

STATE OF NEW JERSEY  
DEPARTMENT OF LABOR & INDUSTRY  
PERCY A. MILLER, JR., Commissioner

RULES AND REGULATIONS

for

EXPLOSION AND FIRE PROTECTION IN PLANTS  
PRODUCING OR HANDLING MAGNESIUM POWDER OR DUST

Bureau of Explosives  
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*Trenton, New Jersey*

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NOTE: These Rules and Regulations are based upon the recommendations of the Committee on Dust Explosion Hazards of the National Fire Protection Association.



# **RULES AND REGULATIONS**

## **FOR EXPLOSION AND FIRE PROTECTION IN PLANTS**

### **PRODUCING OR HANDLING MAGNESIUM POWDER OR DUST**

#### **SECTION 1 - Definitions**

The following terms are used in these rules and regulations as defined below:

- 1.1 *Magnesium Powder*: fine magnesium, 30 mesh or finer, a product specially prepared in equipment designed or installed for the purpose.
- 1.2 *Magnesium Dust*: fine magnesium considered as a waste product in grinding, or otherwise preparing magnesium parts.
- 1.3 *Approved*: refers to approval by the Department of Labor and Industry.
- 1.4 *Commissioner*: refers to the Commissioner of Labor and Industry

#### **SECTION 2 - General**

- 2.1 These rules and regulations are promulgated by the Commissioner of Labor and Industry under authority vested in him by the Revised Statutes of the State of New Jersey, to wit:

R.S. 34:1-20. The commissioner may make and publish rules and regulations not inconsistent with law as he shall deem necessary to enforce the provisions of this title.

Whenever any condition is found to exist in contravention of any provision of this title the commissioner may, by written order, signed by him, specifying the things to be done and the time for compliance, require such condition to be corrected.

- 2.2 Unusual explosion and fire hazards are present in plants producing and handling magnesium powder and in plants producing magnesium dust, shavings, or chips in connection with sawing, grinding, machining, or buffing of castings, or stampings made from magnesium or its alloys. Magnesium in the form of powder, shavings, chips or dust can be ignited readily by a spark, flame, or friction sufficient to raise the temperature to about 900° F.
- 2.3 Magnesium powder or dust will ignite readily and when ignited while in suspension in air, it will explode violently. The high pressure recorded and the very rapid rate of pressure rise observed in laboratory tests emphasize the importance of adopting all possible protective measures wherever magnesium powder is produced, processed or handled.
- 2.4 Burning magnesium produces a temperature of about 2,500° F. and cannot be extinguished by the application of water, carbon dioxide, foam carbon tetrachloride, or other common fire extinguishing agents. Application of these agents may intensify the burning, or cause violent explosions.
- 2.5 The purpose of these rules and regulations is to make available to plant operators precautions which can be taken and safe practices which shall be followed in guarding against magnesium fire and explosion hazards.
- 2.6 Plans for construction of buildings, alterations thereto or additions, mechanical and electrical installations and operations must be approved by the Department of Labor and Industry before any work is begun.
- 2.7 Excepting only where specified exemptions have been granted in writing, existing plants engaged in the production of magnesium powder or dust shall conform to the provisions of these rules and regulations.

**NOTE:** All dust concentrations of 500 milligrams per liter (500 ounces per 1,000 cubic feet) maximum pressures in excess of 60 pounds per square inch (4 1/3 tons per square foot) were recorded in laboratory tests. The maximum rate of pressure rise determined in the Clement Frazer apparatus is nearly 800 pounds per square inch per second; in the Hartmann apparatus at the Bureau of Mines laboratories, a rate of nearly 2,600 pounds per square inch per second was recorded. This means that the maximum pressure of 60 pounds per square inch at the concentration cited is developed in from 1/10 to 1/40 of a second.



- 2.8 Smoking and the carrying of matches within the plant area is ABSOLUTELY PROHIBITED.
- 2.9 A thorough search shall be made of all persons entering the plant to insure the removal of all matches, smoking materials and any other harmful materials or foreign matter from their person.
- 2.10 The statutes of this state prohibit any person from obstructing the Commissioner of Labor and Industry or any authorized representative of the Department of Labor and Industry in the performance of their duties.
- 2.11 Suitable identification devices, similar to those in common use at the plant shall be prepared and kept available at the main entrance to the plant for the use of the Commissioner of Labor and Industry, the Deputy Commissioner of Labor and Industry, the Chief Safety Inspector and Safety Inspector in whose inspection district the plant is located, the Industrial Chemist and two Industrial Engineers of the Department and any other representative of the Department so designated by the Commissioner.
- 2.12 A sign shall be conspicuously posted in every work-room or area indicating the maximum allowable number of operators and transients and quantity of materials that must not be exceeded in the room or area at any one time.
- 2.13 Approved copy of plot plan is to be posted and kept posted in the main plant office. Neither physical changes in plant property nor changes in operating procedure may be made without the approval of the Bureau of Explosives of the Department of Labor and Industry.
- 2.14 A detailed report of any accident involving: (1) lost time or more than one day for any injured employ; (2) equipment damage of excess of \$100.00 must be reported by mail to the Bureau of Explosives at Trenton within twenty-four hours after occurrence.
- 2.15 Any fire, however slight, must be reported by telephone immediately to the Bureau of Explosives at Trenton, excepting that between the hours of 5:30 P. M. and 9 A. M., such report shall be made by telephone to the State House operator at Trenton.

## A. MAGNESIUM POWDER PLANTS

### SECTION 3 - Location of Plant

- 3.1 At the present time no practical method of providing complete protection against ignitions and explosions during the manufacture of magnesium powder is known. Accordingly, it is required that plants engaged in magnesium powder production be located in sparsely settled sections where sufficient space is available to permit location of the buildings in which the grinding, screening, collection and packaging equipment is installed, in accordance with the quantity and distance tables herein.
- 3.2 All buildings on the plant shall be spaced from each other in accordance with the quantity and distance tables herein.
- 3.3 Quantity and distance table for magnesium powder or dust not in sealed containers.

TABLE A		QUANTITY - DISTANCE TABLE			
QUANTITY		DISTANCE IN FEET FROM NEAREST (with or without barricade)			
Pounds over	Pounds not over	Bldg. not on Plant property	Railway	Highway	Bldg. on Plant property
10	25	60	40	20	40
25	50	145	90	45	60
50	100	240	140	70	80
100	200	360	220	110	100
200	300	520	310	150	120
300	400	640	380	190	130
400	500	720	430	220	140
500	750	890	535	270	160
750	1,000	1,020	610	310	180
1,000	1,500	1,060	640	320	210
1,500	2,000	1,200	720	360	230
2,000	3,000	1,300	780	390	260

NOTE: Buildings housing magnesium powder producing or handling equipment shall be at least 100 feet from electric or steam power plants.

- 3.4 Quantity and distance table for magnesium powder is sealed containers.



TABLE B *You're viewing an archived copy from the New Jersey State Library* QUANTITY - DISTANCE TABLE

QUANTITY		DISTANCE IN FEET FROM NEAREST (with or without barricade)			
Pounds over	Pounds not over	Bldg. not on Plant property	Railway	Highway	Bldg. on Plant Property
100	1,000	75	75	75	50
1,000	5,000	115	115	115	75
5,000	10,000	150	150	150	100
10,000	20,000	190	190	190	125
20,000	30,000	215	215	215	145
30,000	40,000	235	235	235	155
40,000	50,000	250	250	250	165

NOTE: These distances may be reduced 50% if storage is in building with 12 inches solid reinforced concrete or masonry walls and a light roof which will provide a venting area of 1 sq. ft. for each 25 cu. ft. of room volume.

- 3.5 The entire property shall be surrounded with a high, strong fence designed to present unauthorized access to the plant, or traversing the grounds.
- 3.6 Gates or entrances to the property shall be guarded.

#### SECTION 4 - Construction and Location of Buildings

- 4.1 All buildings comprising a magnesium powder producing plant shall be of fire-resistive construction.
- 4.2 Separate rooms or separate buildings shall be provided for the cutting, grinding, screening, and packaging operations. If separate rooms in one building are used, the rooms shall have 12 inch reinforced masonry division walls extended as parapets 3 feet above the roof and 3 feet beyond the side walls.
- 4.3 Where separate buildings are used and two buildings face each other and both facing walls containing windows or other openings, the buildings shall have not less than 50 feet of clear space between them. Where only one facing wall has windows or openings and the other wall is reinforced masonry of 8 hour fire retardant rating, the building shall not have less than 25 feet of clear space between them.
- 4.4 Buildings in which the cutting, grinding, screening, collecting or packaging machines are located shall be constructed without basements and be not more than (1) one story in height.
- 4.5 Each grinding mill or screen shall be installed in a separate room or compartment with at least two exterior walls and where hammer mills or pulverizers are used for grinding, not more than two rooms containing such grinding equipment shall be permitted in one building. One exterior wall shall be of light construction to provide adequate explosion venting. An emergency exit from each screening or grinding room shall be provided in the light venting wall. This exit may be a panel or light door, operable from the inside only and designed to open outward. The normal means of entrance and exit shall be through an approved Class A self-closing fire door in one of the reinforced masonry walls, hinged to open outward, and this door shall be equipped with a positive latch. There shall be no direct communication between rooms or buildings in which the grinding or screening equipment is installed.
- 4.6 Buildings shall be designed so that all horizontal ledges, or surfaces above the floor level are eliminated as far as practical. Ledges that cannot be eliminated shall be filled and leveled to provide a smooth surface inclined at 90° with the horizontal so as not to retain dust deposits.
- 4.7 The top of flooring shall be an approved, conductive non-sparking material to prevent the production of metallic or static sparks. All floors shall be effectively grounded.
- 4.8 Floors shall be smooth with the junction of floor and wall free from cracks or other dust catchers. Fillets with 2 inch radius at floor and wall junctures, shall be provided wherever possible.
- 4.9 All interior walls shall be made as smooth as possible to prevent the retention of dust on their surface. Walls shall be coated with enamel, or other material to produce a surface which will prevent adherence of dust.
- 4.10 Roofs of buildings shall be as light as practical and arranged so that they will be easily blown off by an internal explosion. Piping, or other equipment shall not be supported by the roof deck, but secured only to structural members not likely to be damaged by an explosion.
- 4.11 Roofs shall be constructed and maintained in a tight condition to prevent leakage.



- 4.12 Windows shall be large in area to provide maximum lighting and to provide a vent for the release of pressure in case of an explosion. A venting ratio of not less than 1 square foot for each 25 cubic feet of volume is recommended. Windows or sections of windows which open should be hinged at the top and be of an explosion venting type with catches designed to release on the application of pressure from within. Fixed glass should be scored on the outside with a glass cutter to reduce the resistance of the glass to pressure from within.
- 4.13 Covered passageways with sloping roof enclosed on the low side only may be provided between buildings or alongside the rooms or compartments housing individual machines. Entrance to rooms shall be at right angles to the direction of travel through the passageway and all connections to the passageway shall be protected by approved Class A self-closing swinging fire doors. An opening from one room to the passageway shall not be directly opposite the opening from another room to the passageway.

## SECTION 5 - Making and Handling Magnesium Powder

NOTE: Several different methods of producing magnesium powder are not in use and new systems are being tried but comparable data on explosion hazards during operation are not available. Where magnesium powder is manufactured by the so-called wet process, that is, by the use of special files or milling cutters operated under a liquid medium such as mineral spirits having a flash point of approximately 105 degrees F., the hazards up to the time of the removal of the oil from the magnesium powder by drainage and evaporation are principally those associated with flammable liquids and the recommendations of the committee on flammable liquids are applicable. The provisions of this code will apply to magnesium powder manufactured by the so-called wet process whenever the material is handled or stored in the dry powdered form. The following recommendations covering the making and handling of magnesium powder are based on past experiences and information now available on manufacturing methods.

- 5.1 All magnesium powder shall be produced and handled by the batch system as used in the manufacture of explosives; unless otherwise approved.
- 5.2 Conveying magnesium powder by air stream is generally prohibited and shall only be used where expressly approved.
- 5.3 Hand trucks, carts, and drums shall be used for transporting both the magnesium in the process of being reduced to powder and the finished product itself.
- 5.4 Carts, trucks, boxes, or drums used during manufacture as containers for magnesium powder shall be constructed for non-sparking materials, or be lined with non-sparking material, and have non-sparking tires on wheels or casters, either of which shall be of conductive, non-sparking material.
- 5.5 Shovels or scoops used in handling magnesium powder shall be made of magnesium, aluminum, copper or other non-sparking materials.
- 5.6 Grinding equipment used for the production of magnesium powder shall not be used for any other grinding.
- 5.7 Screens and magnetic separators should be used to remove all foreign material and oversize pieces from the magnesium entering the grinder.
- 5.8 Automatic operation of mills, and screens shall be arranged with remote control for starting and stopping the machinery.
- 5.9 Devices to detect unusual increases in temperature are recommended for installation in grinding or processing equipment. These devices should be arranged to shut down the equipment when a hazardous condition is indicated.
- 5.10 Not more than two (2) persons shall enter the room, or compartment to charge or unload the machines, or perform cleaning or maintenance duties. A statement to this effect shall be posted in all such rooms or compartments.
- 5.11 All powder producing and handling machinery shall be as dust tight as possible to prevent the escape of powder into the air of the room in which it is located.
- 5.12 Operators shall be instructed to shut down machinery before entering screening or pulverizing rooms. To insure compliance with this rule, entrance doors to such rooms shall be interlocked with the power supply so that machinery will be automatically stopped if the door is opened while the machinery is operating. A reset system should be provided to prevent restarting of machinery when the door is closed until the normal starting procedure is followed.
- 5.13 Magnesium powder shall be handled and transported in bulk containers and shall not be allowed to fall through chutes or sprouts into open bins or hoppers where dangerous dust clouds may be created.
- 5.14 All enclosed equipment for the production and handling of magnesium powder shall be provided with explosion relief vents to the outside of buildings, wherever possible; shall be so constructed that there will be no loss of fine powder and shall be designed to prevent the entrance of moisture.



- 5.15 To make explosion vents most effective, searchlights or other machines shall be installed close to walls or windows to permit using the shortest possible vent duct.

## **SECTION 6 - Electrical Wiring and Equipment**

- 6.1 All electrical wiring and equipment in buildings where magnesium powder is regularly produced or handled, and in other sections of the plant where magnesium powder or dust may be present, shall be suitable for atmospheres containing metal dust.
- 6.2 Provisions shall be made for remote control of the electrical circuits, so that the current for light and power in any dust making building may be disconnected by switches outside of the building at a distance of at least 4 feet from the nearest doorway. Arrangements shall also be made to disconnect the power of the whole plant by switches located at one or more central points, such as the office, watchman's booth, etc.
- 6.3 All electrical equipment shall be inspected and cleaned periodically.
- 6.4 Where flash lights or storage battery lamps are used, they shall be of a type approved for the purpose.
- 6.5 Installation of transformers and capacitors shall be outside and at a safe approved distance from the magnesium powder production buildings.
- 6.6 Electric lights for use in magnesium powder plants shall be of a type which will operate continuously with all exposed parts of the lamp and fixture at a temperature well below the ignition temperature of the powder.
- 6.7 All electric lines in the vicinity of the power buildings shall be underground. If overhead, they shall be protected against arcing caused by lightning.

## **SECTION 7 - Control of Static Electricity**

- 7.1 Preventing the formation or accumulation of static electricity is essential for safety in magnesium powder plants. Grounding of all buildings, machines and equipment is necessary from the stand-point of static control, as well as for lightning protection. Grounding shall be done in an approved manner.
- 7.2 Magnesium powder shall not be allowed to slide over metal aprons or chutes, unless they are grounded to prevent static charges accumulating.

## **SECTION 8 - Lightning Protection**

- 8.1 A lightning conductor system shall be provided around or upon the powder producing and handling section of the plant, of sufficient size and capacity to fully protect all buildings in the area from lightning.

## **SECTION 9 - Preventing Ignitions of Magnesium Powder**

- 9.1 Particular attention must be given to the elimination of all possible sources of ignition in magnesium powder plants. Ignitions of magnesium powder can be prevented under certain conditions when helium or nitrogen is used to create inert atmospheres but has not been found practical to provide such protection under all commercial methods of production and handling. In addition to the recommendations and requirements under previous headings, the following general precautions should be adopted.
- 9.2 No open flames, electric or gas, cutting or welding equipment shall be permitted within the building housing the powder producing or handling machinery. It becomes absolutely necessary to use such equipment inside the building for making repairs, the plant shall be shut down and the section in which the repairs are to be made shall be thoroughly cleaned to remove all accumulations of magnesium powder.
- 9.3 Hot air heating shall not be employed. The stirring action of a forced hot air heating system might easily be dangerous as it would keep fine dust in suspension. Heating shall be provided by employing easily cleaned steam or hot water coils.
- 9.4 Shovels or scoops used in handling magnesium powder shall be made of magnesium, aluminum, copper or other non-sparking metal.
- 9.5 Only non-sparking tools shall be used in making repairs, or adjustments on magnesium powder producing or handling equipment. Such tools shall be frequently inspected and corrected for defects.
- 9.6 Grinding wheels shall not be used where magnesium powder is present or where accumulations of powder may be ignited by sparks from the wheel.



- 9.7 Grinding wheels used for grinding magnesium, or wheels coated with a magnesium powder shall not be used for grinding other metals.
- 9.8 Signs painted in contrasting colors with the legend 'DO NOT USE WATER IN CASE OF FIRE' in letters 3 inches high shall be posted conspicuously on the outside of all buildings containing powder producing or handling equipment or used for the storage of magnesium powder.

#### SECTION 10 - Storage of Magnesium Powder

- 10.1 The principle precaution to observe in storing magnesium powder is to avoid storage in open bins, or other open containers and limit the storage in any one area to the smallest possible amount, which in any case shall not exceed the approved quantity, as provided by the quantity and distance tables.
- 10.2 Magnesium powder must be kept dry.
- 10.3 Magnesium powder shall be protected against any form of heat capable of raising the temperature to the ignition point.
- 10.4 Magnesium in the process of being manufactured into powder shall be kept in covered containers to protect it against possible ignition by sparks.
- 10.5 The finished product shall be packed in cans, drums, or moisture-proof containers which can be closed to prevent accidental spilling during handling.

NOTE: Special types of containers have been approved for use in shipping magnesium by common carriers.

- 10.6 All containers in which magnesium is stored shall be plainly labeled.

#### SECTION 11 - Fire Protection for Magnesium Powder Plants

NOTE: Fire protection for magnesium plants is largely a fire prevention problem. Small magnesium fires can be extinguished, but no satisfactory method of combating large fires is known. It is essential, therefore, that magnesium fires be detected in the incipient stage and the proper extinguishing procedure followed.

- 11.1 Water, vaporizing-liquid, foam, dry chemical, or carbon dioxide type extinguishers shall not be used as first-aid fire protection equipment and shall be excluded from the area. These extinguishing agents when applied to a magnesium fire may stimulate the burning and may cause an explosion. Approved type fire extinguishers shall be available for use of every operator.
- 11.2 Small fires in dry magnesium can be checked by carefully spreading, graphite, dry sand, dry salt, clean cast iron borings, talc, slag, or certain other materials on and around the fire, but if air reaches the fire through this covering the magnesium will continue to burn, and the mass will remain hot for a long time.
- 11.3 Coal-tar pitch of the type known as 'very hard' with a softening point of approximately 200° F. has been found to be a satisfactory extinguishing agent for magnesium fires in tests made with quantities of burning magnesium ranging from 1 to 10 pounds. When spread over a hot magnesium fire the pitch softens and seals the burning magnesium with an air-tight covering which smothers the flames. Because pitch is combustible and fine particles may ignite readily, it is important that only granulated pitch, through 6 mesh and on 40 mesh U. S. sieves, or pitch in flake or other form screened to remove the fines under 40 mesh, be used as an extinguishing agent. On tight non-combustible surfaces, magnesium fires of moderate size, even when quite active may be extinguished by carefully and completely covering the burning pile with a layer of pitch of the type and size specified and allowing the pitch to cool and partially harden without disturbing the fire.
- 11.4 Other effective extinguishing agents for magnesium fires are available in powder form and are applied by means of shovels, or scoops. Their use is limited to moderate-sized fires.
- 11.5 Extinguishing a magnesium fire may be a very dangerous undertaking because of the possibility of an explosion occurring when the burning powder is disturbed. For this reason, many operators prefer to seal a magnesium fire in the room or compartment in which it originates and allow it to burn itself out. Sand or other non-combustible material can be used to seal openings around the fire doors at entrances to these rooms.
- 11.6 To avoid the possibility of extinguishers of the types mentioned being used by persons unfamiliar with the hazard, all such extinguishers shall be excluded from sections of the plant in which magnesium fires may occur.
- 11.7 Sprinkler systems shall not be installed in buildings where magnesium powder constitutes the principal fire hazard.



- 11.8 Violent disturbance of a magnesium powder fire by the application of extinguishing agents, drafts of air, or movement of the surface on which the fire is burning shall be avoided. Magnesium powder thrown into the air under such conditions will explode violently.
- 11.9 Special fire brigades of employees shall be organized and trained in fire fighting operations by conducting tests and demonstrations with the extinguishing agents on fires built at a safe distance from the plant.

## SECTION 12 - Safety Precautions

- 12.1 As in all other plants where fire and explosion hazards exist, good housekeeping is essential and all possible precautions shall be taken to insure safe operation of the plant.
- 12.2 Employees shall be carefully instructed in their duties.
- 12.3 All employees shall be advised of the fire and explosion hazard and instructed in the procedure to follow in case of emergencies.
- 12.4 Rules and regulations for safe operating procedure shall be conspicuously posted throughout the plant.
- 12.5 Special groups shall be trained in fire-fighting operations by conducting extinguishing tests or demonstrations with small fires built at a safe distance from the plant.
- 12.6 Thorough inspections of the plant shall be made at frequent intervals by competent persons to see that no powder, or dust has been allowed to accumulate around the machines, floors, walls and structural members of the buildings; that no excessive amounts of powder are stored in any one area; that all equipment is in perfect operating condition and that proper protection facilities are available. Records of such inspection shall be kept on file.
- 12.7 Dust shall not be allowed to accumulate as it is a factor of utmost importance. Each time any of the powder making machines are charged, or discharged all dust and other materials spilled on open surfaces of the machinery, or on the floor of the building shall be promptly and thoroughly removed. Soft push brooms and non-sparking scoops shall be employed.
- 12.8 Competent supervision and periodic cleaning shall always be maintained and the foreman shall be alert to prevent the accumulation of excessive dust and any portion of the buildings, or machinery which are not regularly cleaned in daily operation. Regular periodic cleaning, with all machinery idle and power off shall be carried out as often as local conditions require it to maintain safety, but in any case at least once a week.
- 12.9 Motor driven vehicles shall not be permitted to enter factory buildings. Receiving and delivery doors shall be so arranged that the exhaust from motor vehicles cannot be directed through the door opening into the factory buildings. Such doors shall be kept in closed position whenever the motor or the vehicle is running.
- 12.10 Smoking materials and the carrying of matches shall be prohibited on the premises, except in the official change-house at the entrance provided permission has been received in writing from the Commissioner of Labor and Industry. They shall not be carried or used by employees or visitors about the premises adjacent to, or in any building in which explosive dust is made, or loaded for shipment. This is not intended to preclude the bringing of tobacco by employees in their street clothes in the 'change', or 'wash-house'. The change house shall be of fire-resistive construction, located at or near the entrance to the premises, and shall be surrounded by a fence. In this building, the employees shall leave their street clothes and put on the fire-resistant clothing.
- 12.11 Special fire-resistant clothing for employees in magnesium powder producing plants shall be provided. Employees clothing shall be kept clean and free from powder. Leather, or other smooth clothing properly treated from which the dust can be brushed off readily may be worn. Wearing of woollen, rayon, nylon, silk or fuzzy outer clothing and jewelry shall be prohibited. Powder shoes shall be worn by all persons entering any building in which magnesium powder is produced, or handled. Female employees shall wear a hair covering.
- 12.12 Deluge showers to extinguish clothing fires shall be installed at approved locations.

## B. COLLECTION AND DISPOSAL OF DUST FROM GRINDING, BUFFING AND SIMILAR DUST PRODUCING OPERATIONS IN THE HANDLING OF MAGNESIUM ALLOY CASTINGS

### SECTION 13 - Dust Collection

- 13.1 Dust shall be collected by means of suitable hoods or enclosures at each operation such enclosures to be connected to a liquid precipitation type of separator, preferably oil, and the suction unit in such a way



that the dust shall be converted to sludge without contact, in a dry state, with any high speed moving parts. Wetting sprays and collectors shall be located as close as possible to the point at which the dust is produced.

- 13.2 Connecting ducts or suction tubes shall be as small in diameter and as short as possible, and with no unnecessary bends. Ducts shall be carefully fabricated and assembled, with a smooth interior and with internal lap joints pointing in the direction of an air flow, and without unused capped side outlets, pockets or other dead-end spaces which might allow an accumulation of dust. Ducts shall be effectively grounded.
- 13.3 Each machine shall be equipped with its individual dust separating unit, except that with multi-unit machines not more than two dust-producing units may be served by one separator unit. Not more than two portable dust-producing units in a single enclosure or stand may be served by one separator unit.
- 13.4 Power supply to machines shall be interlocked with (a) exhaust air flow (b) liquid pressure level or flow of separators, in such a way that improper functioning of the dust removal and separator system will shut down the machine it serves.
- 13.5 Magnesium dust collection systems shall conform in principle and general arrangement to the types illustrated herein.

#### **SECTION 14 - Cleaning**

- 14.1 Systematic cleaning of entire area involved, including roof numbers, pipes, conduits, etc., should be conducted daily or as often as conditions warrant.
- 14.2 Turnings and chips shall be constantly swept away from beneath tool and frequently placed in a covered metal container and shall never be permitted to remain around an unattended machine.

#### **SECTION 15 - Dust Disposal**

- 15.1 Sludge from dust separators shall be removed at least daily or immediately following each cleaning operation. Covered containers preferably of not over five pounds capacity each should be used to transport the collection sludge to a safe point for disposal at an approved burning ground. The disposal method of mixing with sand and burying shall only be used where expressly permitted by the Commissioner.
- 15.2 Not more than ten pounds of chips or turnings shall be permitted to accumulate in metal containers near the tool.
- 15.3 Such filled containers shall be removed and stored in a fire-resistive storage building.
- 15.4 A large accumulation of turnings and chips in storage shall be avoided.

#### **SECTION 16 - Electrical Equipment**

- 16.1 Electric motors, lighting fixtures, control equipment and wiring in immediate vicinity of or attached to dust producing machines, including that used in connection with separator equipment, shall be suitable for atmospheres containing metal dust.
- 16.2 Where flashlights or storage battery lamps are used, they should be of a type approved for the purpose.
- 16.3 Installation of transformers and capacitors shall be outside and at a safe distance from magnesium powder production buildings.
- 16.4 Electric lights for use in magnesium powder plants must be of a type which will operate continuously with all exposed parts of the lamp and fixture at a temperature well below the ignition temperature of the powder.

#### **SECTION 17 - Grounding of Equipment**

- 17.1 All equipment shall be securely grounded in an approved manner by permanent ground wires to prevent the accumulation of static electricity.

#### **SECTION 18 - Safety Precautions**

- 18.1 Special clothing for machine operators shall be provided. Employees' clothing should be kept clean and free from dust. Leather or other smooth clothing, without pockets, and with snap fasteners, from which the dust can be brushed off readily may be worn. Smooth canvas or denim suits can be made fire-retardant by treatment with chemicals. Wearing of woollen, rayon, nylon, silk or fuzzy outer clothing and jewelry is prohibited. Female employees shall wear a hair covering.
- 18.2 Machinery and equipment described in this section shall not be used for processing ferrous metals.
- 18.3 Tools used on finished operations shall be kept sharp.
- 18.4 Deluge showers shall be provided at approved locations.
- 18.5 A sufficient number of persons in the operating area shall be trained in extinguishing magnesium fires and shall act as a special fire brigade.