	7
Phenyl ether-biphenyl mixture (vapor)	1	7
Phenylethylene, see Styrene		
Phenyl glycidyl ether (PGE)	10	60
Phenylhydrazine—Skin	5	22
Phosdrin (Mevinphos ®)—Skin		0.1
Phosgene (carbonyl chloride)	0.1	0.4
Phosphine	0.3	0.4
Phosphoric acid		1
Phosphorus (yellow)		0.1
Phosphorus pentachloride		1
Phosphorus pentasulfide		1
Phosphorus trichloride	0.5	3
Phthalic anhydride	2	12
Picric acid—Skin		0.1
Pival ® (2-Pivalyl-1,3-indandione)		0.1
Platinum (Soluble Salts) as Pt		0.002
Propargyl alcohol—Skin	1	
n-Propyl acetate	200	840
Propyl alcohol	200	500
n-Propyl nitrate	25	110
Propylene dichloride	75	350
Propylene imine—Skin	2	5
Propylene oxide	100	240
Propyne, see Methylacetylene		
Pyrethrum		5
Pyridine	5	15
Quinone	0.1	0.4
RDX—Skin		1.5
Rhodium, Metal fume and dusts, as Rh		0.1
Soluble salts		0.001
Ronnel		10
Rotenone (commercial)		5
Selenium compounds (as Se)		0.2
Selenium hexafluoride	0.05	0.4
Titaniumdioxide		15
Trichloromethane, see Chloroform		

TABLE G-1—Continued

Substance	p.p.m.[a]	mg./M³ [b]
Trichloronaphthalene—Skin		5
1,2,3-Trichloropropane	50	300
1,1,2-Trichloro 1,2,2-trifluoroethane	1,000	7,600
Triethylamine	25	100
Trifluoromonobromomethane	1,000	6,100
2,4,6-Trinitrophenol, see Picric acid		
2,4,6-Trinitrophenylmethylnitramine, see Tetryl		
Trinitrotoluene—Skin		1.5
Triorthocresyl phosphate		0.1
Triphenyl phosphate		3
Turpentine	100	560
Uranium (soluble compounds)		0.05
Uranium (insoluble compounds)		0.25
C Vanadium:		
V_2O_3 dust		0.5
V_2O_5 fume		0.1
Vinyl benzene, see Styrene		
**C Vinyl chloride	500	1,300
Vinylcyanide, see Acrylonitrile		
Vinyl toluene	100	480
Warfarin		0.1
Xylene (xylol)	100	435
Xylidine—Skin	5	25
Yttrium		1
Zinc chloride fume		1
Zinc oxide fume		5
Zirconium compounds (as Zr)		5

*1970 Addition.

[a] Parts of vapor or gas per million parts of contaminated air by volume at 25° C. and 760 mm. Hg pressure.

[b] Approximate milligrams of particulate per cubic meter of air.

(No footnote "c" is used to avoid confusion with ceiling value notations.)

[d] An atmospheric concentration of not more than 0.02 p.p.m., or personal protection may be necessary to avoid headache.

[e] As sampled by method that does not collect vapor.

[f] For control of general room air, biologic monitoring is essential for personnel control.

TABLE G-2

Material	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift. Concentration	Maximum duration
Benzene (Z37.4–1969)	10 p.p.m	25 p.p.m	50 p.p.m	10 minutes.
Beryllium and beryllium compounds (Z37.29–1970).	2 μg./M³	5 μg./M³	25 μg./M³	30 minutes.
Cadmium fume (Z37.5–1970)	0.1 mg./M³	3 mg./M³		
Cadmium dust (Z37.5–1970)	0.2 mg./M³	0.6 mg./M³		
Carbon disulfide (Z37.3–1968)	20 p.p.m	30 p.p.m	100 p.p.m	Do.
Carbon tetrachloride (Z37.17–1967)	10 p.p.m	25 p.p.m	200 p.p.m	5 minutes in any 4 hours.
Ethylene dibromide (Z37.31–1970)	20 p.p.m	30 p.p.m	50 p.p.m	5 minutes.
Ethylene dichloride (Z37.21–1969)	50 p.p.m	100 p.p.m	200 p.p.m	5 minutes in any 3 hours.
Formaldehyde (Z37.16–1967)	3 p.p.m	5 p.p.m	10 p.p.m	30 minutes.
Hydrogen fluoride (Z37.28–1969)	do			
Fluoride as dust (Z37.28–1969)	2.5 mg./M³			
Lead and its inorganic compounds (Z37.11–1969).	0.2 mg./M³			
Methyl chloride (Z37.18–1969)	100 p.p.m	200 p.p.m	300 p.p.m	5 minutes in any 3 hours.
Methylene Chloride (Z37.3–1969)	500 p.p.m	1,000 p.p.m	2,000 p.p.m	5 minutes in any 2 hours.
Organo (alkyl) mercury (Z37.30–1969)	0.01 mg./M³	0.04 mg./M³		
Styrene (Z37.15–1969)	100 p.p.m	200 p.p.m	600 p.p.m	5 minutes in any 3 hours.
Trichloroethylene (Z37.19–1967)	do	do	300 p.p.m	5 minutes in any 2 hours.
Tetrachloroethylene (Z37.22–1967)	do	do	do	5 minutes in any 3 hours.
Toluene (Z37.12–1967)	200 p.p.m	300 p.p.m	500 p.p.m	10 minutes.
Hydrogen sulfide (Z37.2–1966)	20 p.p.m		50 p.p.m	10 minutes once only if no other measurable exposure occurs.
Mercury (Z37.8–1971)		1 mg./10M³ [h]		
Chromic acid and chromates (Z37.7–1971)		do [i]		

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TABLE G-3—MINERAL DUSTS

Substance	Mppcf *	Mg/M³
Silica:		
Crystalline:		
Quartz (respirable)	250 †	10mg/M³ ■
	%SiO₂+5	%SiO₂+2
Quartz (total dust)		30mg/M³
		%SiO₂+2
Cristobalite: Use ½ the value calculated from the count or mass formulae for quartz.		
Tridymite: Use ½ the value calculated from the formulae for quartz.		
Amorphous, including natural diatomaceous earth	20	80mg/M³
		%SiO₂
Silicates (less than 1% crystalline silica):		
Mica	20	
Soapstone	20	
Talc	20	
Portland cement	50	
Graphite (natural)	15	
Coal dust (respirable fraction less than 5% SiO₂)		2.4mg/M³ or 10mg/M³
For more than 5% SiO₂		
		%SiO₂+2
Inert or Nuisance Dust:		
Respirable fraction	15	5mg/M³
Total dust	50	15mg/M³

NOTE: Conversion factors—
mppcf×35.3=million particles per cubic meter
=particles per c.c.

* Millions of particles per cubic foot of air, based on impinger samples counted by light-field technics.

† The percentage of crystalline silica in the formula is the amount determined from air-borne samples, except in those instances in which other methods have been shown to be applicable.

‡ As determined by the membrane filter method at 430×phase contrast magnification.

■ Both concentration and percent quartz for the application of this limit are to be determined from the fraction passing a size-selector with the following characteristics:

Aerodynamic diameter (unit density sphere)	Percent passing selector
2	90
2.5	75
3.5	50
5.0	25
10	0

The measurements under this note refer to the use of an AEC instrument. If the respirable fraction of coal dust is determined with a MRE the figure corresponding to that of 2.4 Mg/M³ in the table for coal dust is 4.5 Mg/M³.

[36 FR 23207 effective Decmeber 7, 1971]

§ 1910.93a Asbestos dust.

(a) The 8-hour time-weighted average airborne concentration of asbestos dust to which employees are exposed shall not exceed 5 fibers per milliliter greater than 5 microns in length, as determined by the membrance filter method at 400–450× magnification (4 millimeter objective) phase contrast illumination. Concentrations above 5 fibers per milliliter but, not to exceed 10 fibers per milliliter, may be permitted up to a total of 15 minutes in an hour for up to 5 hours in an 3-hour day.

(b) Engineering methods, such as but not limited to, enclosure, vacuum sweeping, and local exhaust ventilation, shall be used to meet the exposure limits prescribed in paragraph (a) of this section. Where such engineering methods are not feasible, or do not otherwise reduce the concentrations below those prescribed in paragraph (a) of this section, respiratory protective devices shall be provided and used in accordance with paragraph (c) of this section.

(c)(1) (i) When the limits of exposure to asbestos dust prescribed in paragraph (a) of this section are exceeded and when engineering controls required by paragraph (b) of this section are not feasible or do not otherwise reduce the concentration of asbestos dust below those prescribed in paragraph (a) of this section, the employer shall require the use of respiratory protective devices. The selection of respiratory protective devices shall be limited to those specified in the remaining subparagraphs of this paragraph (c).

(ii) The employer shall require that each employee test his respiratory protective device before each use in order to insure a proper fit according to the manufacturer's instructions. The employer shall further provide for effective training or supervision of employees in the testing of respiratory protective devices for fit before their use.

(2) For an atmosphere containing not more than 25 fibers per milliliter greater than 5 microns in length over an 8-hour average, or more than 50 fibers per milliliter over any period of 15 minutes, a reusable or single-use filter type respirator, operating with negative pressure during the inhalation phase of breathing, approved by the U.S. Bureau of Mines under the provisions of 30 CFR Part 14 (Bureau of Mines Schedule 21B), or a valveless respirator providing equivalent protection, shall be used.

(3) For an atmosphere containing not more than 250 fibers per milliliter greater than 5 microns in length over an 8-hour average, or more than 500 fibers per milliliter over any period of 15 minutes, a powered filter positive pressure respirator approved by the U.S. Bureau of Mines under the provisions of 30 CFR Part 14 (Bureau of Mines Schedule 21B) shall be used.

(4) For an atmosphere containing more than 250 fibers per milliliter greater than 5 microns in length over an 8-hour average a type C positive pressure supplied-air respirator approved by the U.S. Bureau of Mines under the provisions of 30 CFR Part 12 (Bureau of Mines Schedule 19B) shall be used.

(5) The employer shall establish a respirator program in accordance with the requirements of American National Standard Practice for Respiratory Protection Z88.2—1969.

(6) The respirators provided each employee shall be properly inspected, cleaned, repaired and stored.

(d) (1) When an employer has employees who are exposed to asbestos dust exceeding the limits prescribed in paragraph (a) of this section and the exposure results from the operations described in the remaining subparagraphs of this paragraph (d), the employer shall comply with the requirements of these subparagraphs relating to the operations involved. The requirements of this paragraph are in addition to those prescribed in paragraph (b) of this section.

(2) All hand- or power-operated tools which produce asbestos dust such as, but not limited to, saws, scorers, abrasive wheels, and drills shall be provided with local exhaust ventilation and dust collectors in accordance with the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems; ANSI Z9.2—1971.

(3) Employees exposed to the spraying of asbestos or the demolition of pipes, structures, or equipment covered or insulated with asbestos shall be provided with respiratory protective devices in accordance with paragraph (c)(4) of this section.

(e) Asbestos cement, mortar, coatings, grout, and plaster shall be mixed in closed bags or other containers.

(f) Asbestos waste and scrap shall be collected and disposed of in sealed bags or other containers.

(g) All cleanup of asbestos dust and blowing shall be performed by vacuum cleaners. No dry sweeping shall be performed.

§ 1910.94 Ventilation.

(a) *Abrasive blasting*—(1) *Definitions applicable to this paragraph.*—(i) *Abrasive.* A solid substance used in an abrasive blasting operation.

(ii) *Abrasive-blasting respirator.* A continuous flow air-line respirator constructed so that it will cover the wearer's head, neck, and shoulders to protect him from rebounding abrasive.

(iii) *Blast cleaning barrel.* A complete enclosure which rotates on an axis, or which has an internal moving tread to tumble the parts, in order to expose various surfaces of the parts of the action of an automatic blast spray.

(iv) *Blast cleaning room.* A complete enclosure in which blasting operations are performed and where the operator works inside of the room to operate the blasting nozzle and direct the flow of the abrasive material.

(v) *Blasting cabinet.* An enclosure where the operator stands outside and operates the blasting nozzle through an opening or openings in the enclosure.

(vi) *Clean air.* Air of such purity that it will not cause harm or discomfort to an individual if it is inhaled for extended periods of time.

(vii) *Dust collector.* A device or combination of devices for separating dust from the air handled by an exhaust ventilation system.

(viii) *Exhaust ventilation system.* A system for removing contaminated air from a space, comprising two or more of the following elements (a) enclosure or hood, (b) duct work, (c) dust collecting equipment, (d) exhauster, and (e) discharge stack.

(ix) *Particulate-filter respirator.* An air purifying respirator, commonly referred to as a dust or a fume respirator, which removes most of the dust or fume from the air passing through the device.

(x) *Respirable dust.* Airborne dust in sizes capable of passing through the upper respiratory system to reach the lower lung passages.

(xi) *Rotary blast cleaning table.* An enclosure where the pieces to be cleaned are positioned on a rotating table and are passed automatically through a series of blast sprays.

(xii) *Abrasive blasting.* The forcible application of an abrasive to a surface by pneumatic pressure, hydraulic pressure, or centrifugal force.

(2) *Dust hazards from abrasive blasting.* (i) Abrasives and the surface coatings on the materials blasted are shattered and pulverized during blasting operations and the dust formed will contain particles of respirable size. The composition and toxicity of the dust from these sources shall be considered in making an evaluation of the potential health hazards.

(ii) The concentration of respirable dust or fume in the breathing zone of the abrasive-blasting operator or any other worker shall be kept below the levels specified in § 1910.93.

(iii) Organic abrasives which are combustible shall be used only in automatic systems. Where flammable or explosive dust mixtures may be present, the construction of the equipment, including the exhaust system and all electric wiring shall conform to the requirements of American National Standard Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying, Z33.1-1961 (NFPA 91-1961), and American National Standard National Electrical Code, C1-1968 (NFPA 70-1968). The blast nozzle shall be bonded and grounded to prevent the buildup of static charges. Where flammable or explosive dust mixtures may be present, the abrasive blasting enclosure, the ducts, and the dust collector shall be constructed with loose panels or explosion venting areas, located on sides away from any occupied area, to provide for pressure relief in case of explosion, following the principles set forth in the National Fire Protection Association Explosion Venting Guide, NFPA 68-1954.

(3) *Blast-cleaning enclosures.* (i) Blast-cleaning enclosures shall be exhaust ventilated in such a way that a continuous inward flow of air will be maintained at all openings in the enclosure, during the blasting operation.

(a) All air inlets and access openings shall be baffled or so arranged that by the combination of inward air flow and baffling the escape of abrasive or dust particules into an adjacent work area will be minimized and visible spurts of dust will not be observed.

(b) The rate of exhaust shall be sufficient to provide prompt clearance of the dust-laden air within the enclosure after the cessation of blasting.

(c) Before the enclosure is opened, the blast shall be turned off and the exhaust system shall be run for a sufficient period of time to remove the dusty air within the enclosure.

(d) Safety glass protected by screening shall be used in observation windows, where hard deep-cutting abrasives are used.

(e) Slit abrasive-resistant baffles shall be installed in multiple sets at all small access openings where dust might escape, and shall be inspected regularly and replaced when needed.

(f) Doors shall be flanged and tight when closed.

(g) Doors on blast-cleaning rooms shall be operable from both inside and outside, except that where there is a small operator access door, the large work access door may be closed or opened from the outside only.

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hood or enclosures that are connected to exhaust systems.

(ii) Such exhaust systems shall be operated continuously whenever such operations are carried on, and be capable of preventing contaminants from entering the breathing zone.

(3) *Hood and branch pipe requirements.* (i) Hoods connected to exhaust systems shall be used, and such hoods shall be designed, located, and placed so that the dust or dirt particles shall fall or be projected into the hoods in the direction of the air flow. No wheels, discs, straps, or belts shall be operated in such manner and in such direction as to cause the dust and dirt particles to be thrown into the operator's breathing zone.

(ii) Grinding wheels on floor stands, pedestals, benches, and special-purpose grinding machines and abrasive cutting-off wheels shall have not less than the minimum exhaust volumes shown in Table G-4 with a recommended minimum duct velocity of 4,500 feet per minute in the branch and 3,500 feet per minute in the main. The entry losses from all hoods except the vertical-spindle disc grinder hood, shall equal 0.65 velocity pressure for a straight takeoff and 0.45 velocity pressure for a tapered takeoff. The entry loss for the vertical-spindle disc grinder hood is shown in figure G-1 (following § 1910.94(b)).

TABLE G-4—GRINDING AND ABRASIVE CUTTING-OFF WHEELS

Wheel diameter (inches)	Wheel width (inches)	Minimum exhaust volume (feet³/min.)
To 9	1½	220
Over 9 to 16	2	390
Over 16 to 19	3	500
Over 19 to 24	4	610
Over 24 to 30	5	880
Over 30 to 36	6	1,200

For any wheel wider than wheel diameters shown in Table G-4, increase the exhaust volume by the ratio of the new width to the width shown.

Example:

If wheel width = 4½ inches, then

$$\frac{4.5}{4} \times 610 = 686 \text{ (rounded to 690).}$$

(iii) Scratch-brush wheels and all buffing and polishing wheels mounted on floor stands, pedestals, benches, or special-purpose machines shall have not less than the minimum exhaust volume shown in Table G-5.

TABLE G-5—BUFFING AND POLISHING WHEELS

Wheel diameter (inches)	Wheel width (inches)	Minimum exhaust volume (feet³/min.)
To 9	2	300
Over 9 to 16	3	500
Over 16 to 19	4	610
Over 19 to 24	5	740
Over 24 to 30	6	1,040
Over 30 to 36	6	1,200

(iv) Grinding wheels or discs for horizontal single-spindle disc grinders shall be hooded to collect the dust or dirt generated by the grinding operation and the hoods shall be connected to branch pipes having exhaust volumes as shown in Table G-6.

TABLE G-6—HORIZONTAL SINGLE-SPINDLE DISC GRINDER

Disc diameter (inches):	Exhaust volume (ft. 3/min.)
Up to 12	220
Over 12 to 19	390
Over 19 to 30	610
Over 30 to 36	880

(v) Grinding wheels or discs for horizontal double-spindle disc grinders shall have a hood enclosing the grinding chamber and the hood shall be connected to one or more branch pipes having exhaust volumes as shown in Table G-7.

TABLE G-7—HORIZONTAL DOUBLE-SPINDLE DISC GRINDER

Disc diameter (inches):	Exhaust volume (ft. 3/min.)
Up to 19	610
Over 19 to 25	880
Over 25 to 30	1,200
Over 30 to 53	1,770
Over 53 to 72	6,280

(vi) Grinding wheels or discs for vertical single-spindle disc grinders shall be encircled with hoods to remove the dust generated in the operation. The hoods shall be connected to one or more branch pipes having exhaust volumes as shown in Table G-8.

TABLE G-8—VERTICAL SPINDLE DISC GRINDER

Disc diameter (inches)	One-half or more of disc covered		Disc not covered	
	Number[1]	Exhaust foot³/min.	Number[1]	Exhaust foot³/min.
Up to 20	1	500	2	750
Over 20 to 30	2	750	2	1,480
Over 30 to 53	2	1,770	4	3,530
Over 53 to 72	2	3,140	5	6,010

[1] Number of exhaust outlets around periphery of hood, or equal distribution provided by other means.

(vii) Grinding and polishing belts shall be provided with hoods to remove dust and dirt generated in the operations and the hoods shall be connected to branch pipes having exhaust volumes as shown in Table G-9.

TABLE G-9—GRINDING AND POLISHING BELTS

Belts width (inches):	Exhaust volume (ft.³/min.)
Up to 3	220
Over 3 to 5	300
Over 5 to 7	390
Over 7 to 9	500
Over 9 to 11	610
Over 11 to 13	740

(viii) Cradles and swing-frame grinders. Where cradles are used for handling the parts to be ground, polished, or buffed, requiring large partial enclosures to house the complete operation, a minimum average air velocity of 150 feet per minutes shall be maintained over the entire opening of the enclosure. Swing-frame grinders shall also be exhausted in the same manner as provided for cradles. (See fig. G-2)

(ix) Where the work is outside the hood, air volumes must be increased as shown in American Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z9.2-1960 (section 4, exhaust hoods).

(4) *Exhaust systems.* (i) Exhaust systems for grinding, polishing, and buffing operations should be designed in accordance with American Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z9.2-1960.

(ii) Exhaust systems for grinding, polishing, and buffing operations shall be tested in the manner described in American Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z9.2-1960.

(iii) All exhaust systems shall be provided with suitable dust collectors.

(5) *Hood and enclosure design.* (i) (a) It is the dual function of grinding and abrasive cutting-off wheel hoods to protect the operator from the hazards of bursting wheels as well as to provide a means for the removal of dust and dirt generated. All hoods shall be not less in structural strength than specified in the American National Standard Code for the Use, Care, and Protection of Abrasive Wheels, B7.1-1970.

(b) Due to the variety of work and types of grinding machines employed, it is necessary to develop hoods adaptable to the particular machine in question, and such hoods shall be located as close as possible to the operation.

(ii) Exhaust hoods for floor stands, pedestals, and bench grinders shall be designed in accordance with figure G-2. The adjustable tongue shown in the figure shall be kept in working order and shall be adjusted within one-fourth inch of the wheel periphery at all times.

(iii) Swing-frame grinders shall be provided with exhaust booths as indicated in figure G-3.

(iv) Portable grinding operations, whenever the nature of the work permits, shall be conducted within a partial enclosure. The opening in the enclosure shall be no larger than is actually required in the operation and an average face air velocity of not less than 200 feet per minute shall be maintained.

(v) Hoods for polishing and buffing and scratch-brush wheels shall be constructed to conform as closely to figure G-4 as the nature of the work will permit.

(vi) Cradle grinding and polishing operations shall be performed within a partial enclosure similar to figure G-5. The operator shall be positioned outside the working face of the opening of the enclosure. The face opening of the enclosure should not be any greater in area than that actually required for the performance of the operation and the average air velocity into the working face of the enclosure shall not be less than 150 feet per minute.

(vii) Hoods for horizontal single-spindle disc grinders shall be constructed to conform as closely as possible to the hood shown in figure G-6. It is essential that there be a space between the back of the wheel and the hood, and a space around the periphery of the wheel of at least 1 inch in order to permit the suction to act around the wheel periphery. The opening on the side of the disc shall be no larger than is required for the grinding operation, but must never be less than twice the area of the branch outlet.

(viii) Horizontal double-spindle disc grinders shall have a hood encircling the wheels and grinding chamber similar to that illustrated in figure G-7. The

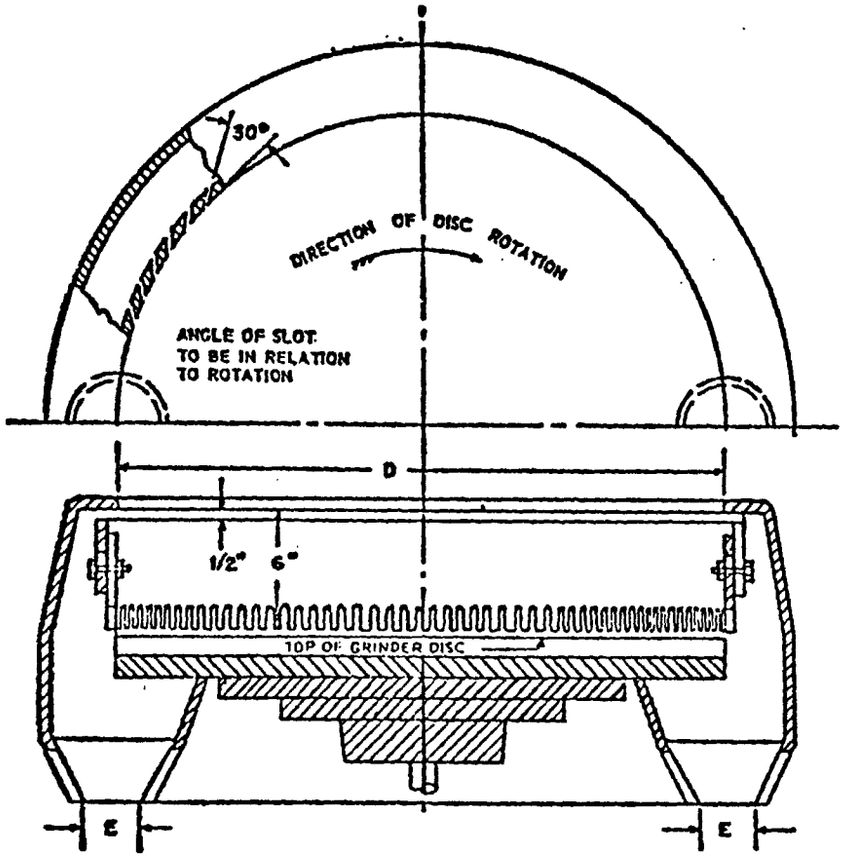

Fig. G-1
Vertical Spindle Disc Grinder Exhaust Hood and Branch Pipe Connections

Dia *D*, Inches		Exhaust *E*		Volume Exhausted at 4,500 ft/min ft³/min	Note
Min	Max	No. Pipes	Dia		
	20	1	4½	500	When one-half or more of the disc can be hooded, use exhaust ducts as shown at the left.
Over 20	30	2	4	780	
Over 30	72	2	6	1,770	
Over 53	72	2	8	3,140	
	20	2	4	780	When no hood can be used over disc, use exhaust ducts as shown at left.
Over 20	30	2	5½	1,480	
Over 30	53	4	6	3,530	
Over 53	72	5	7	6,910	

Entry loss = 1.0 slot velocity pressure + 0.5 branch velocity pressure
Minimum slot velocity = 2,000 ft/min – ½-inch slot width

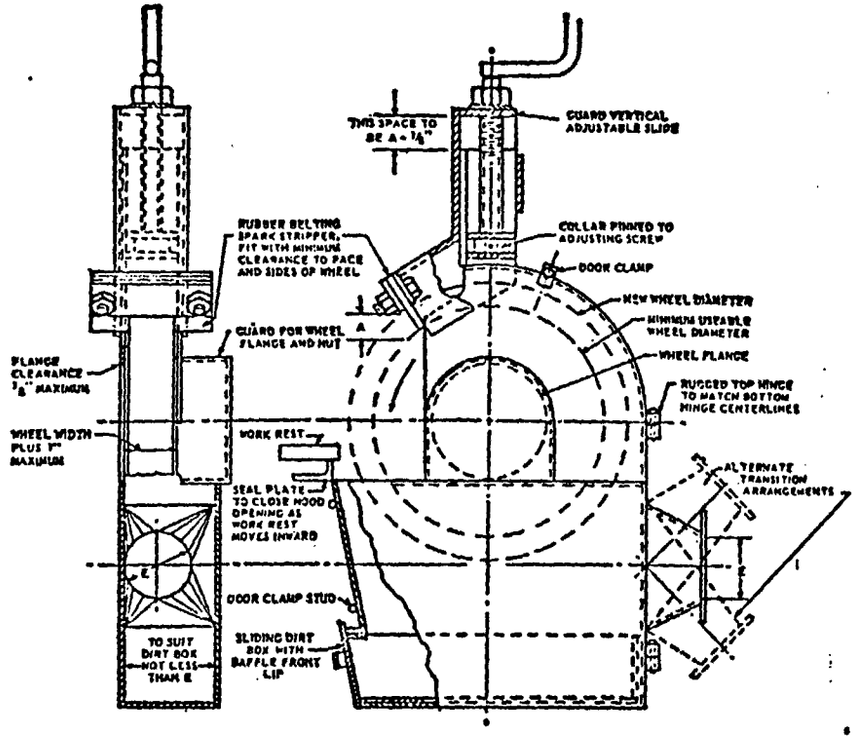

Fig. G-2
Standard Grinder Hood

Wheel Dimension			Exhaust Outlet, Inches	Volume of Air at 4,500 ft/min
Diameter, Inches		Width, Inches		
Min = *d*	Max = *D*	Max	*E*	
	9	1¼	3	220
Over 9	16	2	4	390
Over 16	19	3	4½	500
Over 19	24	4	5	610
Over 24	30	5	6	880
Over 30	36	6	7	1,200

Entry loss = 0.45 velocity pressure for tapered takeoff
0.65 velocity pressure for straight takeoff

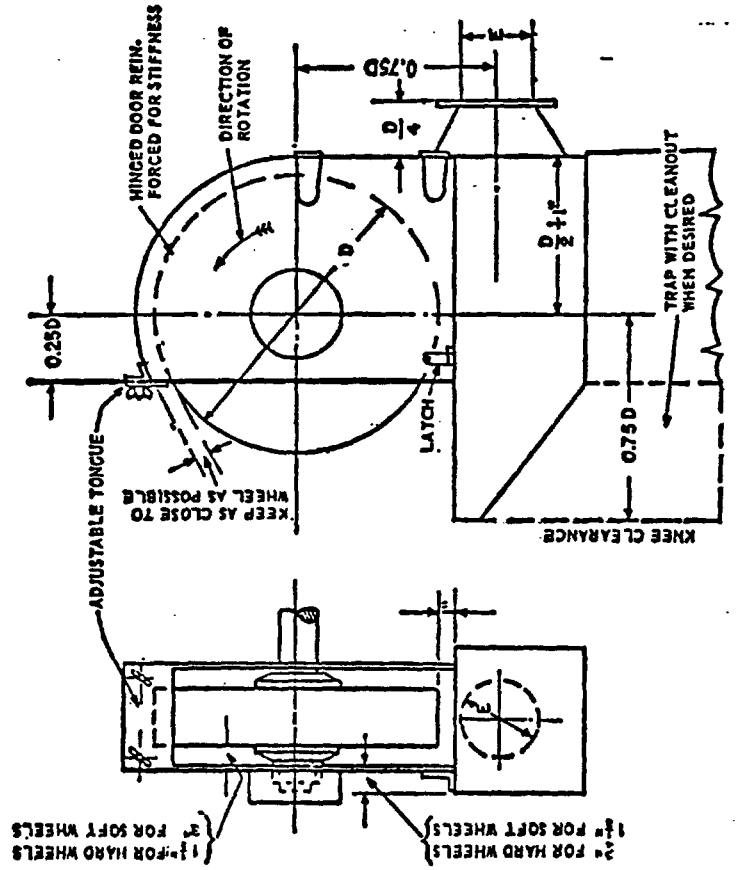

Fig. G-4
Standard Buffing and Polishing Hood

Wheel Dimension, Inches			Exhaust Outlet, Inches	Volume of Air at 4,500 ft/min
Diameter		Width		
Min = d	Max = D	Max	E	
	9	2	3½	310
Over 9	16	3	4	501
Over 16	19	4	5	610
Over 19	24	5	5½	741
Over 24	30	5	6½	1,040
Over 30	36	6	7	1,200

Entry loss = 0.15 velocity pressure for tapered takeoff
0.65 velocity pressure for straight takeoff

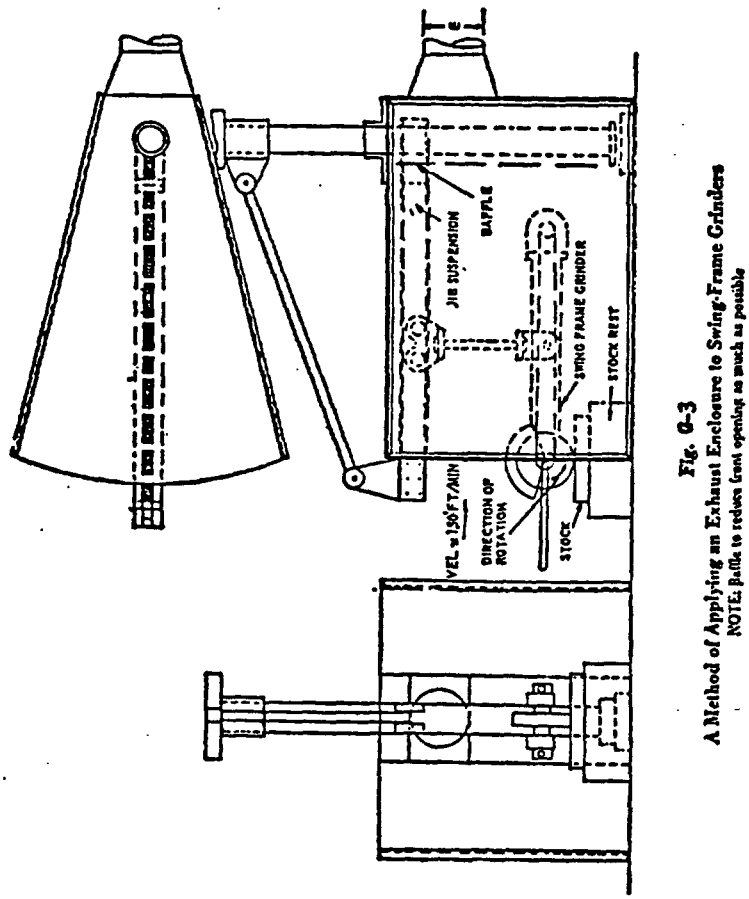

Fig. G-3
A Method of Applying an Exhaust Enclosure to Swing-Frame Grinders
NOTE: Baffle to reduce front opening as much as possible

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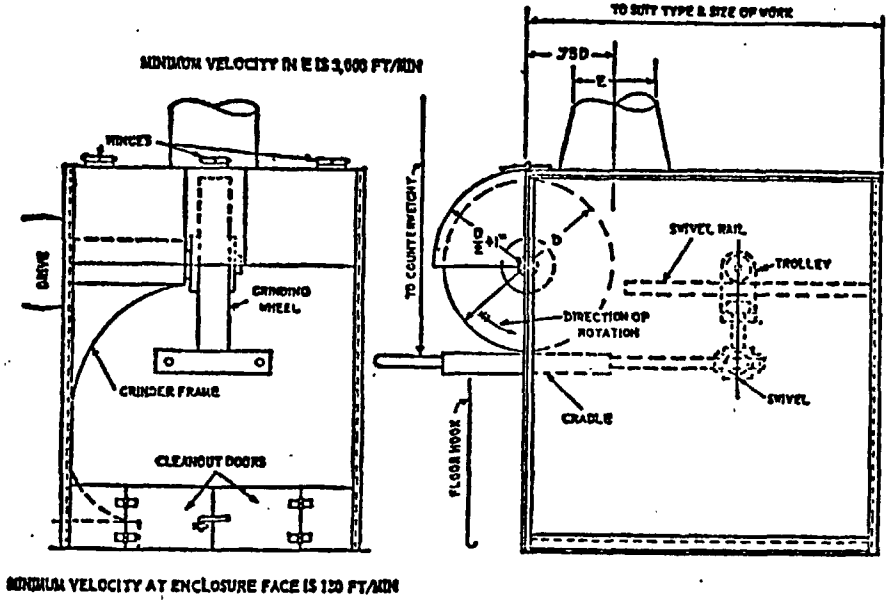

Fig. G-5
Cradle Polishing or Grinding Enclosure
Entry loss = 0.45 velocity pressure for tapered takeoff

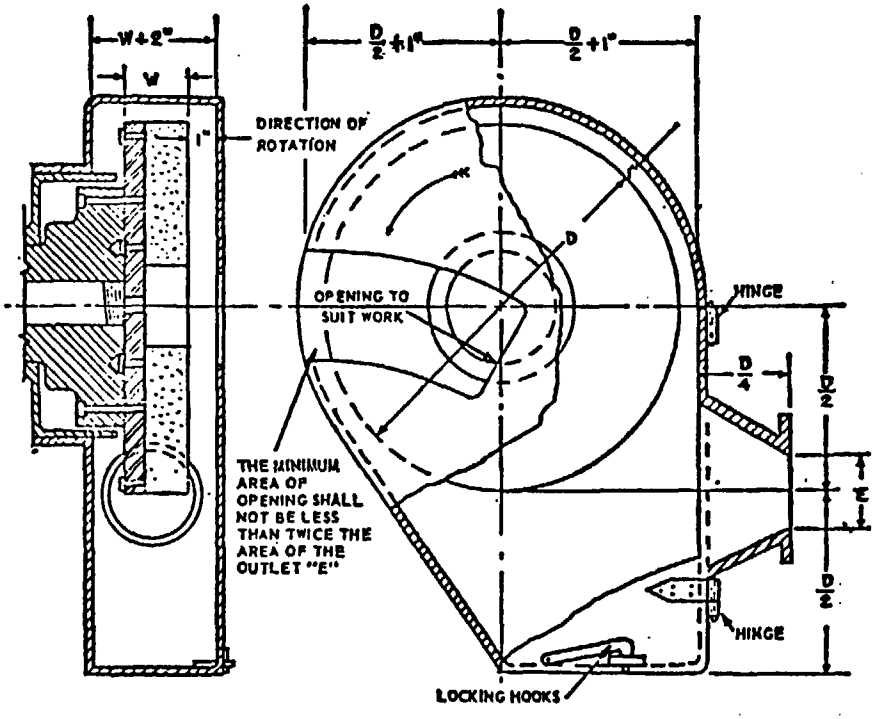

Fig. G-6
Horizontal Single-Spindle Disc Grinder Exhaust Hood and Branch Pipe Connections

openings for passing the work into the grinding chamber should be kept as small as possible, but must never be less than twice the area of the branch outlets.

(ix) Vertical-spindle disc grinders shall be encircled with a hood so constructed that the heavy dust is drawn off a surface of the disc and the lighter dust exhausted through a continuous slot at the top of the hood as shown in figure G-1.

(x) Grinding and polishing belt hoods shall be constructed as close to the operation as possible. The hood should extend almost to the belt, and 1-inch wide openings should be provided on either side. Figure G-8 shows a typical hood for a belt operation.

Dia *D*, Inches		Exhaust *E*	Volume Exhausted at 4,500 ft/min
Min	Max	Dia, Inches	ft³/min
	12	3	220
Over 12	18	4	390
Over 18	30	5	610
Over 30	36	6	880

NOTE: If grinding wheels are used for disc grinding purposes, hoods must conform to structural strength and materials as described in 9.1.

Entry loss = 0.45 velocity pressure for tapered takeoff

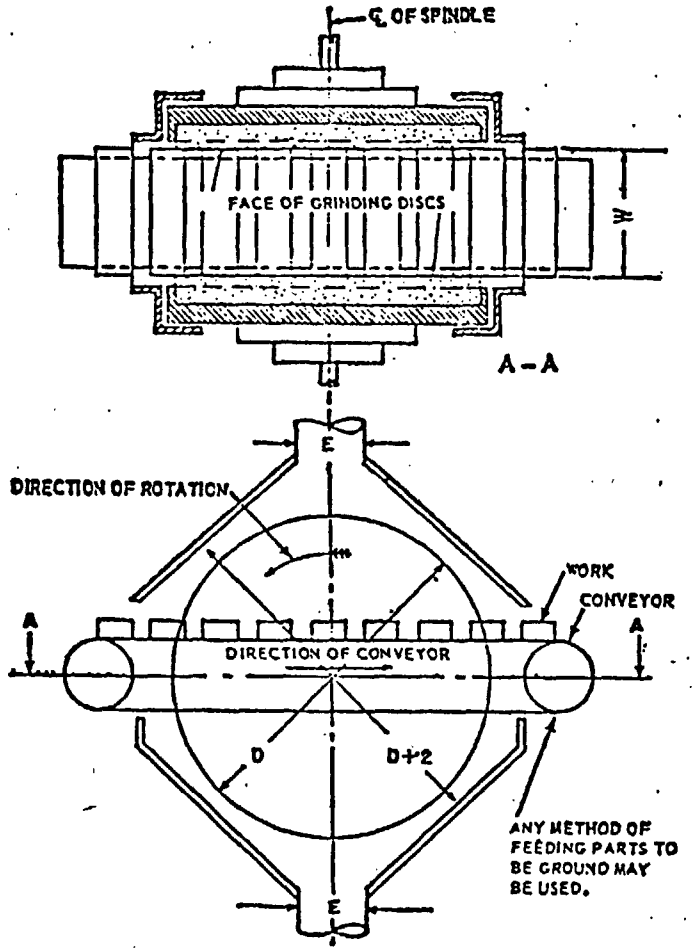

Fig. C-7

Horizontal Double-Spindle Disc Grinder Exhaust Hood and Branch Pipe Connections

Disc Dia, Inches		Exhaust E		Volume Exhausted at 4,500 ft/min ft³/min	Note
Min	Max	No. Pipes	Dia		
	19	1	5	610	When width "W" permits, exhaust ducts should be as near heaviest grinding as possible.
Over 19	25	1	6	880	
Over 25	30	1	7	1,200	
Over 30	53	2	6	1,770	
Over 53	72	4	6	3,280	

Entry loss = 0.45 velocity pressure for tapered takeoff

* EFFECTIVE 2/15/72 - See F.R. Aug. 13'71.

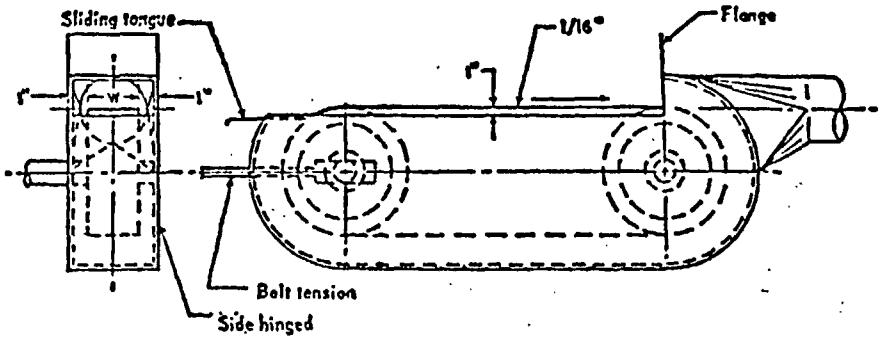

Fig. C-8

A Typical Hood for a Belt Operation

Belt Width W, Inches	Exhaust Volume, ft³/min
up to 3	220
3 to 5	500
5 to 7	390
7 to 9	500
9 to 11	610
11 to 15	740

Minimum duct velocity = 4,500 ft/min branch, 3,500 ft/min main
Entry loss = 0.45 velocity pressure for tapered takeoff
0.55 velocity pressure for straight takeoff

(c) *Spray-finishing operations*—(1) *Definitions applicable to this paragraph*—(i) *Spray-finishing operations.* Spray-finishing operations are employment of methods wherein organic or inorganic materials are utilized in dispersed form from deposit on surfaces to be coated, treated, or cleaned. Such methods of deposit may involve either automatic, manual, or electrostatic deposition but do not include metal spraying or metallizing, dipping, flow coating, roller coating, tumbling, centrifuging, or spray washing and degreasing as conducted in self-contained washing and degreasing machines or systems.

(ii) *Spray booth.* Spray booths are defined and described in § 1910.107(a). (See sections 103, 104, and 105 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33-1969).

(iii) *Spray room.* A spray room is a room in which spray-finishing operations not conducted in a spray booth are performed separately from other areas.

(iv) *Minimum maintained velocity.* Minimum maintained velocity is the velocity of air movement which must be maintained in order to meet minimum specified requirements for health and safety.

* (2) *Location and application.* Spray booths or spray rooms are to be used to enclose or confine all operations. Spray-finishing operations shall be located as provided in sections 201 through 206 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33-1969.

* (3) *Design and construction of spray booths.* (i) Spray booths shall be designed and constructed in accordance with § 1910.107(b) (1)–(4) and (6)–(10) (see sections 301–304 and 306–310 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33-1969), for general construction specifications. For a more detailed discussion of fundamentals relating to this subject, see ANSI A9.2-1960.

(a) Lights, motors, electrical equipment, and other sources of ignition shall conform to the requirements of § 1910.107 (b)(10) and (c). (See section 310 and chapter 4 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33-1969.)

(b) In no case shall combustible material be used in the construction of a

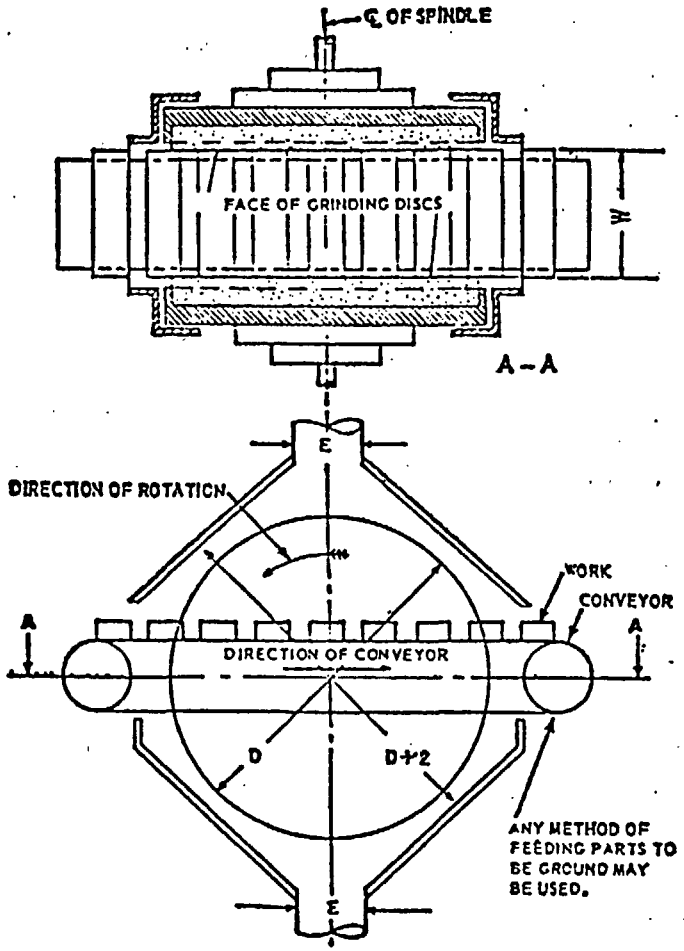

Fig. G-7
Horizontal Double-Spindle Disc Grinder Exhaust Hood and Branch Pipe Connections

Disc Dia, Inches		Exhaust *E*		Volume Exhausted at 4,500 ft/min ft³/min	Note
Min	Max	No. Pipes	Dia		
	19	1	5	610	When width "W" permits, exhaust ducts should be as near heaviest grinding as possible.
Over 19	25	1	6	880	
Over 25	39	1	7	1,200	
Over 39	53	2	6	1,770	
Over 53	72	4	6	6,220	

Entry loss = 0.45 velocity pressure for tapered takeoff

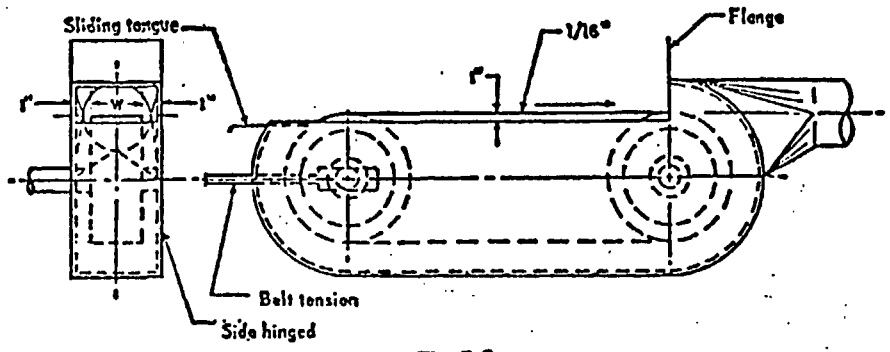

Fig. G-8
A Typical Hood for a Belt Operation

Belt Width W, Inches	Exhaust Volume, ft³/min
up to 3	220
3 to 5	302
5 to 7	390
7 to 9	500
9 to 11	610
11 to 15	740

Minimum duct velocity = 4,500 ft/min branch, 3,500 ft/min main
Entry loss = 0.45 velocity pressure for tapered takeoff
0.65 velocity pressure for straight takeoff

(c) *Spray-finishing operations*—(1) *Definitions applicable to this paragraph*—(i) *Spray-finishing operations.* Spray-finishing operations are employment of methods wherein organic or inorganic materials are utilized in dispersed form from deposit on surfaces to be coated, treated, or cleaned. Such methods of deposit may involve either automatic, manual, or electrostatic deposition but do not include metal spraying or metallizing, dipping, flow coating, roller coating, tumbling, centrifuging, or spray washing and degreasing as conducted in self-contained washing and degreasing machines or systems.

(ii) *Spray booth.* Spray booths are defined and described in § 1910.107(a). (See sections 103, 104, and 105 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33–1969).

(iii) *Spray room.* A spray room is a room in which spray-finishing operations not conducted in a spray booth are performed separately from other areas.

(iv) *Minimum maintained velocity.* Minimum maintained velocity is the velocity of air movement which must be maintained in order to meet minimum specified requirements for health and safety.

* (2) *Location and application.* Spray booths or spray rooms are to be used to enclose or confine all operations. Spray-finishing operations shall be located as provided in sections 201 through 206 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33–1969.

* (3) *Design and construction of spray booths.* (i) Spray booths shall be designed and constructed in accordance with § 1910.107(b) (1)–(4) and (6)–(10) (see sections 301–304 and 306–310 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33–1969), for general construction specifications. For a more detailed discussion of fundamentals relating to this subject, see ANSI A9.2–1960.

(a) Lights, motors, electrical equipment, and other sources of ignition shall conform to the requirements of § 1910.107 (b) (10) and (c). (See section 310 and chapter 4 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33–1969.)

(b) In no case shall combustible material be used in the construction of a

* EFFECTIVE 2/15/72 - See F.R. Aug. 13'71.

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 noncombustible 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.

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

(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.

(b) All fan ratings shall be in accordance with Air Moving and Conditioning Association Standard Test Code for Testing Air Moving Devices, Bulletin 210, April 1962.

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

(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.

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

(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.

(iii) Exhaust shall be so constructed as to provide structural strength and stability at least equivalent to sheet steel of not less than the following thickness:

Diameter or Greater Dimension	(U.S. gauge)
Up to 8 inches inclusive	No. 24
Over 8 inches to 18 inches inclusive	No. 22
Over 18 inches to 30 inches inclusive	No. 20
Over 30 inches	No. 18

(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.

(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.

(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.

(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.

(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 Z9.1–1960.) A clean-out door or doors shall be provided for servicing the fan, and where necessary, a drain shall be provided.

(f) Where ductwork passes through a combustible roof or wall, the roof or wall shall be protected at the point of penetration by open space or fire-resistive material between the duct and the roof or wall. When ducts pass through firewalls, they shall be provided with automatic fire dampers on both sides of the wall, except that three-eighth-inch steel plates may be used in lieu of automatic fire dampers for ducts not exceeding 18 inches in diameter.

(g) Ductwork used for ventilating any process covered in this standard shall not be connected to ducts ventilating any other process or any chimney or flue used for conveying any products of combustion.

(6) *Velocity and air flow requirements.* (i) Except where a spray booth has an adequate air replacement system, the velocity of air into all openings of a spray booth shall be not less than that specified in Table G–10 for the operating conditions specified. An adequate air replacement system is one which introduces replacement air upstream or above the object being sprayed and is so designed that the velocity of air in the booth cross section is not less than that specified in Table G–10 when measured upstream or above the object being sprayed.

EFFECTIVE 2/15/72 - See F.R. Aug. 13'71.

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TABLE G-10—MINIMUM MAINTAINED VELOCITIES INTO SPRAY BOOTHS

Operating conditions for objects completely inside booth	Crossdraft, f.p.m.	Airflow velocities, f.p.m.	
		Design	Range
Electrostatic and automatic airless operation contained in booth without operator.	Negligible	50 large booth	50- 75
		100 small booth	75-125
Air-operated guns, manual or automatic	Up to 50	100 large booth	75-125
		150 small booth	125-175
Air-operated guns, manual or automatic	Up to 100	150 large booth	125-175
		200 small booth	150-250

NOTES:
(1) Attention is invited to the fact that the effectiveness of the spray booth is dependent upon the relationship of the depth of the booth to its height and width.
(2) Crossdrafts can be eliminated through proper design and such design should be sought. Crossdrafts in excess of 100 fpm (feet per minute) should not be permitted.
(3) Excessive air pressures result in loss of both efficiency and material waste in addition to creating a backlash that may carry overspray and fumes into adjacent work areas.
(4) Booths should be designed with velocities shown in the column headed "Design." However, booths operating with velocities shown in the column headed "Range" are in compliance with this standard.

* (ii) In addition to the requirements in subdivision (i) of this subparagraph the total air volume exhausted through a spray booth shall be such as to dilute solvent vapor to at least 25 percent of the lower explosive limit of the solvent being sprayed. An example of the method of calculating this volume is given below.

Example: To determine the lower explosive limits of the most common solvents used in spray finishing, see Table G-11. Column 1 gives the number of cubic feet of vapor per gallon of solvent and column 2 gives the lower explosive limit (LEL) in percentage by volume of air. Note that the quantity of solvent will be diminished by the quantity of solids and nonflammables contained in the finish.

To determine the volume of air in cubic feet necessary to dilute the vapor from 1 gallon of solvent to 25 percent of the lower explosive limit, apply the following formula:

$$\text{Dilution volume required per gallon of solvent} = \frac{4\,(100-\text{LEL})\,(\text{cubic feet of vapor per gallon})}{\text{LEL}}$$

Using toluene as the solvent.

(1) LEL of toluene from Table G-11, column 2, is 1.4 percent.

(2) Cubic feet of vapor per gallon from Table G-11, column 1, is 30.4 cubic feet per gallon.

(3) Dilution volume required =

$$\frac{4\,(100-1.4)\,30.4}{1.4} = 8{,}564 \text{ cubic feet.}$$

(4) To convert to cubic feet per minute of required ventilation, multiply the dilution volume required per gallon of solvent by the number of gallons of solvent evaporated per minute.

TABLE G-11—LOWER EXPLOSIVE LIMIT OF SOME COMMONLY USED SOLVENTS

Solvent	Cubic feet of vapor per gallon of liquid at 70° F	Lower explosive limit in percent by volume of air at 70° F
	Column 1	*Column 2*
Acetone	44.0	2.6
Amyl Acetate (iso)	21.6	[1] 1.0
Amyl Alcohol (n)	28.6	1.2
Amyl Alcohol (iso)	29.6	1.2
Benzene	30.6	[1] 1.4
Butyl Acetate (n)	24.8	1.7
Butyl Alcohol (n)	35.2	1.4
Butyl Cellosolve	24.8	1.1
Cellosolve	33.6	1.8
Cellosolve Acetate	23.2	1.7
Cyclohexanone	31.2	[1] 1.1
1,1 Dichloroethylene	42.4	5.6
1,2 Dichloroethylene	42.4	9.7
Ethyl Acetate	32.8	2.5
Ethyl Alcohol	55.2	4.3
Ethyl Lactate	26.0	[1] 1.5
Methyl Acetate	40.0	3.1
Methyl Alcohol	80.8	7.3
Methyl Cellosolve	40.8	2.5
Methyl Ethyl Ketone	36.0	1.8
Methyl n-Propyl Ketone	30.4	1.5
Naphtha (VM&P) (76° Naphtha)	22.4	0.9
Naphtha (100° Flash) Safety Solvent—Stoddard Solvent	23.2	1.1
Propyl Acetate (n)	27.2	2.0
Propyl Acetate (iso)	28.0	1.8
Propyl Alcohol (n)	44.8	2.1
Propyl Alcohol (iso)	44.0	2.0
Toluene	30.4	1.4
Turpentine	20.8	0.8
Xylene (o)	26.4	1.0

[1] At 212° F.

(iii) (*a*) When an operator must position himself in a booth downstream of the object being sprayed, an air supplied respirator or other type of respirator approved by the Bureau of Mines, U.S. Department of the Interior (see 30 CFR Part 11) or specified in ANSI Z88.2–1969 for the material being sprayed should be used by the operator.

(*b*) Where downdraft booths are provided with doors, such doors shall be closed when spray painting.

(7) *Make-up air.* (i) Clean fresh air, free of contamination from adjacent industrial exhaust systems, chimneys, stacks, or vents, shall be supplied to a spray booth or room in quantities equal to the volume of air exhausted through the spray booth.

(ii) Where a spray booth or room receives make-up air through self-closing doors, dampers, or louvers, they shall be fully open at all times when the booth or room is in use for spraying. The velocity of air through such doors, dampers, or louvers shall not exceed 200 feet per minute. If the fan characteristics are such that the required air flow through the booth will be provided, higher velocities through the doors, dampers, or louvers may be used.

(iii) (*a*) Where the air supply to a spray booth or room is filtered, the fan static pressure shall be calculated on the assumption that the filters are dirty to the extent that they require cleaning or replacement.

(*b*) The rating of filters shall be governed by test data supplied by the manufacturer of the filter. A pressure gage shall be installed to show the pressure drop across the filters. This gage shall be marked to show the pressure drop at which the filters require cleaning or replacement. Filters shall be replaced or cleaned whenever the pressure drop across them becomes excessive or whenever the air flow through the face of the booth falls below that specified in Table G–10.

(iv) (*a*) Means of heating make-up air to any spray booth or room, before or at the time spraying is normally performed, shall be provided in all places where the outdoor temperature may be expected to remain below 55° F. for appreciable periods of time during the operation of the booth except where adequate and safe means of radiant heating for all operating personnel affected is provided. The replacement air during the heating seasons shall be maintained at not less than 65° F. at the point of entry into the spray booth or spray room. When otherwise unheated make-up air would be at a temperature of more than 10° F. below room temperature, its temperature shall be regulated as provided in section 3.6 of ANSI Z9.2–1960.

(*b*) As an alternative to an air replacement system complying with the preceding section, general heating of the building in which the spray room or booth is located may be employed provided that all occupied parts of the building are maintained at not less than 65° F. when the exhaust system is in operation or the general heating system supplemented by other sources of heat may be employed to meet this requirement.

(*c*) No means of heating make-up air shall be located in a spray booth.

(*d*) Where make-up air is heated by coal or oil, the products of combustion shall not be allowed to mix with the make-up air, and the products of combustion shall be conducted outside the building through a flue terminating at a point remote from all points where make-up air enters the building.

(*e*) Where make-up air is heated by gas, and the products of combustion are not mixed with the make-up air but are conducted through an independent flue to a point outside the building remote from all points where make-up air enters the building, it is not necessary to comply with (*f*) of this subdivision.

(*f*) Where make-up air to any manually operated spray booth or room is heated by gas and the products of combustion are allowed to mix with the supply air, the following precautions must be taken:

(*1*) The gas must have a distinctive and strong enough odor to warn workment in a spray booth or room of its presence if in an unburned state in the make-up air.

(*2*) The maximum rate of gas supply to the make-up air heater burners must not exceed that which would yield in excess of 200 p.p.m. (parts per million) of carbon monoxide or 2,000 p.p.m. of total combustible gases in the mixture if the unburned gas upon the occurrence of flame failure were mixed with all of the make-up air supplied.

(*3*) A fan must be provided to deliver the mixture of heated air and products

* EFFECTIVE 2/15/72 – SEE F.R. AUG. 13 '71.

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Color Definitions of ANSI Z53.1-1967 Safety Color Code for Marking Physical Hazards.

§ 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.

(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 and colors*—(1) *Design features.* The colors, proportions, and location of the identification panels on each sign shall be in accordance with this paragraph. 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. When conditions warrant the use of a sign size not covered in the following tables, the ratio of the depth of the identifying panel (Danger, Caution, etc.) to the width of the sign shall be as established in Tables J-1 to J-4.

(2) *Danger signs.* (i) The colors red, black, and white shall be those of opaque

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glossy samples as specified in Table 1 of Fundamental Specification of Safety Colors for CIE Standard Source "C", nerican 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.

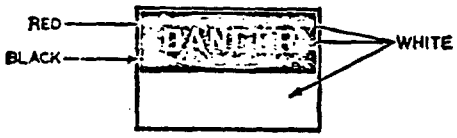

Fig. J-1
Danger Sign

TABLE J-1—STANDARD PROPORTIONS FOR DANGER SIGNS

Sign size, inches Height	Width	Black rectangular panel, inches Height	Width	Red oval, inches Height	Width	Word danger, height inches	Maximum space available for sign wording, inches
			HORIZONTAL PATTERN				
7	10	3¼	9⅜	2⅞	8¾	1 3/16	2⅝ x 9¾
10	14	4⅝	13⅜	4⅛	11⅝	2 1/16	4¼ x 13⅜
14	20	6½	19⅜	5¾	17	2⅞	6¼ x 19⅜
20	28	9¼	27⅜	8¼	23⅜	4⅛	9¼ x 27⅜
			UPRIGHT PATTERN				
10	7	2⅝	6¼	2¼	5⅞	1 1/16	6⅝ x 6¼
14	10	3½	9⅜	2⅞	8¼	1 3/16	9½ x 9¾
20	14	4⅝	13⅜	4⅛	11⅞	2 1/16	14 x 13⅜
28	20	6½	19⅜	5¾	17	2⅞	20¼ x 19⅜

(3) *Radiation warning signs.* (i) Standard color of the background shall be yellow; the panel, reddish purple with yellow letters; the symbol, reddish purple; 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.

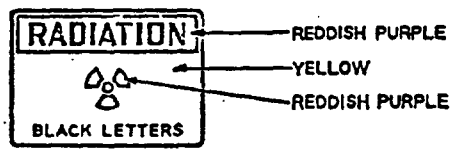

Fig.J-2
Radiation Warning Sign

(ii) The standard symbol shall be as in Figure J–3. Method of dimensioning, design, and orientation of the standard symbol (one blade pointed downward and centered on the vertical axis) shall be executed as illustrated. The symbol shall be prominently displayed, and of a size consistent with the size of the equipment or material or area to which it is attached.

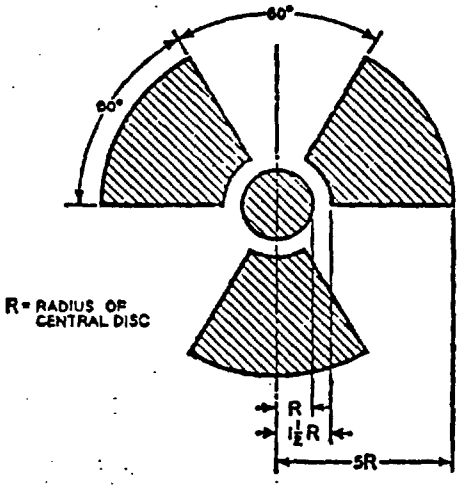

Fig. J-3
Standard Radiation Symbol

(iii) Format shall be as in Figure J–2. Sign proportions shall be the same as those for danger signs in Table J–1.

(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.

(ii) Standard proportions shall be as indicated in Table J–2, and format shall be as in Figure J–4.

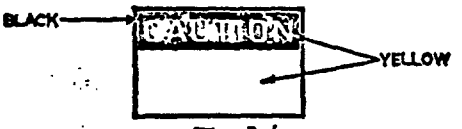

Fig. J-4
Caution Sign

TABLE J-2—STANDARD PROPORTIONS FOR CAUTION SIGNS

Sign size inches height	width	Black rectangular panel, inches height	width	Word "Caution" height of letter, inches	Maximum space available for sign wording below panel inches height	width
			HORIZONTAL PATTERN			
7	10	2¾	9⅜	1⅜	3¼	9⅜
10	14	3¾	13⅜	2⅛	8⅛	13⅜
14	20	5⅛	19⅜	2⅞	9	19⅜
20	28	4¼	27⅜	3¼	14⅛	27⅜
			UPRIGHT PATTERN			
10	7	1⅝	6¼	1⅛	7	6¼
14	10	2¼	9⅜	1⅜	10⅛	9⅜
20	14	3¼	13⅜	2⅛	15¼	13⅜
28	20	3¼	19⅜	2⅞	24	19⅜

(5) *Exit signs.* Exit signs shall be in accordance with § 1910.37(q).

(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.

(ii) Standard proportions shall be as indicated in Table J–3, and format shall be as in Figure J–5.

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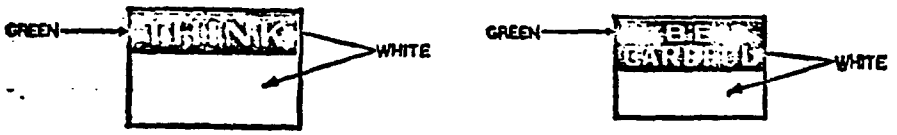


(Note: The words "Think" and "Be Careful," given here, are only illustrations. Other wordings may be used.)

Fig. J-5
Safety Instruction Signs

TABLE J-3—STANDARD PROPORTIONS FOR SAFETY INSTRUCTION SIGNS

Sign size, inches, height, width	Green rectangular panel, inches, height, width	Word "Think" height of letters, inches	Maximum space available for sign wording below panel, inches height, width	Sign size, inches height, width	Green panel, inches, height, width	Word "Be" height of letters, inches	Word "Careful" height of letters, inches	Maximum space available for sign wording below panel, inches, height, width
7 x 10	2¾ x 9⅝	1⅜	3¼ x 9⅝	7 x 10	3¾ x 9⅝	1¼	1 7/16	2¾ x 9⅝
10 x 14	3¼ x 13⅜	2¼	5⅛ x 13⅜	10 x 14	4¼ x 13⅜	1¾	2 1/16	4 x 13⅜
14 x 20	3¾ x 19⅛	2¾	9 x 19⅛	14 x 20	6¼ x 19⅛	2¼	3 1/16	6 x 19⅛
20 x 28	4¼ x 27⅜	3¼	14⅛ x 27⅜	20 x 28	9⅛ x 27⅜	3½	4 1/16	9¼ x 27⅜

(7) *Directional signs.* (i) Standard color of the background shall be white; and the panel, black with white directional symbol. 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.

(ii) Standard proportions shall be as indicated in Table J–4, and format shall be as in Figure J–6.

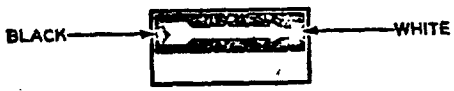


Fig. J-6
Directional Signs

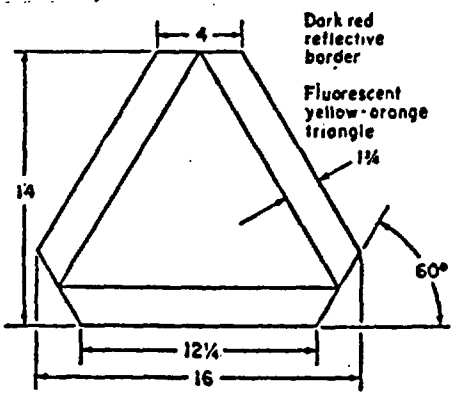
Table J-4—Standard Proportions for Directional Signs

Sign size, inches height width	Black rectangular panel, inches height width	White arrow, inches: Overall length	Arrow head height width	Arrow shaft height	Arrow tail height width	Maximum space for sign wording below panel height
6½ x 14	3¼ x 13⅜	12⅝	2⅝ x 3	1¼	2 9/16 x 3¼	2¾ x 13⅜
9 x 20	4½ x 19⅛	18⅜	3¾ x 4½	1⅝	3¼ x 4 1/16	3¾ x 19⅛
12 x 28	6 x 27⅜	26⅛	5¼ x 6⅜	2¼	4 3/16 x 6	4 3/16 x 27⅜
18 x 36	7½ x 35⅜	34⅜	6⅞ x 8⅜	2⅞	5½ x 7½	6¼ x 35⅜

(8) *In-Plant traffic signs.* Regulatory and control signs required for the safe movement of vehicles and pedestrians on thoroughfares on plant property shall conform to the standards established in American National Standard Manual on Uniform Traffic Control Devices for Streets and Highways, D6.1–1961.

(9) *Informational signs.* Blue shall be the standard color for informational signs. It may be used as the background color for the complete sign or as a panel at the top of such types of "Notice" signs, which have a white background. The colors shall be those of opaque glossy samples as specified in Table 1 of American National Standard Z53.1–1967.

(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 fluorescene 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 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

(11) *Symbols.* Symbols used on signs shall follow recognized practices, such as in Figure J–8. For radioactive materials, see symbol in Figure J–3.

POISON:

ELECTRICITY:

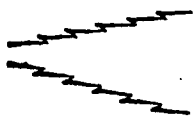


Fig. J-8
Symbols Used on Signs

(e) *Sign wordings*—(1) *Examples of wordings.* The lists in subparagraphs (3) through (7) of this paragraph are intended to serve as a guide for choosing the correct sign design for the message to be displayed.

(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.*

Danger—Keep Off, Electric Current.
Danger—No Smoking, Matches, or Open Lights.
Danger—Men Working Above.
Danger—Not Room Enough Here to Clear Men on Cars.
Danger—Keep Away.
Danger—Men in Boiler.
Danger—Insufficient Clearance.
Danger—2,300 Volts.
Danger—Keep Out.
Danger—Crane Overhead.
Danger—Keep Off.

(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 biohazard symbol shall be designed and proportioned as illustrated in figure J–9.

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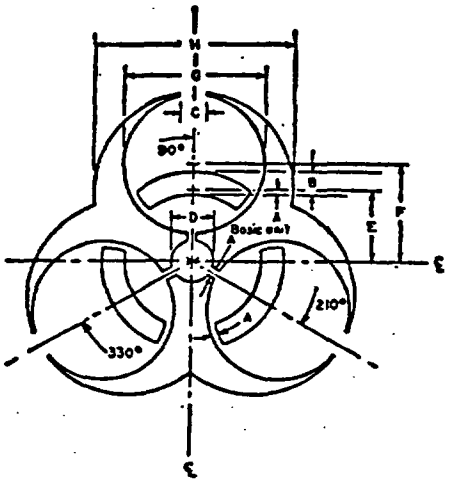


Dimension	A	B	C	D	E	F	G	H
Units	1	3½	4	6	11	15	21	30

Fig. J-9
Symbol for Biological Hazard

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.

(5) *Caution signs.*

Caution—Do Not operate, Men Working on Repairs.
Caution—Hands Off Switch, Men Working on Line.
Caution—Working on Machines, Do Not Start.
Caution—Goggles Must Be Worn When Operating This Machine.
Caution—This Door Must Be Kept Closed.
Caution—Electric Trucks, Go Slow.
Caution—This Space Must Be Kept Clear at All Times.
Caution—Stop Machinery to Clean, Oil, or Repair.
Caution—Keep Aisles Clear.
Caution—Operators of This Machine Shall Wear Snug Fitting Clothing—No Gloves.
Caution—Close Clearance.
Caution—Watch Your Step.
Caution—Electric Fence.

(6) *Safety instruction signs.*

Report All Injuries to the First-Aid Room at Once.
Walk—Don't Run.
Report All Injuries No Matter How Slight.
Think, If Safe Go Ahead.
Make Your Work Place Safe Before Starting the Job.
Report All Unsafe Conditions to Your Foreman.
Help Keep This Plant Safe and Clean.

(7) *Directional signs.*

This Way Out (below arrow panel).
This Way (inside arrow) Out (below arrow panel).
Fire Exit (below arrow panel).
Fire (inside arrow) Extinguisher (below arrow panel).
To the (inside arrow) Fire Escape (below arrow panel).
To the (inside arrow) First Aid (below arrow panel).
Manway (below arrow panel).
This Way to (inside arrow) First-Aid Room (below arrow panel).

(8) *Informational signs.*

No Trespassing Under Penalty of the Law.
This Elevator Is for Freight Only, Not for Passengers.
No Admittance Except to Employees on Duty.
No Admittance.
No Admittance, Apply at Office.
No Trespassing.
Men.
Women.
For Employees Only.
Office.

NOTE: When sign wordings such as those listed in this section are contemplated, care should be taken to be sure that they are suitable for the particular location at which the sign is to be placed and that wording meets the requirements of the intended purpose. When there is a reasonable doubt, a sign of a standard design should be used.

(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 or damage to property, or both.

(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.

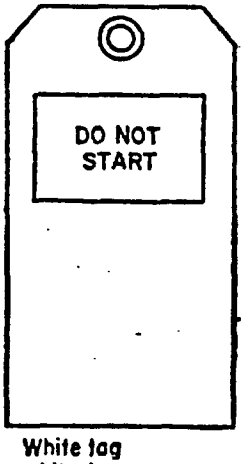
(iii) Do Not Star tags shall be placed in a conspicuous location or shall be placed in such a manner that they effectively block the starting mechanism which would cause hazardous conditions should the equipment be energized.

(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. (See Fig. J-11.)

(ii) All employees should be instructed that Danger tags indicate immediate danger and that special precautions are necessary.

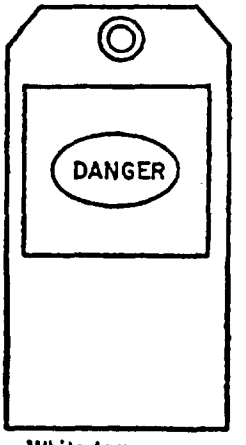
(5) *Caution tags.* (i) Caution tags should be used only to warn against potential hazards or to caution against unsafe practices. (See Fig. J-12.)

(ii) All employees should be instructed that Caution tags indicate a possible hazard against which proper precautions should be taken.



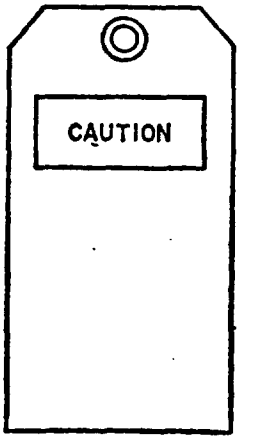
White tag
white letters on
red square

Fig. J-10
Do Not Start Tag



White tag
white letters on
red oval with a
black square

Fig. J-11
Danger Tag



Yellow tag
yellow letters on a
black background

Fig. J-12
Caution Tag

(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. (See Fig. J-13.)

(7) *Radiation tags.* (i) The standard background for Radiation tags shall be yellow; the panel shall be reddish purple. Any letters used against the yellow background shall be black. The colors shall be those of opaque glossy samples as

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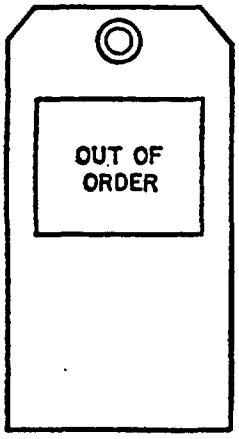
specified in Table 1, Fundamental Specification of Safety Colors for CIE Standard Source "C" American National Standard Safety Color Code for Marking Physical Hazards and the Identification of Certain Equipment, Z53.1-1967.

(ii) The method of dimension, design, and orientation of the standard symbol (one blade pointed downward and centered on the vertical axis) shall be executed as illustrated in Figure J-14. The symbol shall be prominently displayed and of a size consistent with the size of the equipment or area in which it is to be used.

(8) *Biological hazard tags.* (i) The standard background color for the Biological Hazard symbol is optional as long as there is sufficient contrast for the symbol to be clearly defined. The symbol design (see Fig. J-15) shall be a fluorescent orange or orange-red color.

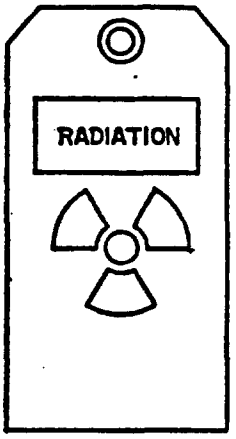
(ii) The biological Hazard tag shall be used to signify the actual or potential presence of a biohazard, to identify equipment, containers, rooms, materials, experimental animals, or combinations thereof, which contain or are contaminated with viable hazardous agents.

(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.



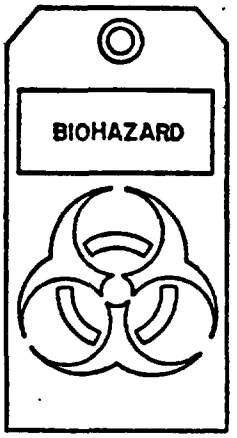
White tag
white letters on
black background

Fig. J-13
Out of Order Tag



Yellow tag
yellow letters in
reddish-purple panel
(Added wording in black
on yellow background)

Fig. J-14
Radiation Tag



White tag
black letters on
fluorescent-orange
background and
symbol

Fig. J-15
Biological Hazard Tag

§ 1910.147 Sources of standards.

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

Sec.	Source
1910.141	ANSI Z4.1-1968, Minimum Requirements for Sanitation in Places of Employment.
1910.142	ANSI Z4.4-1968, Minimum Requirements for Sanitation in Temporary Labor Camps.
1910.143	ANSI Z4.3-1970, Minimum requirements for Nonwater Carriage, Disposal Systems.
1910.144	ANSI Z53.1-1967, Safety Color Code for Marking Physical Hazards.
1910.145 (a)-(e)	ANSI Z35.1-1969, Specifications for Accident Prevention Signs, and ANSI B114.1-1971, Slow-Moving Vehicle Identification Emblem.
1910.145(f)	ANSI Z35.2-1968, Specifications for Accident Prevention Tags.

§ 1910.148 Standards organizations.

Standard and specifications of the following organizations have been referenced in this Subpart J:

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

National Association of Plumbing and Mechanical Officials, 5032 Alhambra Avenue, Los Angeles, CA 90032.

American Society of Agricultural Engineers, 2950 Niles Road, Post Office Box 229, St. Joseph, MI 49085.

§ 1910.149 Effective dates.

(a) The provisions of this Subpart J 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:

§1910.142 (b)(2), (b)(5), (b)(7), (d)(6), (f), (g), (i)(1), and (i)(2).

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

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

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