ANSI/NFPA 1123 An American National Standard February 5, 1990

NFPA 1123 Outdoor Display of Fireworks 1990 Edition

National Fire Protection Association 1 Batterymarch Park, Quincy, MA 02269-9101

NOTICE

All questions or other communications relating to this document should be sent only to NFPA Headquarters, addressed to the attention of the Committee responsible for the document.

For information on the procedures for requesting Technical Committees to issue Formal Interpretations, proposing Tentative Interim Amendments, proposing amendments for Committee consideration, and appeals on matters relating to the content of the document, write to the Secretary, Standards Council, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

A statement, written or oral, that is not processed in accordance with Section 16 of the Regulations Governing Committee Projects shall not be considered the official position of NFPA or any of its Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation.

Users of this document should consult applicable Federal, State and local laws and regulations. NFPA does not, by the publication of this document, intend to urge action which is not in compliance with applicable laws and this document may not be construed as doing so.

Policy Adopted by NFPA Board of Directors on December 3, 1982

The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

---

1. Adoption by Reference — Public authorities and others are urged to reference this document in laws, ordinances, regulations, administrative orders or similar instruments. Any deletions, additions and changes desired by the adopting authority must be noted separately. Those using this method are requested to notify the NFPA (Attention: Secretary, Standards Council) in writing of such use. The term "adoption by reference" means the citing of title and publishing information only.

2. Adoption by Transcription — A. Public authorities with lawmaking or rule-making powers only, upon written notice to the NFPA (Attention: Secretary, Standards Council), will be granted a royalty-free license to print and republish this document in whole or in part, with changes and additions, if any, noted separately, in laws, ordinances, regulations, administrative orders or similar instruments having the force of law, provided that: (1) due notice of NFPA's copyright is contained in each law and in each copy thereof; and, (2) that such printing and republication is limited to numbers sufficient to satisfy the jurisdiction's lawmaking or rulemaking process. **B.** Once this NFPA Code or Standard has been adopted into law, all printings of this document by public authorities with lawmaking or rulemaking powers or any other persons desiring to reproduce this document or its contents as adopted by the jurisdiction in whole or in part, in any form, upon written request to NFPA (Attention: Secretary, Standards Council), will be granted a nonexclusive license to print, republish, and vend this document in whole or in part, with changes and additions, if any, noted separately provided that due notice of NFPA's copyright is contained in each copy. Such license shall be granted only upon agreement to pay NFPA a royalty. This royalty is required to provide funds for the research and development necessary to continue the work of NFPA and its volunteers in continually updating and revising NFPA standards. Under certain circumstances, public authorities with lawmaking or rulemaking powers may apply for and may receive a special royalty when the public interest will be served thereby.

3. Scope of License Grant — The terms and conditions set forth above do not extend to the index to this document.

(For further explanation, see the Policy Concerning the Adoption, Printing and Publication of NFPA Documents which is available upon request from the NFPA.)

Statement on NFPA Procedures

This material has been developed under the published procedures of the National Fire Protection Association, which are designed to assure the appointment of technically competent Committees having balanced representation. While these procedures assure the highest degree of care, neither the National Fire Protection Association, its members, nor those participating in its activities accepts any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

NFPA has no power or authority to police or enforce compliance with the contents of this document and any certification of products stating compliance with requirements of this document is made at the peril of the certifier.

NFPA 1123

Code for the

Outdoor Display of Fireworks

1990 Edition

This edition of NFPA 1123, *Code for the Outdoor Display of Fireworks*, was prepared by the Technical Committee on Pyrotechnics and acted on by the National Fire Protection Association, Inc. at its Fall Meeting held November 13-15, 1989 in Seattle, WA. It was issued by the Standards Council on January 12, 1990, with an effective date of February 5, 1990, and supersedes all previous editions.

The 1990 edition of this document has been approved by the American National Standards Institute.

Origin and Development of NFPA 1123

The development of NFPA 1123 began in 1975 with the submittal to the Committee on Pyrotechnics of a proposed standard drafted by the American Pyrotechnics Association. The proposed standard was redrafted and was officially adopted by the National Fire Protection Association at its 1978 Fall Meeting. The 1978 edition was amended in 1980, and the amended version was adopted by the Association at its 1981 Fall Meeting.

For the 1990 edition of NFPA 1123, the Committee initiated a complete revision of the document that incorporates a good deal of additional detail on the operation of outdoor fireworks displays including enhancements in the safe conduct of outdoor fireworks displays by increasing the audience separation distances. In this edition, the Committee has also addressed the new technology of electrically firing outdoor displays of fireworks. Generally, the Committee provided performance requirements rather than supply specific prescriptions for meeting those requirements.

Technical Committee on Pyrotechnics

G. Harry Stine, *Chairman*
Phoenix, AZ
(Rep. National Association of Rocketry)

Kenneth L. Kosanke, *Secretary*
Whitewater, CO

Thomas J. Blazanin, Pittsburgh, PA
Rep. Tripoli Rocketry Assn.
Dane Boles, Phoenix, AZ
Jose R. Colon, Connecticut Dept. of Public Safety
John A. Conkling, Chestertown, MD
Daniel F. Crowley, Bureau of Alcohol, Tobacco and Firearms
Thomas DeWille, Luna Tech Inc.
Thomas H. Eberhart, State Fire Marshal's Office, GA
Rep. Fire Marshals Association of North America
Vernon Estes, Canon City, CO
Anthony Fabrizi, NJ Fireworks Mfg. Co.
Rep. American Pyrotechnics Assn.
Gary A. Fadorsen, Automatic Sprinkler Corporation of America
Felix J. Grucci, Jr., Fireworks by Grucci, Inc.
H. B. Harryman, State Fire Marshal's Office, SD
Lansden E. Hill, Jr., E. E. Hill & Son, Inc./Pyro Shows
Bonnie J. Kosanke, KSI, Inc.
Rep. Pyrotechnics Guild Intl Inc.
Duane B. Matthews, State Fire Marshal's Office, CA
Donald F. McCaulley, Falls Church, VA
Frederick L. McIntyre, Sverdrup Technology, Inc.
Dale C. Miller, Falls Church, VA
Mary Roberts, Estes Industries
Rep. Hobby Industry of America—Model Rocket Div.
Gary C. Rosenfield, Industrial Solid Propulsion Inc.
Bill Stine, Cave Creek, AZ
Pamela K. Stout, Fireworks Productions Intl
Gerald D. Ward, Bethany Fire & Ambulance Dist., IL
Charles Weeth, Skyrockers of LaCrosse, Inc., WI

Alternates

J. Patrick Miller, National Association of Rocketry
(Alternate to G. H. Stine)
Joseph D. Stefano, Estes Industries
Rep. Hobby Industry of America—Model Rocket Div.
(Alternate to M. Roberts)
Edward R. Tindell, Houston Lighting & Power
Rep. Tripoli Rocketry Assn.
(Alternate to T. J. Blazanin)
Lawrence G. White, Bureau of Alcohol, Tobacco and Firearms
(Alternate to D. F. Crowley)

Martha H. Curtis, NFPA Staff Liaison

This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

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.

Contents

NFPA 1123

Code for the

Outdoor Display of Fireworks

1990 Edition

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates explanatory material on that paragraph 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 construction, handling, and use of fireworks intended solely for outdoor fireworks display. It also shall apply to the general conduct and operation of the display. (*See definition of Public Display.*)

1-1.2 This code shall not apply to the manufacture, transportation, or storage of fireworks at a manufacturing facility. (*See NFPA 1124, Code for the Manufacture, Transportation, and Storage of Fireworks.*) Similarly, this code shall not apply to the testing of fireworks under the direction of its manufacturer, provided permission for such testing has been obtained from the authority having jurisdiction.

1-1.3 This code shall not apply to the use of common (Class C) fireworks by the general public.

1-1.4 This code shall not apply to the transportation, handling, or use of fireworks by the Armed Forces of the United States.

1-1.5 This code shall not apply to the transportation, handling, or use of industrial pyrotechnic devices or fireworks, such as railroad torpedoes, fusees, automotive, aeronautical, and marine flares and smoke signals.

1-1.6 This code shall not apply to the use of pyrotechnic devices in the performing arts.

1-1.7 This code shall not apply to the sale and use of unmanned rockets and rocket motors used in conformance with NFPA 1122, *Code for Unmanned Rockets.*

1-2 Purpose.

1-2.1 The purpose of this code is to provide requirements for the reasonably safe conduct of outdoor fireworks displays.

1-2.2 The purpose of this code is also to provide a suggested local permit regulation. (*See Appendix C.*)

1-2.3 The purpose of this code is to provide a suggested regulation for state certification of display operators. (*See Appendix D.*)

1-3 Equivalency. This code is not intended to prevent the use of systems, methods, or devices that provide equivalent protection to the provisions of this code, providing equivalency can be demonstrated to the authority having jurisdiction.

1-4 Definitions. For the purpose of this code, the following terms shall have the meanings shown below:

Approved. Acceptable to the "authority having jurisdiction."

NOTE: The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment, or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

Assistant. A person who works under the direction of the operator to put on an outdoor fireworks display. The duties of an assistant include tasks such as: loading mortars, spotting the bursting location of aerial shells, tending a ready box, setting up and cleaning the discharge site, igniting fireworks, etc.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

NOTE: 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, 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 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."

Barrage. A rapidly fired sequence of aerial fireworks. Mortars are loaded prior to the display, and the aerial shells are chain fused to fire in rapid sequence.

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

Break. An individual burst from an aerial shell, generally either producing a visual effect (stars) or noise (salute). Aerial shells can be either single-break (having only one burst) or multi-break (having two or more bursts).

Chain Fusing. A series of two or more aerial shells fused so as to fire in sequence from a single ignition. Finales and barrages typically are chain fused.

Discharge Site. The area immediately surrounding the special fireworks mortars used for an outdoor fireworks display.

Electric Match. A device consisting of wires terminating at a relatively high resistance element surrounded with a small quantity of heat-sensitive pyrotechnic composition. When a sufficient electric current is passed through the wire circuit, the heat that is generated ignites the pyrotechnic composition, producing a small burst of flame. This flame can be used to ignite a fuse or a lift charge in a fireworks device.

Electrical Firing Unit. The source of electrical current used to ignite electric matches. Generally the firing unit will have switches to control the routing of the current to various firework items and shall have test circuits and warning indicators, etc.

Electrical Ignition. A technique used to discharge fireworks in which an electric match and source of electric current are used to ignite fuses or lift charges. The electric matches are attached prior to the display, generally with wires connected to an electrical firing unit during the display. The operator or an assistant ignites the fireworks from the electrical firing unit during the display.

Fallout Area. The area over which aerial shells are fired. The shells burst over this area, and unsafe debris and malfunctioning aerial shells fall into this area. The fallout area is the location where a typical aerial shell dud will fall to the ground considering wind and the angle of mortar placement.

Finale. A rapidly fired sequence (barrage) of aerial fireworks, typically fired at the end of a display. The mortars are loaded prior to the display, and the aerial shells are chain fused to fire in rapid sequence.

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 "common" or "special" fireworks as set forth in the U.S. Department of Transportation's (DOT) Hazardous Materials Regulations, Title 49, *Code of Federal Regulations*, Parts 173.88 and 173.100.

Exception No. 1: Toy pistols, toy canes, toy guns, or other devices in which paper and/or plastic caps, manufactured in accordance with DOT regulations, Title 49, Code of Federal Regulations, Part 173.100 (p), and packed and shipped according to said regulations, and are not considered to be fireworks and shall be allowed to be used and sold at all times.*

Exception No. 2: Unmanned rockets and rocket motors designed, sold, and used in compliance with NFPA 1122, Code for Unmanned Rockets, are not considered fireworks. (See NFPA 1122, Code for Unmanned Rockets.)

Exception No. 3: Propelling or expelling charges consisting of a mixture of sulfur, charcoal, and potassium nitrate are not considered as being designed for producing audible effects.

Exception No. 4: Items described in Part E of the definition of Common Fireworks.

Common Fireworks. Any small firework device designed primarily to produce visible effects by combustion and which must comply with the construction, chemical composition, and labeling regulations of the U.S. Consumer Product Safety Commission, as set forth in Title 16, *Code of Federal Regulations*, Parts 1500 and 1507. Some small devices designed to produce audible effects are included, such as whistling devices, ground devices containing 50 mg or less of explosive composition, and aerial devices containing 130 mg or less of explosive composition. Common fireworks are classified as Class C explosives by the U.S. Department of Transportation and include the following:

A. Ground and Hand-Held Sparkling Devices.

(1) *Dipped Stick; Sparkler.* Stick or wire coated with pyrotechnic composition that produces a shower of sparks upon ignition. Total pyrotechnic composition may not exceed 100 g per item. Those devices containing any perchlorate or chlorate salts may not exceed 5 g of pyrotechnic composition per item. Wire sparklers that contain no magnesium and that contain less than 100 g of composition per item are not included in this category, in accordance with DOT regulations.

(2) *Cylindrical Fountain.* Cylindrical tube not more than $^3/_4$ in. (19 mm) inside diameter, containing up to 75 g of pyrotechnic composition. Upon ignition, a shower of colored sparks, and sometimes a whistling effect, is produced. This device may 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, if intended to be hand-held (handle fountain).

(3) *Cone Fountain.* Cardboard or heavy paper cone containing up to 50 g of pyrotechnic composition. The effect is the same as that of a cylindrical fountain.

(4) *Illuminating Torch.* Cylindrical tube containing up to 100 g of pyrotechnic composition. Upon ignition, colored fire is produced. May be spike, base, or hand-held.

(5) *Wheel.* Pyrotechnic device attached to a post or tree by means of a nail or string. Each wheel may contain up to 6 "driver" units: tubes not exceeding $^1/_2$ in. (12.7 mm) inside diameter and containing up to 60 g of pyrotechnic composition. Upon ignition, the wheel revolves, producing a shower of color and sparks and sometimes a whistling effect.

(6) *Ground Spinner.* Small device similar to a wheel in design and effect and placed on the ground and ignited. A shower of sparks and color is produced by the rapidly spinning device.

(7) *Flitter Sparkler.* Narrow paper tube filled with pyrotechnic composition that produces color and sparks upon ignition. This device does not have a fuse for ignition. The paper at one end of the tube is ignited to make the device function.

B. Aerial Devices.

(1) *Sky Rocket.* Tube not exceeding $^1/_2$ in. (12.7 mm) inside diameter that may contain up to 20 g of pyrotechnic composition. Sky rockets contain a wooden stick for guidance

and stability and rise into the air upon ignition. A burst of color or noise or both is produced at the height of the flight.

(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.

(3) *Helicopter, Aerial Spinner.* A tube not more than 1/2 in. (12.7 mm) inside diameter and containing up to 20 g of pyrotechnic composition. A propeller or blade is attached, which, upon ignition, lifts the rapidly spinning device into the air. A visible or audible effect is produced at the height of flight.

(4) *Roman Candles.* Heavy paper or cardboard tube not exceeding 3/8 in. (9.5 mm) inside diameter and containing up to 20 g of pyrotechnic composition. Upon ignition, up to 10 "stars" (pellets of pressed pyrotechnic composition that burn with bright color) are individually expelled at several-second intervals.

(5) *Mine, Shell.* Heavy cardboard or paper tube up to 2 1/2 in. (63.5 mm) inside diameter attached to a wood or plastic base and containing up to 40 g of pyrotechnic composition. Upon ignition, "stars" [*See B(4)*], firecrackers [*see C(1)*], or other devices are propelled into the air. The tube remains on the ground.

C. Audible Ground Devices.

(1) *Firecracker.* Small paper-wrapped or cardboard tube containing not more than 130 mg of pyrotechnic composition. Upon ignition, noise and a flash of light are produced.

NOTE: Firecrackers offered for sale to the public shall not contain more than 50 mg of pyrotechnic composition.

(2) *Chaser.* Small paper or cardboard tube that travels along the ground upon ignition. A whistling effect, or other noise, often is produced. The explosive composition used to create the noise may not exceed 50 mg.

D. Combination Items. Fireworks devices containing combinations of two or more of the effects described in categories A, B, and C.

E. Novelties and Trick Noisemakers.

NOTE: Items listed in this section are not classified as common fireworks by the U.S. Department of Transportation.

(1) *Snake, Glow Worm.* Pressed pellet of pyrotechnic composition that produces a large, snake-like ash upon burning. The ash expands in length as the pellet burns. These devices may not contain mercuric thiocyanate.

(2) *Smoke Device.* Tube or sphere containing pyrotechnic composition that, upon ignition, produces white or colored smoke as the primary effect.

(3) *Wire Sparkler.* Wire coated with pyrotechnic composition that produces a shower of sparks upon ignition. These items may not contain magnesium and must not exceed 100 g of composition per item. Devices containing any chlorate or perchlorate salts may not exceed 5 g of composition per item.

(4) *Trick Noisemaker.* Item that produces a small report intended to surprise the user. These devices include:

(a) Party Popper. Small plastic or paper item containing not more than 16 mg of explosive composition that is friction-sensitive. A string protruding from the device is pulled to ignite it, expelling paper streams and producing a small report.

(b) Booby Trap. Small tube with string protruding from both ends, similar to a party popper in design. The ends of the string are pulled to ignite the friction-sensitive composition, producing a small report.

(c) Snapper. Small, paper-wrapped item containing a minute quantity of explosive composition coated on small bits of sand. When dropped the device explodes, producing a small report.

(d) Trick Match. Kitchen or book match that has been coated with a small quantity of explosive or pyrotechnic composition. Upon ignition of the match, a small report or a shower of sparks is produced.

(e) Cigarette Load. Small wooden peg that has been coated with a small quantity of explosive composition. Upon ignition of a cigarette containing one of the pegs, a small report is produced.

(f) Auto Burglar Alarm. Tube that contains pyrotechnic composition that produces a loud whistle and/or smoke when ignited. A small quantity of explosive, not exceeding 50 mg, also may be used to produce a small report. A squib is used to ignite the device.

Special Fireworks. Large fireworks primarily designed to produce visible or audible effects by combustion, deflagration, or detonation. This term includes, but is not limited to, firecrackers containing more than 2 grains (130 mg) of explosive composition, aerial shells containing more than 40 g of pyrotechnic composition, and other display pieces that exceed the limits for classification as "common fireworks." Special fireworks are classified as Class B explosives by the U.S. Department of Transportation.

Fireworks Display. An outdoor display of common or special fireworks performed as entertainment.

Flash Powder. Explosive composition intended for use in firecrackers and salutes. Flash powder produces an audible report and a flash of light when ignited. Typical flash powder composition contains potassium chlorate or potassium perchlorate, sulfur or antimony sulfide, and powdered aluminum.

Fusee. A highway distress flare, sometimes used to ignite fireworks at outdoor fireworks displays.

Ground Display Piece. A pyrotechnic device that functions on the ground (as opposed to an aerial shell that functions in the air). Typical ground display pieces include fountains, roman candles, wheels, and "set pieces."

Labeled. Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization 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.

Lance. A thin cardboard tube packed with color-producing pyrotechnic composition used to construct ground display pieces. Lances are mounted on a frame and fused so that ignition of all tubes is nearly simultaneous.

Lift Charge. That composition in an aerial shell that propels (lifts) the shell into the air when ignited. It usually consists of a black powder charge ignited by a quick match fuse. (A time delay fuse then ignites the main part of the shell, producing the desired effect.)

Listed. Equipment or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which 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.

Manual Ignition. A technique used to ignite fireworks using a hand-held ignition source such as a fusee or port fire.

Monitor. A person designated by the sponsors of the display to keep the audience in the intended viewing area and out of the discharge site and fallout area.

Mortar. A tube from which aerial shells are fired into the air.

Mortar Rack. A strong frame containing mortars. Such racks most often are used for barrages and finales and in electrically ignited displays.

Mortar Trough. Above-ground structures filled with sand or similar material into which mortars are positioned ready for use in a fireworks display.

No-fire Current. The maximum current that can be applied to an electric match for 5 seconds at room temperature without the match igniting.

Operator. The person with overall responsibility for safety and the setting up and discharge of an outdoor fireworks display.

Portfire. A long tube containing slow-burning pyrotechnic composition that can be used to ignite fireworks at outdoor fireworks displays.

Potential Landing Area. See Fallout Area.

Public Display. An outdoor display (*see Fireworks Display*) of aerial shells [*see Shell (Aerial)*] and/or ground display pieces (*see Ground Display Piece*).

Quick Match. Black match that is encased in a loose-fitting sheath. While exposed black match burns slowly, quick match propagates flame extremely rapidly, 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.

Ready Box. A storage container for aerial shells at the site of a fireworks display.

Safety Cap. A paper tube, closed at one end, that is placed over the end of the fuse of a fireworks device to protect it from damage and accidental ignition.

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

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

Shall. Indicates a mandatory requirement.

Shell (Aerial). Usually a cylindrical or spherical cartridge containing pyrotechnic composition, a long fuse or electric match wires, and a black powder lift charge. The shells are most commonly 3 in. (76 mm) to 6 in. (152 mm) outside diameter and are fired from mortars. Upon firing, the fuse and lift charge are consumed.

Shooter. (*See Operator.*)

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

Theatrical Flash Powder. A pyrotechnic composition intended for use in theatrical shows. Theatrical flash powder produces a flash of light when ignited. Typical theatrical flash powder burns more slowly than salute powder and also may produce a shower of sparks. Theatrical flash powder is not intended to produce a loud report.

Chapter 2 Requirements for Special Firework Aerial Shells and Equipment

2-1 Construction of Special Firework Aerial Shells.

2-1.1 Shells shall be classified and described only in terms of the inside diameter of the mortar in which they can be safely used [e.g., 3 in. (76 mm) shells are only for use in 3 in. (76 mm) mortars].

2-1.2* Aerial shells shall be constructed so that they fit easily into the appropriate size mortar and so that the lift charge and internal delay fuse are appropriate to propel the shell to a safe altitude before functioning.

2-1.3 Shells shall be labeled with the type of shell, the shell size, and the name of the manufacturer or distributor. Shells also shall carry a warning label, as described in Appendix B.

2-1.3.1 The label or wrapper of any type of aerial shell shall be conspicuously marked with a number to indicate the shell size (the diameter of the mortar to be used).

2-1.3.2 The label or wrapper of any type of aerial salute shall be conspicuously marked with the word "Salute."

2-1.4 For aerial shells using quick match fuse to ignite the lift charge, that fuse shall be long enough to allow not less than 6 in. (152 mm) of fuse to protrude from the mortar after the shell has been properly inserted.

Exception: This requirement does not apply when shells are to be fired electrically.

2-1.5 In order to allow the person igniting the aerial shells to safely retreat, the time delay between igniting the tip of the shell's fuse and the firing of the shell shall not be less than 3 seconds or more than 6 seconds.

Exception: For electrically ignited displays there is no requirement for a delay period.

2-1.6 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. The safety cap shall be installed in such a manner that the fuse is not damaged.

Exception: For electrically fired displays there is no requirement for safety caps except that there shall be no exposed pyrotechnic composition.

2-1.7 Single break salute shells shall not exceed 3 in. (76 mm) in diameter or 3 in. (76 mm) in length (exclusive of the propellant charge). The maximum quantity of salute powder in such salutes shall not exceed 2.5 oz (71 g).

2-1.7.1 For single break shells greater than 3 in. (76 mm) in diameter containing multiple internal salutes and for multibreak shells greater than 3 in. (76 mm) in diameter, the maximum quantity of salute powder per shell shall not exceed 5 oz (142 g).

2-2 Storage of Aerial Shells Not in Mortars.

2-2.1 All fireworks shall be stored and transported according to the requirements of NFPA 1124, *Code for the Manufacture, Transportation, and Storage of Fireworks,* prior to reaching the display site.[1]

2-2.2 As soon as the fireworks have been delivered to the display site, they shall not be left unattended nor shall they be allowed to become wet.

2-2.3 All shells shall be inspected upon delivery to the display site by the operator. Any shells having tears, leaks, broken fuses, or showing signs of having been wet shall be set aside and shall not be fired. After the display any such shells shall either be returned to the supplier or destroyed according to the supplier's instructions.

Exception: Minor repairs to fuses shall be allowed. Also, for electrically ignited displays, attachment of electric matches and other similar tasks shall be permitted.

[1] See also *Code of Federal Regulations,* Title 27, Part 18, Subparts J and JJ.

2-2.4 Upon delivery to the display site all shells shall be separated according to size and as to whether they are salutes. Until they are loaded into mortars shells shall be stored in covered containers such as ready boxes or corrugated cartons meeting U.S. Dept. of Transportation requirements for the transportation of special fireworks.

Exception: For electrically ignited displays there is no requirement for separation of shells according to size or whether they are salutes.

2-2.5* During performance of an outdoor fireworks display, ready boxes shall be located at a distance of not less than 25 ft (7.7 m) upwind from the mortar placements. If the wind should shift during a display, the ready boxes shall be located so as to again be upwind from the discharge site.

Exception No. 1: When acceptable to the authority having jurisdiction, alternate measures shall be taken.

Exception No. 2: When there are no shells needing storage during a display, such as for an electrically ignited display, there is no need for ready boxes.

2-3 Installation of Mortars.

2-3.1* Prior to placement mortars shall be carefully inspected for defects, such as dents, bent ends, damaged interiors, and damaged plugs. Mortars found to be defective shall not be used.

2-3.2* Mortars shall be positioned so that shells are propelled away from spectators and over a fallout area. Under no circumstances shall mortars be angled toward the spectator viewing area. (*Also see Section 3-2.*)

2-3.3* Mortars shall be buried to a depth of at least $^2/_3$ to $^3/_4$ of their length, either in the ground or in above-ground troughs or drums.

Exception: Securely positioned mortar racks may be used for the firing of single break shells not exceeding 6 in. (152 mm) in diameter.

2-3.3.1 Under conditions when paper mortars may be damaged by placement in damp ground, paper mortars shall be placed inside a moisture-resistant bag prior to placement in damp ground.

2-3.3.1.1 Whenever there is the likelihood of ground water leaking into the mortar, the mortar shall be placed inside a water-resistant bag prior to placement in the ground.

2-3.3.2 Weather-resistant coverings shall be placed over the mouth of mortars whenever there is imminent danger of water collecting in the mortars.

2-3.3.3* In soft ground, when there is significant danger of the mortars being driven further into the ground when they are fired, sufficient added support shall be placed beneath the mortars.

Exception: When a mortar is only to be used once, such as for an electrically fired display, added support shall be optional.

2-3.3.4* Mortars that are buried in the ground, in troughs, or in drums shall be separated from adjacent mortars by a distance at least equal to the diameter of the mortar. Mortars in troughs or drums shall be positioned to afford the maximum protection to the shooter.

Exception: This requirement shall not apply when electrical firing is used.

2-3.3.5 If troughs and drums are used, they shall be filled with sand or soft dirt; in no case shall stones or other possibly dangerous debris be present.

2-3.3.6 Whenever more than 3 shells are to be chain fused, such as for sequential firing, additional measures are required to prevent adjacent mortars from being repositioned in the event that a shell detonates in a mortar, causing it to burst. For buried mortars, this shall be accomplished by placing the mortars with a minimum separation of four times their diameter. For mortars in racks, this shall be accomplished by using mortar racks that have sufficient strength to successfully withstand such a failure.

Exception No. 1: When there is doubt concerning the strength of racks holding chain fused mortars, the separation distances for those racks shall be twice those listed in Table 3-1.3 for the largest mortar in the sequence.

Exception No. 2: When the separation distance is two times that required in Table 3-1.3, buried mortars shall be separated by a minimum of one times the internal diameter of the largest mortar in the sequence.

2-3.3.7* When mortars are to be reloaded during a display, mortars of various sizes shall not be intermixed. Mortars of the same size shall be placed in groups, and the groups must be separated from one another.

2-3.4 When personnel are to be in the immediate area of the mortars during an outdoor fireworks display, sand bags or other suitable protection shall be placed around the mortars up to the approximate level of the mouth of the mortar in each direction where personnel could be located.

2-3.5 Mortars shall be inspected before the first shells are loaded to be certain that no water or debris has accumulated in the bottom of the mortar.

2-3.6* Mortars shall be of sufficient strength and durability to safely fire the aerial shells to be used.

2-3.6.1 Cast iron mortars shall not be used.

2-3.6.2 Metal mortars shall be either seamed or seamless; however, seamed mortars must be placed such that the seam is facing either right or left as one faces the line of mortars.

2-3.6.3* Mortars shall be of sufficient length to cause aerial shells to be propelled to safe heights.

2-3.7* A cleaning tool shall be provided for the cleaning of debris from mortars as necessary.

Exception: When mortars are not to be reloaded during a display, there is no requirement for a cleaning tool.

2-3.8 Numerals indicating the inside diameter of the mortar shall be conspicuously painted or otherwise marked on the top of all mortars.

Exception: This numeral designation is not mandatory for outdoor fireworks displays fired under the direct control of a professional fireworks display company.

2-4 Electrical Firing Unit.

2-4.1 The purpose of this section is to provide guidance for the design of electrical firing units to be used when it is decided to electrically fire outdoor fireworks displays.

2-4.2 At no point shall electrical contact be allowed to occur between any wiring associated with the electrical firing unit and any metal object in contact with the ground.

2-4.2.1 If the electrical firing unit is powered from AC power lines, some form of line isolation shall be employed (e.g., a line isolation transformer).

2-4.3* The electrical firing unit shall include a key-operated switch or other similar device that greatly reduces the possibility that unauthorized or unintentional firings can occur.

Exception: When the electrical firing unit is very small in size and attached to the wire running to electric matches for the brief duration of the actual firing, there is no requirement for a key-operated switch.

2-4.3.1 Manually activated electrical firing units shall be designed such that at least 2 positive actions must be taken to apply electric current to an electric match. For example, this might be accomplished with 2 switches in series, both of which must be operated in order to pass current.

2-4.3.2 Computer-activated automatic sequencing type electrical firing units shall have some form of "dead-man-switch," such that all firings will cease the moment the switch is released.

2-4.4 If the electrical firing unit has a built-in test circuit, the unit shall be designed to limit the test current (into a short circuit) to 0.05 ampere or to 20% of the no-fire current of the electric match, whichever is less.

2-4.4.1 Multi-testers, such as Volt-Ohm Meters, shall not be used for testing unless their maximum current delivering potential has been measured and found to meet the requirements of 2-4.4.

2-4.4.2 When any testing of firing circuits is performed, no person shall be allowed to be present in the immediate area of fireworks that have been attached to the electrical firing unit.

Chapter 3 Site Selection

3-1 General.

3-1.1 The intent of this chapter is to provide guidance for clearances upon which the authority having jurisdiction shall base its approval of the outdoor fireworks display site. Where

added safety precautions have been taken, or particularly favorable conditions exist, the authority having jurisdiction shall decrease the recommended separation distances as it deems appropriate. When unusual or safety threatening conditions exist, the authority having jurisdiction shall increase the recommended separation distances as it deems necessary.

3-1.2 The areas selected for the discharge site, spectator viewing area, parking areas, and the fallout area shall be inspected and approved by the authority having jurisdiction.

3-1.3* The site for the outdoor display shall have at least a 70 ft (22 m) radius per inch of internal mortar diameter of the largest aerial shell to be fired, except as noted in Table 3-1.3. No spectators, dwellings, or spectator parking areas shall be located within the display site.

3-1.3.1 Distances from health care and detention and correctional facilities shall be at least twice the distances specified in Table 3-1.3.

NOTE: See NFPA *101®, Life Safety Code®*, for definitions of health care and detention and correctional facilities.

Exception: With the approval of the health care or detention and correctional facility, this requirement shall be waived.

3-1.3.2 Distances from bulk storage areas of materials that have a flammability, explosive, or toxic hazard shall be twice that required by Table 3-1.3.

NOTE: To determine whether materials are considered to possess these hazards, see NFPA 325M, *Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids*, and NFPA 49, *Hazardous Chemicals Data*.

Table 3-1.3 Minimum Radius of Display Site for Outdoor Display of Fireworks

Shell Size	Minimum Radius of Display Site for Outdoor Display of Fireworks
< 3 in. (76 mm)	140 ft (43 m)
3 in.(76 mm)	210 ft (64 m)
4 in. (102 mm)	280 ft (85 m)
5 in. (127 mm)	350 ft (107 m)
6 in. (152 mm)	420 ft (128 m)
7 in. (178 mm)	490 ft (149 m)
8 in. (203 mm)	560 ft (170 m)
10 in. (254 mm)	700 ft (214 m)
12 in. (305 mm)	840 ft (256 m)
> 12 in. (305 mm)	Approval of authority having jurisdiction

For SI Units: 1 in. = 25.4 mm

3-2 Discharge Site.

3-2.1 The area selected for the discharge of aerial shells shall be located so that the trajectory of the shells shall not come within 25 ft (7.7 m) of any overhead object.

3-2.2 Ground display pieces shall be located at a minimum distance of 75 ft (23 m) from spectator viewing areas and parking areas.

Exception: For ground pieces with greater hazard potential (such as large wheels with powerful drivers, roman candle batteries, and items employing large salutes) the minimum separation distance shall be increased to 125 ft (38.5 m).

3-2.3* When the mortars are positioned vertically, the mortars shall be placed at the approximate center of the display site.

3-2.3.1* When aerial shells are to be stored at the discharge site for subsequent loading into mortars during the display, mortars shall be placed at least 1/6, but not more than 1/3, the distance from the center of the display site toward the main spectator area. The mortars shall be angled such that any dud shells will fall at a point approximately equal to the offset of the mortars from the center of the display site but in the opposite direction.

3-2.4 Fireworks shall not be discharged within 100 feet (31 m) of any tent or canvas shelter.

3-3 Fallout Area.

3-3.1* The fallout area shall be a large open area.

3-3.2 Spectators, vehicles, or readily combustible materials shall not be located within the fallout area during the display.

Chapter 4 Operation of the Display

4-1 General Requirements.

4-1.1 The sponsor of the display shall provide adequate fire protection for the display.

4-1.1.1* The sponsor shall consult with the authority having jurisdiction to determine the level of fire protection required.

4-1.2* Monitors whose sole duty shall be the enforcement of crowd control shall be located around the display area by the sponsor. The authority having jurisdiction shall approve the provisions for crowd control.

4-1.2.1 Monitors shall be located around the discharge site to prevent spectators or any other unauthorized persons from entering the discharge site. The discharge site shall be so restricted throughout the display and until the discharge site has been inspected after the display. Where practical, fences and rope barriers shall be used to aid in crowd control.

4-1.2.2 During the period before the display, when pyrotechnic materials are present, unescorted public access to the site shall not be allowed.

4-1.3 The operator has the primary responsibility for safety. While the operator is allowed to actively participate in the firing of the fireworks display, safety shall be his primary concern.

4-1.3.1* The operator is responsible for ensuring that a sufficient number of assistants are on hand for the safe conduct of the fireworks display. Only the operator and necessary assistants shall be permitted in the discharge area while the display is in progress.

4-1.3.2 The operator is responsible for ensuring that all assistants are fully trained in the proper performance of their assigned tasks and that they are knowledgeable of safety hazards.

4-1.4 Whenever, in the opinion of the authority having jurisdiction or the operator, any adverse condition exists that significantly affects safety, the fireworks display shall be postponed until the condition is corrected.

4-1.4.1 If, in the opinion of the authority having jurisdiction or the operator, the lack of crowd control poses a danger, the fireworks display shall immediately be discontinued until such time as the situation is corrected.

4-1.4.2 If high winds, precipitation, or other adverse weather conditions prevail, such that in the opinion of the authority having jurisdiction or the operator a significant safety danger exists, the fireworks display shall be postponed until weather conditions improve to an acceptable level.

4-1.5 Operators and assistants shall use only flashlights or electric lighting for artificial illumination.

4-1.6 No smoking shall be allowed within 50 ft (15.2 m) of any area where fireworks or other pyrotechnic materials are present.

4-1.7 Measures shall be taken to protect all pyrotechnic materials to be used in the display from adverse weather conditions. Moisture-damaged materials shall not be used.

4-1.8 No person shall be allowed in the discharge area while under the influence of alcohol, narcotics, or drugs that could adversely affect judgment, movement, or stability.

4-2 Firing of Shells.

4-2.1* Shells shall be carried from the storage area to the discharge site only by their bodies, never by their fuses.

Exception: As specified in 4-2.3

4-2.2 Shells shall be checked for proper fit in their mortars prior to the display.

4-2.3* When being loaded into the mortars, shells shall be held by their fuses or lowering cord if provided and carefully lowered into the mortar. At no time shall the person loading the shells place any part of his body over the mouth of the mortar.

4-2.4* The person loading shells shall be reasonably certain that the shell is properly seated in the bottom of the mortar.

4-2.5 Shells shall not, under any circumstances, be forced into a mortar too small to accept them. Shells that do not fit properly into the mortars shall not be fired; they shall be disposed of according to the procedure described in 4-2.8.

4-2.6 Shells shall be ignited by lighting the tip of the fuse with a fusee, torch, portfire, or similar device. The operator shall never place any part of his body over the mortar at any time. As soon as the fuse is ignited, the operator shall retreat from the mortar area.

Exception: Alternatively, electrical ignition may be used.

4-2.6.1 The safety cap protecting the fuse shall not be removed by the person responsible for igniting the fuse until immediately before the shell is to be fired.

Exception: Where electrical ignition is used.

4-2.7 The first shell fired shall be observed carefully to determine that its trajectory is such that the shell functions over the fallout area and that any dangerous debris or unexploded shells will land in the fallout area.

4-2.7.1 The display shall be interrupted and the mortars shall be re-angled or repositioned as necessary for safety any time during an outdoor fireworks display.

4-2.8* In the event of a shell failing to ignite in the mortar, the mortar shall be marked in some manner to indicate the presence of an unfired shell, and the mortar shall not be reloaded or reused so long as the misfired shell remains. Immediately following the display but no sooner than 15 minutes after the attempted firing, if the shell still has not fired, the mortar shall be cautiously flooded with water and let stand for a minimum of 5 minutes before it is cautiously emptied of the shell. The supplier shall be contacted as soon as possible for proper disposal instructions.

Exception: When electrical ignition is used and the firing failure is electrical in nature or the aerial shell was intentionally not fired, the shell may be salvaged by the operator.

4-2.8.1* It is the responsibility of the person igniting the aerial shells to detect when a shell does not fire from a mortar. That person shall warn others in the area and immediately shall cause the mortar to be marked to indicate the presence of an unfired aerial shell.

Exception: When electrically firing, it is not necessary to mark the mortar. However, persons entering the area after the fireworks display shall conduct themselves as though unfired shells remain until advised to the contrary by the operator.

4-2.9* Manual re-ignition of chain fused aerial shells shall only be attempted at properly installed ignition points.

4-2.10* Following the display, the firing crew shall conduct an inspection of the fallout area for the purpose of locating any unexploded aerial shells. This inspection shall be conducted before any public access to the site is allowed. Any shells found during the search shall not be handled until at least fifteen minutes have elapsed from the time the shells

were fired. The fireworks shall then be doused with water and allowed to remain for at least five more minutes before being cautiously placed in a plastic bucket or fiberboard box. The supplier shall be contacted as soon as possible for disposal instructions.

4-2.10.1 When fireworks are displayed at night and it is not possible to thoroughly inspect the site, the operator shall ensure that the entire site is reinspected very early the following morning.

4-3 Ground Display Pieces.

4-3.1 To the extent that it is practical, all ground pieces shall be positioned outside of the discharge area of aerial displays.

Exception No. 1: When ground display pieces are to be fired electrically, they can be located in the fallout area.

Exception No. 2: When aerial shells have been preloaded, ground display pieces can be located in that discharge area.

4-3.2 Dry grass or combustible materials located beneath ground display pieces shall be wet down before the display if they are in sufficient quantity to be a fire hazard.

4-3.3 Poles for ground display pieces shall be securely placed and firmly braced so that they will not fall over during functioning of the firework device.

4-3.4 Specific instructions from the supplier shall accompany all ground display pieces. A list of required accessories also shall be supplied.

Exception: Specific instructions are not mandatory for outdoor fireworks displays fired under the direct control of a professional display company.

Chapter 5 Qualifications

5-1 Operator Qualifications.

5-1.1 All operators shall be at least 21 years old and licensed or approved by the authority having jurisdiction in accordance with any and all applicable laws.

5-1.2 Applicants for licensing as operators shall successfully complete a written examination of laws, regulations, and safety practices pertaining to the discharge of fireworks administered by the authority having jurisdiction, or otherwise demonstrate proficiency.

5-2 Assistants. All assistants shall be at least 18 years of age.

5-3 Permits Required.

5-3.1 The fireworks display company, the organization, or the group of individuals shall obtain a permit from the authority having jurisdiction prior to performing the fireworks display.

5-3.2 As part of the permit process, the fireworks display company, the organization, or the group of individuals shall demonstrate financial responsibility by providing proof of insurance or by other appropriate means.

Chapter 6 Referenced Publications

6-1 The following documents or portions thereof are referenced within this code and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

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

NFPA 1122-1987, *Code for Unmanned Rockets*

NFPA 1124-1988, *Code for the Manufacture, Transportation, and Storage of Fireworks.*

6-1.2 Government Publications.

6-1.2.1 US Government Publications. Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Title 16, *Code of Federal Regulations*, Parts 1500 and 1507, U.S. Consumer Products Safety Commission Labeling Regulations, Federal Hazardous Substances Act

Title 27, *Code of Federal Regulations*, Part 18, Bureau of Alcohol, Tobacco and Firearms, Part 181, Commerce in Explosives

Title 49, *Code of Federal Regulations*, U.S. Department of Transportation, Parts 171-177, Hazardous Materials Regulations.

Appendix A

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

A-1-4 Fireworks, Exception No. 1. The regulations referred to limit the explosive content of each cap to not more than an average of 0.25 grains (16.25 mg). Also, each package containing such caps must be labeled to indicate the maximum explosive content per cap.

A-2-1.2 If there is doubt whether aerial shells were manufactured to operate safely, or if there is doubt whether the mortars and shells are properly sized, it is recommended that test firings be conducted in order to establish whether or not they perform safely. It is generally believed that shells should be constructed so that the difference between the inside diameter of the mortar and the outside diameter of the shell is no less than $\frac{1}{8}$ in. (3.2 mm) for all shell sizes. Further, it is generally believed that aerial shells should be constructed so that the difference between the inside diameter of the mortar and the outside diameter of the shell is no more than $\frac{1}{4}$ in. (6.4 mm) for 2 in. (51 mm) through 3 in. (76 mm) shells; $\frac{3}{8}$ in. (9.4 mm) for 4 in. (102 mm) through 6 in. (152 mm) shells; or $\frac{1}{2}$ in. (12.7 mm) for shells larger than 6 in. (152 mm).

A-2-2.5 An example of additional protection to ready boxes would be the use of a flame-resistant tarpaulin meeting the requirements of NFPA 701, *Standard Methods of Fire Tests for Flame-Resistant Textiles and Films.*

A-2-3.1 The requirements for careful inspection of mortars is of particular importance for paper mortars that can sustain undetected damage to their interiors that can result in serious malfunctions.

A-2-3.2 If there is doubt concerning the proper angling of mortars, it is appropriate to fire one or more test shells for verification.

A-2-3.3 All mortars are capable of generating dangerous flying debris and this must be taken into consideration, especially when above ground; e.g., racks.

A-2-3.3.3 Examples of materials for use in providing added support are wood and flat stones.

A-2-3.3.4 When practical, additional separation distances between buried mortars is recommended.

A-2-3.3.7 To the extent practical, when mortars are to be reloaded during a display, groups of one size mortars should not be placed adjacent to mortars of only 1 inch difference in diameter. This will reduce the likelihood that shells will be loaded into oversized mortars. For example, an arrangement of mortar groups such as 5 in. – 3 in. – 6 in. – 4 in. (127 mm – 76 mm – 152 mm – 102 mm) is greatly preferred over an arrangement such as 3 in. – 4 in. – 5 in. – 6 in. (76 mm – 102 mm – 127 mm – 152 mm).

A-2-3.6 If there is reason to doubt that the strength of a mortar is adequate, a test may be devised to determine whether its strength is sufficient. One possible strength test for mortars is to fire the heaviest aerial shell of a given size to be used with a charge of lift powder that is 1.5 times the normal amount. This will approximately double the normal stress on the mortar. In addition, mortars meeting the following specifications generally are believed to have ample strength:

Steel Mortars:

Minimum Mortar Wall Thickness (inches) (a)

Mortar ID (in.)	Spherical	Cylindrical Single Break	Cylindrical Multi-Break(b)
3	0.04	0.11	0.21
4	0.05	0.12	0.23
5	0.06	0.13	0.25
6	0.07	0.14	0.27
8	0.09	0.16	0.31
10	0.11	0.18	0.35
12	0.13	0.20	0.39

For SI units: 1 in. = 25.4 mm

(a) The tensile strength of steel pipe should be at least 40,000 psi.

(b) Wall thicknesses are those of American National Standard Schedule 40 wrought pipe.

Paper Mortars (Convolute or Spiral):

Minimum Mortar Wall Thickness (inches)(a)

Mortar ID (in.)	Spherical	Cylindrical Single Break	Cylindrical Two Break
3	0.25	0.25	0.37
4	0.25	0.33	0.50
5	0.31	0.42	0.62
6	0.37	0.50	0.75
8	0.50	0.62	(b)
10	0.62	(b)	(b)
12	0.75	(b)	(b)

For SI Units: 1 in. = 25.4 mm

(a) The cross-grain tensile strength of the paper should be at least 2,300 psi.

(b) Data not currently available.

High Density Polyethylene Mortars:

Minimum Mortar Wall Thickness (inches) (a)

Mortar ID (in.)	Spherical	Cylindrical Single Break	Cylindrical Two Break
3	0.15	0.20	(b)
4	0.20	0.26	(b)
5	0.25	(b)	(b)
6	0.30	(b)	(b)

For SI units: 1 in. = 25.4 mm

(a) The tensile strength of plastic should be at least 3,500 psi.

(b) Data not currently available.

A-2-3.6.3 When there is concern that a mortar may be too short to cause an aerial shell to be propelled to a safe altitude, it is best to conduct a test firing. However, it generally is believed that mortars of the following length are sufficient:

Minimum Inside Mortar Length (inches)

Mortar ID (in.)	Single Break	Double Break	Up to 4-Break
3	15	18	21
4	20	23	27
5	24	28	32
6	28	32	37
8	34	40	46
10	40	46	54
12	46	52	62

For SI units: 1 in. = 25.4 mm

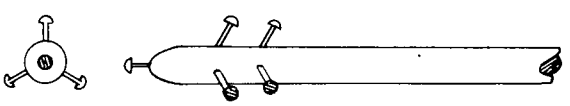

Figure A-2-3.7 A mortar cleaning tool made from a broom handle.

A-2-3.7 In most cases, when aerial shells fire from mortars, relatively little debris remains in the mortar, and that amount remaining usually is not sufficient to cause a malfunction of

the next shell to be fired. The operation of cleaning mortars is dangerous because of the possibility that the mortar may contain a live aerial shell that has not yet fired. Thus, it is appropriate that mortars not be cleaned after every firing but only when it is found to be necessary. An acceptable tool is shown in Figure A-2-3.7.

A-2-4.3 It is preferred that electrical firing units have some form of warning device to indicate when the unit is armed and capable of igniting attached electric matches. This could be accomplished using warning lights or audio alarms.

A-3-1.3 When more than one person will be igniting the aerial shells for an outdoor fireworks display, it is preferred that the line of mortars be separated in some manner and that only one person be lighting shells in each area.

A-3-2.3 Figure A-3-2.3 demonstrates some of the requirements for a suitable display site where mortars are placed vertically, such as may be the case for an electrically ignited display.

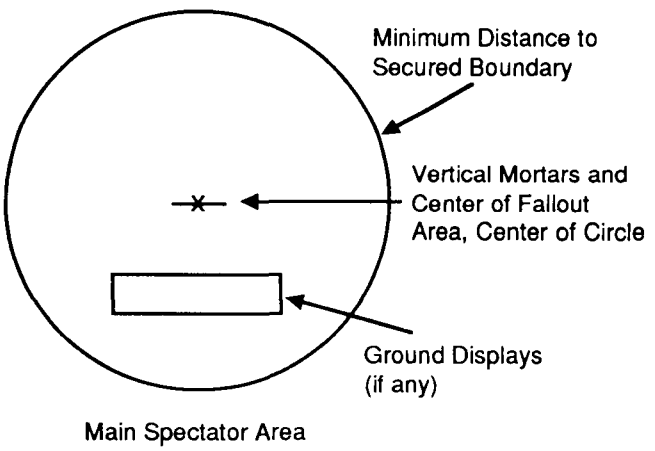

Figure A-3-2.3 Typical layout for a display site with vertically positioned mortars.

A-3-2.3.1 Figure A-3-2.3.1 demonstrates some of the requirements for a suitable display site when aerial shells are to be stored at the discharge site for subsequent loading into mortars during the display, such as may be the case for a manually ignited display.

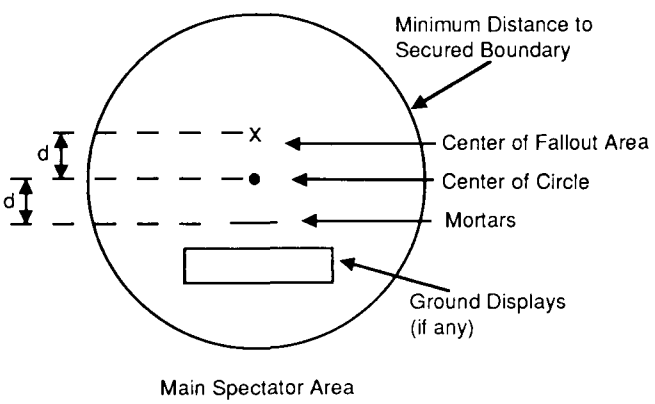

Figure A-3-2.3.1 Typical layout for a display site using angled mortars. The distance indicated as "d" shall be at least 1/6 but not more than 1/3 the radius of the circle indicating the minimum distance to the secured boundary.

A-3-3.1 The presence of a modest number of trees and shrubs is not considered to pose a safety problem, providing that they are not so numerous as to make it significantly more difficult to locate unexploded aerial shells or that they pose a serious fire safety threat.

A-4-1.1.1 The authority having jurisdiction should be consulted well enough in advance so that the required fire protection may be arranged for. Fire protection may include portable fire extinguishers for the discharge area and standby fire apparatus for protection down range.

A-4-1.2 Monitors should wear some distinctive identification, e.g., badges, brightly colored vests, etc.

A-4-1.3.1 In most situations, it is believed that it is appropriate to have one person tending each ready box or shell storage area in use at a given time. Similarly, it is believed that there should be 2 persons reloading shells into mortars for each person igniting the aerial shells. Unless racks of chain fused shells are being fired, it generally is believed that a single person can safely ignite no more than about 10 shells per minute. If a greater rate of firing is desired, it is appropriate to have more than one person lighting them.

A-4-2.1 It should be noted that shell fuses can be damaged by rough handling. Therefore, appropriate care should be taken when handling shells and fuses.

A-4-2.3 It generally is believed that it is not safe to be loading mortars within 10 ft (3 m) of mortars that are being fired. When loading a shell into a recently fired mortar, the person should crouch along side the mortar with his back toward the area where shells are being fired.

A-4-2.4 If there is doubt concerning whether a shell has been properly seated in the bottom of the mortar, a gentle tug on the fuse usually will determine this.

A-4-2.8 The operator and assistants should use extreme caution whenever approaching or handling a malfunctioned live aerial shell. Before approaching or handling the shell, as much time as practical should be allowed to pass. This will minimize the possibility that the shell still contains a live spark that could cause the shell to explode unexpectedly. Operators or assistants never should attempt to dry or repair a damaged shell. In all such cases the supplier should be contacted for disposal instructions.

A-4-2.8.1 When firing aerial shells electrically or as a finale or barrage, it often is difficult to detect when unfired shells remain in the mortars. Thus, it is advisable to use some method to aid in identifying when shells have not fired properly. One such method is to place a strip of paper tape over the mouth of each mortar, then the presence of unbroken tape is a sure indication that the shell has not fired. However, it should be noted that broken tape is NOT a certain indication that the shell has fired. Always assume the mortar is loaded.

A-4-2.9 Remaining within 25 ft (7.7 m) of chain fused aerial shells after their ignition, for the purpose of manual re-ignition, is unreasonably dangerous. Similarly, the act of manual re-ignition of chain fused aerial shells is dangerous unless re-ignition is attempted at properly installed ignition points.

The necessity for such actions may be avoided through the use of redundant fusing or multiple ignition points.

A-4-2.10 The operator and assistants should use extreme caution whenever approaching a malfunctioned live aerial shell. Before approaching or handling the shell, as much time as practical should be allowed to pass. This will minimize the possibility that the shell still contains a live spark that could cause the shell to explode unexpectedly. Operators or assistants should never attempt to dry or reuse a shell that has malfunctioned. In all such cases the supplier should be contacted for disposal instructions.

Appendix B

This Appendix is not a part of the requirements of this NFPA document. Appendix B provides additional explanatory information on the requirements in 2-1.3.

B-2-1.3 Labeling of Special Fireworks Aerial Shells.

B-2-1.3.1 As a minimum, each shell should bear a label containing the following information:

(a) A description of the size of the shell (e.g., "3-in. (76 mm) shell");

(b) A description of the type of shell (e.g, "2-break with report");

(c) A warning statement reading:

WARNING: DANGEROUS EXPLOSIVE
If found, do not handle –
Contact local fire or
police department

(d) The name and place of business of the manufacturer, importer, or distributor.

B-2-1.3.2 Conspicuousness.

(a) The statement "WARNING: DANGEROUS EXPLOSIVE" should be printed in capital letters having a printed image of at least 1/8 in. (3.2 mm) and should be underlined.

(b) The remaining printed matter need not be printed in capital letters but should have a printed image at least 1/8 in. (3.2 mm).

(c) 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 sq in. (57.8 sq cm), unless the size of the shell is too small to accommodate such size, in which case the size may be reduced but to a size no smaller than necessary.

Appendix C Suggested Regulations for Applications for Permits for the Outdoor Display of Fireworks

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

1. Application for permit to operate a display of outdoor fireworks in conformance with the terms of _____ of the General Laws of _____ shall be made in writing on forms provided by the authority having jurisdiction.

2. Such application shall set forth:

(a) The name of the individual, group, or organization sponsoring the outdoor fireworks display together with the names of persons actually in charge of the firing of the display.

(b) Evidence of financial responsibility.

(c) The date and time of day at which the outdoor fireworks display is to be held.

(d) The exact location planned for the outdoor fireworks display.

(e) Confirmation of the license of the operator and the number of assistants that will be present.

(f) The approximate number and kinds of fireworks to be discharged.

(g) The manner and place of storage of such fireworks prior to delivery to the outdoor fireworks display site.

(h) A diagram of the grounds on which the outdoor fireworks display is to be held showing the point at which the fireworks are to be discharged, the location of all buildings, highways and other lines of communication, the lines behind which the audience will be restrained, and the location of other possible overhead obstructions.

3. Upon receipt of such application _____ days in advance of the date set for this outdoor fireworks display, the authority having jurisdiction shall make, or cause to be made, an investigation of the site of the proposed display for the purpose of determining whether provisions of these regulations are complied with in the case of the particular display.

Appendix D Suggested Requirements for Operator Licensing

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

D-1 Operator Licensing Requirements.

D-1.1 A requirement of licensing is that the applicant has attained the age of 21 years.

D-1.2 A requirement of licensing is that the applicant has passed a comprehensive written examination covering state laws pertaining to the display of fireworks and this code. At the option of the issuing office, an alternate requirement may be substituted, such as acceptance of competency certification by a national organization or of licensing by another state.

D-1.3 A requirement of licensing is that the applicant has provided evidence of actively participating in the performance of at least 5 outdoor fireworks displays. At the option of the issuing office, an alternate requirement may be substituted.

D-2 Provisions of Operator Licensing.

D-2.1 The license shall be valid for a period of 4 years.

D-2.2 Renewal of the license shall be automatic upon provision of proof of actively participating in at least 3 outdoor fireworks displays during the prior 4 years.

Appendix E Referenced Publications

E-1 The following documents or portions thereof are referenced within this code for informational purposes only and

thus are not considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

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

NFPA 10-1988, *Standard for Portable Fire Extinguishers.*

NFPA 49-1975, *Hazardous Chemicals Data*

NFPA 101-1988, *Life Safety Code®*

NFPA 325M-1984, *Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids*

NFPA 701-1989, *Standard Methods of Fire Tests for Flame-Resistant Textiles and Films*

Index