ANSI/NFPA 1126 An American National Standard August 14, 1992

NFPA 1126 Pyrotechnics before a Proximate Audience 1992 Edition

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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.

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NFPA 1126

Standard for the

Use of Pyrotechnics before a Proximate Audience

1992 Edition

This edition of NFPA 1126, *Standard for the Use of Pyrotechnics before a Proximate Audience*, 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, 1992 in New Orleans, LA. It was issued by the Standards Council on July 17, 1992, with an effective date of August 14, 1992.

The 1992 edition of this document has been approved by the American National Standards Institute.

Origin and Development of NFPA 1126

NFPA 1126, *Standard for the Use of Pyrotechnics before a Proximate Audience*, is a new standard. It was developed by the Pyrotechnics Committee in response to a recognized need for a document to provide guidance to public safety officials for the safe use of pyrotechnic special effects at both indoor and outdoor locations. The purpose of this standard is to provide requirements for reasonable protection for pyrotechnic operators, performers, support personnel, and viewing proximate audiences where pyrotechnic special effects are used indoors and outdoors.

The standard was submitted and adopted at the Annual Meeting in New Orleans, Louisiana, May 18-21, 1992. The 1992 edition is the first edition of this standard.

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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.

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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 7 and Appendix E.

Chapter 1 General

1-1 Scope.

1-1.1 This standard shall apply to the use of pyrotechnic special effects in the performing arts in conjunction with theatrical, musical, or any similar productions before a proximate audience, performers, or support personnel.

1-1.2 This standard shall apply to any indoor display of pyrotechnic special effects.

1-1.3 This standard shall apply to any outdoor use of pyrotechnic special effects at distances less than those required by NFPA 1123, *Code for the Outdoor Display of Fireworks*. The use of pyrotechnic special effects before a proximate audience shall not be construed as an outdoor display of fireworks as regulated by NFPA 1123, *Code for the Outdoor Display of Fireworks*.

Exception: Any use of aerial shells as regulated in NFPA 1123, Code for the Outdoor Display of Fireworks, shall comply with the provisions of that code.

1-1.4 This standard shall apply to the videotaping, audiotaping, or filming of any television, radio, or movie production only if such production shall be before a proximate audience and such productions include the use of pyrotechnic special effects.

1-1.5 This standard shall apply to the rehearsal of any production in which pyrotechnic special effects are used.

1-1.6 This standard 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.*)

1-1.7 This standard shall not apply to the use of common fireworks by the general public.

1-1.8 This standard shall not apply to the manufacture, transportation, storage, and use of explosives. (*See NFPA 495, Explosive Materials Code.*)

1-1.9 This standard shall not apply to the transportation, handling, or use of pyrotechnic materials and devices by the Armed Forces of the United States of America.

1-1.10 This standard shall not apply to the transportation of pyrotechnic materials and devices approved and governed by U.S. Department of Transportation regulations.

1-1.11 This standard shall not apply to the use of pyrotechnics special effects in training. (*See NFPA 1403, Standard on Live Fire Training Evolutions in Structures.*)

1-1.12 Facilities in or at which pyrotechnic special effects are to be used or stored shall comply with the applicable provisions of NFPA *101,® Life Safety Code.®* Pyrotechnic special effects shall be permitted to be used in accordance with the provisions of NFPA *101*, Section 31-2.3, Open Flame Devices, when approved by the authority having jurisdiction.

1-1.13 This standard shall not apply to the use of flammable liquids and flammable gases in the performing arts. (*See NFPA 30, Flammable and Combustible Liquids Code, and NFPA 58, Standard for the Storage and Handling of Liquefied Petroleum Gases.*)

1-1.14 This standard shall not apply to the manufacture of model rocket motors as covered in NFPA 1125, *Code for the Manufacture of Model Rocket Motors*.

1-1.15 This standard shall not apply to the design, construction, limitation of propellant mass and power, and reliability of all rocket motors, other than fireworks rockets, produced commercially for sale to or use by the public for purposes of education, recreation, and sporting competition. (*See NFPA 1122, Code for Unmanned Rockets.*)

1-1.16 This standard 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 standard is to provide requirements for reasonable protection for pyrotechnic operators, performers, support personnel, and viewing proximate audiences where pyrotechnic special effects are used indoors or outdoors.

1-2.2 The purpose of this standard is to provide guidelines to the authority having jurisdiction for approval of such use.

1-2.3 The purpose of this standard is to provide suggested guidelines for local permit requirements.

1-3 Definitions.

NOTE: The following definitions are used in the body of this standard. Additional terms are listed in Appendix D.

Aerial Shell. Usually a cylindrical or spherical cartridge containing pyrotechnic material, 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 of the shell, the fuse and lift charge are consumed.

Airburst. An effect intended to be suspended in the air to simulate outdoor aerial fireworks shells without hazardous debris.

Approved. Acceptable to the "authority having jurisdiction."

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

Assistant. A person who works under the supervision of the pyrotechnic operator.

Audience. Those spectators whose primary purpose is to view a performance.

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

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since jurisdiction 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 have jurisdiction." In many circumstances, the property owner or a designated agent assumes the role of "authority having jurisdiction"; at government installations, the commanding officer or departmental official may be the "authority having jurisdiction."

Binary Materials. See Binary System.

Binary System. A two-component system for mixing certain pyrotechnic materials on site. Such items are commonly shipped as separate ingredients: an oxidizer, typically labeled "A"; and a fuel, typically labeled "B." These ingredients do not become a pyrotechnic material until they are mixed. For the purposes of this standard, the supplier of such ingredients shall be considered the manufacturer, not the person mixing the ingredients.

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

Comet. A pellet of pyrotechnic material projected from a mortar, which produces a streamer of sparks or fire. It is usually supplied as a preload with an integral mortar.

Concussion Effect. An effect intended to produce a loud noise and a violent jarring shock for dramatic effect.

Concussion Mortar. A device specifically designed and constructed to produce a loud noise without producing any damage.

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

Electrical Isolation. See Isolated Power Supply.

Explosives Special Effect. See Pyrotechnic Special Effect.

Fallout Area. The area in which any hazardous debris falls after a pyrotechnic device is fired. The fallout area is defined as a circle that, in turn, is defined by the fallout radius.

Fallout Radius. A line that defines the fallout area of a pyrotechnic device. It is defined by two points. The first point is the center of a pyrotechnic device. The second point is the point most distant from the center of the pyrotechnic device at which any hazardous debris from the device can fall.

Fire (v.). To ignite pyrotechnic materials by using a match, electrical current, or some other means.

Firing System. The source of ignition for pyrotechnic special effects devices. For an electrical system, it is the source of electric current used to initiate electric matches or other devices. Generally, the electrical firing system will have components, such as a primary key switch, test circuits, warning indicators, cables, isolation transformers, and switches to control the routing of the current to various pyrotechnic devices.

Fixed Production. Any production repeatedly performed in only one geographic location.

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

Flash Pot. A device containing flashpowder, intended to produce a flash of light and capable of directing the flash in an upward direction.

Flashpowder. A mixture of metal fuel and oxidizer. It is intended to be used to produce a flash of light, sparkles, an audible report, or a combination of these effects.

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. Fuels are an ingredient of pyrotechnic materials.

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

Hazardous Debris. Any debris produced or expelled by the functioning of a pyrotechnic device that is capable of causing personal injury or unpredicted property damage.

This includes but is not limited to hot sparks, heavy casing fragments, and unignited components. Confetti, lightweight foam pieces, feathers, novelties, etc., are not to be construed as hazardous debris.

Holder. Any device to hold a pyrotechnic device other than a mortar. The purpose of a holder is to maintain the position of a pyrotechnic device. Holders hold preloads, which are self-contained. A holder shall not be construed to be a mortar.

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 a pyrotechnic material by itself.

Integral Mortar. A preloaded mortar containing pyrotechnic materials and intended for only one firing.

Isolated Power Supply. An ungrounded power supply that provides electricity with both output wires isolated from ground. An isolated power supply can be an ungrounded generator, an ungrounded DC-to-AC converter, or commercial power supplied through an isolation transformer.

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

Magazine. Any building, structure, or indoor container used exclusively for the storage of explosive materials as defined in NFPA 495, *Explosive Materials Code*.

Manufacturer. The person who:

(a) Prepares any pyrotechnic material;

(b) Loads or assembles any pyrotechnic device.

Exception No. 1: In the case of binary systems, the supplier of preweighed or premeasured ingredients, not the person mixing the ingredients, is considered the manufacturer of any pyrotechnic materials created from binary components.

Exception No. 2: The person loading binary materials into devices supplied by the manufacturer of binary systems shall not be considered a manufacturer when such loading is performed according to the instructions of the manufacturer.

NOTE: A federal manufacturer license is required when a binary system is used and the components are mixed in the course of a trade or business to create an explosive material.

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

Mortar. A tube or a pot-like device used to direct and control the effect of the pyrotechnic material. Mortars also prevent debris from falling into unsafe areas. Mortars shall be sufficient in strength to withstand the firing of the pyrotechnic device or material without the mortar becoming distorted.

Oxidizer. Usually oxygen-rich, ionically bonded chemicals that decompose at moderate to high temperatures. When these chemicals decompose, they release 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.

Performance. The enactment of a musical, dramatic, or operatic show or other entertainment production. The enactment starts at its beginning and goes to its end according to a script, plan, or other preconceived list of events. A performance can include encores.

Performer. Any person active in the performance during which a pyrotechnic special effect occurs who is not audience or support personnel. Among others, performers can include, but are not limited to, actors, singers, musicians, acrobats, and the like.

Permittee. The person or persons who are responsible for obtaining the necessary permits for a production.

Preload. An item supplied by the manufacturer in a ready-to-use condition and intended to be used in accordance with the manufacturer's supplied instructions.

Production. All the performances of a musical, dramatic, operatic, or other series of shows. There are two types of productions: fixed and touring.

Proximate Audience. An audience closer to pyrotechnic devices than allowed by NFPA 1123, *Code for the Outdoor Display of Fireworks*.

Pyrotechnic Device. Any device containing pyrotechnic materials and capable of producing a special effect as defined in this standard.

Pyrotechnic Operator (Special Effects Operator). The person with responsibility for pyrotechnic safety and who controls, initiates, or otherwise creates special effects. The operator is also responsible for storing, setting up, and removing pyrotechnic materials or devices after a performance.

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

Pyrotechnics. The science of 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.

Pyrotechnics 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 predominantly consists 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.

Rehearsal. A practice performance during which no audience is present.

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

Saxon. A rotating effect consisting of a tube that rotates about a pivot point to produce a circular shower of sparks.

Shall. Indicates a mandatory requirement.

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

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

Special Effect. A visible or audible effect for entertainment purposes. Frequently an illusion; that is, something that appears to be other than what it really is. For example, smoke may be created to give an audience the impression of fog being present. Or a puff of smoke, a flash of light, and a loud sound may be produced to give an audience the impression that a cannon has fired, when in reality the cannon has not been fired.

Support Personnel. Any person who is not a performer or member of the audience. Among others, support personnel include the road crew of any production, stage hands, property masters, security guards, fire watch officers, janitors, or any other employee.

Touring Production. Any production performed in more than one geographic location.

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

Wheel. An effect that rotates on a central axis consisting of multiple gerbs or rockets attached to a framework.

Chapter 2 Transportation of Pyrotechnic Materials

2-1 Transportation. All pyrotechnic special effects materials and devices shall be transported in accordance with Title 49, *Code of Federal Regulations* ("Federal Regulation for Transport"), and any state and local requirements.

Chapter 3 Storage of Pyrotechnic Materials and Devices

3-1 All pyrotechnic materials and devices shall be stored in accordance with Title 27, *Code of Federal Regulations*, Subpart K ("Federal Storage Regulation") and any state and local regulations.

3-2 All pyrotechnic materials and devices not stored in magazines meeting the requirements of Title 27, CFR, Subpart K shall remain in their prescribed U.S. Department of Transportation containers until it becomes necessary to set them up for a performance. The time between removal from storage and actual use shall be the shortest practical time in view of the needs of a performance. Unless the pyrotechnic special effect devices are secured or inaccessible, they shall be supervised.

Exception: Unless pyrotechnic special effect devices are located in an inaccessible, secured, or supervised location.

3-3 Pyrotechnic materials and devices shall not be stored within 50 ft (15.3 m) of any unprotected source of heat or open flame.

NOTE: Binary materials are usually supplied in A and B packages, which are intended to be mixed as single units of fixed size. If more material than is required for the performance is prepared by mixing a single unit, the excess mixed material shall be considered, handled, stored, and disposed of as a pyrotechnic material of the appropriate explosive class.

Chapter 4 Permit Requirements and Operator Qualifications

4-1 Permit Requirements.

4-1.1 Permit requirements will vary with each location. The intent of this standard is to provide guidelines for the authority having jurisdiction to make a sound judgment as to the safety of the production and the qualifications of the pyrotechnic operator.

4-1.2 All use of pyrotechnic materials or devices shall be approved by the authority having jurisdiction.

4-2 Pyrotechnic Special Effects Plans. Before the performance of any production, the permit applicant shall submit a plan for the use of pyrotechnic special effects to the authority having jurisdiction. After a permit has been granted, the permittee shall keep the plan available at the site for safety inspectors or other designated agents of the authority having jurisdiction. Any performance adding pyrotechnic special effects different from the performance described in the permittee's plan shall require approval by the authority having jurisdiction.

4-3 Content of Plans.

4-3.1 The plan for the use of pyrotechnic special effects shall be made in writing or such other form as is acceptable to the authority having jurisdiction.

4-3.2 The plan shall set forth the following:

(a) The name of the person, group, or organization sponsoring the production.

(b) The date and time of day of the production.

(c) The exact location of the production.

(d) The name of the person actually in charge of creating the pyrotechnic special effect; that is, the pyrotechnic operator.

(e) The number, names, and ages of all assistants that will be present.

(f) The qualifications of the pyrotechnic operator.

(g) The experience of the pyrotechnic operator in using pyrotechnic special effects.

(h) Confirmation of any applicable state and federal licenses of the operator or assistant(s).

(i) Evidence of the permittee's insurance carrier or financial responsibility.

(j) The number and types of pyrotechnic devices and materials to be used, the operator's experience with those devices and effects, and a definition of the general responsibilities of assistants.

(k) A diagram of the grounds or facilities at which the production will be held. This diagram shall show the point at which the pyrotechnic devices are to be fired, the fallout radius for each pyrotechnic device used in the performance, and the lines behind which the audience shall be restrained.

(l) The point of on-site assembly of pyrotechnic devices.

(m) The manner and place of storage of the pyrotechnic materials and devices.

(n) The manufacturer(s) of the devices to be used shall be permitted in some cases to be the special effects person on the set.

(o) A material safety data sheet (MSDS) for the effect(s) to be used.

(p) Certifications that the set, scenery, and rigging materials are treated with appropriate flame retardant.

4-3.3 All plans shall be submitted as soon as feasible so that the authority having jurisdiction has sufficient time to be present and to notify other interested parties. In no event shall such notice be less than 24 hours unless acceptable to the authority having jurisdiction.

4-4 Pyrotechnic Special Effects Demonstration.

4-4.1 Upon request, a walk-through and a representative demonstration of the pyrotechnic special effects shall be given to the satisfaction of the authority having jurisdiction before a permit shall be approved. The demonstration shall be scheduled with enough time allowed to reset/reload the effects before the arrival of the audience.

Exception: The authority having jurisdiction shall be permitted to waive this requirement based on past history, prior knowledge, and other factors if the authority is confident that the discharge of pyrotechnic devices can be conducted safely.

4-4.2 Because some indoor pyrotechnic displays require smoke detectors to be bypassed and air-handling systems to be disengaged, the fire department shall be notified and a representative present for the demonstration. The building engineering staff shall place all fire protection and fire detection appliances, devices, and systems back to normal operating condition immediately upon completion of the demonstration. (*See also 6-7.6.*)

4-5 Qualifications of Operators and Assistants.

4-5.1 All pyrotechnic 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.

4-5.2 All assistants shall be at least 18 years old.

Chapter 5 Labeling of Pyrotechnic Preloads

5-1 All pyrotechnic preloads shall have identifying markings referring to an available sheet of instructions for use and a description of the effect produced. This instruction sheet shall identify the type of item and performance specification including (where applicable) the length of burn time, height, and diameter (fallout area) of the pyrotechnic special effect created by the device, a material safety data sheet (MSDS), and any other required or pertinent data or description. This information shall be available to the authority having jurisdiction.

5-2 Each pyrotechnic preload shall bear a label containing the following information:

(a) The name of the device.

(b) The name and address of the manufacturer.

(c) A warning statement describing the conditions of use and the nature of any hazards.

(d) Pyrotechnic devices acceptable for indoor use shall be so labeled.

NOTE: If the preload is too small to bear this label, this information shall be printed on the instruction sheet or on the shipping container for the preload.

Chapter 6 Use of Pyrotechnic Special Effects

6-1 General Fire Protection.

6-1.1 A sufficient number and classification of fire extinguishers shall be located within a reasonable distance of all pyrotechnic materials while the materials are being loaded, prepared for firing, or fired. In all cases, there shall be present at least two pressurized-water or pump extinguishers. Additional fire extinguishing equipment shall be provided as required by NFPA 10, *Standard for Portable Fire Extinguishers*, and the authority having jurisdiction.

6-1.2 A sufficient number of personnel having a working knowledge of the use of these fire extinguishers shall be present while the pyrotechnic materials are present so that these personnel can use the fire extinguishers if required.

6-1.3 These fire extinguishers and their knowledgeable operators shall remain on site until all pyrotechnic special effect devices and materials have been fired or disposed of in a safe manner.

6-1.4 The management of the performance site shall provide a separate, lockable room or suitable facility for the preparation of pyrotechnic materials and devices, acceptable to the pyrotechnic operator and the authority having jurisdiction, to prevent unauthorized personnel from gaining access to the pyrotechnic materials and devices. Provisions for lockable storage acceptable to the authority having jurisdiction shall be provided.

6-1.5 No personnel shall use or handle pyrotechnic materials or devices under the influence of intoxicating beverages, narcotics, controlled substances, or prescription or nonprescription drugs that can impair judgment.

6-1.6 If the performance requires the bypassing of any smoke detectors, the permittee shall arrange for a firewatch officer from the authority having jurisdiction to be available during performances and rehearsals. This firewatch officer shall be in direct communication with the local fire protection establishment. Bypassing of smoke detectors shall be minimized, but can be necessary to reduce the possibility of audience panic and shall be reactivated to working order as soon as possible. (*See also 6-7.6.*)

6-2 Firing Prerequisites.

6-2.1 All pyrotechnic special effect devices shall be mounted in a substantial manner to maintain the devices in their proper positions and orientations so that, when they are fired, the devices produce the pyrotechnic special effects described in the plan submitted by the permittee. Pyrotechnic devices shall be mounted so that no fallout from the device endangers human lives, results in personal injury, or damages property.

NOTE: Deliberate destruction of properties or portions of the set, when destroyed as part of the pyrotechnic special effects, shall not be construed as property damage.

6-2.2 Pyrotechnic materials shall be fired only from devices specifically constructed for the purpose of firing pyrotechnic materials.

6-2.2.1 The use of special effects flashpowder mortars consisting of converted electrical switch boxes, lamp sockets, or lamp holders, plug fuses, or similar devices is prohibited.

6-2.3 Binary materials shall be mixed and used in accordance with the manufacturer's instructions.

6-2.4 Binary materials shall be mixed one unit at a time, and no more units than are required for immediate use shall be mixed. Binary materials shall only be mixed in the bottles supplied. No additional tools shall be used.

6-2.5 All holders shall be constructed and secured so that they remain in a fixed position when the pyrotechnic device is fired.

6-2.6 Mortars and flash pots shall be constructed so that they do not fragment when the pyrotechnic material is fired and so that their shapes are not distorted after use. Distorted mortars and flash pots shall not be used.

6-2.7 Before firing of the pyrotechnic device, the pyrotechnic operator or designated performance security staff shall prevent unauthorized entry into the area where the pyrotechnic special effects shall occur.

6-2.8 Rotating devices, such as wheels and saxons, shall be securely mounted so that their rotation does not cause the holder to fail.

6-2.9 When rockets are launched before a proximate audience, performers, or support personnel, the rockets shall be securely attached to a guide wire or cable with both ends securely attached and an impact-resistant surface at the terminal end of the guide. This guide wire or cable shall be of sufficient strength and flame resistance to withstand the exhaust from the rocket. An effective stopping arrangement shall be provided.

6-2.10 Flares shall be placed so that any debris shall fall into a safe, flame-resistant area.

6-2.11 Comets and mines shall be fired so that the trajectory of their pyrotechnic material is not carried over the audience.

6-2.12 Waterfalls shall be placed so that no flammable materials are within their fallout area.

6-2.13 Pyrotechnic devices and materials used indoors shall be specifically manufactured and labeled for indoor use.

6-3 Firing Safeguards.

6-3.1 Any circuit tester shall not be capable of delivering sufficient energy to cause firing of the pyrotechnic device being tested. Permissible testers shall supply no more than 25 mA. Permissible testers include but are not limited to blasting galvanometers, low-current multimeters, or a firing system with a built-in circuit tester.

6-3.2 Power sources for firing pyrotechnic devices shall be restricted to batteries or isolated power supplies used for firing purposes only.

Exception: Firing systems employing isolation transformers can be powered by commercial power. Transformers can be located within the controllers of firing systems, within the pyrotechnic devices themselves, or elsewhere within the firing circuit.

6-3.3 All firing systems shall be designed to insure against accidental firing by providing at least a two-step interlock in which no firing power can be applied to any firing circuit unless the operator intentionally: (1) enables or arms the firing system, and (2) deliberately applies firing power.

6-3.3.1 Firing panels shall not be left unattended when connected to loaded pyrotechnic devices.

Exception: Panels that are disconnected from their power source and have a removable activator, keyswitch, or coded arming system.

6-3.4 Pyrotechnic devices shall only be fired when the area where the effect will occur is in clear view of: (1) the pyrotechnic operator, or (2) an assistant who is in direct

communication with the operator. This communication can be accomplished with signal lights or other nonverbal means of communication.

6-3.5* To allow the support personnel to take appropriate action, the use of warning signal lights to indicate the impending execution of a pyrotechnic effect is appropriate.

6-3.6 Because of their potential hazard, concussion mortars shall be placed in a secured location that shall prevent the audience and support personnel from coming into the secured location. The concussion mortars can be secured by placing them under the stage or by placing them behind barricades made of equipment road cases.

6-3.7 While the authority having jurisdiction has the authority to stop the discharge of a pyrotechnic special effect, the ultimate responsibility for firing shall lie with the pyrotechnic operator.

6-4 Separation Distances for Audiences.

6-4.1* Each pyrotechnic device fired during a performance shall be separated from the audience by at least 15 ft (4.6 m) but not less than 2 times the fallout radius of the device, unless otherwise approved by the authority having jurisdiction.

6-4.2 Concussion mortars shall be separated from the audience by a minimum of 25 ft (7.6 m).

6-5 Safety Precautions.

6-5.1 The premises where pyrotechnic materials and devices are handled and used shall be maintained in a neat and orderly condition and free of any conditions that can create a fire hazard.

6-5.2 The pyrotechnic operator shall inspect the containers in which all pyrotechnic materials and devices have been shipped. All damaged pyrotechnic materials and devices shall be disposed of in accordance with the manufacturer's recommendations and shall not be used. Before disposal, shipping containers shall be inspected for loose pyrotechnic materials. If a shipping container is found to contain loose pyrotechnic materials, it shall also be disposed of in accordance with the manufacturer's instructions.

6-5.3 Pyrotechnic materials and devices shall be stored in accordance with regulations promulgated by the Bureau of Alcohol, Tobacco, and Firearms (BATF). A closed vehicle, such as a truck, shall be permitted to be used for storage when allowed by BATF regulations.

6-5.4 No more pyrotechnic materials than are required for the production of special effects in one performance or rehearsal shall be removed from storage.

6-5.5 Smoking shall be prohibited within 25 ft (7.6 m) of the area where pyrotechnic special effect devices are being handled or fired.

Exception: Smoking by performers as part of the performance shall be permitted as blocked in rehearsals and approved by the pyrotechnic operator and the authority having jurisdiction.

6-5.6 No pyrotechnic materials and devices shall be left unattended unless in a secured, approved location.

6-5.7* The pyrotechnic operator and assistants shall wear safety glasses and protective clothing suitable to the hazard of the material during preparation and loading of pyrotechnic special effect devices.

6-6 Performance.

6-6.1 Because of the very nature of pyrotechnic special effects, the pyrotechnic operator shall warn all performers and support personnel that they are exposed to a hazardous situation when performing or otherwise carrying out their responsibilities in the vicinity of a pyrotechnic special effect. Performers and support personnel familiar and experienced with the effects being used can elect to be in the fallout area of a pyrotechnic device, but only of their own volition and only if in the performance of their duties.

6-6.2 No part, projectile, or debris from the pyrotechnic material or device shall be propelled so that it damages overhead properties, overhead equipment, or the ceiling and walls of the performance site.

6-6.3 Immediately before any performance, the pyrotechnic operator shall make a final check of wiring, position(s), hookups, and pyrotechnic devices to assure that all is in proper working order. The pyrotechnic operator shall also verify safety distances.

6-6.4 The placement and wiring of all pyrotechnic special effect devices shall be designed to minimize the possibility that performers and support personnel can disturb the devices during performance.

6-6.5 The pyrotechnic operator shall exercise extreme care throughout the performance to see that the pyrotechnic devices function correctly and that the performers, support personnel, and audience are clear of the devices.

6-7 Requirements after Performance.

6-7.1 Immediately after each performance and before support personnel remove any property relating to a performance, the pyrotechnic operator shall verify that all pyrotechnic devices have fired. Any unfired pyrotechnic materials or devices shall be either fired or disposed of in accordance with the manufacturer's recommendations.

6-7.2 All unused pyrotechnic materials or devices shall be disposed of in accordance with the manufacturer's instructions or returned to storage as soon as possible following the performance or rehearsal.

6-7.3 After all other properties and devices relating to the production have been removed from the performance site, the pyrotechnic operator shall verify that the performance site is free of any pyrotechnic devices or materials.

6-7.4 All pyrotechnic materials and devices shall be stored properly for transportation to the next performance. No pyrotechnic materials shall be transported unless such transportation meets U.S. Department of Transportation regulations.

6-7.5 Binary materials that have been mixed in excess of requirements for a rehearsal or performance shall be stored as an explosive of the appropriate class or disposed of in accordance with the manufacturer's instructions. See Section 3-3 for storage requirements.

6-7.6 Fire safety systems and other building systems that have been disarmed or disengaged as permitted by 4-4.2 and 6-1.6 shall be reinstated to normal functioning each day within four hours of the last use of pyrotechnic special effects, and the fire-watch required by 6-1.6 shall be maintained until the restoration of normal functioning has been verified.

Chapter 7 Referenced Publications

7-1 The following documents or portions thereof are referenced within this standard 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.

7-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 10, *Standard for Portable Fire Extinguishers*, 1990 edition

NFPA 30, *Flammable and Combustible Liquids Code*, 1990 edition

NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases*, 1992 edition

NFPA *101*, *Life Safety Code*, 1991 edition

NFPA 495, *Explosive Materials Code*, 1992 edition

NFPA 1122, *Code for Unmanned Rockets*, 1987 edition

NFPA 1123, *Code for the Outdoor Display of Fireworks*, 1990 edition

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

NFPA 1125, *Code for the Manufacture of Model Rocket Motors*, 1988 edition

NFPA 1403, *Standard on Live Fire Training Evolutions in Structures*, 1992 edition.

7-1.2 Other Publications.

7-1.2.1 U.S. Government Publications. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Title 27, *Code of Federal Regulations*, Part 18, Bureau of Alcohol, Tobacco and Firearms, Part 181, Subpart K, 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 information purposes only.

A-6-3.5 Warning lights should be used for warning support personnel of concussion special effects.

A-6-4.1 For example, if a pyrotechnic device has a 10 ft (3 m) fallout radius, the pyrotechnic device shall be separated from the audience by a minimum distance of 20 ft (6.1 m).

A-6-5.7 Suitable protective clothing should include long-sleeved shirts and long pants made of 100 percent cotton, leather, or other equivalent fabric.

Appendix B Inspection Requirements

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

B-1 Inspection Requirements. The authority having jurisdiction, who is required to judge the safety of any production, may or may not be familiar with pyrotechnic special effects. The following guidelines are presented as a possible inspection routine that can be used as a standard:

I. Access.

A. Fire lane kept clear.

B. Hydrants not blocked.

C. Fire department connections clear.

D. Standpipe connections clear.

E. At least two fire extinguishers provided.

F. Extinguishing equipment charged and in good working order.

G. Warning signs.

II. Exits.

A. All designated exits clear.

B. Exits visible.

III. Pyrotechnic Materials and Devices.

A. Proper and current license in the possession of the pyrotechnic operator.

B. Permit on site.

C. Fire department briefed on proposed activity.

D. Proper ventilation.

IV. Electrical.

A. Cords and connections in good condition.

B. Appropriate power supply.

C. Pyrotechnic firing mechanism in good working order.

V. Flameproofing.

A. Set and scenic materials appropriately treated for flame retardance.

B. Burlap or other protective materials used for rigging treated for flame retardance.

Appendix C Licensing Requirements for Pyrotechnic Operators

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

C-1 No person who has not actively participated in the set-up and loading of at least 5 performances in which pyrotechnic special effects were used should be granted a license. (At the option of the issuing office, an alternative number should be permitted to be substituted.)

C-2 No person should be granted a license who has not met at least one of the following requirements:

(a) Successfully completed a comprehensive written examination covering this standard and state laws pertaining to the display of pyrotechnic special effects.

(b) Received a competency certificate from a national organization that promotes the safe use of pyrotechnic special effects.

(c) Has been licensed for the use of pyrotechnic special effects by another state.

C-3 Provisions for License Renewal. A license should be permitted to be granted upon review of the applicant's record, proving active participation in at least 3 pyrotechnic special effect performances during the last 4 years and that these displays were operated in a safe manner. The displays can be either indoor or outdoor.

Appendix D Glossary

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

NOTE: The following terms are not necessarily inclusive of all of the terms used in the pyrotechnic special effects industry.

Alternating Current (AC). 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 blank cartridge is constructed from a cartridge case with a percussion primer and filled with various loads of smokeless powder or other propellant. Weapons using blank cartridges are often 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 striking 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 striking a person or object.

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

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

Common Fireworks. Any small firework devices designed primarily to produce visible effects by combustion. Common fireworks must comply with construction, chemical composition, and labeling regulations of the U.S. Consumer Products 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 regulations.

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

Day Box. A portable magazine used for immediate storage of pyrotechnic materials.

Deflagration. A rapid chemical reaction in which the output of heat is sufficient to enable the reaction to proceed and be accelerated 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 (Primacord). 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 acts to cause the reaction to proceed. 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 (of 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 may also be an explosive or device initiated by a primer and used to initiate another explosive that is less sensitive and larger.

Direct Current (DC). 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 relates 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. Explosion is also a mechanical phenomenon in which failure of the container results in sudden release of pressure from within a vessel.

Explosive. Any chemical compound, mixture, or device whose primary or common purpose is to function by explosion. The term includes, but is not limited to, dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cords, igniter cords, and igniters. The term "explosives" includes any material 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 material classified as a Class A or Class B explosive by the Hazardous Material Regulations of the U.S. Department of Transportation.

Fireworks. Any composition or device for producing a visible, audible, or both visible and 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 Hazardous Material Regulation, Title 49, *Code of Federal Regulations*, Parts 173.88 and 173.100.

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 must be readily ignitable and capable of igniting the underlying pyrotechnic 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 them 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.

Nonelectric Detonator. A detonator that does not require the use of 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.

Quick Match. Black match that is encased in a loose-fitting paper sheath. Although exposed black match burns slowly, quick match burns 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.

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.

Salute Powder. See Sonic Flash.

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

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

Sonic Flash (Salute Powder, Extra Fast Flash, Concussion Flashpowder). Flashpowder specifically formulated to produce a loud concussive effect.

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

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

Special Fireworks. Large fireworks designed primarily 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 grams of pyrotechnic composition, and other display pieces that exceed the limit for classification as "Common Firework." Special fireworks are classified as Class B explosives by the U.S. Department of Transportation.

Stars. Small masses of pyrotechnic compounds that are projected from aerial shells, mines, or roman candles. Stars burn while in the air, producing color or streamer effects.

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 may also produce a shower of sparks. Theatrical flashpowder is not intended to produce a loud report.

Appendix E Referenced Publications

E-1 The following documents or portions thereof are referenced within this standard 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 U.S. Government Publications. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

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

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

Title 49, *Code of Federal Regulations*, Parts 173.88 and 173.100, U.S. Department of Transportation.

Index

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SUBMITTING PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Contact NFPA Standards Administration for final date for receipt of proposals on a specific document.

Note: All proposals must be received by 5:00 p.m. E.S.T./E.D.S.T. on the published proposal closing date.

INSTRUCTIONS

Use a separate proposal form for submitting each proposed amendment.

1. Type or print legibly in black ink.

2. Indicate the number, edition year, and title of the document. Also indicate the specific section or paragraph that the proposed amendment applies to.

3. Check the appropriate box to indicate whether this proposal recommends adding new text, revising existing text, or deleting text.

4. In the space identified as "Proposal" indicate the exact wording you propose as new or revised text, or the text you propose be deleted.

5. In the space titled "Statement of Problem and Substantiation for Proposal" state the problem which will be resolved by your recommendation and give the specific reason for your proposal. Include copies of test results, research papers, fire experience, or other materials that substantiate your recommendation.

6. Check the appropriate box to indicate whether or not this proposal is original material, and if it is not, indicate the source of the material.

7. Sign the proposal.

If supplementary material (photographs, diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee. The technical committee is authorized to abstract the "Statement of Problem and Substantiation for Proposal" if it exceeds 200 words for publication in the Technical Committee Reports.

NOTE: The NFPA Regulations Governing Committee Projects in Paragraph 10-10 state: Each proposal shall be submitted to the Council Secretary and shall include:

(a) identification of the submitter and his affiliation (Committee, organization, company) where appropriate, and

(b) identification of the document, paragraph of the document to which the proposal is directed, and

(c) a statement of the problem and substantiation for the proposal, and

(d) proposed text of proposal, including the wording to be added, revised (and how revised), or deleted.