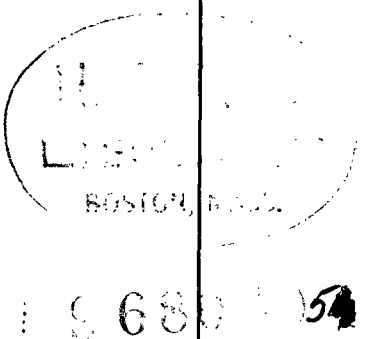
NFPA No.

652

DUST EXPLOSION PREVENTION

MAGNESIUM POWDER 1968



Fifty Cents

NATIONAL FIRE PROTECTION ASSOCIATION
International
60 Batterymarch Street, Boston, Mass. 02110

4M-6-68-WP-FP
Printed in U.S.A.

National Fire Protection Association

International

Official NFPA Definitions

Adopted Jan. 23, 1964. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations or that which is advised but not required.

APPROVED means acceptable to the authority having jurisdiction. The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of nationally recognized testing laboratories,* i.e., laboratories qualified and equipped to conduct the necessary tests, in a position to determine compliance with appropriate standards for the current production of listed items, and the satisfactory performance of such equipment or materials in actual usage.

*Among the laboratories nationally recognized by the authorities having jurisdiction in the United States and Canada are the Underwriters' Laboratories, Inc., the Factory Mutual Engineering Division, the American Gas Association Laboratories, the Underwriters' Laboratories of Canada, the Canadian Standards Association Testing Laboratories, and the Canadian Gas Association Approvals Division.

LISTED: Equipment or materials included in a list published by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

LABELED: Equipment or materials to which has been attached a label of a nationally recognized testing laboratory that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling is indicated compliance with nationally recognized standards or the conduct of tests to determine suitable usage in a specified manner.

AUTHORITY HAVING JURISDICTION: The organization, office or individual responsible for "approving" equipment, an installation, or a procedure.

Units of Measurements

Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters. One foot = 0.3048 meters. One inch = 25.40 millimeters. One pound per square inch = 0.06805 atmospheres = 2.307 feet of water. One pound = 453.6 grams.

Standard for Explosion and Fire Protection in PLANTS PRODUCING OR HANDLING MAGNESIUM POWDER

NFPA No. 652 — 1968

1968 Edition of No. 652

This revised edition of NFPA No. 652 supersedes the 1959 edition. This standard was prepared by the Sectional Committee on Metal Dusts and adopted at the 1968 Annual Meeting of the National Fire Protection Association upon recommendation of the Committee on Dust Explosion Hazards.

Amendments and changes in the 1968 edition are essentially for clarification and to bring this standard up to date.

Origin and Development of No. 652

This standard was originally prepared by the Committee on Dust Explosion Hazards in 1942 and was officially adopted in 1944. Amendments recommended by the Committee were adopted in 1945, 1946, 1952, 1959 and 1968.

Committee on Dust Explosion Hazards

C. G. Gibson, *Chairman,*
Ontario Department of Labour, 8 York St., Toronto 1, Ont., Canada
(rep. Canadian Assn. of Administrators of Labour Legislation)

R. W. Andrews, Jr., American Society of Mechanical Engineers.
David W. Bixby, The Sulphur Institute.
A. Radford Barton, National Confectioners' Assn.
C. M. Blaesi, NFPA Committee on Blower Systems.
J. J. Burke, American Society of Heating, Refrigerating & Air Conditioning Engineers, Inc.
Dean M. Clark, Grain Elevator and Processing Superintendents.
D. P. Congdon, Factory Insurance Assn.
R. E. Dufour, Underwriters' Laboratories, Inc.
Douglas L. Hail, Millers' National Federation.
S. F. Henderson, National Electrical Manufacturers Assn.
J. A. Houghton, American Foundrymen's Society.
David H. Hunt, The Spencer Turbine Co.
Guy Isenberg, Manufacturing Chemists' Assn., Inc.
Murray Jacobson, American Industrial Hygiene Assn.
Frank Jun, Quaker Oats Co.
George L. Kitchen, Terminal Elevator Grain Merchants' Assn.
J. R. McCann, National Safety Council.
Reynar Meadowcroft, Corn Industries Foundation.
John Nagy, U. S. Department of the Interior.
Don O. Noel, Metal Powder Producers Assn. of the Metal Powder Industries Federation.
John P. O'Neill, U.S. Department of Labor.
Thomas A. Oravecz, International Assn. of Governmental Labor Officials.
J. A. Peloubet, Sanford, Mich.
Frank E. Rademacher, Factory Insurance Assn.
J. M. Robinson, American Insurance Assn.
W. A. Roessler, Assn. of Mill & Elevator Mutual Ins. Cos.
T. T. Singer, Western Actuarial Bureau.
J. Karel Sundermeyer, Society of the Plastics Industry, Inc.
Paul J. Turner, Great Northern Railway.
H. L. Walker, Edison Electric Institute.
James B. Walker, Jr., American Boiler Mfrs. Assn.
George E. Weldon, Factory Mutual Engineering Corp.
J. A. Wood, National Automatic Sprinkler & Fire Control Assn.
G. M. Woods, Jr., Kemper Insurance Company.

Alternates.

G. Walker Daubenspeck, U. S. Department of Labor. (Alternate to John P. O'Neill.)
John F. Hennessey, National Confectioners' Assn. (Alternate to A. Radford Barton.)
J. M. Jensen, Corn Industries Foundation. (Alternate to Reynar Meadowcroft.)
Harry G. Lacey, International Assn. of Governmental Labor Officials. (Alternate to Thomas A. Oravecz.)
Gordon A. Olson, Edison Electric Institute. (Alternate to H. L. Walker.)
G. D. Perkins, Association of Mill & Elevator Mutual Insurance Cos. (Alternate to W. A. Roessler.)
R. F. Schwab, Factory Insurance Assn. (Alternate to D. P. Congdon and Frank E. Rademacher.)
L. S. Shook, Western Actuarial Bureau. (Alternate to T. T. Singer.)
Max Spencer, Grain Elevator & Processing Superintendents. (Alternate to Dean M. Clark.)
E. J. Williams, American Society of Heating, Refrigerating & Air Conditioning Engineers, Inc. (Alternate to J. J. Burke.)

SCOPE: The prevention of dust explosions in connection with processes and industries producing combustible or explosive dusts, including measures for the prevention of ignition, restriction of potential damage by proper construction and arrangement of buildings, restriction of the production and escape of dust through the control of dust-producing processes and equipment, extinguishing methods, and related features. Fire prevention and extinguishing are included, since dust explosions may result from fire.

Standard for Explosion and Fire Protection in PLANTS PRODUCING OR HANDLING MAGNESIUM POWDER

NFPA No. 652 — 1968

Introduction

Magnesium powders are produced either by mechanical degrading or by the atomization of molten metal by one of several methods.

Burning magnesium powder produces a flame temperature of about 7200°F. Such fires cannot be extinguished by the application of water, carbon dioxide, foam, carbon tetrachloride or other common fire extinguishing agents. Application of these materials may greatly intensify the burning or cause violent explosions.

Both explosion and fire hazards are present in plants producing or handling magnesium powder. Fine magnesium powder can be readily ignited by a spark, flame, or frictional heat sufficient to raise its temperature to about 900°F. When ignited while in suspension in air it will explode violently. The high pressure developed and the very rapid rate of pressure rise emphasize the importance of adopting all possible protective measures wherever magnesium powder is produced, processed or handled.

NOTE: The U.S. Bureau of Mines reports that milled magnesium powder has an explosibility index greater than 10, in common with aluminum powder, thorium and thorium hydride powders, titanium powder, uranium and uranium hydride powders, and zirconium powder. It requires 40 millijoules of energy to ignite a dust cloud and as little as 0.8 millijoules to ignite a static layer. The minimum ignition temperatures for a dust cloud and static layer are 1000°F. and 800°F. respectively. Minimum explosive concentration in air is 0.025 ounces per cubic foot. In a dust cloud having a concentration of 0.5 ounces per cubic foot a maximum pressure of 100 psig and a maximum rate of 15000 psi per second have been recorded. For additional data refer to U.S. Bureau of Mines Report of Investigations 6516, "Explosibility of Metal Powders".

This Standard is prepared to direct attention to the precautions which can be taken and safe practices that should be followed in guarding against magnesium fire and explosion hazards in connection with the production and handling of magnesium powder. For information and recommendations dealing with the collection, removal and disposition of dust produced in grinding, buffing, and other processing operations refer to Standard for the Storage, Handling and Processing of Magnesium, NFPA No. 48.

Definitions

The following terms are used in this Standard as defined below:

MAGNESIUM POWDER, fine magnesium all or part of which is 30 mesh or finer, a product specially prepared in equipment designed or installed for the purpose.

MAGNESIUM DUST, fine magnesium considered as a waste product in grinding or otherwise preparing magnesium parts.

SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations or that which is advised but not required.

APPROVED refers to approval by the authority having jurisdiction in the enforcement of regulations.

DAMAGE-LIMITING CONSTRUCTION consists of pressure-resistant walls, pressure-relieving walls, or a combination of both.

MAGNESIUM POWDER PLANTS

1. Location of Plants

101. No practical method is known for accomplishing complete protection against ignitions and explosions of magnesium powder. Accordingly, it is recommended that plants engaged in the production, processing, handling and storage of magnesium powder be located in sparsely settled sections where sufficient space is available to have buildings in which magnesium powder is produced or handled in unsealed containers at least 300 feet distant from railways, highways and occupied structures such as public buildings, dwellings, stores or manufacturing establishments other than those which are a part of the powder manufacturing plant.

102. Buildings in which magnesium powder is produced or handled in unsealed containers shall be at least 50 feet apart, at least 100 feet from electric or steam power plants and at least 75 feet from other buildings on the plant property not connected with magnesium powder operations.

103. Buildings in which more than 1,000 pounds of magnesium powder may be exposed during screening, blending, or processing operations shall be at least 75 feet apart and at least 115 feet from other buildings on the plant property not connected with magnesium powder operations. In no case shall more than 5,000 pounds be exposed in processing equipment or in unsealed containers in one building.

104. The entire property should be surrounded with a high, strong fence, preferably of noncombustible material, designed to prevent the entrance of unauthorized persons.

105. Gates or entrances to the property should be guarded.

2. Construction of Buildings

201. All buildings comprising a magnesium powder plant shall be of noncombustible, damage-limiting construction.

202. Separate rooms or detached buildings shall be provided for each manufacturing operation such as cutting, grinding, screening and packaging. If separate rooms within one building are used, there shall be at least one exterior wall comprising at least 25 percent of the total wall area. Exterior walls should be of pressure-relieving construction. The wall should provide a vent ratio of not less than 1 square foot for each 15 cubic feet of volume. Interior walls should be of pressure-resistant construction, capable of withstanding at least 150 pounds per square foot. Because of the extremely high rate of pressure rise, interior walls should preferably be constructed of more elastic materials such as insulated metal panels with gypsum board core or metal lath and plaster on steel studs.

203. Buildings in which the cutting or grinding, screening, collecting or packaging machines are located shall be constructed without basements and shall not be more than one story regardless of roof height.

204. Each grinding mill or screen shall be installed in a separate room or compartment. Construction shall be as outlined in paragraphs 201 and 202. 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 pressure-resistant walls, hinged to open outward. This door shall be equipped with a positive latch and a panic bar.* There shall be no direct communication between rooms or buildings in which the grinding or screening equipment is installed.

205. Each hammermill or pulverizing unit shall be installed in a detached building. Construction shall be of the pressure-relieving type as outlined in paragraphs 201 and 202. If personnel are within 50 feet of the building while the mill is in operation they should be protected by a 12-inch reinforced concrete barrier wall. Where the charging hopper and the pulverizing unit are in separate compartments, a choke or damper shall be provided in the separating barrier wall or in the feeding mechanism through which the material passes from the hopper to the pulverizer. One end wall of the building shall be of reinforced concrete and shall be constructed as a wing or buttress to brace the barrier wall.

*NFPA No. 101, Life Safety Code

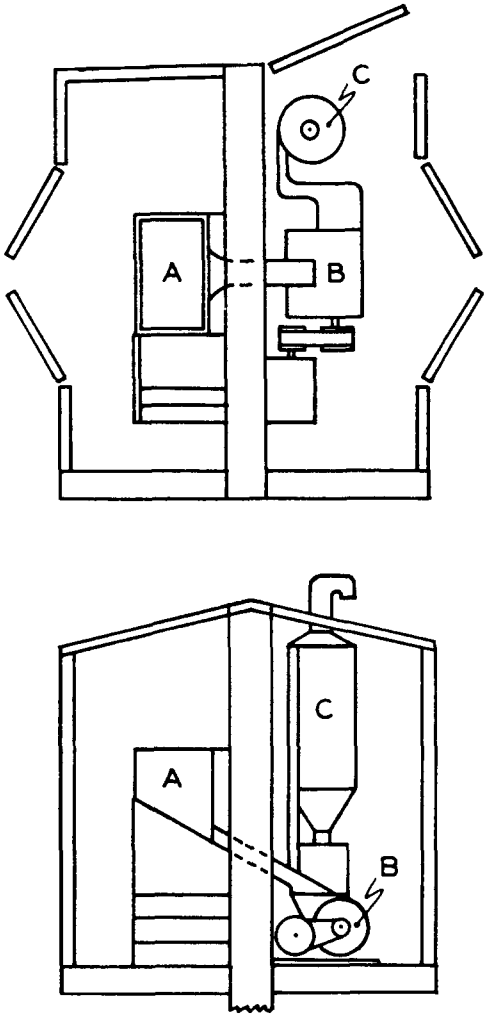


FIG. 1

A. Hopper (Automatic Feed)

B. Pulverizer or Hammer Mill

C. Collector

Other walls shall be of the pressure-relieving construction. See Figure 1. Where dual installation of pulverizing units is permitted, the wing or buttress wall should be of 12-inch reinforced concrete and be constructed to serve as a barrier wall.

206. Covered passageways or corridors may be provided between buildings or alongside the rooms or compartments housing individual machines other than pulverizing units. 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.

207. Buildings shall be designed so that all horizontal ledges or surfaces above the floor level are eliminated as far as practical. Ledges which cannot be eliminated shall be filled and beveled to provide a smooth steeply inclined surface which will not retain dust deposits.

208. Floors shall be constructed to prevent the production of metallic or static sparks. If conductive flooring is used, it shall be effectively bonded and grounded.

209. Floors shall be smooth with the junction of floor and walls free from cracks or other dust catchers. Fillets with a minimum radius of 2 inches at floors and wall junctures are recommended.

210. All interior walls shall be made as smooth as possible to prevent the retention of dust on their surfaces. Coating of the walls with enamel or other material to produce a surface which will reduce to a minimum the adherence of dust is recommended.

211. Roofs of buildings should be as light as practical and arranged so that they will be easily blown off by an internal explosion. Piping or other equipment should not be supported by the roof deck but secured only to structural members not likely to be damaged by an explosion.

212. Roofs shall be constructed and maintained in a tight condition to prevent leakage of moisture.

3. Making and Handling Magnesium Powder

301. Production units designed to use air in connection with their operation shall be installed with the pulverizer and cyclone directly connected with metal ducts of minimum length that installation conditions will permit.

302. Air shall not be used for conveying magnesium powder to or between production or processing units.

303. Magnesium powder should not be allowed to fall through chutes or spouts into open bins or hoppers where dust clouds may be produced.

304. Hand trucks and carts should be used for transporting both the magnesium in the process of being reduced to powder and the finished product itself. Power driven trucks other than the type approved for use in Class II Group E locations shall not be used.

305. Carts and trucks used for transporting magnesium powder should have nonsparking tires on wheels or casters. Wheels and rubber tires should be electrically conductive where carts or trucks are used on conductive floors.

306. Shovels or scoops used in handling magnesium powder should be made of magnesium, aluminum, copper, or other minimum-sparking metal.

307. Grinding equipment used for the production of magnesium powder should not be used for any other grinding until it has been thoroughly cleaned and all traces of magnesium removed.

308. Magnetic separators should be used to remove all foreign magnetic material from magnesium entering the grinders. Screens should be installed ahead of hammermills or pulverizers to prevent the entrance of oversized pieces of magnesium.

309. Automatic operation of mills and screens should be arranged with remote controls for starting and stopping the machinery.

310. 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 should be interlocked with the power supply so that machinery will be automatically stopped if the door is opened while the machinery is operating. A sufficient time interval should elapse to permit all moving parts to come to rest before the room is entered. A reset system should be provided to prevent restarting of machinery when the door is closed until the normal starting procedure is followed. This rule is not intended to prohibit the presence of needed maintenance or repair men in the room while machinery is being operated for required tests or observations.

311. Not more than two and preferably only one person should enter the rooms or compartments to charge or unload the machines or perform cleaning or maintenance duties.

312. All powder producing and handling machinery should be as dust-tight as possible to prevent the escape of powder into the air of the room in which it is located.

313. If practical, all enclosed equipment for the production and handling of magnesium powder should be provided with explosion relief vents to the outside of the building. These vents should be so constructed that there will be no loss of fine powder and should be designed to prevent the entrance of moisture. To make explosion vents most effective, mills or other machines should be installed close to outside walls to permit using short vent ducts but sufficient space should be provided between machines and walls for cleaning and maintenance operations. Ducts should be strong enough to resist maximum explosion pressure.

4. Electrical Wiring and Equipment

401. All electrical wiring and equipment shall conform to the National Electrical Code, NFPA No. 70, or to the Canadian Electrical Code, whichever is applicable. All parts of manufacturing buildings shall be considered Class II Division 1 locations under Articles 500 and 502 of the National Electrical Code (Section 18 of the Canadian Electrical Code) except offices and similar locations so occupied and segregated as to be reasonably free from dust, and so classed by the authority having jurisdiction.

402. Attention should be specifically directed to the requirements of the National Electrical Code, NFPA No. 70, or of the Canadian Electrical Code for the location of transformers, type and location of motors, generators, and their control equipment, cables, fuses, circuit breakers, conduits and lights of all types.

403. Provision should be made for remote control of the electrical circuits so that light and power in any dust-making building may be cut off by switches outside of the building at a distance of at least 4 feet from the nearest doorway. It should also be arranged that the power of the whole plant can be cut off by switches located at one or more central points, such as the office, watchman's booth, etc. All electrical equipment shall be inspected and cleaned periodically. Where flashlights or storage battery lamps are used, they should be of a type approved for the purpose.

5. Control of Static Electricity

501. Grounding machinery to remove static electricity produced in powder manufacture and collection is vital for safety. It should be thoroughly done according to Recommended Practice on Static Electricity, NFPA No. 77, for all machinery, fans, ducts, screens, collectors, and other equipment.

502. Magnesium powder should not be allowed to slide over metal aprons or chutes unless they are properly bonded and grounded to prevent static charges from accumulating. Non-conducting or insulated chutes shall not be used.

6. Lightning Protection

601. An approved lightning conductor system should be provided around or upon the powder producing and handling section of the plant, of sufficient size and capacity to protect fully all buildings in the area from lightning. The system should be installed in accordance with the Code for Protection Against Lightning, NFPA No. 78.

7. Preventing Ignition of Magnesium Powder

701. Ignition of magnesium powder can be prevented in laboratory apparatus when argon, neon, or helium are used to create an inert atmosphere. Practical and economic problems have limited their use in commercial operation. Nitrogen gives partial protection, but it will react directly with magnesium when the source of ignition is strong. Carbon dioxide reacts readily with magnesium and should not be used. It is necessary, therefore, to give particular attention to the elimination of all possible sources of ignition in magnesium powder plants, and the following general recommendations and requirements covering ignition hazards have been prepared to supplement the rules listed under separate headings.

702. No open flames nor electric or gas cutting or welding equipment shall be permitted within the buildings housing the powder producing or handling machinery during operation. If it becomes necessary to use such equipment inside the building for making repairs, all machinery in the room or section of the building where repairs are to be made shall be shut down and the entire room or section with its machinery shall be thoroughly cleaned to remove all accumulations of magnesium powder.

NOTE: Operators of cutting or welding torches should be required to obtain a written permit from the safety or fire protection officer of the plant before using such equipment under any condition around magnesium powder plants. Attention is called to the hazardous conditions that may exist either inside or outside of the plant if cutting torches are used in dismantling dust collectors or powder producing machinery before all dust accumulations have been removed.

703. Hot air heating should not be employed. The stirring action of a forced hot air heating system might easily be dangerous as it would keep the fine dust in suspension. Heating by easily cleaned steam or hot water coils is satisfactory and safe.

704. Only minimum-sparking tools shall be used in cleaning, repairing or adjusting magnesium powder equipment. Tool materials that collect static charges should be avoided. Friction must be avoided or minimized.

705. Grinding wheels previously used for other metals, or intended for use with other metals, shall not be used where magnesium powder is being produced or handled or where accumulations of powder may be ignited by sparks from the wheel.

706. Grinding wheels used for grinding magnesium or wheels coated with magnesium powder shall never be used for grinding other metals.

707. Gun-type tools using powder or cartridges for driving pegs or pins into concrete, brick, steel, etc., shall not be used where flammable dust or dust clouds are present. When the use of this type equipment becomes necessary, all dust producing machinery in the area shall be shut down; all equipment, floors and walls shall be carefully cleaned; and all dust accumulations shall be removed. A careful check shall be made to be sure that no cartridges or charges are left on the premises where they could enter equipment or be accidentally discharged after operation of the powder producing or handling machinery is resumed.

8. Storage of Magnesium Powder

801. The principal precaution to observe in storing magnesium powder is to avoid storage in open bins or other open containers and to limit the storage in any one area to the smallest feasible amount.

NOTE: This paragraph places no restriction upon the storage of magnesium powder in sealed containers regarding quantity or distance insofar as the explosion hazard is concerned. Precautions should be observed with regard to the fire hazard involved.

802. Magnesium powder shall be kept free of water or moisture.

803. Magnesium powder shall be protected against any form of heat capable of raising the temperature to the ignition point.

804. Finely divided magnesium in the process of being manufactured into powder or powder stored for short periods shall be kept in closed containers to protect it against possible ignition.

805. The finished product shall be packed in cans, drums, or moisture-proof containers which can be closed to prevent accidental spilling during handling.

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

9. Fire Protection for Magnesium Powder Plants

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

902. Burning magnesium powder produces a flame temperature of approximately 7,200°F. and it cannot be extinguished by the application of water, carbon dioxide, foam, carbon tetrachloride or common fire extinguishing agents. These materials when applied to a magnesium fire may stimulate the burning and can cause a strong explosion. To avoid the possibility of extinguishers of the type mentioned being used by persons unfamiliar with the hazard, it is recommended that all such extinguishers be excluded from sections of the plant in which magnesium fires may occur.

903. Sprinkler systems should not be installed in buildings where magnesium powder constitutes an important hazard. If sprinklers are employed in any area, the system should be designed only with the counsel of technical personnel highly skilled and experienced in magnesium powder fire problems.

904. 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 propelled into the air under such conditions will explode violently.

905. Small fires in dry magnesium powder can be controlled by carefully spreading dry graphite, dry magnesium foundry flux or clean dry cast iron chips on and around the fire. If air reaches the fire through this covering the magnesium will continue to burn and the mass may remain hot for a long time.

906. Other effective extinguishing agents for magnesium fires are marketed as proprietary compounds. These are generally in powder form and are applied by means of scoops, shovels, tubes or specially designed distributing apparatus. Their use is generally limited to fires of small or moderate size which can be approached closely enough to permit the proper manual application of the extinguishing medium.

907. Special fire brigades of employees should 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. Members of nearby fire departments

who may be called to the plant should be instructed in magnesium fire control and advised of the possible hazards incident to the use of certain types of extinguishers on magnesium powder fires. Only men trained to fight magnesium fires should be allowed near the scene of the fire.

908. Extinguishing a magnesium powder fire may be a very dangerous undertaking because of the possibility of an explosion occurring when 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. Dry sand or other noncombustible material can be used to seal openings around the fire doors at entrances to these rooms.

10. Safety Precautions

1001. 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.

1002. Employees shall be carefully instructed in their duties.

1003. All employees shall be advised of the fire and explosion hazard and instructed in the procedure to follow in case of emergencies.

1004. Rules and regulations for safe operating procedure shall be conspicuously posted throughout the plant and distributed in manual or pamphlet form to employees for their constant reference.

1005. Thorough inspections of the plant shall be made at frequent and regular intervals by competent persons to see that no powder or dust has been allowed to accumulate around the machines; 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 inspections shall be kept on file.

1006. Cleanliness is a factor of utmost importance. Loose or spilled powder shall not be allowed to accumulate. Each time any of the powder-making machines is charged or discharged, all dust and other material spilled on open surfaces of the machinery or on the floor of the room shall be promptly and thoroughly removed. Soft push brooms and minimum-sparking scoops shall be used for cleaning.

1007. Competent supervision and regularly scheduled cleaning shall always be maintained. The supervisor shall be constantly alert to avoid the accumulation of excessive dust in any portions