

NFPA 1124
Code for
the Manufacture,
Transportation, and
Storage of
Fireworks
1998 Edition

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NFPA 1124

Code for the

Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles

1998 Edition

This edition of NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles*, was prepared by the Technical Committee on Pyrotechnics 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.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

This edition of NFPA 1124 was approved as an American National Standard on August 6, 1998.

Origin and Development of NFPA 1124

NFPA 44A was originally developed by the Technical Committee on Explosives of the NFPA Committee on Chemicals and Explosives. It was adopted as a Tentative Code at the 1972 NFPA Annual Meeting. It was further revised and officially adopted at the 1973 NFPA Annual Meeting. A revised edition was adopted in 1974.

In 1980, the Technical Committee on Explosives and the Committee on Pyrotechnics voted to transfer responsibility for NFPA 44A to the Committee on Pyrotechnics. The Correlating Committee on Chemicals and Explosives concurred and petitioned the NFPA Standards Council to effect the change. The Standards Council approved the change in June 1981.

The 1984 edition of NFPA 1124 was the result of a complete review of the 1974 edition of NFPA 44A by the Committee on Pyrotechnics, including the redesignation of the document as NFPA 1124 for consistency with the designations for other documents relating to pyrotechnics.

The 1988 edition of NFPA 1124 was the result of a thorough review of and partial revision to the 1984 edition of NFPA 1124 by the Technical Committee on Pyrotechnics, including reference updating and incorporation of the latest separation distances as approved by the Institute of Makers of Explosives in May 1983. It included new provisions for salute manufacturing and storage of salute powder.

The 1995 edition of NFPA 1124 included partial amendments to the document and editorial revisions, improving its ability to be used, adopted, and enforced and making it conform with the NFPA *Manual of Style*. The Committee incorporated the latest separation distances as approved by the Institute of Makers of Explosives in June 1991. The Committee also updated the definitions of fireworks to be consistent with the new terminology used in the U.S. Department of Transportation regulations that incorporated the United Nations shipping designations for fireworks (explosives).

For this edition, the requirements for fireworks laboratories were clarified by the addition of a definition and clarification of the storage and separation distances that are appropriate for them. The Committee added an appendix that extracts language from the American Pyrotechnics Association Standard 87-1 to provide users of this document with the approved definitions used in the Federal Regulations for fireworks, novelties, and theatrical pyrotechnics.

The 1998 edition incorporates amendments to the separation distances for fireworks manufacturing plants based upon gross weight. Amendments to Chapter 4 clarify the storage requirements for manufacturing facilities and provide requirements for storage at nonmanufacturing facilities such as warehouses and distribution facilities.

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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 the manufacture, transportation, and storage for consumer and display fireworks, pyrotechnic special effects and model and high power rocket motors; the use of display fireworks; and the construction, launching, and other operations that involve model and high power rockets.

This Committee does not have responsibility for documents on the use of consumer fireworks by the general public and the use of pyrotechnic special effects before a proximate audience.

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NFPA 1124**Code for the****Manufacture, Transportation, and Storage of
Fireworks and Pyrotechnic Articles****1998 Edition**

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 6 and Appendix E.

Chapter 1 General**1-1 Scope.**

1-1.1 This code shall apply to the manufacture, transportation, and storage of fireworks, pyrotechnic devices used in the entertainment industry, or any component(s) containing pyrotechnic or explosive materials.

1-1.2 This code shall not apply to the retail sale of consumer fireworks and use of consumer fireworks by the general public.

1-1.3 This code shall not apply to the display site storage and use of display fireworks conducted in accordance with NFPA 1123, *Code for Fireworks Display*.

1-1.4 This code shall apply to the testing of fireworks, or pyrotechnic devices used in the entertainment industry, or the testing of any component(s) containing pyrotechnic or explosive materials at a manufacturing facility.

1-1.5 This code shall not apply to the transportation of fireworks, pyrotechnic devices used in the entertainment industry, or any component(s) containing pyrotechnic or explosive materials, where such transportation is under the jurisdiction of the U.S. Department of Transportation (U.S. DOT) or any other national transportation authority.

1-1.6 This code shall not apply to the manufacture, transportation, or storage of model rockets or high power rockets, model rocket motors or high power rocket motors, model rocket motor reloading kits or modules, or high power motor reloading kits or modules, as covered by NFPA 1122, *Code for Model Rocketry*, NFPA 1125, *Code for the Manufacture of Model Rockets and High Power Rocket Motors*, or NFPA 1127, *Code for High Power Rocketry*.

1-1.7 This code shall not apply to the manufacture, transportation, and storage of fireworks by federal and state military agencies.

1-1.8 This code shall not apply to storage at the site of use and the use of pyrotechnic special effects in the entertainment industry conducted in accordance with NFPA 1126, *Standard for the Use of Pyrotechnics before a Proximate Audience*.

1-1.9 This code shall not apply to those laboratories covered by NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*.

1-1.10 This code shall not apply to the manufacture, transportation, or storage of flammable gases or liquids.

1-1.11 This code shall apply to fireworks or pyrotechnic articles used in conjunction with flammable gas or flammable liquid special effects.

1-2 Purpose.

1-2.1 The purpose of this code is to improve safety in the manufacture, transportation, and storage of fireworks, pyrotechnic devices used in the entertainment industry, and any component(s) containing pyrotechnic or explosive materials.

1-2.2 The purpose of this code also is to supplement existing federal, state, or local regulations.

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

1-4 Definitions. For the purpose of this code, the following terms shall be defined as follows.

Aerial Shell.* Usually a cylindrical or spherical cartridge containing pyrotechnic material, a long fuse or electric match wires, and a black powder lift charge.

Airburst. A pyrotechnic device that is suspended in the air to simulate outdoor aerial fireworks shells without producing hazardous debris.

Approved.* Acceptable to the authority having jurisdiction.

Articles, Pyrotechnic. See Pyrotechnic Articles.

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

Barricade. A natural or artificial barrier that effectively screens a magazine, building, railway, or highway from the effects of an explosion in a magazine or building containing explosives. To be effective, a barricade shall be of such height that a straight line from the top of any sidewall of a magazine or building containing explosives to the eave line of any magazine or building, or to a point 12 ft (3.7 m) above the center of a railway or highway, passes through the barricade.

Artificial Barricade. An artificial mound or revetted wall of earth of a minimum thickness of 3 ft (0.9 m).

Natural Barricade. Natural features of the ground, such as hills or timber of sufficient density that the surrounding exposures that require protection cannot be seen from the magazine or building containing explosives when the trees are bare of leaves.

Binary Materials. See Binary System.

Binary System.* A two-component pyrotechnic system.

Black Powder. A low explosive consisting of an intimate mixture of potassium or sodium nitrate, charcoal, and sulfur.

Bulk Salute Powder. Any quantity of salute powder in amounts exceeding 1 lb (0.45 kg).

Bulk Salutes. A collection of salutes or salute components containing more than 2 lb (0.9 kg) of salute powder, unless the salutes are mixed with other types of aerial shells so that the total quantity of salutes to other types of shells is less than 50 percent.

Bullet-Sensitive Explosive Material.* Explosive material that can be detonated by 150-grain (9.8-g) M2 ball ammunition having a nominal muzzle velocity of 2,700 ft/sec (824 m/sec) where fired from a 0.30 caliber rifle at a distance of 100 ft (30 m), measured perpendicular.

Code.* A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards.

Electric Match. An electric device containing a small amount of pyrotechnic material that ignites when current flows through the leads and that is used to initiate the burning of pyrotechnics.

Explosive.* Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion. This term includes but is not limited to dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, and igniters. The term explosive includes any materials determined to be within the scope of Title 18, *United States Code*, Chapter 40, "Importation, Manufacture, Distribution, and Storage of Explosive Materials," and also includes any materials classified as an explosive by the Hazardous Materials Regulations of the U.S. Department of Transportation (U.S. DOT).

Explosive Composition. Any chemical compound or mixture, the primary or common purpose of which is to function by explosion.

Fireworks. Any composition or device for the purpose of producing a visible or an audible effect by combustion, deflagration, or detonation, and that meets the definition of Consumer Fireworks or Display Fireworks as set forth in this code.

*Exception No. 1:** Toy caps for use in toy pistols, toy canes, toy guns, and novelties and trick noisemakers shall not be considered as fireworks. (See Appendix C.)

*Exception No. 2:** Model rockets and model rocket motors designed, sold, and used for the purpose of propelling recoverable aero models shall not be considered as fireworks.

Common Fireworks. See Consumer Fireworks.

*Consumer Fireworks.** (Formerly known as Common Fireworks.) Any small fireworks device designed primarily to produce visible effects by combustion that complies with the construction, chemical composition, and labeling regulations of the U.S. Consumer Product Safety Commission, as set forth in Title 16, *CFR*, Parts 1500 and 1507. Some small devices designed to produce audible effects are included, such as whistling devices, ground devices containing 0.8 grains (50 mg) or less of explosive composition (salute powder), and aerial devices containing 2 grains (130 mg) or less of explosive composition (salute powder) per explosive unit.

*Display Fireworks.** (Formerly known as Special Fireworks.) Large fireworks articles designed to produce visible or audible effects for entertainment purposes by combustion, deflagration, or detonation. This term includes, but is not limited to, salutes containing more than 2 grains (130 mg) of explosive composition (salute powder), aerial shells containing more than 60 g (2.1 oz) of total pyrotechnic and explosive composition, and other display pieces that exceed the limits for classification as consumer fireworks.

Special Fireworks. See Display Fireworks.

Flash Powder. See Salute Powder.

Fuel.* In pyrotechnics, anything combustible or acting as a chemical-reducing agent such as but not limited to sulfur, aluminum powder, iron powder, charcoal, magnesium, gums, and organic plastic binders.

Highway. Any public street, public alley, or public road.

Inhabited Building. Any building or structure regularly used in whole or part as a place of human habitation. The term includes any church, school, store, railway passenger station, airport passenger terminal, and any other building or structure where people are accustomed to congregate or assemble. This term does not include any building or structure occupied in connection with the manufacture, transportation, storage, or use of explosive materials at a fireworks plant.

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.

Magazine. Any building or structure, other than an explosives manufacturing building, approved for the storage of explosive materials.

Manufacture. The mixing, pressing, and loading of pyrotechnic compositions for the purpose of producing fireworks or pyrotechnic articles. The term also includes the assembly of fireworks and pyrotechnic articles from component parts.

Exception: The following operations performed in a separate building or area are not considered to be manufacturing:

- (a) Assembly of display pieces from finished pyrotechnic articles classed as Explosive 1.4
- (b) Minor repairs or modification of consumer fireworks not involving exposed pyrotechnic material
- (c) Packing of finished consumer fireworks into consumer fireworks assortments
- (d) The attachment of electric matches and minor repairs to display fireworks and pyrotechnic articles

Manufacturing Facility. A place where a licensed business conducts mixing, handling, or loading of explosive or pyrotechnic composition for fireworks, pyrotechnic articles, or components for these devices, or a place where fireworks or pyrotechnic articles are assembled from component parts.

Exception: The following operations performed in a separate building or area are not considered to be manufacturing:

- (a) Assembly of display pieces from finished pyrotechnic articles classed as Explosive 1.4

- (b) *Minor repairs or modification of consumer fireworks not involving exposed pyrotechnic material*
- (c) *Packing of finished consumer fireworks into consumer fireworks assortments*
- (d) *The attachment of electric matches and minor repairs to display fireworks and pyrotechnic articles*

Mechanical Building. A building that contains mechanical, electrical, air conditioning, or other equipment and that usually is connected to a process or nonprocess building. A mechanical building is intended to be an unoccupied building.

Mixing Building. Any building used primarily for mixing and blending of pyrotechnic compositions.

Exception: This definition does not apply to wet sparkler mix preparation.

Motor Vehicle. Any self-propelled vehicle, truck, tractor, semitrailer, or truck-trailer combination used for the transportation of freight over public highways.

Nonprocess Building.* Any office building, warehouse, or other building or area located in a manufacturing facility, where no fireworks, pyrotechnic or explosive composition, pyrotechnic articles, or any component(s) containing pyrotechnic or explosive materials are processed or stored.

Novelties and Trick Noisemakers. Small devices containing limited amounts of pyrotechnic explosive or composition that produce a visible or audible effect. (See Appendix C.)

Oxidizer.* Usually an oxygen-rich, ionically bonded chemical that decomposes at moderate to high temperatures.

Person. Any individual, firm, copartnership, corporation, company, association, or joint-stock association, including any trustee, receiver, assignee, or personal representative thereof.

Process Area. An outside area complying with the applicable provisions of this code for a process building that is used for the manufacture of fireworks and pyrotechnic articles.

Process Building.* Any building or any room at a manufacturing facility where fireworks, pyrotechnic articles, or component(s) containing explosive or pyrotechnic compositions are manufactured or assembled. A process building is also any building at a manufacturing facility where consumer fireworks are prepared for shipment.

Public Conveyance. Any railroad car, street car, ferry, cab, bus, airplane, or other vehicle that carries passengers for hire.

Pyrotechnic Articles. Pyrotechnic devices, other than devices classed as fireworks, for use in the entertainment industry.

Pyrotechnic Composition. A chemical mixture that, upon burning, produces visible, brilliant displays, bright lights, or sounds.

Pyrotechnic Laboratory.* A building or room used for research, development, or testing of chemicals, fireworks, pyrotechnic articles, or component(s) containing explosive or pyrotechnic compositions.

Pyrotechnic Material (Pyrotechnic Special Effects Material). A chemical mixture used in the entertainment industry to produce visible or audible effects by combustion, deflagration, or detonation. Such a chemical mixture consists predominantly of solids capable of producing a controlled, self-sustaining, and self-contained exothermic chemical reaction that results in heat, gas, sound, light, or a combination of these effects. The chemical reaction functions without external oxygen.

Pyrotechnic Special Effect. A special effect created through the use of pyrotechnic materials and devices. (See also *Special Effect in Appendix D.*)

Pyrotechnics. Controlled exothermic chemical reactions that are timed to create the effects of heat, gas, sound, dispersion of aerosols, emission of visible electromagnetic radiation, or a combination of these effects to provide the maximum effect from the least volume.

Railway. Any steam, electric, diesel-electric, or other railroad or railway that carries passengers for hire on the particular line or branch in the vicinity of a pyrotechnics manufacturing or storage facility.

Rocket. A pyrotechnic device that moves by the ejection of matter produced by the internal combustion of propellants.

Salute. A display firework that is designed to produce a loud report.

Salute Powder. An explosive composition that makes a loud report when ignited and constitutes the sole pyrotechnic mixture in a salute.

Screen Barricade. Any barrier that contains the embers and debris from a fire or deflagration in a process building, thus preventing propagation of fire to other buildings or areas. Such barriers shall be permitted to be constructed of metal roofing, 1/4-in. to 1/2-in. (6-mm to 13-mm) mesh screen, or equivalent material. The barrier extends from floor level to a height such that a straight line from the top of any sidewall of the donor building to the eave line of any exposed building intercepts the screen at a point not less than 5 ft (1.5 m) from the top of the screen. The top 5 ft (1.5 m) of the screen are inclined toward the donor building at an angle of 30 degrees to 45 degrees.

Shipping Building. A building used for the packing of assorted display fireworks into shipping cartons or for the loading of the cartons onto vehicles for shipment to purchasers.

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

Stars.* Small masses of pyrotechnic compounds that are projected from aerial shells, mines, or roman candles.

Storage Building. Any building, structure, or facility in which consumer fireworks (formerly Common Fireworks) in any state of processing are stored, but in which no processing or manufacturing is actually performed.

Unoccupied Building. Any building that is normally unoccupied during the entire daily period of operations of the facility. An unoccupied building can be used for long-term storage of materials acceptable to the authority having jurisdiction, provided that no fireworks or pyrotechnic composition is stored within the building.

Chapter 2 Manufacturing Operations

2-1 Applicability. All manufacturing facilities shall comply with the requirements of this chapter.

Exception: Manufacturing facilities shall not be required to comply with Sections 2-5, 2-8, 2-10, and 2-11, provided they meet all of the following conditions.

- (a) *Only custom fireworks, pyrotechnic articles, and any component(s) containing pyrotechnic or explosive materials, not for general sale, are manufactured.*

- (b) Not more than 5 lb (2.3 kg) of pyrotechnic composition, of which no more than 1/2 lb (0.23 kg) shall be permitted to be of explosive composition, is present in any one building at any one time.
- (c) All explosive and pyrotechnic compositions are removed to an appropriate storage magazine at the end of each workday.

2-2 Basic Requirements. The manufacture of any fireworks, as defined in Section 1-4, shall be prohibited unless it is authorized by federal license, where required, and is conducted in accordance with this code.

2-3 Permit Requirements.

2-3.1 Any person engaged in the business of importing, manufacturing, or dealing in fireworks shall possess a valid federal license or permit, where required by Title XI, "Regulation of Explosives, of the Crime Control Act of 1970" (Title 18, *United States Code*, Chapter 40) and shall comply with all applicable state and local laws and regulations.

2-3.1.1 Copies of all required licenses and permits shall be posted at each fireworks plant.

2-3.1.2 License and permit holders shall take reasonable precaution to protect licenses and permits from loss, theft, defacement, destruction, or unauthorized duplication. Any such occurrence shall be reported immediately to the issuing authority.

2-3.1.3 Licenses or permits shall not be assigned or transferred.

2-3.2 The issuing authority shall be notified immediately of any change of business address.

2-4 Recordkeeping and Reporting.

2-4.1 Manufacturers shall maintain records in compliance with federal regulations. Such records shall be kept for five years and shall be made available upon request to the authorities having jurisdiction.

Exception: Where only consumer fireworks are handled, records shall be required to be kept for three years only.

2-4.2 The loss, theft, or unlawful removal of explosive materials shall be reported immediately to the nearest office of the Bureau of Alcohol, Tobacco and Firearms, U.S. Department of the Treasury, and to local law enforcement authorities.

Exception: Loss of consumer fireworks shall not be required to be reported to the Bureau of Alcohol, Tobacco and Firearms.

2-4.3 Manufacturers shall maintain records for all chemicals and chemical mixtures in compliance with the requirements of Title 29, *CFR*, Part 1910.1200, "Hazard Communication."

2-5 Site Security.

2-5.1 All plant buildings containing pyrotechnic composition, explosive composition, or fireworks shall be locked securely at the end of the workday or wherever plant personnel are not present to provide security.

2-5.2 All roads leading into the plant shall have gates that shall be kept closed and locked securely at all times when not actually in use. Vehicle access into the plant shall be restricted to roadways by means of a fence, natural barriers such as trees, culverts, or other appropriate means.

Exception: The main plant entrance shall be permitted to be left open during regular plant operating hours, provided it is in full view of and under observation by an authorized responsible employee or guard.

2-5.3 Conspicuous signs that read "WARNING — NO SMOKING — NO TRESPASSING" shall be posted at frequent intervals around the plant perimeter.

2-5.4 Only authorized employees or representatives of federal, state, or local agencies having jurisdiction over the plant shall be permitted inside the plant without special permission of the person in charge.

2-6 Separation Distances.

2-6.1 Process buildings and areas shall be separated from other process buildings and areas and from nonprocess buildings in accordance with the distances specified in Table 2-6.1.

Table 2-6.1 Minimum Separation Distances Between Fireworks Plant Buildings¹

Net Weight of Fireworks Over		Distance Between Process Buildings and Areas and Distance Between Process and Nonprocess Buildings and Areas		Not Over		In-Process Display Fireworks Without Barricades		In-Process Display Fireworks With Barricades		In-Process Consumer Fireworks or Pyrotechnic Articles ^{2,3}	
		lb	kg			ft	m	ft	m	ft	m
0	0	—	—	100	45	114	35	57	17	37	11
100	45	—	—	200	91	138	42	69	21	37	11
200	91	—	—	300	136	154	47	77	23	37	11
300	136	—	—	400	181	170	52	85	26	37	11
400	181	—	—	500	227	182	55	91	28	37	11
500	227	—	—	1000	454	not permitted		not permitted		37	11
		>1000	454			not permitted		not permitted		37	11
		>2000	907			not permitted		not permitted		48	15
		>3000	1361			not permitted		not permitted		60	18
		>4000	1814			not permitted		not permitted		67	20

¹Net weight equals the weight of all pyrotechnic and explosive composition and fuse only.

²For maximum quantity of pyrotechnic composition in a pyrotechnics laboratory, see 2-10.5.

³See 2-6.1.5.

2-6.1.1 A maximum of 500 lb (227 kg) of in-process composition, either loose or in partially assembled display fireworks, shall be permitted in any process building or area.

2-6.1.2 Finished display fireworks shall not be stored in a process building. (See 2-10.3.)

2-6.1.3 A maximum of 10 lb (4.5 kg) of salute powder, either in loose form or in assembled units, shall be permitted in any process building or area.

2-6.1.4 Quantities of loose salute powder in excess of 10 lb (4.5 kg) shall be kept in an approved magazine.

2-6.1.5 The minimum separation distance for in-process consumer fireworks or pyrotechnic articles shall be limited to 100 lb (45 kg) of loose powder or stars. If a greater quantity of loose powder or stars is present, the minimum separation distances in Table 2-6.1 for in-process display fireworks shall be used.

2-6.2 Process buildings and areas shall be separated from inhabited buildings, passenger railways, public highways, magazines, display fireworks shipping buildings, and consumer fireworks storage buildings in accordance with the distances specified in Table 2-6.2.

2-6.2.1 Table 2-6.2 shall not apply to the separation distances between process buildings or areas (see Table 2-6.1), between magazines (see Tables 2-6.3 and 2-6.4), and between storage buildings (see Table 2-6.5).

2-6.2.2* The distances in Table 2-6.2 shall apply with or without barricades or screen-type barricades.

2-6.2.3 A maximum of 500 lb (227 kg) of in-process composition, either loose or in partially assembled display fireworks, shall be permitted in any process building or area. Finished display fireworks shall not be stored in a process building.

2-6.2.4 A maximum of 10 lb (4.5 kg) of salute powder, either in loose form or in assembled units, shall be permitted in any process building or area.

2-6.2.5 Quantities in excess of 10 lb (4.5 kg) shall be kept in an approved magazine.

2-6.3 Magazines for the storage of display fireworks and components for display fireworks, loose pyrotechnic composition, and stars shall be separated from inhabited buildings, passenger railways, public highways, and other magazines in accordance with the distances specified in Table 2-6.3. For the purposes of applying this table, a shipping building for display fireworks shall be considered a magazine. At a fireworks plant, up to 50 lb (22.7 kg) of pyrotechnic composition or display fireworks shall be permitted to be stored in a Type 2 or Type 4 indoor magazine in any process building.

Exception: Magazines for the storage of bulk salute powder and bulk salutes shall comply with Table 2-6.4.

Table 2-6.2 Minimum Separation Distances of Process Buildings and Areas from Inhabited Buildings, Passenger Railways, Public Highways, Fireworks Plant Magazines and Shipping Buildings, and Storage Buildings for Consumer Fireworks

Net Weight of Fireworks ¹ Over		Distance from Passenger Railways, Public Highways, Fireworks Magazines and Shipping Buildings, Storage Buildings, and Inhabited Buildings		Not Over		In-Process Display Fireworks ²		In-Process Consumer Fireworks or Pyrotechnic Articles			
		lb	kg	lb	kg	lb	kg	ft	m	ft	m
0	0	—	—	100	45	200	61	25	7.6		
100	45	—	—	500	227	200	61	50	15		
		> 500	227					75	23		
		> 1000	454					100	30		
		> 2000	907					115	35		
		> 3000	1361					124	38		
		> 4000	1814					130	40		

¹Net weight equals the weight of all pyrotechnic and explosive compositions and fuse only.

²For information on the separation distances between process buildings see Table 2-6.1, between magazines see Tables 2-6.3 and 2-6.4, and between storage buildings see Table 2-6.5.

Table 2-6.3 Distances for the Storage of Display Fireworks, Except Bulk Salutes, at Fireworks Manufacturing Plants

Net Weight of Fireworks* Over		Distance Between Magazine and Inhabited Building, Passenger Railway, or Public Highway		Distance Between Magazines Not Over		In-Process Display Fireworks		In-Process Consumer Fireworks or Pyrotechnic Articles			
		lb	kg	lb	kg	lb	kg	ft	m	ft	m
0	0	—	—	1,000	454	150	46	100	30		
1000	454	—	—	5,000	2268	230	70	150	46		
5000	2268	—	—	10,000	4536	300	91	200	61		
		> 10,000	4536					See Table 2-6.4			

*Net weight equals the weight of all pyrotechnic and explosive compositions and fuse only.

2-6.3.1 For fireworks storage magazines in active use prior to March 7, 1990, the distances in Table 2-6.3 shall be permitted to be halved, provided earthen barricades are used between the magazine and potential receptor sites.

2-6.3.2 Table 2-6.3 shall not apply to the storage of bulk salute powder or to the storage of shipping cartons or storage containers containing primarily salutes or salute components. (See Table 2-6.4 for bulk salute powder and bulk salute storage requirements.)

2-6.3.3 For the purposes of applying Table 2-6.3, display fireworks shipping buildings shall meet the same distance requirements as magazines.

2-6.4 Magazines containing salute powder and salutes shall be separated from each other and from inhabited buildings, public highways, and passenger railways in accordance with the distances specified in Table 2-6.4.

2-6.5 Storage buildings for consumer fireworks located at fireworks manufacturing facilities shall be separated from inhabited buildings, passenger railways, public highways, and other storage buildings in accordance with the distances specified in Table 2-6.5.

2-6.6 If any process building is separated from any other process or nonprocess building by less than the distance specified in Table 2-6.1, then two or more such buildings, as a group, shall be considered as one building. The total quantity of explosive and pyrotechnic composition in this group of buildings shall not exceed 500 lb (227 kg), or 10 lb (4.5 kg) of salute powder. Each building in the group otherwise shall comply with the separation distances specified in Tables 2-6.1 and 2-6.2.

Exception: Unoccupied buildings at manufacturing facilities shall not be subject to the separation distance requirements of Section 2-6.

2-6.7 If any two or more magazines or storage buildings are separated by less than the distance specified in Table 2-6.3, Table 2-6.4, or Table 2-6.5, then two or more such structures shall be considered as one magazine or storage building. The total quantity of explosive and pyrotechnic composition stored in the group of buildings shall be used to determine the minimum separation distances of each building in the group from inhabited buildings, passenger railways, public highways, and other magazines and storage buildings.

Exception: Unoccupied buildings at manufacturing facilities shall not be subject to the separation distance requirements of Section 2-6.

2-6.8 Pyrotechnics laboratories shall be considered process buildings for consumer fireworks for the purpose of separation distances.

2-6.9 Pyrotechnics laboratories are considered to be nonprocess buildings with respect to the other requirements of this code.

2-6.10 There shall be no minimum separation distance for process buildings, magazines, or storage buildings within a group.

2-7 Process Building Construction.

2-7.1 Process buildings shall be single story and shall not have basements.

2-7.2 Wall joints and openings for wiring, plumbing, and other utilities shall be sealed to prevent entry of dusts.

2-7.3 Horizontal ledges and surfaces upon which dust can settle and accumulate shall be minimized.

2-7.4* Floors and work surfaces shall not have cracks or crevices in which explosives or pyrotechnic compositions can lodge. Floors and work surfaces in mixing and loading buildings for salute powder shall be of conductive materials. Conductive footwear or other grounding techniques for personnel shall be used wherever exposed salute powder is present.

2-7.5 A means for discharging static shall be provided at the entrance to all mixing, pressing, and loading buildings where exposed salute powder is present. All personnel entering these buildings shall utilize these means.

2-7.6* Consideration shall be given in each process building in which an explosion hazard exists for explosion relief, either by pressure-relieving construction or by explosion vents.

Exception: This shall not be required when climatic conditions (or local building code requirements) prevent the use of pressure-relieving construction or explosion vents. Alternate methods of protecting nearby buildings, such as but not limited to screen-type barricades, differences in elevation of trees, and so forth, shall be provided for buildings in which an explosion hazard exists.

2-8 Means of Egress.

2-8.1 Means of egress in all buildings shall comply with applicable requirements of NFPA 101®, *Life Safety Code*®.

2-8.2 Means of egress in process buildings also shall comply with the following requirements.

- (a) From every point in every undivided floor area of more than 100 ft² (9 m²), there shall be at least two remotely located means of egress.
- (b) Where process buildings are divided into rooms, there shall be at least two means of escape from each room of more than 100 ft² (9 m²).

Exception: Toilet rooms shall be required to have only one means of egress, provided they are located away from or shielded from process areas.

- (c) Means of egress shall be located so that every point within the room or undivided floor area is within 25 ft (7.6 m) of a means of egress. The means of egress shall not be obstructed.
- (d) Exit doors shall open outward and shall be capable of being pressure actuated from the inside.

2-9 Heat, Light, and Electrical Equipment.

2-9.1 Stoves, exposed flames, and portable electric heaters shall be prohibited in any building where fireworks, fireworks components, or flammable liquids are or can be present.

Exception: This requirement shall not apply to nonprocess buildings.

2-9.2 Heating shall be provided by steam, hot water, or indirect hot air radiators, or any other means acceptable to the authority having jurisdiction.

Exception: This requirement shall not apply to nonprocess buildings.

Table 2-6.4 Table of Distances for Magazines for the Storage of Bulk Salute Powder and Bulk Salutes

Quantity of Explosive Materials ^{1,2,3,4}		Distances (ft)							
		Inhabited Buildings ⁹		Public Highways Class A to D ¹¹		Passenger Railways — Public Highways with Traffic Volume of More than 3000 Vehicles/Day ^{10,11}		Separation of Magazines ¹²	
		Pounds Over	Pounds Not Over	Barri-caded ^{6,7,8}	Unbarri-caded	Barri-caded ^{6,7,8}	Unbarri-caded	Barri-caded ^{6,7,8}	Unbarri-caded
0	5	70	140	30	60	51	102	6	12
5	10	90	180	35	70	64	128	8	16
10	20	110	220	45	90	81	162	10	20
20	30	125	250	50	100	93	186	11	22
30	40	140	280	55	110	103	206	12	24
40	50	150	300	60	120	110	220	14	28
50	75	170	340	70	140	127	254	15	30
75	100	190	380	75	150	139	278	16	32
100	125	200	400	80	160	150	300	18	36
125	150	215	430	85	170	159	318	19	38
150	200	235	470	95	190	175	350	21	42
200	250	255	510	105	210	189	378	23	46
250	300	270	540	110	220	201	402	24	48
300	400	295	590	120	240	221	442	27	54
400	500	320	640	130	260	238	476	29	58
500	600	340	680	135	270	253	506	31	62
600	700	355	710	145	290	266	532	32	64
700	800	375	750	150	300	278	556	33	66
800	900	390	780	155	310	289	578	35	70
900	1000	400	800	160	320	300	600	36	72
1000	1200	425	850	165	330	318	636	39	78
1200	1400	450	900	170	340	336	672	41	82
1400	1600	470	940	175	350	351	702	43	86
1600	1800	490	980	180	360	366	732	44	88
1800	2000	505	1010	185	370	378	756	45	90
2000	2500	545	1090	190	380	408	816	49	98
2500	3000	580	1160	195	390	432	864	52	104
3000	4000	635	1270	210	420	474	948	58	116
4000	5000	685	1370	225	450	513	1026	61	122
5000	6000	730	1460	235	470	546	1092	65	130
6000	7000	770	1540	245	490	573	1146	68	136
7000	8000	800	1600	250	500	600	1200	72	144
8000	9000	835	1670	255	510	624	1248	75	150
9000	10,000	865	1730	260	520	645	1290	78	156
10,000	12,000	875	1750	270	540	687	1374	82	164
12,000	14,000	885	1770	275	550	723	1446	87	174
14,000	16,000	900	1800	280	560	756	1512	90	180
16,000	18,000	940	1880	285	570	786	1572	94	188
18,000	20,000	975	1950	290	580	813	1626	98	196
20,000	25,000	1055	2000	315	630	876	1752	105	210
25,000	30,000	1130	2000	340	680	933	1866	112	224
30,000	35,000	1205	2000	360	720	981	1962	119	238
35,000	40,000	1275	2000	380	760	1026	2000	124	248
40,000	45,000	1340	2000	400	800	1068	2000	129	258
45,000	50,000	1400	2000	420	840	1104	2000	135	270
50,000	55,000	1460	2000	440	880	1140	2000	140	280
55,000	60,000	1515	2000	455	910	1173	2000	145	290
60,000	65,000	1565	2000	470	940	1206	2000	150	300
65,000	70,000	1610	2000	485	970	1236	2000	155	310
70,000	75,000	1655	2000	500	1000	1263	2000	160	320
75,000	80,000	1695	2000	510	1020	1293	2000	165	330
80,000	85,000	1730	2000	520	1040	1317	2000	170	340
85,000	90,000	1760	2000	530	1060	1344	2000	175	350
90,000	95,000	1790	2000	540	1080	1368	2000	180	360
95,000	100,000	1815	2000	545	1090	1392	2000	185	370

Table 2-6.4 Table of Distances for Magazines for the Storage of Bulk Salute Powder and Bulk Salutes, (Continued)

Quantity of Explosive Materials ^{1,2,3,4}		Distances (ft)							
		Inhabited Buildings ⁹		Public Highways Class A to D ¹¹		Passenger Railways — Public Highways with Traffic Volume of More than 3000 Vehicles/Day ^{10,11}		Separation of Magazines ¹²	
Pounds Over	Pounds Not Over	Barri-caded ^{6,7,8}	Unbarri-caded	Barri-caded ^{6,7,8}	Unbarri-caded	Barri-caded ^{6,7,8}	Unbarri-caded	Barri-caded ^{6,7,8}	Unbarri-caded
100,000	110,000	1835	2000	550	1100	1437	2000	195	390
110,000	120,000	1855	2000	555	1110	1479	2000	205	410
120,000	130,000	1875	2000	560	1120	1521	2000	215	430
130,000	140,000	1890	2000	565	1130	1557	2000	225	450
140,000	150,000	1900	2000	570	1140	1593	2000	235	470
150,000	160,000	1935	2000	580	1160	1629	2000	245	490
160,000	170,000	1965	2000	590	1180	1662	2000	255	510
170,000	180,000	1990	2000	600	1200	1695	2000	265	530
180,000	190,000	2010	2010	605	1210	1725	2000	275	550
190,000	200,000	2030	2030	610	1220	1755	2000	285	570
200,000	210,000	2055	2055	620	1240	1782	2000	295	590
210,000	230,000	2100	2100	635	1270	1836	2000	315	630
230,000	250,000	2155	2155	650	1300	1890	2000	335	670
250,000	275,000	2215	2215	670	1340	1950	2000	360	720
275,000	300,000	2275	2275	690	1380	2000	2000	385	770

Note: Numbers in superscript refer to explanatory notes.

Explanatory Notes Essential to the Application of the American Table of Distances for Storage of Explosives

¹“Explosive materials” means explosives, blasting agents, and detonators.

²“Explosives” means any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion. A list of explosives determined to be within the coverage of 18 U.S.C., Chapter 40, “Importation, Manufacture, Distribution, and Storage of Explosive Materials,” is issued at least annually by the Director of the Bureau of Alcohol, Tobacco, and Firearms of the Department of the Treasury. For quantity and distance purposes, detonating cord of 50 grains per foot should be calculated as equivalent to 8 lb (3.7 kg) of high explosives per 1000 ft (305 m). Heavier or lighter core loads should be rated proportionately.

³“Blasting agents” means any material or mixture consisting of fuel and oxidizer, intended for blasting, not otherwise defined as an explosive, provided that the finished product, as mixed for use or shipment, cannot be detonated by means of a No. 8 test blasting cap where unconfined.

⁴“Detonator” means any device containing any initiating or primary explosive that is used for initiating detonation. A detonator shall not be permitted to contain more than 10 g of total explosives by weight, excluding ignition or delay charges. The term includes, but is not limited to, electric blasting caps of instantaneous and delay types, blasting caps for use with safety fuses, detonating cord delay connectors, and nonelectric instantaneous and delay blasting caps that use detonating cord, shock tube, or any other replacement for electric leg wires. All types of detonators in strengths through No. 8 cap should be rated at 1 1/2 lb (0.7 kg) of explosives per 1000 caps. For strengths higher than No. 8 cap, consult the manufacturer.

⁵“Magazine” means any building, structure, or container, other than an explosives manufacturing building, approved for the storage of explosive materials.

⁶“Natural barricade” means natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures that require protection cannot be seen from the magazine when the trees are bare of leaves.

⁷“Artificial barricade” means an artificial mound or revetted wall of earth of a minimum thickness of 3 ft (0.9 m).

⁸“Barricaded” means the effective screening of a building containing explosive materials from the magazine or other building, railway, or highway by a natural or an artificial barrier. A straight line from the top of any sidewall of the building containing explosive materials to the eave line of any magazine or other building or to a point 12 ft (3.7 m) above the center of a railway or highway shall pass through such barrier.

⁹“Inhabited building” means a building regularly occupied in whole or part as a habitation for human beings, or any church, schoolhouse, railroad station, store, or other structure where people are accustomed to assemble, except any building or structure occupied in connection with the manufacture, transportation, storage, or use of explosive materials.

¹⁰“Railway” means any stream, electric, or other railroad or railway that carries passengers for hire.

¹¹“Highway” means any public street, public alley, or public road.

¹²Where two or more storage magazines are located on the same property, each magazine must comply with the minimum distances specified from inhabited buildings, railways, and highways, and, in addition, they should be separated from each other by not less than the distances shown for “separation of magazines,” except that the quantity of explosive materials contained in detonator magazines shall govern with regard to the spacing of the detonator magazines from magazines containing other explosive materials. If any two or more magazines are separated from each other by less than the specified “separation of magazines” distances, then those two or more magazines, as a group, must be considered as one magazine, and the total quantity of explosive materials stored in such group must be treated as if stored in a single magazine located on the site of any magazine of the group, and must comply with the minimum distances specified from other magazines, inhabited buildings, railways, and highways.

¹³Storage in excess of 300,000 lb (136,200 kg) of explosive materials in one magazine is generally not required for commercial enterprises.

¹⁴This table applies only to the manufacture and permanent storage of commercial explosive materials. It is not applicable to transportation of explosives or any handling or temporary storage necessary or incident thereto. It is not intended to apply to bombs, projectiles, or other heavily encased explosives.

¹⁵Where a manufacturing building on an explosive materials plant site is designed to contain explosive materials, such building shall be located from inhabited buildings, public highways, and passenger railways in accordance with the American Table of Distances based on the maximum quantity of explosive materials permitted to be in the building at one time.

Source: The American Table of Distances is reproduced from the American Table of Distances for Storage of Explosives as revised and approved by the Institute of Makers of Explosives in June 1991.

Table 2-6.5 Minimum Separation Distances of Consumer Fireworks Storage Buildings at Fireworks Manufacturing Plants from Inhabited Buildings, Magazines, Passenger Railways, Public Highways, and Other Storage Buildings

Gross Weight of Consumer Fireworks		Distance from Passenger Railways, Public Highways, and Other Storage Buildings		Distance from Inhabited Buildings and Magazine	
		ft	m	ft	m
0-1000	0-454	35	11	70	21
1000-5000	454-2268	55	17	110	34
5000-10,000	2268-4536	60	18	120	37
10,000-20,000	4536-9072	65	20	135	41
20,000-50,000	9072-22,680	80	24	160	49
50,000-100,000	22,680-45,360	90	27	180	55
100,000 and over	45,360	100	30	200	61

2-9.3 Unit heaters located in buildings that contain exposed explosive or pyrotechnic composition shall be equipped with motors and electrical devices for use in hazardous locations in accordance with Article 502 of NFPA 70, *National Electrical Code*[®].

2-9.4 All wiring, switches, and electrical fixtures in process buildings shall meet the requirements for hazardous locations in accordance with Article 502 of NFPA 70, *National Electrical Code*.

2-9.4.1 Portable lighting equipment shall not be used.

Exception: Listed portable lighting equipment shall be permitted to be used during repair operations, provided the area has been cleared of all pyrotechnic or explosive material and all dust or residue has been removed.

2-9.4.2 All presses and other such mechanical devices used in the vicinity of exposed explosive or pyrotechnic composition shall be electrically bonded and grounded.

2-9.5 All artificial lighting shall be electrically powered.

2-10 Maximum Number of Occupants and Maximum Quantity Limitations.

2-10.1* The number of occupants in each process building and in each magazine shall not exceed the number necessary for proper conduct of production operations.

2-10.2 The maximum number of occupants and maximum weight of pyrotechnic and explosive composition permitted in each process building and in each magazine shall be posted in a conspicuous location in each process building or magazine.

2-10.3* No more than 500 lb (227 kg) of pyrotechnic or explosive composition shall be permitted at one time in any process building or area. All compositions not in current use shall be kept in covered, nonferrous containers.

Exception: Composition that has been loaded or pressed into tubes or other containers as consumer fireworks.

2-10.4* The Bureau of Alcohol, Tobacco and Firearms' requirements shall be met, pertaining to the removal of dry explosive powders and mixtures, partially assembled, display fireworks, and finished display fireworks from process buildings to magazines at the conclusion of each day's operation.

Exception: Where a variance from this requirement has been issued in writing to a manufacturer by the Bureau of Alcohol, Tobacco and Firearms.

2-10.5 Pyrotechnics laboratories shall not contain more than 10 lb (4.5 kg) of pyrotechnic composition and no more than 0.5 lb (0.23 kg) of salute powder, provided that all fireworks and pyrotechnic composition are stored properly when not in use.

2-11 Fire and Explosion Prevention.

2-11.1 All buildings shall be kept clean and orderly, and dust or rubbish shall be kept to a minimum.

2-11.1.1 Spills of explosive or pyrotechnic composition shall be cleaned up and removed immediately from the building. The spilled material shall be destroyed by immersion in water or by burning in a manner acceptable to the authority having jurisdiction.

2-11.1.2 Rags, combustible scrap, and paper shall be kept separate from waste explosive or pyrotechnic materials. They shall be kept in approved, marked containers until removed from the building. Disposal containers shall be removed from buildings on a daily basis and removed from the plant at regular intervals. Waste explosive or pyrotechnic materials shall be destroyed as described in 2-11.1.1.

2-11.2 Smoking materials shall not be carried into or in the vicinity of process buildings. Personnel shall deposit all smoking materials at a designated location in a nonprocess building immediately upon entering the plant.

2-11.2.1* Smoking shall be permitted only in office buildings or in buildings used exclusively as lunchrooms or rest rooms and in which the presence of explosive or pyrotechnic materials is prohibited.

2-11.2.2 Authorized smoking locations shall be so marked, shall contain designated receptacles for disposal of smoking materials, and shall be provided with at least one approved portable fire extinguisher for use on Class A fires.

2-11.2.3 Personnel whose clothing is contaminated with explosive or pyrotechnic composition to a degree that endangers personnel safety shall not be permitted in smoking areas.

2-11.3 No employee or other person shall be permitted to enter the plant while in possession of or under the influence of alcohol, drugs, or narcotics.

2-11.4 Personnel working at or supervising mixing, pressing, and loading operations shall be provided with and shall wear cotton or other similarly effective clothing. Other protective clothing, eye protection, and respiratory protection shall be worn as needed.

2-11.4.1 Washing and changing facilities shall be provided for personnel.

2-11.4.2 Work clothing shall be washed frequently to prevent accumulation of explosive or pyrotechnic composition and shall not be worn outside the plant.

2-11.5 Each plant shall designate an employee as safety officer who shall be responsible for general safety, fire prevention and protection, and employee safety training.

2-11.6 The safety officer shall provide formal instruction to all employees upon their commencing employment and at least annually thereafter, regarding proper methods and proce-

dures, safety requirements, and procedures for handling explosive and pyrotechnic compositions and devices.

2-11.7* Oxidizers shall be stored to avoid contact with incompatible materials such as ordinary combustibles, flammable or combustible liquids, greases, and those materials that could react with the oxidizer or promote or initiate its decomposition. These shall not include approved packaging materials, pallets, or other dunnage. This storage shall comply with NFPA 430, *Code for the Storage of Liquid and Solid Oxidizers*.

2-11.8* Machinery and tooling shall be permitted to be made of ferrous metal. (See also 2-9.4.2.)

2-12 Fire Protection and Emergency Plans.

2-12.1 Portable fire extinguishers shall be provided in all buildings in accordance with the requirements of NFPA 10, *Standard for Portable Fire Extinguishers*.

Exception: Extinguishers shall not be located in buildings in which explosive or pyrotechnic mixtures are exposed.

2-12.2 Each plant shall have a formal emergency plan. Such a plan shall include employee instruction and training and shall be applicable to all anticipated emergencies. An emergency warning signal shall be established.

2-12.3 The emergency plan shall include instruction in the use of portable fire extinguishers and the identification of those fires on which they can be used safely.

2-12.4 Employees shall be instructed to abandon fire-fighting efforts if the fire involves or appears likely to spread to explosive or pyrotechnic composition or devices. In such cases, employees shall evacuate the building immediately and alert other plant personnel.

2-12.5 A master electrical disconnect shall be provided at the point where the electrical service enters the plant. This master disconnect shall be arranged to disconnect all electrical power to the plant.

Exception: Emergency circuits, such as the electrical supply to fire pumps or emergency lighting, shall have their own master disconnects.

2-13 Testing of Fireworks and Pyrotechnic Articles.

2-13.1 Testing of fireworks, pyrotechnic materials, and pyrotechnic and explosive compositions shall be performed only in a building or area specifically designated for that purpose.

2-13.2 The testing shall be conducted at a safe distance from other plant buildings or structures and process areas.

2-13.2.1 Items suitable for indoor use shall be so marked, including accurate performance characteristics of the device. For fountains, gerbs, and other preloads, this shall include the following:

- (a) Duration
- (b) Height
- (c) Diameter of the effect, as applicable

2-13.2.2 Articles marked for indoor use shall be permitted to be used outdoors, but only items marked by the manufacturer for indoor use shall be used indoors.

2-13.2.3 Binary Systems. All binary systems shall have the following information provided in addition to the general requirements:

- (a) The type of contents and general use of the material

- (b) A statement describing conditions of use, potential hazards, and suitable equipment with instructions for use

- (c) A manufacturer's statement regarding whether the material is suitable for indoor use and under what conditions

- (d) All binary materials intended for indoor use shall be preweighed, premeasured, prepackaged, and identified by the manufacturer as suitable for indoor use

2-13.3 Requirements for Display Fireworks Aerial Devices. In addition to the general requirements, the following requirements are specific for display fireworks aerial devices.

2-13.3.1 Aerial shells, mines, and comets shall be classified and described only in terms of the inside diameter of the mortar from which they are to be fired.

2-13.3.2 Aerial shells shall be constructed so that they fit easily into the appropriately sized mortar and so that the appropriate lift charge and internal delay fuse are used to propel the shell to a safe altitude before functioning.

2-13.3.3 As a minimum, each shell shall be marked with the following information:

- (a) The size of the shell
- (b) A description of the type of shell
- (c)* A warning statement reading

WARNING: DANGEROUS EXPLOSIVE.
If found, do not handle.

Contact local fire or police department.

- (d) Instruction for the user for proper disposal if needed

2-13.3.4 In order to allow the person igniting the aerial shells to retreat safely, the time delay between igniting the tip of the shell's fuse and the firing of the shell shall be not less than 3 seconds or more than 6 seconds.

Exception: For electrically ignited displays, no delay period shall be required.

2-13.3.5 A safety cap shall be installed over the exposed end of the fuse. The safety cap shall be of a different color than that of the fuse and shall be installed in such a manner that the fuse remains undamaged upon removal.

Exception: For electrically fired displays, no safety cap shall be required, but there shall be no exposed pyrotechnic composition.

2-13.3.6 Single-break salute shells shall not exceed 3 in. (76 mm) in diameter or 3 in. (76 mm) in length (exclusive of propellant charge). The maximum quantity of salute powder shall not exceed 2.5 oz (71 g).

2-13.3.7 The label or wrapper of any type of aerial salute shall be conspicuously marked with the word "salute."

2-13.3.8 All preloaded-chain fused aerial items shall have detailed and usable instructions for secure placement and necessary stabilization to prevent tipover.

2-13.3.9 Display Fireworks—Ground Salutes.

2-13.3.9.1 Display fireworks—ground salutes shall not exceed 3 in. (76 mm) in diameter by 3 in. (76 mm) in length.

2-13.3.9.2 The maximum quantity of salute powder in display fireworks—ground salutes shall not exceed 2.5 oz (71 g).

2-13.3.9.3 Display fireworks—ground salutes shall not be constructed using brittle plastic.

2-14 Testing of Fireworks, Pyrotechnic Articles, and Any Component(s) Containing Pyrotechnic or Explosive Materials. The testing of fireworks, pyrotechnic articles, and any component(s) containing pyrotechnic or explosive materials shall be performed only in an area specifically designated by the manufacturer and approved by the authority having jurisdiction.

Chapter 3 Storage of Display Fireworks, Pyrotechnic Articles, Salute Powder, Pyrotechnic and Explosive Compositions, and Black Powder

3-1 Basic Requirements.

3-1.1 Display fireworks, pyrotechnic articles, salute powder, pyrotechnic and explosive compositions, and black powder shall be stored at all times in magazines.

Exception: During the process of manufacture, packaging, transportation, or use.

3-1.1.1 Bulk salutes and bulk salute powder shall be stored only in Type 1 or Type 2 magazines.

3-1.1.2 Display fireworks that are not bullet-sensitive; pyrotechnic articles that are Explosives 1.3, other than bulk salutes and bulk salute powder; and black powder shall be stored only in Type 1, 2, or 4 magazines.

3-1.2 Magazines containing display fireworks and pyrotechnic articles that are not Explosives 1.4, shall be separated from inhabited buildings, passenger railways, and public highways by the distances specified in Table 2-6.3 or Table 2-6.4.

3-1.3 Magazines containing display fireworks and pyrotechnic articles that are not Explosives 1.4 shall be separated from other magazines and from plant buildings by the distances specified in Table 2-6.2.

3-1.4 Magazines containing black powder shall be separated from inhabited buildings, passenger railways, public highways, and other magazines by the distances specified in Table 2-6.3.

3-2 Magazine Construction — General.

3-2.1 Magazines shall be constructed to comply with Section 3-2 or in a manner equivalent to the requirements of Section 3-2.

3-2.2 The ground around magazines shall be graded so that water drains away from the magazine.

3-2.3 Magazines requiring heat shall be heated by either hot water radiant heating within the magazine building or by indirect warm air heating.

3-2.3.1 Indirect warm air shall be heated by either hot water or low-pressure [15 psig (103 kPa gauge) or less] steam coils located outside the magazine building.

3-2.3.2 Magazine heating systems shall meet the following requirements.

(a) Radiant heating coils within the building shall be installed so that explosive materials or their containers cannot contact the coils and so that air is free to circulate between the coils and the explosives. The surface temperature of the coils shall not exceed 165°F (74°C).

(b) Heating ducts shall be installed so that the hot air discharge from the ducts is not directed against explosive materials or their containers.

(c) The heating system shall be controlled so that the ambient temperature of the magazine does not exceed 130°F (54°C).

(d) Any electric fan or pump used in the heating system shall be located outside the magazine, separate from the magazine walls, and shall be grounded.

(e) Any electric motor and any controls for electric heating devices used to heat water or produce steam shall have overload devices and disconnects that comply with NFPA 70, *National Electrical Code*. All electrical switchgear shall be located at least 25 ft (7.6 m) from the magazine.

(f) Any fuel-fired heating source for the hot water or steam shall be separated from the magazine by a distance of not less than 25 ft (7.6 m). The area between the heating unit and the magazine shall be cleared of all combustible materials.

(g) Explosive materials stored in magazines shall be arranged so that uniform circulation of air is ensured.

3-2.4 Where lighting is necessary within the magazine, electric safety flashlights or electric safety lanterns shall be used.

Exception: As provided for in 3-2.5.

3-2.5 Where electric lighting is used within a magazine, the installation shall meet the following requirements for hazardous locations in accordance with NFPA 70, *National Electrical Code*.

(a) Junction boxes containing fuses or circuit breakers and electrical disconnects shall be located at least 25 ft (7.6 m) from the magazine.

(b) Disconnects, fuses, and circuit breakers shall be protected by a voltage surge arrester capable of handling 2500 amperes for 0.1 seconds.

(c) All wiring from switches, both inside and outside the magazine, shall be installed in rigid conduit. Wiring leading into the magazine shall be installed underground.

(d) Conduit and light fixtures inside the magazine shall be protected from physical damage by guards or by location.

(e) Light fixtures shall be enclosed to prevent sparks or hot metal from falling on the floor or onto material stored in the magazine.

(f) Junction boxes located within the magazine shall have no openings and shall be equipped with close-fitting covers.

(g) Lights inside magazines shall not be left on when the magazines are unattended.

3-2.6 There shall be no exposed ferrous metal on the interior of the magazine where it might contact material stored within.

3-2.7 Where ventilation is required in the magazine, sufficient ventilation shall be provided to protect the stored materials for the specific area in which the plant is located.

3-2.8 Stored materials shall be placed so that they do not interfere with ventilation and so as to prevent contact with masonry walls, any steel, or any other ferrous metal by means of a nonsparking lattice or equivalent lining.

3-3 Magazine Construction — Requirements for Specific Types.

3-3.1 Type 1 Magazine. A Type 1 magazine shall be a permanent structure, such as a building or igloo, that is bullet-resistant, fire-resistant, theft-resistant, weather-resistant, and ventilated. A Type I magazine shall comply with provisions (a) through (h).

(a) Walls and doors shall be bullet-resistant and shall be constructed in accordance with any of the specifications in Appendix B.

(b) The roof shall be constructed of any type of structurally sound material that is or has been made fire-resistant on the exterior.

(c)*Where the natural terrain around a Type 1 magazine makes it possible for a bullet to be shot through the roof and ceiling at such an angle that the bullet can strike the explosive materials within, then either the roof or the ceiling shall be of bullet-resistant construction.

(d) The foundation shall be enclosed completely. A wood foundation enclosure shall be covered on the exterior with not less than 26-gauge metal.

Exception: Openings provided for cross ventilation.

(e) The floor shall be constructed of wood or other equivalent material. Floors constructed of materials that can cause sparks shall be covered with a nonsparking surface, or the packages of explosive material shall be packed on pallets of nonsparking material.

(f) Type 1 magazines shall be ventilated to prevent dampness or heating of explosives. Ventilation openings shall be screened to prevent entrance of sparks. Ventilators in sidewalls shall be offset or shielded. Magazines having foundation and roof ventilators, with the air circulating between sidewalls and floor and between sidewalls and ceiling, shall have a wood-lattice lining or equivalent means to prevent packages from being stacked against sidewalls and blocking air circulation. A 2-in. (50.8-mm) air space shall be provided between sidewalls and the floor.

(g) Each door of the magazine shall be equipped with one of the following locking systems:

1. Two mortise locks
2. Two padlocks in separate hasps and staples
3. A mortise lock and a padlock
4. A mortise lock that needs two keys to be opened
5. A three-point lock or an equivalent lock that secures the door to the frame at more than one point

(h) Padlocks shall be steel, shall have at least five tumblers, and shall have at least a $\frac{3}{8}$ -in. (9.5-mm), case-hardened shackle. All padlocks shall be protected by steel hoods installed to discourage the insertion of bolt cutters. Doors secured by a substantial internal bolt shall not require additional locking devices. Hinges and hasps shall be fastened securely to the magazine, and all locking hardware shall be secured rigidly and directly to the door frame.

3-3.2 Type 2 Magazine. A Type 2 magazine shall be a portable or mobile structure, such as a box, skid-magazine, trailer, or semitrailer that is fire-resistant, theft-resistant, weather-resistant, and ventilated. If used for outdoor storage, Type 2 magazines shall be bullet-resistant.

3-3.2.1 Type 2 Outdoor Magazine. A Type 2 outdoor magazine shall comply with provisions (a) through (h).

- (a) Walls and roof or ceiling shall be constructed according to the provisions of 3-3.1(a), (b), and (c).
- (b) Doors shall be of metal, constructed in accordance with the provisions of 3-3.1(a), or shall have a metal exterior with an inner door meeting the provisions of 3-3.1(a).
- (c) Floors constructed of ferrous metal shall be covered with a nonsparking surface.

(d) A top-opening magazine shall have a lid that overlaps the sides by at least 1 in. (25.4 mm) when in the closed position.

(e) The magazine shall be supported so that its floor does not contact the ground directly.

(f) Magazines less than 3 ft³ (0.77 m³) in size shall be fastened securely to a fixed object to prevent theft of the entire magazine.

(g) Hinges, hasps, locks, and locking hardware shall comply with 3-3.1(g).

Exception: Padlocks on vehicular magazines do not have to be protected by steel hoods.

(h) Wherever a vehicular magazine is left unattended, its wheels shall be removed, or its kingpins shall be locked, or it shall be otherwise effectively immobilized.

3-3.2.2 Type 2 Indoor Magazines. A Type 2 indoor magazine shall comply with provisions (a) through (e).

(a) The magazine shall have substantial wheels or casters to facilitate removal from the building in case of emergency.

(b) The cover of the magazine shall have substantial strap hinges and a means for locking. The magazine shall be kept locked with a five-tumbler padlock or its equivalent.

Exception: A magazine shall be permitted to be unlocked during the placement or removal of explosive materials.

(c) The magazine shall be painted red, and the top shall bear the words "EXPLOSIVES — KEEP FIRE AWAY" in white letters at least 3 in. (76.2 mm) high.

(d) Magazines constructed of wood shall have sides, bottoms, and covers or doors of 2-in. (50.8-mm) hardwood, well-braced at the corners. The magazines shall be covered with sheet metal of not less than 26 gauge. Nails exposed to the interior of the magazines shall be countersunk.

(e) Magazines constructed of metal shall be of 12-gauge sheet metal and shall be lined with a nonsparking material. The edges of metal covers shall overlap the sides by at least 1 in. (25.4 mm).

3-3.3 Type 3 Magazine. A Type 3 magazine (day box) shall be a portable structure that is fire-resistant, theft-resistant, and weather-resistant, and shall comply with provisions (a) through (c).

(a) The magazine shall be equipped with a five-tumbler padlock.

(b) Magazines constructed of wood shall have sides, bottoms, and covers or doors of 4-in. (101.6-mm) hardwood, well-braced at the corners. They shall be covered with sheet metal of not less than 26 gauge. Nails exposed to the interior of the magazine shall be countersunk.

(c) Magazines constructed of metal shall meet the requirements of 3-3.2.2(e).

3-3.4 Type 4 Magazine. A Type 4 magazine shall be a permanent, portable, or mobile structure such as a building, igloo, box, semitrailer or other mobile container that is fire-resistant, theft-resistant, and weather-resistant.

3-3.4.1 Type 4 Outdoor Magazine. A Type 4 outdoor magazine shall comply with provisions (a) through (c).

(a) The magazine shall be constructed of masonry, wood covered with sheet metal, fabricated metal, or a combination of these materials. Doors shall be metal or wood covered with metal.

(b) Permanent magazines shall comply with 3-3.1(d), (f), and (g).

(c) Vehicular magazines shall comply with 3-3.2.1(g) and shall be immobilized where unattended, as described in 3-3.2.1(h).

3-3.4.2 Type 4 Indoor Magazine. A Type 4 indoor magazine shall comply with all the provisions of 3-3.2.2.

3-4 Storage Within Magazines.

3-4.1 Magazines shall be supervised by a competent person at all times. Such person shall be at least 21 years old and shall be responsible for the enforcement of all safety precautions.

3-4.2* All magazines containing explosives shall be inspected at intervals not exceeding seven days to determine whether there has been unauthorized or attempted entry or whether there has been unauthorized removal of the magazines.

3-4.3* Magazine doors shall be kept closed. Magazine doors shall be kept locked at all times when the facility is not in operation.

Exception: During placement or removal of explosive materials or during inspection.

3-4.4* Containers of explosive materials shall be piled in a stable manner and laid flat with top side up.

3-4.5 Containers of explosive materials shall not be opened, unpacked, or repacked inside of or within 50 ft (15 m) of a magazine or in close proximity to other explosives.

Exception: Fiberboard containers shall be permitted to be opened inside of or within 50 ft (15 m) of a magazine. However, they shall not be unpacked.

3-4.6 Tools used for opening containers of explosive materials shall be nonsparking.

Exception: Metal slitters shall be permitted to be used for opening fiberboard containers.

3-4.7 Magazines shall be used exclusively for the storage of explosive and pyrotechnic materials. Metal tools other than nonferrous conveyors shall not be stored in magazines. Ferrous metal conveyor stands protected by a coat of paint shall be permitted to be stored within magazines.

3-4.8 Magazine floors shall be swept regularly and kept clean, dry, and free of grit, paper, empty packing materials, and rubbish. Brooms and other cleaning utensils shall not have spark-producing metal parts. Sweepings from magazine floors shall be disposed of in accordance with the manufacturer's instructions.

3-4.9 Where any explosive or pyrotechnic material has deteriorated to the extent that it has become unstable or dangerous, the person responsible shall contact the manufacturer for assistance immediately.

3-4.10 Before repairs are made to the interior of a magazine, all explosive or pyrotechnic material shall be removed and the interior shall be cleaned.

3-4.11 Before repairs are made to the exterior of a magazine where there is a possibility of causing sparks or fire, all explosive and pyrotechnic material shall be removed.

3-4.12 Explosive or pyrotechnic material removed from a magazine undergoing repair shall be either placed in another

magazine or placed a safe distance from the magazine, where such material shall be guarded and protected properly. Upon completion of the repairs, the materials shall be returned promptly to the magazine.

3-5 Miscellaneous Safety Precautions.

3-5.1 Smoking, matches, open flames, spark-producing devices, and firearms shall not be permitted inside of or within 50 ft (15 m) of a magazine.

Exception: Firearms carried by authorized guards.

3-5.2 The area around a magazine shall be kept clear of brush, dried vegetation, leaves, and similar combustibles for a distance of at least 25 ft (7.6 m).

3-5.3 Combustible materials shall not be stored within 50 ft (15 m) of a magazine.

3-6 Requirements for Shipping Buildings for Display Fireworks.

3-6.1 Shipping buildings shall be separated from process buildings in accordance with the distances specified in Table 2-6.2.

3-6.2 Shipping buildings shall be separated from inhabited buildings, passenger railroads, public highways, and magazines in accordance with the distances specified in Table 2-6.3.

3-6.3* Separation distances for shipping buildings for storage of display fireworks shall be in accordance with Table 2-6.3 or Table 2-6.4, as appropriate, with a maximum of 50,000 lb (22,680 kg) net weight of display fireworks permitted to be stored.

3-6.4 Separation distances for shipping buildings for the storage of finished salutes shall be in accordance with Table 2-6.4 with a maximum of 500 lb (227 kg) net weight of finished salutes permitted to be stored.

3-6.5 All electrical equipment and fixtures in a shipping building shall meet the requirements for hazardous locations in accordance with NFPA 70, *National Electrical Code*.

3-6.6 Display fireworks awaiting packing and shipping shall remain in a shipping building overnight, provided that the building is fire-resistant and theft-resistant. The building shall be locked securely when not in operation, and windows shall be guarded with bars or similar protection.

Chapter 4 Storage of Consumer Fireworks at Manufacturing Facilities

4-1 Basic Requirements.

4-1.1 Consumer fireworks at fireworks manufacturing facilities shall be stored in buildings meeting the requirements of this chapter.

4-1.2 Storage buildings shall be constructed to comply with this chapter.

4-1.3 Storage buildings containing consumer fireworks at fireworks manufacturing plants shall be separated from inhabited buildings, passenger railways, and public highways by the distances specified in Table 2-6.5. They shall be separated from other storage buildings, magazines, and fireworks manufacturing buildings by the distances specified in Table 2-6.2.

4-1.4* All buildings other than at a manufacturing plant containing stored consumer fireworks shall be subject to the quantity limitations of Table 4-1.4.

Table 4-1.4 Minimum Separation Distances of Consumer Fireworks Storage Buildings at Fireworks Manufacturing Plants from Inhabited Buildings, Magazines, Passenger Railways, Public Highways, and Other Storage Buildings

Gross Weight of Fireworks		Distance from Passenger Railways, Public Highways, and Other Storage Buildings		Distance from Inhabited Buildings and Magazine	
		ft	m	ft	m
lb	kg				
0-1000	0-454	35	11	70	21
1000-5000	454-2268	55	17	110	34
5000-10,000	2268-4536	60	18	120	37
10,000-20,000	4536-9072	65	20	135	41
20,000-50,000	9072-22,680	80	24	160	49
50,000-100,000	22,680-45,360	90	27	180	55
100,000 and over	45,360 and over	100	30	200	61

4-2 Construction of Storage Buildings.

4-2.1 Consumer fireworks storage shall be in a building, igloo, trailer, semitrailer, or metal shipping container. Storage shall be constructed to resist fire from an external source and to be weather-resistant and theft-resistant.

4-2.2 All openings shall be equipped with a means for locking.

4-2.2.1 Means of egress in all buildings shall comply with applicable requirements of NFPA 101, *Life Safety Code*.

Exception: Trailers, semitrailers or metal shipping containers that are not normally occupied.

4-2.3 All doors shall open outward, and all exits shall be marked clearly. Aisles and exit doors shall be kept free of obstructions.

4-2.3.1 Doors shall be equipped with panic hardware. Doors shall be unlocked during operation.

Exception: Trailers, semitrailers or metal shipping containers that are not normally occupied.

4-2.4 Buildings used for the storage of consumer fireworks shall be non-residential, shall not exceed one story, and shall be without basements.

4-2.4.1 Consumer fireworks stored in a building that is also used for other purposes shall be stored in a room or area used exclusively for the storage of consumer fireworks. Interior walls of such rooms shall have a minimum fire-resistance rating of 1 hour with doors having a 45-minute fire-resistance rating.

Exception: When acceptable to the authority having jurisdiction, non-combustible materials shall be permitted to be stored in the same room or area with consumer fireworks.

4-3 Electrical Requirements.

4-3.1 All electrical fixtures in storage buildings at fireworks manufacturing plants shall be dusttight. All electrical wiring

shall comply with Article 502 of NFPA 70, *National Electrical Code*.

4-3.2 Electrical receptacles or unguarded light fixtures shall not be permitted within 25 ft (7.6 m) of any fireworks. Light fixtures within 25 ft (7.6 m) of any fireworks shall have guards.

4-3.3 An electrical disconnect shall be located outside each storage building, and the disconnect shall be arranged to deenergize all electrical power to the building.

4-3.4 All electrical fixtures and wiring for storage buildings shall comply with NFPA 70, *National Electrical Code*.

4-3.5 No extension cords or other temporary wiring shall be permitted within 25 ft (7.6 m) of any stored consumer fireworks.

4-4 Operations in Storage Buildings.

4-4.1 Storage buildings shall be under the direct supervision of a competent person while in operation. Such person shall be at least 21 years old, and shall be responsible for enforcing all safety precautions.

4-4.2 Operations in consumer fireworks storage buildings shall be limited to the packaging of finished fireworks into assortment packages or shipping cartons.

4-4.3 Housekeeping.

4-4.3.1 No loose black powder or other exposed pyrotechnic composition shall be permitted to be present in a consumer fireworks storage building. If loose composition is discovered, it shall be removed immediately.

4-4.3.2 Storage buildings shall be kept clean, dry, and free of grit, paper, empty used packages, and rubbish. Brooms and other cleaning utensils shall not have spark-producing metal parts. Sweepings from magazine floors shall be disposed of in compliance with all applicable regulations.

4-4.3.3 The area around storage buildings shall be kept clear of brush, dried vegetation, leaves, and similar combustibles for a distance of at least 25 ft (7.6 m).

4-4.4 All doors shall be kept locked when the building is not occupied or not attended.

4-4.5* Consumer fireworks shall be stored in cartons complying with the regulations of the U.S. Department of Transportation (U.S. DOT), Title 49 *CFR*, Part 178. All containers shall be stacked neatly and in a stable manner.

Exception: Unpackaged consumer fireworks returned to the storage building shall be permitted to be stored temporarily until repackaging can be performed.

4-4.6 Tools used for opening containers shall be nonsparking.

Exception: Metal slitters shall be permitted to be used for opening fiber-board containers.

4-4.7 Before repairs are performed on the interior or exterior of a storage building and where there is a possibility of causing sparks or a fire, all fireworks shall be removed from the repair area, and the interior shall be cleaned.

4-4.8 The removal of fireworks from a storage building undergoing repair shall be in accordance with 3-4.12.

4-4.9 Smoking, matches, open flames, spark-producing devices, and firearms shall not be permitted inside of a storage

building or within 25 ft (7.6 m) of stored consumer fireworks. Signs that read "FIREWORKS — NO SMOKING" [in letters not less than 4 in. (101.6 mm) in height on a contrasting background] shall be conspicuously posted.

Exception: Firearms shall be permitted to be carried by authorized security personnel.

44.10 No consumer fireworks shall be stored within 100 ft (30.5 m) of any dispensing unit for flammable liquids or gases.

44.11* Portable fire-fighting equipment shall be provided in consumer fireworks storage areas as required by the authority having jurisdiction.

44.12 The operator of each consumer fireworks storage building shall prepare a written emergency action plan for employees that provides specific directions to be followed in the event of a fire. Employees shall be trained to follow this plan.

4-5 Work Areas in Consumer Fireworks Storage Buildings.

4-5.1 Work areas shall be separated from stored consumer fireworks by a wall with a fire-resistance rating of 1 hour or by a minimum separation distance of 25 ft (7.6 m) for the purposes of repackaging consumer fireworks only.

4-5.2 Work areas shall have an exit other than through the area where consumer fireworks are stored.

Chapter 5 Transportation of Fireworks, Pyrotechnic Articles, and Any Component(s) Containing Pyrotechnic or Explosive Materials on Public Highways

5-1 Basic Requirements. Transportation of fireworks, pyrotechnic articles, and any component(s) containing pyrotechnic or explosive materials shall meet all applicable requirements of the U.S. Department of Transportation (U.S. DOT), Title 49, *CFR*, Parts 170 to end and any applicable local, state, or international requirements.

Chapter 6 Referenced Publications

6-1 The following documents or portions thereof are referenced within this code as mandatory requirements and shall be considered part of the requirements of this code. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this code. Some of these mandatory documents might also be referenced in this code for specific informational purposes and, therefore, are also listed in Appendix E.

6-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 10, *Standard for Portable Fire Extinguishers*, 1998 edition.

NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*, 1996 edition.

NFPA 70, *National Electrical Code*®, 1999 edition.

NFPA 101®, *Life Safety Code*®, 1997 edition.

NFPA 430, *Code for the Storage of Liquid and Solid Oxidizers*, 1995 edition.

NFPA 1122, *Code for Model Rocketry*, 1997 edition.

NFPA 1123, *Code for Fireworks Display*, 1995 edition.

NFPA 1125, *Code for the Manufacture of Model Rocket and High Power Rocket Motors*, 1995 edition.

NFPA 1126, *Standard for the Use of Pyrotechnics before a Proximate Audience*, 1996 edition.

NFPA 1127, *Code for High Power Rocketry*, 1998 edition.

6-1.2 U.S. Government Publications. Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Title XI, "Regulation of Explosives, of the Crime Control Act of 1970" (Title 18, *United States Code*, Chapter 40, "Importation, Manufacture, Distribution, and Storage of Explosive Materials"), 1970.

Title 16, *Code of Federal Regulations*, Parts 1500 and 1507, U.S. Consumer Product Safety Commission.

Title 18, *United States Code*, Chapter 40, "Importation, Manufacture, Distribution, and Storage of Explosive Materials," 1970.

Title 29, *Code of Federal Regulations*, Part 1910.1200, "Hazard Communication," U.S. Department of Labor.

Title 49, *Code of Federal Regulations*, Parts 171 to end, U.S. Department of Transportation.

Appendix A Explanatory Material

Appendix A is not a part of the requirements of this NFPA document but is included for informational purposes only. This appendix contains explanatory material, numbered to correspond with the applicable text paragraphs.

A-1-4 Aerial Shell. The shells are most commonly 3-in. to 6-in. (76-mm to 152-mm) outside diameter and are fired from mortars. Upon firing of the shell, the fuse and lift charge are consumed.

A-1-4 Approved. 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, 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 an organization concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A-1-4 Authority Having Jurisdiction. The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the

commanding officer or departmental official may be the authority having jurisdiction.

A-1-4 Binary System. These items are shipped as separate ingredients: an oxidizer and a fuel. The ingredients do not become a pyrotechnic material until they are mixed.

A-1-4 Bullet Sensitive Explosive Material. The test material is at a temperature of 70°F to 75°F (21°C to 24°C) and is placed against a 1/2-in. (12.7-mm) steel plate.

A-1-4 Code. The decision to designate a standard as a code is based on such factors as the size and scope of the document, its intended use and form of adoption, and whether it contains substantial enforcement and administrative provisions.

A-1-4 Explosive. U.S. Department of Transportation Revisions of Explosive Materials Transport Regulations.

On December 21, 1990, the U.S. Department of Transportation (U.S. DOT) issued a final rule that revised the Hazardous Materials Regulations contained in Title 49, *CFR*, Parts 171 to 180.

These regulations cover the classification, packaging, and shipping of explosives (including blasting agents), oxidizers (ammonium nitrate), flammable liquids, and flammable solids.

Essentially, the U.S. DOT has revised the U.S. hazardous materials regulations so that they conform with international regulations, which are based on the United Nations Recommendations on the Transport of Dangerous Goods. The revised regulations are designed to standardize testing and classification procedures, nomenclature, packaging, labeling, placarding, and handling and to eliminate inconsistencies that currently exist between the U.S. (domestic) and UN (international) standards.

The most important change affecting the user of explosive materials is likely to be the elimination of the Class A, Class B, and Class C explosives and blasting agents. Under the UN recommendations, all explosive materials are to be placed into Class 1 explosives. Class 1 is divided into six divisions, the divisions being characteristic of the properties and hazards of the particular explosive. Class 1 explosives are broken down into six divisions as follows:

- (a) *Division 1.1.* Explosives that have a mass explosion hazard
- (b) *Division 1.2.* Explosives that have a projection hazard but not a mass explosion hazard
- (c) *Division 1.3.* Explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard, or both, but not a mass explosion hazard
- (d) *Division 1.4.* Explosive devices that present a minor explosion hazard. No device should contain more than 25 g (0.9 oz) of a detonating material
- (e) *Division 1.5.* Very insensitive explosives that have a mass explosion hazard but are so insensitive that there is little probability of initiation or of transition from burning to detonation under normal conditions of transport
- (f) *Division 1.6.* Extremely insensitive articles that do not have a mass explosion hazard, and articles that demonstrate a negligible probability of accidental initiation or propagation (no applicable hazard class)

The classification code for an explosive consists of the division number followed by the compatibility group letter. Compatibility group letters are used to specify the controls for the transportation, and storage related thereto, of explosives and to prevent an increase in hazard that might result if certain types of explosives are stored or transported together.

Compatibility groups and classification codes for the various types of explosives are set forth in Tables A-1-4(a) and (b). Table A-1-4(a) sets forth compatibility groups and classification codes for substances and articles described in the first column of the table. Table A-1-4(b) specifies the number of classification codes that are possible within each explosive division. Altogether, there are 35 possible classification codes for explosives.

For comparative purposes, the classification of explosive materials under the UN recommendations and the current U.S. DOT system is provided as follows:

- (a) *Division 1.1.* Class A explosives (dynamite, cast boosters, cap sensitive emulsions, water gels and slurries, Class A detonators)
- (b) *Division 1.2.* Class A or Class B explosives (Division 1.2 generally is some sort of ammunition or materials that have a projection hazard)
- (c) *Division 1.3.* Class B explosives (generally propellants or explosives that have a fire hazard but not a mass detonation hazard)
- (d) *Division 1.4.* Class C explosives (Class C detonators, safety fuse, and other Class C explosives)
- (e) *Division 1.5.* Blasting agents (AN/FO, noncap-sensitive emulsions, water gels, slurries, packaged blasting agents)
- (f) *Division 1.6.* No applicable class (presently there are no commercial explosives in Division 1.6)

In the UN system, oxidizers and organic peroxides form Class 5. Ammonium nitrate, an oxidizer, is classified as 5.1 (Class 5, Division 1). Flammable and combustible liquids (fuel oils) are Class 3, and flammable solids are Class 4.

To determine the proper classification of an explosive, criteria (class and division) and test procedures have been set up in the UN recommendations. Through this criteria and testing, it initially can be determined if the material is an explosive and subsequently to what hazard division it belongs.

In addition to the class and division number, every explosive under the UN recommendations has a proper shipping name and a four-digit identification number. When this regulation becomes effective, shipping cases are required to show the proper shipping name and the identification number.

The UN Recommendation on the Shipment of Dangerous Goods became effective October 1, 1991, and voluntary compliance was authorized after January 1, 1991. The U.S. DOT has provided a transition period, and present packaging for explosives can be used until October 1, 1996, although packagings currently authorized under U.S. DOT regulations can not be manufactured after October 1, 1994.

A-1-4 Fireworks, Exception No. 1: The regulations referred to limit the explosive content of each toy cap to not more than an average of 0.25 grains (16.2 mg). Also, each package containing such caps has to be labeled to indicate the maximum explosive content per cap.

A-1-4 Fireworks, Exception No. 2: For information on the use of model rockets and model rocket motors, see NFPA 1122, *Code for Model Rocketry*.

A-1-4 Consumer Fireworks. Consumer fireworks contain limited quantities of pyrotechnic composition per unit and do not pose a mass explosion hazard where stored. Therefore, they are not required to be stored in a magazine.

Consumer fireworks are normally classed as Explosives, 1.4G and described as Fireworks, UN 0336 by the U.S. Department of Transportation (U.S. DOT). (*See Appendix C.*)

Table A-1-4(a) Classification Codes

Description of Substances or Article to be Classified	Compatibility Group	Classification Code
Primary explosive substance	A	1.1A
Article containing a primary explosive substance and not containing two or more effective protective features	B	1.1B 1.2B 1.4B
Propellant explosive substance or other deflagrating explosive substance or article containing such explosive substance	C	1.1C 1.2C 1.3C 1.4C
Secondary detonating explosive substance or black powder or article containing a secondary detonating explosive substance, in each case without means of initiation and without a propelling charge; or article containing a primary explosive substance and containing two or more effective protective features	D	1.1D 1.2D 1.4D 1.5D
Article containing a secondary detonating explosive substance, without means of initiation, with a propelling charge (other than one containing flammable liquid or hypergolic liquid)	E	1.1E 1.2E 1.4E
Article containing a secondary detonating explosive substance, with its means of initiation, with a propelling charge (other than one containing flammable liquid or hypergolic liquid) or without a propelling charge	F	1.1F 1.2F 1.3F 1.4F
Pyrotechnic substance or article containing a pyrotechnic substance, or article containing both an explosive substance and an illuminating, incendiary, tear-producing, or smoke-producing substance (other than a water-activated article or one containing white phosphorus, phosphide or flammable liquid or gell or hypergolic liquid)	G	1.1G 1.2G 1.3G 1.4G
Article containing both an explosive substance and white phosphorus	H	1.2H 1.3H 1.1J 1.2J
Article containing both an explosive substance and flammable liquid or gel	J	1.3J
Article containing both an explosive substance and a toxic chemical agent	K	1.2K 1.3K 1.1L 1.2L
Explosive substance or article containing an explosive substance and presenting a special risk (e.g., due to water activation or presence of hypergolic liquids, phosphides, or pyrophoric substances) needing isolation of each type	L	1.3L
Articles containing only extremely insensitive detonating substances	N	1.6N
Substance or article so packed or designed that any hazardous effects arising from accidental functioning are limited to the extent that they do not significantly hinder or prohibit fire fighting or other emergency response efforts in the immediate vicinity of the package	S	1.4S

Table A-1-4(b) Scheme of Classification of Explosives, Combination of Hazard Division with Compatibility Group by Column

Hazard Division	Compatibility Group													
	A	B	C	D	E	F	G	H	J	K	L	N	S	A-S
1.1	1.1A	1.1B	1.1C	1.1D	1.1E	1.1F	1.1G		1.1J		1.1L			9
1.2		1.2B	1.2C	1.2D	1.2E	1.2F	1.2G	1.2H	1.2J	1.2K	1.2L			10
1.3			1.3C			1.3F	1.3G	1.3H	1.3J	1.3K	1.3L			7
1.4		1.4B	1.4C	1.4D	1.4E	1.4F	1.4G						1.4S	7
1.5				1.5D										1
1.6												1.6N		1

A-1-4 Display Fireworks. Display fireworks are described as Fireworks, UN 0335 and classed as Explosives, 1.3G by the U.S. Department of Transportation (U.S. DOT). (See Appendix C.)

A-1-4 Fuel. Fuels are an ingredient of pyrotechnic materials.

A-1-4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A-1-4 Nonprocess Building. A pyrotechnic laboratory is considered to be a nonprocess building, but it is subject to the required separation distances for a consumer fireworks process building.

A-1-4 Oxidizer. Where such a chemical decomposes, it releases oxygen. In addition to ionic solids, an oxidizer can be a material having covalent molecules containing halogen atoms. An oxidizer is an ingredient of pyrotechnic materials.

A-1-4 Process Building. Examples of operations performed in a process building include but are not limited to the following:

- Assembling
- Mixing
- Pressing
- Drying of fireworks or pyrotechnic articles or their compositions
- Any combination of these operations

A-1-4 Pyrotechnic Laboratory. A pyrotechnic laboratory typically processes small batches of chemicals and compositions, manufactures prototypes, or conducts a variety of tests and analyses. See Process Building, 2-6.8 and 2-10.5.

A-1-4 Stars. Stars burn while in the air, producing color or streamer effects.

A-2-6.2.2 The use of barricades is highly recommended.

A-2-7.4 For information on the use of conductive surfaces to minimize the hazard of static electricity, see 12-4.1 of NFPA 99, *Standard for Health Care Facilities*.

A-2-7.6 In general, the wall having the largest area should be chosen to provide explosion relief. The entire area of the wall should be utilized. The term "weakwall" is used to describe the relative strength of the explosion-relieving wall as compared to the rest of the building.

A-2-10.1 This requirement is for purposes of minimizing personnel exposure and is distinct from any requirement on maximum building occupancy that might exist in local ordinances.

A-2-10.3 The maximum quantity of salute powder that is permitted in any process building or area is 10 lb (4.5 kg).

A-2-10.4 Where sufficient separation distances exist, the Regional Director of the Bureau of Alcohol, Tobacco and Firearms can grant a variance from this requirement upon written request.

A-2-11.2.1 Smoking materials include matches, lighters, cigarettes, cigars, and pipes.

A-2-11.7 Care should be exercised, since some oxidizers are mutually incompatible. NFPA 491, *Guide to Hazardous Chemical Reactions*, lists many oxidizers and other materials that result in hazardous interactions. Oxidizers commonly include nitrates, chlorates, and perchlorates.

A-2-11.8 Where practicable, non-sparking machinery and tooling should be used. To the extent practical, ferrous metals should be covered with non-sparking coatings such as epoxy paint.

A-2-13.3.3(c) As a minimum, each shell should bear a label containing the following information:

- A description of the size of the shell [e.g., 3-in. (76-mm) shell]
- A description of the type of shell (e.g., 2-break with report)
- A warning statement reading

WARNING: DANGEROUS EXPLOSIVE.

If found, do not handle. Contact local fire or police department.

- The name and location of business of the manufacturer, importer, or distributor

Conspicuous labeling should be used as follows:

- The statement, "WARNING: DANGEROUS EXPLOSIVE," should be printed in capital letters having a printed image of at least $\frac{1}{8}$ in. (3 mm) and should be underlined.
- The remaining printed matter does not need to be printed in capital letters but should have a printed image at least $\frac{1}{8}$ in. (3 mm) high.
- The required statements should be printed in a color contrasting sharply with the background and should be printed within a borderline.

- (d) The label should be at least 9 in.² (58 cm²), unless the size of the shell is too small to accommodate this size, in which case the size should be reduced to a size no smaller than necessary.

A-3-3.1(c) A bullet-resistant roof should be constructed according to any of the specifications in Appendix B. A bullet-resistant ceiling should be constructed at the eave line, covering the entire area of the magazine, except for the necessary ventilation space. Examples of bullet-resistant ceiling construction include the following:

- (a) Any construction meeting the specifications in Appendix B
- (b) A sand tray having a sand depth of at least 4 in. (101.6 mm)

A-3-4.2 Corresponding grades and brands of explosive materials should be stored together so that brand and grade markings are readily visible. All stock should be stored to be easily counted and checked.

A-3-4.3 Where explosive materials are removed from the magazine for use, the oldest stock should be used first.

A-3-4.4 Open containers of explosive materials should be closed securely before being returned to a magazine. No container without a closed lid should be stored in a magazine.

A-3-6.3 The net weight equals the net weight of all pyrotechnic and explosive compositions and fuse only. For display fireworks, approximately 50 percent of the gross weight of the fireworks equals the net weight of composition and fuse.

A-4-1.4 Water is the best means of fighting a fire involving consumer fireworks. Suffocation methods and dry chemical extinguishers will not be as effective, as the consumer fireworks compositions contain their own oxygen. A water-charged extinguisher or a supply of water, such as a spigot and hose or a barrel of water, should be readily available to fight incipient fires. Should stored consumer fireworks become heavily involved in a fire, employees should evacuate the area. The quantity of consumer fireworks in storage and the location of the storage building with respect to adjacent buildings and combustible materials should be considered in evaluating the type and amount of portable fire-fighting equipment that should be on hand.

A-4-4.5 Pile heights should be limited to 12 ft (3.7 m). Aisle widths should be equivalent to pile heights. For information on general storage requirements, see NFPA 231, *Standard for General Storage*. For information on rack storage, see NFPA 231C, *Standard for Rack Storage of Materials*.

A-4-4.11 Water is the best means of fighting a fire involving consumer fireworks. Suffocation methods and dry chemical extinguishers will not be as effective, as the consumer fireworks compositions contain their own oxygen. A water-charged extinguisher or a supply of water, such as a spigot and hose or a barrel of water, should be readily available to fight incipient fires. Should stored consumer fireworks become heavily involved in a fire, employees should evacuate the area. The quantity of consumer fireworks in storage and the location of the storage building with respect to adjacent buildings and combustible materials should be considered in evaluating the type and amount of portable fire-fighting equipment that should be on hand.

Appendix B Magazine Construction

This appendix is not a part of the requirements of this NFPA document but is included for informational purposes only.

B-1 General. Magazines constructed in accordance with the following minimum specifications are approved as bullet-resistant (as defined in Chapter 1 of this code). All steel and wood dimensions are actual thickness; concrete block and brick dimensions are nominal.

B-2 Steel Exterior. Recommended dimensions are as follows:

- (a) Steel of $\frac{5}{8}$ in. (16 mm) with an interior lining of nonsparking material
- (b) Steel of $\frac{1}{2}$ in. (13 mm) with an interior lining of plywood at least $\frac{3}{8}$ in. (9.5 mm) thick
- (c) Steel of $\frac{3}{8}$ in. (9.5 mm) lined with one of the following materials:
 1. Hardwood of 2 in. (50.8 mm)
 2. Softwood of 3 in. (76.2 mm)
 3. Plywood of $2\frac{1}{4}$ in. (57.2 mm)
- (d) Steel of $\frac{1}{4}$ in. (6.4 mm) lined with one of the following materials:
 1. Hardwood of 3 in. (76.2 mm)
 2. Softwood of 5 in. (127 mm)
 3. Plywood of $5\frac{1}{4}$ in. (133.4 mm)
 4. Plywood of $1\frac{1}{2}$ in. (38.1 mm) with an intermediate layer of 2 in. (50.8 mm) of hardwood
- (e) Steel of $\frac{3}{16}$ in. (4.8 mm) lined with one of the following materials:
 1. Hardwood of 4 in. (101.6 mm)
 2. Softwood of 7 in. (177.8 mm)
 3. Plywood of $6\frac{3}{4}$ in. (171.5 mm)
 4. Plywood of $\frac{3}{4}$ in. (19.1 mm) with an intermediate layer of 3 in. (76.2 mm) of hardwood
- (f) Steel of $\frac{1}{8}$ in. (3.2 mm) lined with one of the following materials:
 1. Hardwood of 5 in. (127 mm)
 2. Softwood of 9 in. (228.6 mm)
 3. Plywood of $\frac{3}{4}$ in. (19.1 mm) with an intermediate layer of 4 in. (101.6 mm) of hardwood
 4. Two layers of $\frac{3}{4}$ -in. (19-mm) plywood with an intermediate layer of $3\frac{5}{8}$ in. (92.1 mm) of well-tamped dry sand or sand/cement mixture

B-3 Fire-Resistant Exterior. The exterior of any type of fire-resistant material that is structurally sound should include the following:

- (a) An interior lining of $\frac{1}{2}$ -in. (13-mm) plywood placed securely against an intermediate 4-in. (101.6-mm) thick layer of solid concrete block, solid brick, or solid concrete
- (b) An interior lining of $\frac{3}{4}$ -in. (19-mm) plywood, a first intermediate layer of $\frac{3}{4}$ -in. (19-mm) plywood, a second intermediate layer of $3\frac{5}{8}$ in. (92.1 mm) of well-tamped dry sand or sand/cement mixture, a third intermediate layer of $\frac{3}{4}$ -in. (19-mm) plywood, and a fourth intermediate layer of 2-in. (50.8-mm) hardwood or 14-gauge steel
- (c) An intermediate 6-in. (152.4-mm) space filled with well-tamped dry sand or sand/cement mixture

B-4 Masonry Exterior. Recommended materials include the following:

- (a) Standard 8-in. (203.2-mm) concrete block with voids filled with well-tamped dry sand or sand/cement mixture
- (b) Standard 8-in. (203.2-mm) solid brick
- (c) Solid concrete of 8-in. (203.2-mm)
- (d) Two layers of 4-in. (101.6-mm) concrete block

Appendix C Extract from American Pyrotechnics Association Standard 87-1, Standard for Construction and Approval for Transportation of Fireworks

This appendix is not a part of the requirements of this NFPA document but is included for informational purposes only.

NOTE: Paragraphs of this appendix that apply to the approval by the U.S. Department of Transportation (U.S. DOT) for transportation of fireworks are indicated by a dagger (†) preceding the paragraph number.

C-1 Introduction.

†C-1.1 This appendix provides manufacturers, importers, and distributors of fireworks and novelties information to assist them in manufacturing, testing, shipping, and labeling the products of the fireworks industry in accordance with applicable federal laws and current good manufacturing practices.

C-1.2 The information in this appendix should enable manufacturers, importers, and distributors of fireworks and novelties to provide their customers with products that can be transported and used safely and without unreasonable risk.

†C-1.3 Fireworks and novelties are not acceptable for transportation within the jurisdiction of the United States unless they are classed, packaged, labeled, and marked and are in proper condition for shipment in accordance with the U.S. DOT regulations in Title 49, *CFR*. See Section C-5 of this appendix for further discussion.

C-1.4 Consumer fireworks (fireworks classed as “1.4G” and “1.4S”) (formerly Common Fireworks) and novelties are not acceptable for sale to the public unless they are manufactured, labeled, and sold in conformance with the regulations of the U.S. Consumer Product Safety Commission (CPSC) published in Title 16, *CFR*. See Section C-3 of this appendix for further discussion.

NOTE: Consumer fireworks are normally classed as “1.4G” but can be classed by U.S. DOT as 1.4S on the basis of specific test results.

C-1.5 United States laws and regulations prescribe mandatory requirements that a person must follow in order to market certain products. In these instances, failure to comply can be regarded by courts as negligence per se in product liability litigation.

†C-1.6 This appendix applies to fireworks devices and novelties for entertainment purposes.

C-2 Definitions.

†C-2.1 **Approval.** For purposes of this appendix, approval means the assignment of proper hazard class, EX number, and proper shipping name by the U.S. DOT so that fireworks and novelties can be transported under conditions specified in Title 49, *CFR*. See Section C-5 of this appendix for details.

†C-2.2 **Black Match.** A fuse made from thread impregnated with black powder and used for igniting pyrotechnic devices. Black match is classed as “1.3G” and described as “Fuse, Instantaneous, non-detonating UN0101” or “Quick match UN0101.”

†C-2.3 **Blowout.** The unintended release of a pressure effect from other than the intended orifice of a fireworks device. Examples include expulsion of the bottom plug of a roman candle, expulsion of the clay choke of a fountain, or the rupturing of the wall of a mine or shell.

†C-2.4 **Burnout.** The unintended escape of flame through the wall of a pyrotechnic chamber during functioning of a fireworks device.

†C-2.5 **Chemical Composition.** All pyrotechnic and explosive composition contained in a fireworks device. Inert materials such as clay used for plugs, or organic matter such as rice hulls used for density control, are not considered to be chemical composition.

†C-2.5.1 **Explosive Composition.** Any chemical compound or mixture, the primary purpose of which is to function by explosion, producing an audible effect in a fireworks device.

†C-2.5.2 **Pyrotechnic Composition.** A chemical mixture that on burning and without explosion produces visible or brilliant displays or bright lights, or whistles or motion.

†C-2.6 **Fireworks.** Any device, other than a novelty, intended to produce visible or audible effects, or both, by combustion, deflagration, or detonation. Fireworks are further described as “Fireworks UN0336” or “Fireworks UN0337” (formerly Common Fireworks and now referred to in this document as Consumer Fireworks), “Forbidden Fireworks,” or “Fireworks UN0335” (formerly Special Fireworks and now referred to in this document as Display Fireworks).

NOTE: Propelling and expelling charges consisting of a mixture of sulfur, charcoal, and saltpeter are not considered as designed to produce audible effects.

†C-2.6.1 **Consumer Fireworks (formerly Common Fireworks).** Any fireworks device for use by the public that complies with the construction, performance, composition, and labeling requirements promulgated by the U.S. Consumer Product Safety Commission (CPSC) in Title 16, *CFR*, in addition to any limits and other requirements of this document. See Section C-3 of this appendix for details.

†C-2.6.2 **Display Fireworks (formerly Special Fireworks).** Fireworks devices primarily intended for commercial displays that are designed to produce visible or audible effects, or both, by combustion, deflagration, or detonation, including, but not limited to, salutes containing more than 2 grains (130 mg) of explosive composition; aerial shells containing more than 1.4 oz (40 g) of chemical composition exclusive of lift charge; and other exhibition display items that exceed the limits contained in this document for consumer fireworks. Certain devices intended for signaling, illuminating, and incendiary purposes and formerly classed as Special Fireworks no longer fall into this fireworks category. See Section C-4 of this appendix for details.

†C-2.6.3 **Theatrical Pyrotechnics.** Pyrotechnic devices for professional use in the entertainment industry similar to consumer fireworks in chemical composition and construction but not intended for consumer use. Such articles meeting the

weight limits for consumer fireworks but not labeled as such and containing only chemicals shown in Table C-4-3.1 can be approved under the provisions of this document and classified as “Article, Pyrotechnic, 1.4G, UN0431.”

NOTE: Theatrical pyrotechnics devices can be classed as “Article, Pyrotechnic, 1.4S, UN0432” by U.S. DOT on the basis of specific test results.

†**C-2.7 Labeling.** A display of written, printed, or graphic matter upon a fireworks device(s) or upon the immediate container of any such device(s), or both. Included are diamond-shaped labels required by U.S. DOT to be displayed on outside packaging for transportation purposes. The term also includes any identification, cautions, and other information required by this document or by any federal government agency.

†**C-2.8 Marking.** The application of the proper shipping name, identification number (UN number), instructions, cautions, weight, or specification mark or combination thereof to a package of hazardous material. Marking also includes any required specification mark on the inside or outside of a shipping container.

†**C-2.9 Novelty.** A device containing small amounts of pyrotechnic or explosive composition, or both, but not described as consumer fireworks. Such devices produce limited visible or audible effects. These items shall be classed as “1.4G,” unless classed as “1.4S” or deregulated as a hazardous material by U.S. DOT on the basis of specific test results.

†**C-2.10 Placard.** A warning symbol of a square-on-point configuration mounted on each side and each end of a truck, rail car, or freight container that informs the public and emergency personnel of the hazardous nature of the cargo, as specified in Title 49, *CFR*, Part 172.

†**C-2.11 Quick Match (Instantaneous Fuse).** Black match that is encased in a loose-fitting paper sheath to make it burn extremely rapidly. Quick match is used for aerial shells and for simultaneous ignition of a number of pyrotechnic devices, such as lances in a ground display piece. Quick match is classed as “1.3G” and described as “Fuse, instantaneous, non-detonating” or “Quick match,” and assigned identification number “UN0101.”

†**C-2.12 Safety Fuse.** A fuse consisting of a thread-wrapped black powder train that has been coated with a water-resistant material. Such fuse is typically $\frac{3}{32}$ in. (2.4 mm) in outside diameter and frequently green in color. Safety Fuse is described as “Fuse, Safety UN0105” and classed as “1.4S.”

C-3 Requirements for Consumer Fireworks, Novelties, and Theatrical Pyrotechnics.

NOTE 1: Devices in this category, formerly classed as Class C Explosive, Common Fireworks, are now classed as “Fireworks 1.4G” under the UN system, and referred to in this document as Consumer Fireworks.

NOTE 2: Devices intended for non-consumer use in the entertainment industry that meet the chemical composition requirements of this appendix can be classed as “1.4G” and described as “Article, Pyrotechnic UN0431” under the provisions of this document but are not required to comply with the fuse, construction, and labeling requirements of this appendix.

†**C-3.1 Types of Consumer Fireworks.** The following fireworks devices are subject to the requirements of Section C-3 of this appendix.

C-3.1.1 Ground and Hand-held Sparkling and Smoke Devices.

†**C-3.1.1.1 Cylindrical Fountain.** Cylindrical tube containing not more than 2.6 oz (75 g) of pyrotechnic composition. Upon ignition, a shower of colored sparks, and sometimes a whistling effect or smoke, is produced. This device can be provided with a spike for insertion into the ground (Spike Fountain), a wood or plastic base for placing on the ground (Base Fountain), or a wood or cardboard handle to be hand-held (Handle Fountain). Where more than one tube is mounted on a common base, total pyrotechnic composition cannot exceed 7.1 oz (200 g).

†**C-3.1.1.2 Cone Fountain.** Cardboard or heavy paper cone containing not more than 1.8 oz (50 g) of pyrotechnic composition. The effect is the same as that of a cylindrical fountain. Where more than one cone is mounted on a common base, total pyrotechnic composition cannot exceed 7.1 oz (200 g).

†**C-3.1.1.3 Illuminating Torch.** Cylindrical tube containing not more than 3.5 oz (100 g) of pyrotechnic composition that produces a colored flame upon ignition. Can be spike, base, or hand-held. Where more than one tube is mounted on a common base, total pyrotechnic composition cannot exceed 7.1 oz (200 g).

†**C-3.1.1.4 Wheel.** Pyrotechnic device intended to be attached to a post or tree by means of a nail or string. Can have one or more drivers, each of which can contain not more than 2.1 oz (60 g) of pyrotechnic composition. No wheel can contain more than 7.1 oz (200 g) total pyrotechnic composition. Upon ignition, the wheel revolves, producing a shower of color and sparks and, sometimes, a whistling effect.

†**C-3.1.1.5 Ground Spinner.** Small device containing not more than 0.7 oz (20 g) of pyrotechnic composition, venting out an orifice usually on the side of the tube. Similar in operation to a wheel but intended to be placed flat on the ground and ignited. A shower of sparks and color is produced by the rapidly spinning device.

†**C-3.1.1.6 Flitter Sparkler.** Narrow paper tube attached to a stick or wire and filled with not more than 0.2 oz (5 g) of pyrotechnic composition that produces color and sparks upon ignition. The paper at one end of the tube is ignited to make the device function.

†**C-3.1.1.7 Toy Smoke Device.** Small plastic or paper item containing not more than 3.5 oz (100 g) pyrotechnic composition that, upon ignition, produces white or colored smoke as the primary effect. (These devices, where complying with the provisions of this appendix, are classed as “1.4G” unless classed as “1.4S” or not regulated as an explosive by U.S. DOT on the basis of specific test results.

C-3.1.2 Aerial Devices.

†**C-3.1.2.1 Sky Rockets and Bottle Rockets.** Cylindrical tube containing not more than 0.7 oz (20 g) of chemical composition with a wooden stick attached for guidance and stability. Rockets rise into the air upon ignition. A burst of color or sound, or both, can be produced at or near the height of flight.

†**C-3.1.2.2 Missile-type Rocket.** A device similar to a sky rocket in size, composition, and effect that uses fins rather than a stick for guidance and stability. Missiles shall not contain more than 0.7 oz (20 g) of total chemical composition.

†C-3.1.2.3 **Helicopter, Aerial Spinner.** A tube containing not more than 0.7 oz (20 g) of chemical composition, with a propeller or blade attached. Upon ignition, the rapidly spinning device rises into the air. A visible or audible effect can be produced at or near the height of flight.

†C-3.1.2.4 **Roman Candle.** Heavy paper or cardboard tube containing not more than 0.7 oz (20 g) of chemical composition. Upon ignition, “stars” (pellets of pressed pyrotechnic composition that burn with bright color) are individually expelled.

†C-3.1.2.5 **Mine, Shell.** Heavy cardboard or paper tube usually attached to a wooden or plastic base and containing not more than 1.4 oz (40 g) of chemical composition plus not more than 0.7 oz (20 g) of “lift” charge [the part that actually lifts the aerial effect(s) into the air] per tube. Upon ignition, “stars” (see C-3.1.2.4), components producing reports containing up to 2 grains (130 mg) of explosive composition per report (see C-3.1.3.1), or other devices are propelled into the air. A mine can contain more than one tube, provided the tubes fire in sequence upon ignition of one external fuse. Total chemical composition including lift charges of any multiple tube device cannot exceed 7.1 oz (200 g).

C-3.1.3 Audible Ground Devices.

†C-3.1.3.1 **Firecracker.** Small, paper-wrapped or cardboard tube containing not more than 0.8 grains (50 mg) of explosive composition, except that those used in aerial devices can contain up to 2 grains (130 mg) of explosive composition per report. Upon ignition, noise and a flash of light are produced.

NOTE: Firecrackers are not subject to the requirements of fuse in C-3.5.1 and chemicals in C-3.6.1 of this appendix.

C-3.1.3.2 **Chaser.** Paper or cardboard tube venting out the fuse end of the tube containing not more than 0.7 oz (20 g) of chemical composition. The device travels along the ground upon ignition. A whistling effect or other noise is often produced. Explosive composition can be included to produce a report but cannot exceed 0.8 grains (50 mg).

†C-3.2 **Types of Novelties.** The following devices are classed as Fireworks 1.4G and described as Fireworks UN0336 unless they are classed as 1.4S or not regulated as hazardous materials based on specific test results. These devices that are not regulated are not considered to be consumer fireworks.

†C-3.2.1 **Party Popper.** Small plastic or paper item containing not more than 0.25 grains (16 mg) of explosive composition that is friction sensitive. A string protruding from the device is usually pulled to ignite it. This item expels nonflammable paper streamers or other nonflammable novelties, or both, and produces a small report.

†C-3.2.2 **Snapper.** Small, paper-wrapped item containing not more than 0.02 grains (1 mg) of explosive composition coated on small bits of sand, and packaged with sawdust in individual containers of not more than 50 units. When dropped, the device explodes, producing a small report.

†C-3.2.3 **Snake, Glow Worm.** Pressed pellet of not more than 0.07 oz (2 g) of pyrotechnic composition and packaged in retail packages of not more than 25 units that produces as the primary effect a snake-like ash upon burning. The ash expands in length as the pellet burns. (These devices are not regulated for transportation purposes.)

†C-3.2.4 **Sparkler.** Wire or stick coated with pyrotechnic composition, that cannot exceed 3.5 oz (100 g) per item, that produces a shower of sparks upon ignition. These items cannot contain magnesium, except that magnalium (magnesium-aluminum alloy) is permitted. Items containing any chlorate or perchlorate salts cannot exceed 0.2 oz (5 g) of composition per item. (These items are not regulated as explosives for transportation purposes. However, some meet the criteria for flammable solids.)

†C-3.2.5 **Toy Caps.** Toy plastic or paper caps for toy pistols in sheets, strips, rolls, or individual caps, containing not more than an average of 16 mg (0.25 grains) of explosive composition per cap. Toy caps are described as “Fireworks UN0336” and classed as “1.4G.” Toy caps are to be packed in inside packages constructed of cardboard not less than 0.013 in. (0.33 mm) in thickness, metal not less than 0.008 in. (0.2 mm) in thickness, noncombustible plastic not less than 0.015 in. (0.38 mm) in thickness, or a composite blister package consisting of cardboard not less than 0.013 in. (0.33 mm) in thickness, and noncombustible plastic not less than 0.005 in. (0.13 mm) in thickness, which are to provide a complete enclosure. The minimum dimensions of each side or end of such package are to be not less than $\frac{1}{8}$ in. (3.2 mm) in height. The number of caps in these inside packages are to be limited so that no more than 10 grains (650 mg) of explosive composition are to be packed into 1 in.³ (16.4 cm³) of space. In addition, no more than 17.5 grains (1138 mg) of the explosive composition of toy caps are to be packed in any inside container. These inner containers are to be packed in outside containers meeting the requirements specified in C-5.3.1 of this appendix.

†C-3.2.6 **Other Novelties.** Devices intended to produce unique visual or audible effects and containing 0.8 grains (50 mg) or less of explosive composition and limited amounts of other pyrotechnic composition. Examples include cigarette loads, trick matches, explosive auto alarms, and other trick noise makers.

†C-3.3 **Other Devices.** Any device producing unique pyrotechnic or explosive effects or combinations of effects not enumerated in Section C-3 of this appendix.

†C-3.4 **Combination Items.** Fireworks devices intended to produce more than one of the effects described in Section C-3 of this appendix, and that contain not more than 7.1 oz (200 g) of total chemical composition.

C-3.5 Specific Requirements.

C-3.5.1 Fuse.

C-3.5.1.1 Only safety fuse or other fuse that has been protected to resist side ignition can be used in devices subject to the requirements of this appendix.

NOTE: See APA 87-1, Appendix B, for method of measuring resistance to side ignition. Devices, such as ground spinners, that require a restricted orifice for proper functioning and that contain less than 0.2 oz (6 g) of pyrotechnic composition are not subject to the requirements of C-3.5.1.1.

C-3.5.1.2 The fuse needs to be of sufficient length to burn at least 3 seconds but not more than 6 seconds before ignition of the device, except that fuse for roman candles or similar devices requiring a longer fuse for safe functioning can burn up to 12 seconds before ignition of the device.

C-3.5.1.3 The fuse needs to be securely attached, so that it will support either the weight of the device plus 8 oz (227 g) of

dead weight or double the weight of the device, whichever is less, without separation from the fireworks device.

C-3.5.2 Construction.

C-3.5.2.1 Bases. Each fireworks device that requires a base needs to utilize a base of wood or plastic (preferably nonbrittle, medium-impact polystyrene). The minimum horizontal dimension or the diameter of the base needs to be equal to at least one-third the height of the device (excluding any protruding fuse), unless the device remains upright when subjected to a tilt of 12 degrees from the horizontal. Bases are to remain firmly attached to the item during transportation, handling, and normal operation.

NOTE: See APA 87-1, Appendix B, for method of measuring.

C-3.5.2.2 Sticks. The stick on a rocket (including skyrockets and bottle rockets), and on other fireworks devices that utilize a stick, are to be firmly attached to the body of the device by means of glue, staples, or wire, and are to be secure enough to remain firmly attached during transportation, handling, and normal operation. Sticks are to be rigid and of such length so as to assure stable flight. The maximum curvature of such stick(s) cannot exceed 1 in. (25 mm).

NOTE: See APA 87-1, Appendix B, for method of testing rigidity.

C-3.5.2.3 Handles. Each fireworks device that is intended to be hand-held and is so marked is to incorporate a handle at least 4 in. (101 mm) in length. Handles are to remain firmly attached during transportation, handling, and normal operation of the device, or are to consist of an integral section of the device extending at least 4 in. (101 mm) below the pyrotechnic chamber, except that sparklers 10 in. (253 mm) or less in length shall have handles at least 3 in. (76 mm) in length.

C-3.5.2.4 Spikes. Spikes that constitute an integral part of a fireworks device are to protrude at least 2 in. (51 mm) from the base of the device and are to have a blunt tip not less than 1/8 in. (3.2 mm) in diameter or 1/8 in. (3.2 mm) square.

†**C-3.5.2.5 Pyrotechnic Chamber.** The pyrotechnic chamber in a fireworks device that functions other than by exploding needs to be of sufficient thickness and rigidity to allow normal functioning of the device without burnout or blowout. The chamber also needs to be constructed and sealed to prevent leakage of the pyrotechnic composition during transportation, handling, and normal operation.

C-3.5.2.6 Wings. Wings on helicopter-type rockets and similar devices need to be securely attached to the body by means of gluing, wiring, or other appropriate means so that they will remain firmly attached during transportation, handling, and normal operation.

C-3.5.2.7 Wheel Devices. Each wheel device needs to be constructed so that the driver(s), motor(s), and axle(s), where needed (i.e., on wheel devices intended to operate in a fixed location), remain securely attached to the device during transportation, handling, and normal operation.

C-3.5.2.8 Aerial Devices. Each device intended to produce a visible or audible effect high in the air needs to be designed to produce the effect at or near the apogee of its flight.

C-3.5.2.9 Smoke Devices. Each smoke device needs to be constructed so that it will neither burst nor produce excessive flame (excluding fuse and small but brief bursts of flame

accompanying normal smoke production). Smoke devices cannot contain plastic in direct contact with the pyrotechnic composition, nor can smoke devices resemble, in color and configuration, banned fireworks devices, such as M80 salutes, cherry bombs, or silver salutes.

C-3.6 Prohibited Chemicals and Components.

†**C-3.6.1 Prohibited Chemicals.** Consumer fireworks devices offered or intended for sale to the public cannot contain a chemical enumerated in Table C-3.6.1, except for trace amounts as impurities, and except as specified therein.

NOTE: Display fireworks and theatrical pyrotechnics (see C-2.6.3) are not subject to the provisions of this appendix.

Table C-3.6.1 Prohibited Chemicals for Consumer Fireworks

(a)	Arsenic sulfide, arsenates, or arsenites
(b)	Boron
(c)	Chlorates, except: <ol style="list-style-type: none"> 1. In colored smoke mixtures in which an equal or greater weight of sodium bicarbonate is included 2. In party poppers 3. In those small items (such as ground spinners) wherein the total powder content does not exceed 4 g (0.14 oz) of which not greater than 15 percent or 600 mg (9.3 grains) is potassium, sodium, or barium chlorate 4. In firecrackers 5. In toy caps
(d)	Gallates or gallic acid
(e)	Magnesium (magnesium/aluminum alloys, called magnalium, are permitted)
(f)	Mercury salts
(g)	Phosphorus (red or white), except that red phosphorus is permissible in caps and party poppers
(h)	Picrates or picric acid
(i)	Thiocyanates
(j)	Titanium, except in particle size greater than 100 mesh
(k)	Zirconium

†**C-3.6.2 Prohibited Components.** No component of any consumer fireworks device or novelty can, upon functioning, project or disperse any metal, glass, or brittle plastic fragments.

†**C-3.6.3 Forbidden Explosive Devices.** Any explosive device intended for sale to the public that produces an audible effect (other than a whistle) by a charge of more than 2 grains (130 mg) of explosive composition per report. Devices obtained for bona fide pest control purposes in accordance with regulations promulgated by CPSC in Title 16, *CFR*, are not forbidden.

For transportation purposes, the term forbidden explosive devices also includes mixtures or devices containing a chlorate and an ammonium salt or an acidic metal salt, devices that contain yellow or white phosphorus, devices that combine an explosive and a detonator or blasting cap, and any device that has not been approved by the U.S. DOT.

†**C-3.7 Approval.** All consumer fireworks (Fireworks UN0336), novelties, and theatrical pyrotechnics offered for transportation in the United States need to be classified and approved for transportation purposes by the DOT, in accordance with the following procedure.

†**C-3.7.1** Fireworks and novelties containing only mixtures of chemicals specified in Table C-4.3.1 but none of the chemicals prohibited by C-3.6. For each item for which approval is sought, manufacturers need to submit a copy of the Approval Application (*see APA 87-1, Appendix D*) to the U.S. DOT. U.S. DOT can issue an approval for the device as “1.4G” based on the information contained in the form or, at its option, can require pyrotechnic laboratory examination by the Bureau of Explosives, Bureau of Mines, or other pyrotechnic laboratory acceptable to U.S. DOT.

†**C-3.7.2** Consumer fireworks devices and theatrical pyrotechnics containing any chemical not specified in Table C-4.3.1, but none of the chemicals prohibited by C-3.6. For each item for which approval is sought, the manufacturer needs to submit a sample of each device to the Bureau of Explosives, Bureau of Mines, or other pyrotechnic laboratory acceptable to U.S. DOT (such as a recognized competent authority for fireworks manufactured abroad) for examination and thermal stability testing. The manufacturer needs to then submit a fireworks Approval Application (*see APA 87-1, Appendix D*) together with the appropriate pyrotechnic laboratory reports to U.S. DOT. U.S. DOT can then issue approval based on the information contained in the application and accompanying pyrotechnic laboratory reports.

†**C-3.7.3** Theatrical pyrotechnics containing only mixtures of chemicals specified in Table C-4.3.1. For each item for which approval is sought, manufacturers need to submit a copy of the Approval Application (*see APA 87-1, Appendix D*) to the U.S. DOT. U.S. DOT can issue an approval for the device as “1.4G” based on the information contained in the form or, at its option, can require pyrotechnic laboratory examination by the Bureau of Explosives, Bureau of Mines, or other pyrotechnic laboratory acceptable to U.S. DOT.

†**C-3.7.4** If classification other than as “1.4G” is sought, the U.S. DOT approval procedure in Title 49, *CFR*, 173.56(b)(1) needs to be followed. This includes obtaining a pyrotechnic laboratory report from the Bureau of Explosives or other pyrotechnic laboratory acceptable to U.S. DOT.

†**C-3.8 Marking and Labeling.** Fireworks intended for consumer sale and use need to be labeled in conformance with the requirements of the Federal Hazardous Substances Act and regulations promulgated thereunder in Title 16, *CFR*, Part 1500. All outside packaging containing fireworks must be marked and labeled in conformance with Title 49, *CFR*, Part 172. See APA 87-1, Appendix C, and Section C-5 of this appendix for details and examples.

C-4 Requirements for Display Fireworks Devices.

NOTE: Devices in this category, formerly classed as Class B Explosives, Special Fireworks, are now classed as “1.3G” under the UN system and referred to in this appendix as Display Fireworks.

†**C-4.1 Types of Display Fireworks Devices.** The following fireworks devices are subject to the requirements of Section C-4 of this appendix.

C-4.1.1 Aerial Shell. A cylindrical or spherical cartridge containing chemical composition exceeding 1.4 oz (40 g) in weight or explosive composition exceeding 2 grains (130 mg) per report, and a black powder propelling charge (lift charge). Shells are most commonly 3 in. to 6 in. (76 mm to 152 mm) in diameter, and are fired from metal or heavy cardboard tubes. Upon firing, the lift charge is consumed and the cartridge is expelled into the air. A pyrotechnic effect is produced near the apogee of flight.

†**C-4.1.2 Salute.** Paper-wrapped or cardboard tube containing explosive composition in excess of 2 grains (130 mg). Upon ignition, noise and a flash of light are produced.

C-4.1.3 Other Fireworks Devices.

†**C-4.1.3.1** Where the quantity of explosive or pyrotechnic composition, or both, exceeds the limit for inclusion in the “Fireworks UN0336” category, devices enumerated in C-3.1 are classed as “1.3G” and described as “Fireworks UN0335” (formerly described as Special Fireworks, and classed as “Class B Explosives”). This includes multiple tube devices containing more than 7.1 oz (200 g) of total chemical composition.

†**C-4.1.3.2** Certain devices intended for signaling, illuminating, and incendiary purposes such as railway torpedoes, airplane flares, illuminating projectiles, incendiary and smoke projectiles, and flash cartridges, formerly described as Special Fireworks, no longer fall into the “Fireworks” category under the U.S. DOT regulations effective on October 1, 1991, and are not part of this appendix.

C-4.2 Construction of Aerial Shells.

C-4.2.1 Each shell is to be identified only in terms of the inside diameter (and not the circumference) of the mortar in which it can be safely used. [e.g., 3-in. (76-mm) shells are only for use in 3-in. (76-mm) mortars].

C-4.2.2 Each shell needs to be constructed so that the difference between the inside diameter of the mortar in which it can be safely used and the outside diameter of the shell is no less than $\frac{1}{8}$ in. (3.2 mm) and no more than $\frac{1}{4}$ in. (6.4 mm) for shells not exceeding 3 in. (76 mm) or $\frac{1}{2}$ in. (12.7 mm) for shells larger than 3 in. (76 mm).

C-4.2.3 Each shell needs to be marked with the type of shell, the diameter measurement, and the name of the manufacturer or distributor.

C-4.2.4 The length of the internal delay fuse and the amount of lift charge needs to be sized to ensure proper functioning of the shell in its mortar. Quick match fuse, if required, needs to be long enough to allow not less than 6 in. (152 mm) of fuse to protrude from the mortar after the shell is properly inserted.

C-4.2.5 The length of exposed black match on a shell cannot be less than 3 in. (76 mm) and the fuse is not to be folded or doubled back under the safety cap. Also, the time delay between ignition of the tip of the exposed black match and ignition of the lift charge cannot be less than 3 seconds to allow the operator to retreat safely.

C-4.2.6 A safety cap needs to be installed over the exposed end of the fuse. The safety cap needs to be of a different color than that used for the paper of the fuse.

†**C-4.3 Approval.** Prior to being offered for transportation in the United States, all display fireworks (“Fireworks 1.3G”) need to be classified and approved by U.S. DOT in accordance with the following procedures.

†**C-4.3.1** Devices containing only mixtures of chemicals specified in Table C-4.3-1. The manufacturer needs to submit a copy of the Approval Application (*see APA 87-1, Appendix D*) to U.S. DOT for any item that has not previously been approved by U.S. DOT. U.S. DOT can issue an approval for the device based on the information contained in the form or, at its option, can require pyrotechnic laboratory examination by the Bureau of Explosives, Bureau of Mines, or other pyrotechnic laboratory acceptable to U.S. DOT.

Table C-4.3.1 Standard Fireworks Chemicals

Chemical	Typical Use
Aluminum	Fuel
Ammonium perchlorate	Oxygen donor
Antimony	Fuel
Antimony sulfide	Fuel
Barium carbonate	Neutralizer
Barium nitrate	Oxygen donor
Barium sulfate	Oxygen donor
Boric acid	Neutralizer
Calcium carbonate	Neutralizer
Calcium sulfate	Oxygen donor
Carbon or charcoal	Fuel
Copper metal	Color agent
Copper oxide	Oxygen donor, color agent
Copper salts (except copper chlorate)	Color agent
Dextrine	Fuel/binder
Hexamethylenetetramine (hexamine)	Fuel
Iron and iron alloys (e.g., ferro/titanium)	Fuel
Iron oxide	Oxygen donor
Magnalium (magnesium/aluminum)	Fuel
Magnesium (in display fireworks and theatrical pyrotechnics only)	Fuel
Magnesium carbonate	Neutralizer
Magnesium sulfate	Oxygen donor
Nitrocellulose-based lacquers	Binder
Phosphorus, red (only as provided in Table C-3.6.1)	Fuel
Potassium or sodium benzoate	Whistle
Potassium bichromate (Potassium dichromate) (not to exceed 5% of formulation)	Oxygen donor
Potassium chlorate (only as provided in Table C-3.6.1)	Oxygen donor
Potassium hydrogen phthalate	Whistle
Potassium nitrate	Oxygen donor
Potassium perchlorate	Oxygen donor
Potassium sulfate	Oxygen donor
Sodium bicarbonate (sodium hydrogen carbonate)	Neutralizer
Sodium nitrate	Oxygen donor
Sodium salicylate	Whistle
Sodium salts (except sodium chlorate)	Color agent
Sodium sulphate	Oxygen donor
Strontium carbonate	Color agent
Strontium nitrate	Oxygen donor
Strontium salts (except strontium chlorate)	Color agent
Strontium sulfate	Oxygen donor
Sulfur	Fuel
Titanium (particle size >100 mesh if 1.4G or 1.4S Fireworks)	Fuel

†C-4.3.2 Devices containing any chemical not specified in Table C-4.3.1. For each item for which approval is sought, the manufacturer needs to submit a sample of each pyrotechnic mixture containing any chemical not specified in Table C-4.3.1 to the Bureau of Explosives or other pyrotechnic laboratory acceptable to U.S. DOT for examination. The manufacturer shall then submit an Approval Application (*see APA 87-1, Appendix D*), together with the appropriate pyrotechnic laboratory reports to U.S. DOT. U.S. DOT can then issue approval based on the information contained in the application and accompanying pyrotechnic laboratory report(s).

Miscellaneous Compounds:

Organic compounds [compounds such as lactose, shellac, red gum, chlorinated paraffin, and polyvinyl chloride, consisting of some combination of carbon with hydrogen, oxygen, or chlorine, or all three; nitrogen can be present if it accounts for less than 10 percent (by weight) of the compound].

NOTE: Exact chemical identity of each organic compound is to be included when submitting an Approval Application (*see APA 87-1, Appendix D*) to U.S. DOT.

C-5 Shipping Requirements.

†C-5.1 **Transportation Regulating Authorities.** Transportation of fireworks is regulated by the United States Department of Transportation (U.S. DOT). Some states and municipalities also regulate transportation of fireworks through their jurisdiction, often by incorporation of federal regulations.

†C-5.2 **Approval.** Except for samples prepared in accordance with U.S. DOT regulations, no fireworks device or novelty can be offered for transportation or be transported until it is classed and approved by U.S. DOT, and an approval number (EX number) is issued (Title 49, *CFR*, Part 173.86). (*See Sections C-3 and C-4 of this appendix and APA 87-1, Appendix D.*)

†C-5.2.1 EX numbers for fireworks contained in a shipping carton need to be marked on the shipping carton or on the shipping paper.

†C-5.2.2 Cartons containing more than 5 different fireworks devices need to be marked with at least 5 of the EX numbers covering items in the carton, or the EX numbers need to appear on the shipping paper [Title 49, *CFR*, Parts 172.320(c) and (d)].

C-5.3 Packaging. With certain exceptions, "Fireworks UN0335" (formerly Special Fireworks), "Fireworks UN0336" (formerly Common Fireworks) and Novelties, are to be securely packaged in containers complying with U.S. DOT regulations. Gross weight limitation per package is now dictated by the weight marked on the certified packaging. Until October 1, 1996, these materials were packaged in accordance with the regulations in effect on September 31, 1991 (i.e., U.S. DOT 12B boxes). These materials can be offered in accordance with the new package requirements promulgated under Docket No. HM-181 as of January 1, 1991. However, except as noted below, compliance with these new package standards is mandatory as of October 1, 1996. Fireworks packaged prior to October 1, 1991, in packagings that comply with previous U.S. DOT regulations (such as 12B boxes), can be used until October 1, 2001, but only for shipments in domestic commerce and only if the package has not been emptied or refilled on or after October 1, 1991 [Title 49, *CFR*, Part 171.14(c)]. Articles with match or friction tip ignition are to be packed so that each individual tip is protected against accidental contact or friction (Title 49, *CFR*, Part 173.108). Loose

chemical composition cannot be present in packages in transportation [Title 49, *CFR*, Part 172.102(c)(108)].

†**C-5.3.1 Toy Cap Packaging.** Until October 1, 1996, toy caps were packaged in accordance with Title 49, *CFR*, Part 173.109, in effect on September 31, 1991 [i.e., U.S DOT 12B fiberboard boxes, with gross weight not to exceed 65 lb (30 kg)]. Toy caps are to be packaged in inner containers meeting the requirements specified in C-3.2.5 of this appendix. Toy caps shall not be packed with other fireworks.

†**C-5.4 Placards.** Unless otherwise provided, each motor vehicle, freight container, and rail car is to bear appropriate placards on each end and each side [Title 49, *CFR*, Part 172.504 (a)]. Vehicles containing packages of consumer fireworks or novelties that are labeled “1.4G” require a “1.4G” or “Explosive 1.4G” placard (use of the word “explosive” is optional) (Title 49, *CFR*, Part 172.523). Highway and rail shipments of less than 1000 lb (454 kg) gross weight of such fireworks need not bear a placard [Title 49, *CFR*, Part 172.504(c)]. Vehicles containing display fireworks in any quantity require a “1.3G” or “Explosive 1.3G” placard (the word “explosive” is optional) (Title 49, *CFR*, Part 173.522). If both “1.4G” and “1.3G” are present in a shipment, only the “1.3G” placard is required. Until October 1, 1994, transport vehicles and freight containers were placarded with the old placards (i.e., “Class B Explosive” or “Dangerous” placard), and these placards can be used for domestic highway transportation only until October 1, 2001.

†**C-5.5 Package Marking and Labeling.** Each person who offers fireworks for transportation needs to ensure that the package displays the appropriate square-on-point label [Title 49, *CFR*, Parts 172.400(a) and 172.411]. Consumer fireworks, toy smoke devices, and trick noise makers are either classed as “1.4G,” “1.4S,” or not regulated for transportation purposes, and display fireworks are classed as “1.3G” (Title 49, *CFR*, Part 172.101). The label needs to be printed or affixed to the surface of the package near the proper shipping name and identification number, which are also required to appear on the package [Title 49, *CFR*, Part 172.301(a)].

†**C-5.6 Shipping Papers.** Each person who offers a fireworks device or novelty for transportation needs to describe the item on a shipping paper. The description needs to include the proper shipping name (Title 49, *CFR*, Part 172.101 Table, Col. 2), the hazard class of the material, the identification number (Col. 4), the packing group (Col. 5), and the total quantity covered by the description [Title 49, *CFR*, Part 172.202(a)]. Consumer fireworks (common fireworks) would be described as follows: “Fireworks, 1.4G, UN 0336, PG II.” Display fireworks (special fireworks) would be described as “Fireworks, 1.3G, UN 0335, PG II.” In addition, the shipper needs to certify that the shipment is properly classified, marked, and labeled [Title 49, *CFR*, Part 172.204(a)].

NOTE: EX numbers also are to appear on shipping papers unless they are marked on each shipping carton.

C-6 References.

†**C-6.1** Title 49, *CFR*, Parts 171 to 180, U.S. Department of Transportation, can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, or as republished by the Bureau of Explosives as “Hazardous Materials Regulations of the Department of Transportation,” available from the Association of American Railroads, 50 F Street, NW, Washington, DC 20001.

†**C-6.2** Title 16, *CFR*, Parts 1000 to End, *Consumer Product Safety Commission*, can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Extracts of these regulations pertaining to fireworks can be obtained only from the American Pyrotechnics Association.

Appendix D Glossary

This appendix is not a part of the requirements of this NFPA document but is included for informational purposes only.

D-1 The following terms are not necessarily inclusive of all the terms used in the pyrotechnic special effects industry.

Alternating Current (ac). An electrical current that reverses direction in a circuit at regular intervals. Almost all electrical current supplied from wall outlets or sockets is alternating current.

Black Match. A fuse made from thread impregnated with black powder and used for igniting pyrotechnic devices.

Blank Cartridge. A cartridge constructed from a cartridge case equipped with a percussion primer and filled with various loads of smokeless powder or other propellant. Weapons using blank cartridges often are used in conjunction with bullet hits.

Bridgewire. A fine wire that either heats up or explodes when an electric current is applied. It is used to fire pyrotechnic devices.

Bullet Effect. An effect intended to simulate a slug from a weapon as it strikes a person or object.

Bullet Hit. A small explosive charge attached to a person’s clothing or body, or to an inanimate object, to simulate a slug from a weapon as it strikes a person or object.

Colored Smoke. An aerosol of special dyestuffs of chemical reactants dispersed by pyrotechnic heat or explosion.

Color Pot. A tube containing pyrotechnic materials. It produces a colored flame when ignited.

Concussion Flashpowder. Flashpowder intended to be used in a concussion mortar to produce a loud concussive effect.

Concussion Item. A pyrotechnic item that produces a loud noise and a violent jarring shock for dramatic effect.

Concussion Mortar. A device specifically designed and constructed to produce a loud noise and a violent jarring shock for dramatic effect without producing any damage.

Day Box. A portable magazine used for the immediate storage of pyrotechnics.

Deflagration. A rapid chemical reaction in which the output of heat is sufficient to enable the reaction to continue and accelerate without input of heat from another source. Deflagration is primarily a surface phenomenon, with most reaction products flowing away from the unreacted material along the surface at less than supersonic velocity. The effect of a deflagration under confinement is an explosion. Confinement of the reaction increases pressure, rate of reaction, and temperature and, in some cases, can cause transition into a detonation.

Det Cord. A flexible detonating cord. It is a highly explosive material encased in a plastic-covered cord resembling a clothesline.

Detonation. An extremely rapid chemical reaction in which the pressure generated is sufficient to cause the formation of a shock wave, which causes the reaction to continue. Detonation is a phenomenon with reaction products flowing in the direction of unreacted materials at supersonic velocity.

The effect of a detonation with or without confinement is an explosion.

Detonator. Any device containing an initiating or primary explosive that is used for initiating detonation. The term includes, but is not limited to, electric blasting caps (instantaneous and delay types), blasting caps for use with safety fuses, detonating cord delay connectors, and nonelectric caps that use a detonating cord, shock tube, or any other replacement for electric legwires. A detonator also could be an explosive or device initiated by a primer and used to initiate another explosive that is less sensitive and larger.

Direct Current (DC). An electrical current that flows in one direction. Most frequently, direct current is supplied by a battery.

Explosion. The rapid production of hot gases at a high pressure as the result of a chemical reaction and the sudden release of the energy to cause strong dynamic stresses in the surroundings. The term usually refers to the effects of a detonation of initiating explosives and high explosives but also applies to the effect of a deflagrating propellant explosive in certain circumstances such as heavy confinement. The term also describes a mechanical phenomenon in which failure of the container results in a sudden release of pressure from within a vessel.

Explosive Special Effect. See Pyrotechnic Special Effect.

First Fire. The ignited mixture used with pyrotechnic devices and loaded in direct contact with the main pyrotechnic charge. A pyrotechnic first-fire mixture is compounded to produce a high temperature and hot slag. The mixture is readily ignitable and capable of igniting the underlying pyrotechnic charge.

Flare. A pyrotechnic device designed to produce a single source of intense light for a defined period of time.

Flash Pot. A device used with flashpowder that produces a flash of light and is capable of directing the flash in an upward direction.

Flashpowder. A specific pyrotechnic material in powder form composed of fuel(s) and oxidizer(s). Ignition produces a flash of light, sparkles, an audible report, or a combination of these effects.

Gerb. A cylindrical preload intended to produce a controlled spray of sparks with a reproducible and predictable duration, height, and diameter.

Igniter. An electrical, chemical, or mechanical device normally used to fire pyrotechnics.

Ingredient. A chemical used to create a pyrotechnic material. Such a chemical is not itself a pyrotechnic material.

Lift Charge. The composition in a pyrotechnic device that propels (lifts) the effect into the air when ignited. It usually consists of a black powder charge.

Lycopodium. The spores produced by the genus of mosses called lycopodium. This powdery, organic, yellow material can be agitated and dispersed mechanically into a cloud and then ignited by a spark, pilot flame, or electrical heating device. Although not a pyrotechnic material, this material is used by special effects operators to produce fire effects or in conjunction with other pyrotechnics to create a special effect.

Mine. A pyrotechnic device, usually a preload, that projects multiple pellets of pyrotechnic material that produce sparks or flame. It is usually supplied with an integral mortar.

Nonelectric Detonator. A detonator that does not need electric energy to function.

Photoflash Flashpowder. A loose pyrotechnic mixture that yields a very large amount of light for a small fraction of a second on exploding.

Pyrotechnic Preload. A pyrotechnic device supplied by the manufacturer in a ready-to-use condition.

Pyrotechnic Special Effect. A special effect created through the use of pyrotechnic materials and devices. (*See also Special Effect.*)

Quick Match. Black match that is encased in a loose-fitting paper sheath. Although exposed black match burns slowly, quick match burns extremely rapidly and almost instantaneously. Quick match is used in fuses for aerial shells and for simultaneous ignition of a number of pyrotechnic devices, such as lances in a ground display piece.

Safety Fuse. A flexible cord containing an internal burning medium by which fire or flame is conveyed at a constant and relatively uniform rate from the point of ignition to the point of use.

Saxon. A pyrotechnic device consisting of a tube that rotates around a pivot point to produce a circular shower of sparks.

Smoke Pot. A pyrotechnic device used to create smoke during a production.

Smokeless Powder. A pyrotechnic material containing nitrocellulose and often nitroglycerin used in small arms ammunition, cannons, rockets, and propellant-actuated power devices.

Soft Detonator. A detonator with a higher velocity than a bullet hit, but with no metallic elements or jacket. It is essentially a blasting cap without a metal jacket.

Sparkle Flashpowder. A flashpowder that produces a bright flash of light and a shower of sparks when ignited.

Sparkle Pot. A pyrotechnic device intended to contain and control the discharge of sparkle flashpowder.

Special Effect. A visual or audible effect used for entertainment purposes, often produced to create an illusion. For example, smoke might be produced to create the impression of fog being present, or a puff of smoke, a flash of light, and a loud sound might be produced to create the impression that a cannon has been fired.

Theatrical Flashpowder. A pyrotechnic material intended for use in theatrical shows. Theatrical flashpowder produces a flash of light when ignited. Typical theatrical flashpowders burn more slowly than salute powder and also might produce a shower of sparks. Theatrical flashpowder is not intended to produce a loud report.

Waterfall, Falls, Park Curtain. An effect of a cascade of sparks that usually are produced by multiple devices fired simultaneously.

Wheel. A pyrotechnic device that rotates on a central axis consisting of multiple gerbs or rockets attached to a framework.

Appendix E Referenced Publications

E-1 The following documents or portions thereof are referenced within this code for informational purposes only and are thus not considered part of the requirements of this code unless also listed in Chapter 6. The edition indicated here for each reference is the current edition as of the date of the NFPA issuance of this code.

E-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 99, *Standard for Health Care Facilities*, 1996 edition.

NFPA 231, *Standard for General Storage*, 1998 edition.

NFPA 231C, *Standard for Rack Storage of Materials*, 1998 edition.

NFPA 491, *Guide to Hazardous Chemical Reactions*, 1997 edition.

E-1.2 Other Publications.

E-1.2.1 U.S. Government Publications. Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Title 16, *Code of Federal Regulations*, Parts 1000 to End.

Title 49, *Code of Federal Regulations*, Parts 170 to End.

United Nations Recommendations on the Transport of Dangerous Goods.

E-1.2.2 American Pyrotechnics Association Publication. American Pyrotechnics Association, P.O. Box 213, Chestertown, MD 21620.

American Pyrotechnics Association Standard 87-1, *Standard for Construction and Approval for Transportation of Fireworks*, 1993.

E-1.2.3 Association of American Railroads Publication. Association of American Railroads, Library Room 5800, 50 F Street, NW, Washington, DC 20001.

“Hazardous Materials Regulations of the Department of Transportation.”

Appendix F Informational Sources

This appendix is not a part of the requirements of this NFPA document but is included for informational purposes only.

F-1 For information on fireworks classification testing, contact the following agencies:

F-1.1 U.S. Bureau of Mines. U.S. Bureau of Mines, Pittsburgh Research Center, Cochran Mill Road, Pittsburgh, PA 15236-0070.

F-1.2 Bureau of Explosives. Bureau of Explosives, c/o Association of American Railroads, 50 F Street, NW, Washington, DC 20001.

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