

NFPA 651

Standard for the Machining and Finishing of Aluminum and the Production and Handling of Aluminum Powders

1998 Edition



National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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Machining and Finishing of Aluminum and the Production and Handling of Aluminum Powders

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This edition of NFPA 651, *Standard for the Machining and Finishing of Aluminum and the Production and Handling of Aluminum Powders*, was prepared by the Technical Committee on Combustible Metals and Metal Dusts and acted on by the National Fire Protection Association, Inc., at its Annual Meeting held May 18–21, 1998, in Cincinnati, OH. It was issued by the Standards Council on July 16, 1998, with an effective date of August 5, 1998, and supersedes all previous editions.

This edition of NFPA 651 was approved as an American National Standard on August 6, 1998.

Origin and Development of NFPA 651

NFPA 651, *Manufacture of Aluminum Powder*, was originally prepared by the Committee on Dust Explosion Hazards in 1938 and 1939. It was first adopted in 1939, and revised in 1946, 1952, 1959, 1963, 1967, and 1972. The 1967 edition was approved by the American National Standards Institute in 1967 and designated ANSI Z12.11.

NFPA 652, *Plants Producing or Handling Magnesium Powder*, was originally prepared by the Committee on Dust Explosion Hazards in 1942 and was first adopted in 1944. Amendments were adopted in 1945, 1946, 1952, 1959, and 1968. The 1968 edition was approved by the American National Standards Institute in 1968 and designated ANSI Z12.15.

In 1973, NFPA 651 and 652 were combined into a single standard, NFPA 651-T, and tentatively adopted at the 1973 Annual Meeting and officially adopted at the 1974 Annual Meeting. Revisions were adopted in 1980 and 1987.

For the 1993 edition, the Committee added definitions; clarified the requirements for the location of aluminum powder production plants; and revised the requirements for electrical power, machinery, and operations, and for in-plant conveying of aluminum powder including the provisions for inert conveying. The requirements for explosion venting, manual fire fighting, and automatic sprinkler protection were also updated. This included the change in terminology from “light metal powder” to “aluminum powder” to emphasize that the requirements for the manufacture of magnesium powder were incorporated into the 1993 edition of NFPA 480, *Standard for the Storage, Handling, and Processing of Magnesium Solids and Powders*. The Committee also incorporated various style and editorial revisions to comply with the NFPA *Manual of Style* and to assist in making the document more usable, adoptable, and enforceable.

This edition of NFPA 651 represents a complete revision that incorporates the requirements of NFPA 65 and 651 into a combined document. This new edition reduces redundancy and ensures that a consistent approach is applied to protecting against similar hazards. The new format also provides users with a single reference source for requirements in these operations.

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NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on safeguards against fire and explosion in the manufacturing, processing, handling, and storage of combustible metals, powders, and dusts.

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Appendix A.

Information on referenced publications can be found in Chapter 8 and Appendix C.

Chapter 1 General

1-1 Scope.

1-1.1* This standard shall apply to manufacturing facilities that produce aluminum flake powder, aluminum paste, atomized aluminum powder or aluminum granules, or any aluminum alloy powder that is combustible or explosible in an ambient atmosphere.

1-1.2 This standard also shall apply to operations where aluminum or aluminum alloys are subjected to processing or finishing operations that produce fine metallic powder or dust. Such operations include, but are not limited to, machining, sawing, grinding, buffing, and polishing.

1-1.3 This standard also shall apply to the handling and storage of combustible aluminum dusts, aluminum powders, or aluminum pastes by users of such material.

1-1.4 This standard does not apply to the transportation of combustible aluminum dusts, aluminum powders, or aluminum pastes on public highways, waterways, or by air or rail.

1-1.5 This standard does not apply to the primary production of aluminum metal.

1-2 Purpose. The objective of this standard is to minimize the occurrence of and resulting damage from fire and explosion in areas where combustible aluminum dusts, aluminum powders, or aluminum pastes are manufactured, produced, handled, and stored.

1-3 Equivalency. Nothing in this standard shall be intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard, provided technical documentation is made available to the authority having jurisdiction to demonstrate equivalency, and the system, method, or device is approved for the intended purpose.

1-4 Applicability.

1-4.1 The provisions of this document shall be considered necessary to provide a reasonable level of protection from loss of life and property from fire and explosion. They reflect situations and the state-of-the-art prevalent at the time the standard was issued. Unless otherwise noted, it shall not be intended that the provisions of this document be applied to facilities, equipment, structures, or installations that were

existing or approved for construction or installation prior to the effective date of the document, except in those cases where it is determined by the authority having jurisdiction that the existing situation involves a distinct hazard to life or adjacent property.

1-4.2 Existing plants, equipment, structures, and installations that do not comply strictly with the requirements of this standard shall be considered to be in compliance if it can be shown that an equivalent level of protection has been provided or that no specific hazard will be created or continued through noncompliance.

1-4.3 This standard is not intended to prevent use of systems, methods, or devices that provide equivalent protection from fire and explosion. NFPA 69, *Standard on Explosion Prevention Systems*, shall be referred to when considering the use of optional systems.

1-5 Definitions.

Aluminum Chips.* Particles produced from a cutting, machining, or grinding operation that are not oxidized and that are not diluted by noncombustible materials.

Aluminum Flake. See Aluminum Powder.

Aluminum Granules. Aluminum powders, generally larger than 200 mesh (i.e., material not passing a U.S. No. 200 Standard Sieve, 75 microns).

Aluminum Paste. Aluminum flake pigment homogeneously incorporated in a solid or liquid carrier in such a way so as to have a nonflowing product without a free-flowing liquid.

Aluminum Powder. Aluminum powder can be divided into three broad classifications: atomized, flake, and granules. The length, width, and thickness of an atomized particle or granule are all of approximately the same order; the length dimension probably not exceeding two or three times the thickness dimension. The length or width of a flake particle can be several hundred times its thickness. Granules are generally powders larger than 75 μm (microns) (i.e., 200 mesh).

Aluminum Powder Production Plant. Facilities or buildings in which the primary product is aluminum powder. Facilities or buildings in which aluminum powder or combustible aluminum dust is produced incidental to operations shall not be considered a powder production plant.

Approved.* Acceptable to the authority having jurisdiction.

Authority Having Jurisdiction.* The organization, office, or individual responsible for approving equipment, an installation, or a procedure.

Combustible Aluminum Dust.* Any finely divided aluminum material 420 μm (microns) or smaller in diameter (i.e., material passing a U.S. No. 40 Standard Sieve) that presents a fire or explosion hazard when dispersed and ignited in air.

Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Listed.* Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets identified standards or has been tested and found suitable for a specified purpose.

Shall. Indicates a mandatory requirement.

Should. Indicates a recommendation or that which is advised but not required.

Standard. A document, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

Chapter 2 Aluminum Powder Production Plants

2-1 Location.

2-1.1 Aluminum powder production plants shall be located on a site large enough so that the buildings in which powder is manufactured are at least 300 ft (90.9 m) from public roads and from any occupied structure, such as public buildings, dwellings, business or manufacturing establishments, other than those buildings that are a part of the aluminum powder production plant.

2-1.2 A hazard analysis shall be conducted to determine the minimum separation distance for individual buildings and operations within aluminum powder production plants.

2-2 Building Construction.

2-2.1 All buildings used for the manufacture, packing, or loading for shipment of aluminum powders shall be constructed of noncombustible materials throughout and shall have nonload-bearing walls. The buildings shall be designed so that all internal surfaces are readily accessible to facilitate cleaning.

2-2.2 All walls of areas where fugitive dust can be produced shall have a smooth finish and be sealed so as to leave no interior or exterior voids where aluminum powder can infiltrate and accumulate. The annulus of all pipe, conduit, and ventilation penetrations shall be sealed.

2-2.3 Floors shall be hard-surfaced and installed with a minimum number of joints in which aluminum powder or dust can collect. The requirements of this section shall also apply to elevated platforms, balconies, floors, or gratings. (See Appendix B.)

2-2.4 Roofs of buildings that house combustible aluminum dust-producing operations shall be supported on girders or structural members designed to minimize surfaces on which dust can collect. Where such surfaces are unavoidably present, they shall be covered by a smooth concrete, plaster, or noncombustible mastic fillet having a minimum slope of 55 degrees to the horizontal.

2-2.5 Roof decks and basements shall be watertight.

2-2.6* Explosion venting shall be provided for buildings where aluminum powder is processed.

Exception: Deflagration venting shall not be required for areas where aluminum powder is only stored or moved in covered or sealed containers.

2-2.7 Doors and Windows.

2-2.7.1 All doors in interior fire-rated partitions shall be listed, self-closing fire doors, installed in accordance with NFPA 80, *Standard for Fire Doors and Fire Windows*.

2-2.7.2 Emergency exits shall be provided in compliance with NFPA 101®, *Life Safety Code*®. (See Section 5-11 and Chapter 28 of NFPA 101.)

2-2.8 Enclosed Passageways.

2-2.8.1* Where buildings or process areas are interconnected by enclosed passageways, the passageways shall be designed to prevent propagation of an explosion or fire from one unit to another.

2-2.8.2 All enclosed passageways that can be occupied and that connect with one or more processing areas shall be provided with means of egress in accordance with NFPA 101, *Life Safety Code*.

2-2.9 Grounding and Lightning Protection.

2-2.9.1* All process equipment and all building steel shall be bonded and grounded in accordance with NFPA 70, *National Electrical Code*®.

2-2.9.2 All buildings shall be provided with a lightning protection system in accordance with NFPA 780, *Standard for the Installation of Lightning Protection Systems*.

Exception: Lightning protection systems shall not be required for office buildings and buildings that are used for storage and handling of closed containers.

2-2.10 Electrical Power and Control.

2-2.10.1 All electrical equipment and wiring shall be installed in accordance with NFPA 70, *National Electrical Code*.

2-2.10.1.1* Powder-manufacturing areas shall be classified, where applicable, in accordance with Article 500 of NFPA 70.

Exception No. 1: Offices and similar areas within the aluminum powder-manufacturing building that are segregated and reasonably free from dust shall not be classified.

Exception No. 2: Control equipment meeting the requirements of NFPA 496, Standard for Purged and Pressurized Enclosures for Electrical Equipment, shall be permitted.

2-2.10.2 One or more remotely located control stations shall be provided to allow the safe and selective shutdown of process equipment in an emergency.

2-2.10.3 All manufacturing buildings shall be provided with emergency lighting systems in accordance with Section 5-9 of NFPA 101, *Life Safety Code*.

2-2.10.4 Preventative maintenance for electrical equipment shall be established commensurate with environment and conditions. Electrical equipment shall be inspected and cleaned at least once each year or more frequently if conditions warrant it.

2-2.10.5 Flashlights and other portable electrical equipment shall be listed for the locations where they are used.