NFPA®

1126

Standard for the Use of Pyrotechnics Before a Proximate Audience

2016

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NFPA® 1126

Standard for the

Use of Pyrotechnics Before a Proximate Audience

2016 Edition

This edition of NFPA 1126, *Standard for the Use of Pyrotechnics Before a Proximate Audience*, was prepared by the Technical Committee on Special Effects. It was issued by the Standards Council on May 26, 2015, with an effective date of June 15, 2015, and supersedes all previous editions.

This edition of NFPA 1126 was approved as an American National Standard on June 15, 2015.

Origin and Development of NFPA 1126

The first edition of NFPA 1126, *Standard for the Use of Pyrotechnics Before a Proximate Audience*, was published in 1992. 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 proximate audiences where pyrotechnic special effects are used indoors and outdoors.

For the 1996 edition, several new definitions were added, including *producer* and *venue manager*, that related to requirements in Chapter 4 of the document. In Chapter 5, the requirements relating to labeling of pyrotechnic preloads were revised for clarity and conformance with the NFPA *Manual of Style*. Revisions to Chapter 6 regarding use of pyrotechnics incorporated the tentative interim amendment addressing measures to safeguard the safety of performers.

The 2001 edition represented the first edition completed by the Committee on Special Effects, which now has responsibility for both flame and pyrotechnic special effects before a proximate audience. The previous editions of NFPA 1126 were the responsibility of the Committee on Pyrotechnics, but when the flame special effects activity was initiated (NFPA 160, *Standard for Flame Effects Before an Audience*), NFPA 1126 was assigned to this new committee. The primary revision in the 2001 edition was making the requirements consistent with NFPA's other proximate audience document, NFPA 160, since many users are involved in both types of special effects.

The 2006 edition included a complete revision of the standard, with editorial changes in accordance with the *Manual of Style for NFPA Technical Committee Documents* and several key technical changes. The committee added new definitions and revised existing definitions for consistency with the NFPA Glossary of Terms and with the other pyrotechnics documents. The standard was also revised to include new requirements on operator licensing that makes the document consistent with requirements for flame effect operators.

The 2011 edition incorporated amendments to the Application section to clarify two aspects. First, reference to NFPA 140, *Standard on Motion Picture and Television Production Studio Soundstages, Approved Production Facilities, and Production Locations*, was added to clarify that NFPA 140 applies when pyrotechnics are used in proximate situations where no audience is present. Second, the Committee clarified that use of firearms in motion pictures, television, or other entertainment is not covered by NFPA 1126. The Committee modified definitions used by all NFPA pyrotechnics documents for consistency and amended the requirements pertaining to power sources used as part of the firing systems to protect against ground faults in the firing circuitry.

The 2016 edition of NFPA 1126 defines a hybrid flame effect and adds requirements for their use. It also indicates which portions of hybrid flame effects are covered by NFPA 1126 and which are covered by NFPA 160, since both documents apply. Annex material has been added to provide further guidance on the simultaneous application of the two documents to hybrid flame effects. This edition also clarifies when and how special effects are covered in air shows and provides a reference for the use of such effects.

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

Committee Scope: This Committee shall have primary responsibility for documents on the controlled use of flame, pyrotechnics, or other means of special effects for entertainment, exhibition, demonstration, or simulation before a proximate audience; and the design, fabrication, installation, testing, control, operation, and maintenance of user equipment, fuel storage, and sources for special effects before a proximate audience. This Committee does not have responsibility for documents on hazards other than those involving a proximate audience and the life safety considerations of the audience.

Contents

NFPA 1126

Standard for the

Use of Pyrotechnics Before a Proximate Audience

2016 Edition

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

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex E. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex E.

Chapter 1 Administration

1.1 Scope. This standard shall provide requirements for the protection of property, operators, performers, support personnel, and the viewing audiences where pyrotechnic effects are used indoors or outdoors with a proximate audience.

1.2 Purpose.

1.2.1 The purpose of this standard shall be to provide minimum requirements to the operators and manufacturers for the safe operation of pyrotechnic effects.

1.2.2* The purpose of this standard shall be to provide requirements for the reasonable protection of pyrotechnic operators, performers, support personnel, proximate audiences, property, and buildings where pyrotechnics are used indoors or outdoors from safety and fire hazards.

1.2.2.1 The purpose of this standard shall be to provide guidelines to the authority having jurisdiction for approval of the use of pyrotechnics as specified in 1.2.2.

1.2.2.2 The purpose of this standard shall be to provide requirements for local permits.

1.3 Application.

1.3.1* This standard shall apply to the use of pyrotechnics in the performing arts in conjunction with theatrical, musical, or similar productions before a proximate audience, performers, or support personnel.

1.3.2 This standard shall apply to the performance specifications, instructions, notifications, and labeling by the manufacturer of pyrotechnics materials, devices, equipment, and supplies.

1.3.3 This standard shall apply to any indoor use of pyrotechnics.

1.3.4 This standard shall apply to any hybrid flame effect used before a proximate audience.

1.3.5 Application of NFPA 1123.

1.3.5.1 This standard shall apply to any outdoor use of pyrotechnics at distances less than those required by NFPA 1123.

1.3.5.2 The use of pyrotechnics before a proximate audience shall not be construed as a display of fireworks as regulated by NFPA 1123, except that any use of aerial shells as regulated by NFPA 1123 shall comply with the provisions of that code.

1.3.6 Application to Air Show Environments.

1.3.6.1 This standard shall apply to the installation and use of pyrotechnic devices on aircraft in a static display or as part of ground support acts during an air show when such devices are used at distances less than those specified in NFPA 1123.

1.3.6.2 Devices mounted to aircraft shall be mounted in a secure manner to maintain their proper position and orientation and to prevent the unintentional separation of the device from the aircraft.

1.3.6.3* This standard shall not apply to the use of pyrotechnic devices that have been mounted on aircraft once the aircraft is airborne and operating under the terms of a Federal Aviation Administration (FAA) waiver.

1.3.6.4* This standard shall not apply to the use of ground-based effects utilizing explosives, liquid fuels, or other combustibles in air show environments.

1.3.7 Application to the Entertainment Industry.

1.3.7.1 This standard shall apply to the video recording, audio recording, or filming of any television, radio, or movie production only where such production takes place before a proximate audience and includes the use of pyrotechnics.

1.3.7.2 Where there is no audience present, NFPA 140 shall be used to regulate any pyrotechnic use.

1.3.8 This standard shall apply to the rehearsal of any production in which pyrotechnics are used.

1.3.9 This standard shall not apply to the manufacture, transportation, or storage of fireworks at a manufacturing facility.

1.3.10 This standard shall not apply to the use of consumer fireworks by the general public.

1.3.11* This standard shall not apply to the manufacture, transportation, storage, and use of explosives.

1.3.12 This standard shall not apply to the transportation, handling, or use of pyrotechnics by the Armed Forces of the United States of America.

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

1.3.14* Application to Training.

1.3.14.1 This standard shall not apply to the use of pyrotechnics in training by the fire service, law enforcement, or similar government agencies.

1.3.14.2 This standard shall apply where there is a proximate audience that is not part of the live fire training evolution.

1.3.15 Applicability of NFPA *101*.

1.3.15.1 Facilities in or at which pyrotechnics are to be used or stored shall comply with the applicable provisions of NFPA *101*.

1.3.15.2 Pyrotechnics shall be permitted to be used in accordance with the provisions of NFPA *101*, 13.7.3, where approved by the authority having jurisdiction.

1.3.16* This standard shall not apply to the use of flammable liquids and flammable gases in the performing arts.

1.3.17 This standard shall not apply to the manufacture of model rocket and high power rocket motors as covered in NFPA 1125.

1.3.18* 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.

1.3.19 This standard shall not apply to the sale and use of model rockets and model rocket motors used in conformance with NFPA 1122.

1.3.20 This standard shall not apply to the sale and use of high power sport rockets and high power sport rocket motors used in conformance with NFPA 1127.

1.3.21 This standard shall not apply to the use of firearms used in motion pictures, television, or other entertainment industries.

1.3.22 This standard shall apply to any portion or component of any hybrid flame effect that utilizes materials, devices, and methodologies governed by this standard.

1.3.23* This standard shall not apply to the use of flame effect materials as defined in NFPA 160.

1.4 Retroactivity. The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.

1.4.1 Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.

1.4.2 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this standard deemed appropriate.

1.4.3 The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction, and only where it is clearly evident that a reasonable degree of safety is provided.

1.5 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

1.5.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.5.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2013 edition.

NFPA 72®, *National Fire Alarm and Signaling Code,* 2016 edition.

NFPA *101®*, *Life Safety Code®,* 2015 edition.

NFPA 140, *Standard on Motion Picture and Television Production Studio Soundstages, Approved Production Facilities, and Production Locations,* 2013 edition.

NFPA 160, *Standard for the Use of Flame Effects Before an Audience,* 2016 edition.

NFPA 1122, *Code for Model Rocketry,* 2013 edition.

NFPA 1123, *Code for Fireworks Display,* 2014 edition.

NFPA 1125, *Code for the Manufacture of Model Rocket and High Power Rocket Motors,* 2012 edition.

NFPA 1127, *Code for High Power Rocketry,* 2013 edition.

2.3 Other Publications.

2.3.1 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Title 27, Code of Federal Regulations, Part 55, Bureau of Alcohol, Tobacco, Firearms and Explosives, "Explosives Law and Regulations."

Title 27, Code of Federal Regulations, Subpart K.

Title 49, Code of Federal Regulations, Part 171 to End.

2.3.2 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 1123, *Code for Fireworks Display*, 2014 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

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

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

3.2.5 Shall. Indicates a mandatory requirement.

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

3.2.7 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1* Aerial Shell. A cartridge containing pyrotechnic composition, a burst charge, and an internal time fuse or module that is propelled into the air from a mortar and that is intended to burst at or near apogee.

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

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

3.3.4 Audience. Spectators whose primary purpose is to view a performance.

3.3.5 Binary Materials. See 3.3.6, Binary System.

3.3.6* Binary System. A two-component pyrotechnic system.

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

3.3.8 Combustible. Capable of undergoing combustion.

3.3.9* Comet. A single pellet of pyrotechnic composition that is ignited and simultaneously propelled into the air from a mortar or tube.

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

3.3.11 Concussion Mortar. A device specifically designed and constructed, when loaded with pyrotechnic material, to produce a concussion effect.

3.3.12* Electric Match. An electric device that contains a small amount of pyrotechnic material that ignites when current flows through the device. [**1123,** 2014]

3.3.13* Electrical Firing System. Electrical equipment that provides and/or controls the ignition of pyrotechnics.

3.3.14* Fallout Area. The designated area in which hazardous debris is intended to fall after a pyrotechnic device is fired.

3.3.15* Fallout Radius. A line that defines the fallout area of a pyrotechnic device.

3.3.16 Fire (verb). To ignite pyrotechnics by using an electric match, electrical current, or some other means.

3.3.17* Flammable. A combustible that is capable of easily being ignited and rapidly consumed by fire.

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

3.3.19 Flash Pot. A device used with flashpowder that produces a flash of light and directs the flash.

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

3.3.21* Fuel. In pyrotechnics, anything combustible or acting as a chemical-reducing agent.

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

3.3.23* 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.

3.3.24* Holder. Any device used to hold a pyrotechnic device other than a mortar.

3.3.25* Hybrid Flame Effect. A flame effect that is used in combination with a pyrotechnic material or device.

3.3.26* Ingredient. A chemical used to create a pyrotechnic material.

3.3.27* Isolated Power Supplies. Ungrounded power supplies that provide electricity in which both wires are isolated from ground.

3.3.28* Lift Charge. The composition in a pyrotechnic device that propels (lifts) the effect into the air when ignited.

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

3.3.30* Mine. A device containing multiple pyrotechnic effects that are simultaneously ignited and dispersed into the air from a mortar or tube.

3.3.31 Mortar. A device used to direct and control the effect of the pyrotechnic material.

3.3.32 Oxidizer. Any material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials.

3.3.33* Performance. The enactment of a musical, dramatic, operatic, or other entertainment production.

3.3.34* Performer. Any person active in a performance during which pyrotechnics are used and who is not part of the audience or support personnel.

3.3.35* Permittee. The person or persons responsible for obtaining the required permits for a production that includes the use of pyrotechnics.

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

3.3.37* Producer. An individual who has overall responsibility for the operation and management of the performance where the pyrotechnics are to be used.

3.3.38* Production. All the performances of a musical, dramatic, operatic, or other series of shows.

3.3.39 Proximate Audience. An audience closer to pyrotechnic devices than permitted by NFPA 1123.

3.3.40 Pyrotechnic Device. Any device containing pyrotechnic material or pyrotechnic effect simulation equipment and capable of producing a special effect as defined in this standard.

3.3.41 Pyrotechnic Effect Simulation Equipment. Equipment that uses a chemical mixture, heat source, and the introduction of oxygen to initiate or maintain combustion and is used to produce visible or audible effects by combustion, deflagration, or detonation.

3.3.42* Pyrotechnic Material (Pyrotechnic Special Effects Material). A chemical mixture that contains sufficient oxygen or oxidizing agent required to initiate or maintain combustion and is used in the entertainment industry to produce visible or audible effects by combustion, deflagration, or detonation.

3.3.43* Pyrotechnic Operator. The person who has overall responsibility for the operation and safety of a pyrotechnic display.

3.3.44 Pyrotechnic Special Effect. A special effect created through the use of pyrotechnic materials and devices. *(See also 3.3.48, Special Effect.)*

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

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

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

3.3.48* Special Effect. A visual or audible effect used for entertainment purposes, often produced to create an illusion.

3.3.49* Support Personnel. Any individual who is not a performer or member of the audience.

3.3.50 Venue Manager. An individual who has overall responsibility for the operation and management of the facility where pyrotechnics are to be used in a performance.

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

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

Chapter 4 Transportation of Pyrotechnic Materials

4.1 Transportation. All ingredients, pyrotechnic materials, and pyrotechnic devices shall be transported in accordance with U.S. Department of Transportation (U.S. DOT) 49 CFR and any state and local requirements.

Chapter 5 Storage of Pyrotechnic Materials and Devices

5.1 Storage Requirements.

5.1.1* All pyrotechnic materials and devices shall be stored in accordance with 27 CFR Subpart K (Federal Storage Regulation) and any state and local regulations.

5.1.2 If more pyrotechnic material than is needed 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 applicable explosive class as defined in 27 CFR 55.

5.2 In-Transit Requirements.

5.2.1 All pyrotechnic materials and devices not stored in magazines meeting the requirements of 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.

5.2.2 The time between removal from storage and actual use shall be the shortest time practicable with respect to the needs of a performance.

5.2.3 Pyrotechnic materials and devices shall be supervised, except where they are secured or inaccessible.

5.3 Separation Distance from Unprotected Heat Source or Open Flame. Pyrotechnic materials and devices shall not be stored within 50 ft (15.3 m) of any unprotected source of heat or open flame.

Chapter 6 Permit Requirements and Operator Qualifications

6.1 Permit Requirements.

6.1.1 The requirements of this standard shall be used by the authority having jurisdiction to promote the safety of the production and the qualifications of the pyrotechnic operator.

6.1.2 The use of all pyrotechnics shall be approved by the authority having jurisdiction.

6.1.3 The authority having jurisdiction shall determine that measures are established to provide crowd management, security, fire protection, and other emergency services.

6.1.4 All planning and use of pyrotechnics shall be coordinated with the venue manager and producer.

6.2 Pyrotechnics Plans.

6.2.1 Before the performance of any production, the permittee shall submit a plan for the use of pyrotechnics to the authority having jurisdiction.

6.2.2 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.

6.2.3 The addition of pyrotechnics to a performance or any change in the presentation of pyrotechnics, excluding the reduction in the number or size of the devices, shall require approval by the authority having jurisdiction.

6.2.4* Hybrid flame effects shall meet the requirements of 6.2.4.1 and 6.2.4.2.

6.2.4.1 That portion of the hybrid flame effect that is governed by NFPA 1126 shall meet all of the requirements of NFPA 1126.

6.2.4.2 That portion of the hybrid flame effect that is governed by NFPA 160 shall meet all of the requirements of NFPA 160.

6.3 Content of Plans.

6.3.1 The plan for the use of pyrotechnics shall be made in writing or such other form as is approved by the authority having jurisdiction.

6.3.2 The plan shall include the following:

(1) Name of the person, group, or organization sponsoring the production
(2) Date and time of day of the production
(3) Exact location of the production
(4) Name of the person actually in charge of firing the pyrotechnics (i.e., the pyrotechnic operator)
(5) Number, names, and ages of all assistants who are to be present
(6) Qualifications of the pyrotechnic operator
(7) Pyrotechnic experience of the operator
(8) Confirmation of any applicable state and federal licenses held by the operator or assistant(s)
(9) Evidence of the permittee's insurance carrier or financial responsibility
(10) 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
(11) Diagram of the grounds or facilities where the production is to be held that shows 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 is to be restrained
(12) Point of on-site assembly of pyrotechnic devices
(13) Manner and place of storage of the pyrotechnic materials and devices
(14) Material safety data sheet (MSDS) for the pyrotechnic material(s) to be used
(15) Certification that the set, scenery, and rigging materials are inherently flame-retardant or have been treated to achieve flame-retardancy
(16) Certification that all materials worn by performers in the fallout area during use of pyrotechnic effects shall be inherently flame-retardant or have been treated to achieve flame-retardancy
(17) In the case of a hybrid flame effect, identification of those portions of the flame effect that require compliance with NFPA 160 and those portions that require compliance with NFPA 1126

6.3.3* Plan Submission. All plans shall be submitted as soon as possible so that the authority having jurisdiction has time to be present and to notify other interested parties.

6.4 Pyrotechnics Demonstration.

6.4.1 Pre-Show Review and Demonstration.

6.4.1.1* Where required, a walk-through and a representative demonstration of the pyrotechnics shall be provided to the authority having jurisdiction before a permit is approved.

6.4.1.2 The authority having jurisdiction shall be permitted to waive this requirement based on past history, prior knowledge, and other factors, provided the authority is confident that the discharge of pyrotechnics can be conducted safely.

6.4.2 The demonstration shall be scheduled with sufficient time allowed to reset/reload the pyrotechnics before the arrival of the audience.

6.4.3 Fire Alarms.

6.4.3.1 Where the use of certain indoor pyrotechnics requires smoke detectors to be bypassed or air-handling systems to be disengaged, the fire department shall be notified and a fire department representative shall be present for the demonstration.

6.4.3.2 The individual responsible for the life safety systems of the building shall return those systems to normal operating conditions as soon as the likelihood of false alarms from the pyrotechnics has passed.

6.4.3.3 Alarm verification as described in 23.8.5.4.1 of *NFPA 72* shall be allowed as a means of controlling false alarm initiation resulting from residual particulates suspended in the air.

6.5* Qualifications of Operators and Assistants.

6.5.1 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.

6.5.1.1 An applicant for licensing as an operator shall provide evidence of actual experience as an operator or assistant as part of demonstrating competency to the authority having jurisdiction.

6.5.1.2 An applicant for licensing as an operator shall successfully complete a written examination of laws, regulations, and safety practices pertaining to the discharge of pyrotechnics, which shall be administered by the authority having jurisdiction, or otherwise shall demonstrate knowledge of these areas.

6.5.2 All assistants shall be at least 18 years old.

Chapter 7 Requirements for Manufacturers of Pyrotechnics and Associated Equipment

7.1 Pyrotechnic Product Information. The pyrotechnic operator shall use products provided with written information supplied by the manufacturer detailing the following information:

(1) Name of the pyrotechnic device and a description of its effect
(2) Performance characteristics (duration, height, and diameter of the effect) of the pyrotechnic device where used as specified, or, in the case of binary materials, where used in the specified amounts for the designated materials and equipment
(3) Material safety data sheet (MSDS) for the pyrotechnic materials
(4)* The manufacturer's statement regarding whether the pyrotechnic device or material is intended for indoor use and whether it is to be used with any cautions or special considerations
(5) Instructions for the proper method(s) of placing, loading, and using the pyrotechnic device, including any cautions or special considerations
(6) Name, address, and phone number of the manufacturer

7.2 Identification of Pyrotechnic Devices or Binary Systems.

7.2.1 All pyrotechnic products or binary systems used shall have been identified or marked by the manufacturer with the following information:

(1) Name of the pyrotechnic device or binary system
(2) Name, address, and phone number of the manufacturer
(3) Statement describing the conditions of use and potential hazards
(4)* Manufacturer's statement regarding whether the pyrotechnic device or binary system is intended for indoor use

7.2.2 The marking on the pyrotechnic device shall be of at least 6-point type size.

7.2.3 Where the pyrotechnic device is too small to bear the label specified in 7.2.1, this information shall be printed on the instruction sheet, shipping container, or packaging.

7.3 Pyrotechnic Equipment.

7.3.1 The pyrotechnic operator shall use equipment for which the manufacturer has provided instructions for use, including the ratings of the types and quantities of material(s) for those devices.

7.3.2 The pyrotechnic operator shall use electrical firing systems for which the manufacturer has provided instructions for the setup and use of the system with pyrotechnics.

7.4 Binary Materials.

7.4.1 Binary materials shall be premeasured and packaged by the manufacturer.

7.4.2 Binary materials intended for indoor use shall be labeled by the manufacturer as being intended for indoor use.

Chapter 8 Use of Pyrotechnics

8.1 General Fire Protection.

8.1.1* Portable Fire-Fighting Equipment. Four or more fire extinguishers of the classification and size as approved by the authority having jurisdiction shall be readily accessible while the pyrotechnics are being loaded, prepared for firing, or fired.

8.1.1.1* In all cases, at least two pressurized water, Class 2-A extinguishers and two Class 10-BC extinguishers shall be provided, in addition to those required by NFPA 10, for the building.

8.1.1.2 The extinguishers shall be placed so that at least one is located on each opposing side of the performance where pyrotechnics are used.

8.1.1.3 Additional fire-extinguishing equipment shall be provided as required by NFPA 10 and the authority having jurisdiction.

8.1.2 Personnel who have a working knowledge of the use of the applicable fire extinguishers shall be present while the pyrotechnics are being handled, used, or removed.

8.1.3 To prevent unauthorized personnel from gaining access to the pyrotechnics, the venue manager for the site shall provide a separate, lockable room or facility for the preparation of pyrotechnic materials and devices that has been approved by the authority having jurisdiction and that is acceptable to the pyrotechnic operator.

8.1.4 Provisions for lockable storage for pyrotechnics, approved by the authority having jurisdiction, also shall be provided.

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

8.1.6 Fire Detection and Life Safety Systems.

8.1.6.1 Portions of fire detection and life safety systems shall be permitted to be interrupted during the operation of temporarily installed pyrotechnic effects when the following conditions are met:

(1) Approval by the authority having jurisdiction
(2) Approval by the owner or owner's agent
(3)* Presence of an approved fire watch capable of directing the operation of all fire detection and life safety systems installed in the building

8.1.6.2 Fire detection and life safety systems shall be permitted to be interrupted during the operation of permanently installed pyrotechnic effects only for initial acceptance of the system.

8.2 Firing Prerequisites.

8.2.1 Mounting.

8.2.1.1 All pyrotechnic devices shall be mounted in a secure manner to maintain their proper positions and orientations so that, when they are fired, the pyrotechnic effects described in the plan submitted by the permittee are produced.

8.2.1.2* Pyrotechnic devices shall be mounted so that no fallout from the device endangers human lives, results in personal injury, or damages property.

8.2.2 Equipment.

8.2.2.1 Pyrotechnic materials shall be fired only from equipment specifically constructed for the purpose of firing pyrotechnic materials.

8.2.2.2 The pyrotechnic operator shall be responsible for selecting equipment and materials that are compatible.

8.2.2.3 Protection of Performer.

8.2.2.3.1 Where a pyrotechnic special effect is placed on or in contact with a performer's body, a means of shielding or containment adequate to prevent any injury to the performer shall be provided.

8.2.2.3.2 This protection shall be sufficient to protect against the normal functioning of the pyrotechnic special effect as well as any possible malfunction.

8.2.2.4 Converted electrical switch boxes, lamp sockets, lamp holders, plug fuses, or other similar thin-walled, brittle devices shall not be used for concussion mortars or flash pots.

8.2.3 Mixing of Binary Systems. Binary systems shall be mixed and used in accordance with the manufacturer's instructions.

8.2.3.1 Binary systems shall be mixed one unit at a time, and no more units than are needed for immediate use shall be mixed.

8.2.3.2 Binary systems shall be mixed only in the bottles supplied by the manufacturer.

8.2.3.3 No additional tools shall be used in the mixing of binary systems.

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

8.2.5 Mortars and Flash Pots.

8.2.5.1 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.

8.2.5.2 Distorted mortars and flash pots shall not be used.

8.2.6 Before firing the pyrotechnic device, the pyrotechnic operator or designated performance security staff shall prevent unauthorized entry into the area where the special effects are to occur.

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

8.2.8 Rockets.

8.2.8.1 Where rockets are launched before a proximate audience, performers, or support personnel, the rockets shall be attached securely to a guide wire or cable with both ends attached and placed on an impact-resistant surface located at the terminal end of the guide.

8.2.8.2 The guide wire or cable required by 8.2.8.1 shall be of sufficient strength and flame resistance to withstand the exhaust from the rocket.

8.2.8.3 An effective arrangement to stop the rocket shall be provided.

8.2.9 Flares shall be placed so that any debris falls into a safe, flame-resistant area.

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

8.2.11 Waterfalls and gerbs shall be placed for firing so that no flammable materials are within their fallout area.

8.2.12 Pyrotechnic devices and materials used indoors shall be specifically manufactured and marked for indoor use by the manufacturer.

8.2.13 Airbursts shall be permitted to be fired above the audience, subject to the following conditions:

(1) The airburst shall be suspended by a minimum 30-gauge metal wire that is attached securely to a secure support acceptable to the authority having jurisdiction.
(2) The airburst shall occur at a minimum height of three times the diameter of the effect.
(3) Where the effect is demonstrated, there shall be no burning or glowing particles less than 15 ft (4.6 m) above the floor.

8.3* Firing Safeguards.

8.3.1 Circuit Testers.

8.3.1.1 Circuit testers shall supply no more than 25 mA.

8.3.1.2 Circuit testers shall be permitted to include, but are not limited to, blasting galvanometers, low-current multimeters, or a firing system with a built-in circuit tester.

8.3.2 Power Sources.

8.3.2.1* Grounded power supplies that switch both sides of every electric match firing circuit or that are designed to fail safe upon detection of a ground fault shall be permitted to be used in firing systems.

8.3.2.2 Power sources used for firing pyrotechnic devices shall also be permitted to use batteries, isolated power supplies, or transformers.

8.3.2.3 Only pyrotechnic systems shall be used for pyrotechnic purposes.

8.3.3 All firing systems shall be designed to ensure 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 does both of the following:

(1) Enables or arms the firing system
(2) Deliberately applies firing power

8.3.4* Electrical firing systems shall include a means that greatly reduces the possibility that unauthorized or unintentional firings can occur.

8.3.5 Communication.

8.3.5.1 Pyrotechnic devices shall be fired only when the area where the effect is to occur is in clear view of the pyrotechnic operator or an assistant who is in direct communication with the operator.

8.3.5.2* Direct communication with the pyrotechnic operator or assistant shall be permitted to be accomplished using signal lights or other nonverbal means of communication.

8.3.6* Warning lights or other signals shall be permitted to indicate the impending firing of a pyrotechnic effect.

8.3.7 Concussion mortars and concussion effects shall be secured by being placed under the stage or behind barricades made of equipment road cases to prevent access by the audience, performers, and support personnel.

8.3.8 While the authority having jurisdiction has the authority to stop the firing of pyrotechnics, the ultimate responsibility for firing shall be that of the pyrotechnic operator.

8.4 Separation Distances for Audiences.

8.4.1* Each pyrotechnic device fired during a performance shall be separated from the audience by a minimum of 15 ft (4.6 m) or twice the fallout radius of the device, whichever is greater, except where otherwise approved by the authority having jurisdiction.

8.4.2 Concussion mortars and concussion effects shall be separated from the audience by a minimum of 25 ft (7.6 m).

8.4.3 There shall be no glowing or flaming particles within 10 ft (3 m) of the audience.

8.5 Safety Precautions.

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

8.5.2 Shipping Container Inspection. The pyrotechnic operator shall inspect the containers in which all pyrotechnic materials and devices have been shipped.

8.5.2.1 Damaged pyrotechnic materials and devices shall not be used and shall be disposed of in accordance with the manufacturer's instructions.

8.5.2.2 Before disposal, shipping containers shall be inspected for loose pyrotechnic materials.

8.5.2.3 If a shipping container is found to contain loose pyrotechnic materials, it shall be disposed of in accordance with the manufacturer's instructions.

8.5.3 Storage Requirements.

8.5.3.1 Pyrotechnic materials and devices shall be stored in accordance with regulations promulgated by the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF).

8.5.3.2 A closed vehicle, such as a truck, shall be permitted to be used for storage where permitted by ATF, state, or local regulations.

8.5.4 A quantity of pyrotechnics no greater than that needed for the production of special effects in one performance or rehearsal shall be removed from storage.

8.5.5 Smoking.

8.5.5.1 Smoking shall not be permitted within 25 ft (7.6 m) of the area where pyrotechnics are being handled or stored.

8.5.5.2 NO SMOKING signs shall be conspicuously posted.

8.5.5.3 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.

8.5.6 No pyrotechnics shall be left unattended other than in a secured, approved location.

8.5.7* The pyrotechnic operator and assistants shall wear safety glasses and protective clothing applicable to the hazard associated with the material during preparation and loading of pyrotechnic devices.

8.6 Performance.

8.6.1 Safeguarding Performers.

8.6.1.1 The pyrotechnic effect operator shall advise all performers and support personnel that they are exposed to a potentially hazardous situation when performing or otherwise carrying out their responsibilities in the vicinity of a pyrotechnic effect.

8.6.1.2 Performers and support personnel familiar and experienced with the pyrotechnic effects being used shall be permitted to be in the area of a pyrotechnic effect, but only voluntarily and in the performance of their duties.

8.6.2 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.

8.6.3 Final Pre-Performance Safety Procedures.

8.6.3.1 Immediately before any performance, the pyrotechnic operator shall make a final check of wiring, position(s), hookups, and pyrotechnic devices to ensure that they are in working order.

8.6.3.2 The pyrotechnic operator also shall verify safety distances.

8.6.4 The placement and wiring of all pyrotechnic devices shall be designed to minimize the possibility of performers and support personnel disturbing the devices during a performance.

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

8.6.6 Smoke Control. When pyrotechnics are fired, the quantity of smoke developed shall be controlled so as not to obscure the visibility of exit signs or paths of egress.

8.7 Requirements After Performance.

8.7.1 Post-Performance Procedures.

8.7.1.1 Immediately after each performance and before support personnel remove any property related to a perform-

ance, the pyrotechnic operator shall verify that all pyrotechnic devices have been fired.

8.7.1.2 Any unfired pyrotechnic materials or devices shall be either fired or disposed of in accordance with the manufacturer's recommendations.

8.7.2 All unused pyrotechnics shall be disposed of in accordance with the manufacturer's instructions or returned to storage as soon as possible following the performance or rehearsal.

8.7.3 After all other properties and equipment 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.

8.7.4 Post-Performance Pyrotechnics Storage Requirement.

8.7.4.1 All pyrotechnics shall be stored properly for transportation to the next performance.

8.7.4.2 No pyrotechnics shall be transported unless such transportation meets U.S. Department of Transportation regulations.

8.7.5 Binary systems that have been mixed in excess of the needs of a rehearsal or performance shall be stored as an explosive of the applicable class or disposed of in accordance with the manufacturer's instructions. *(See Section 5.3 for storage requirements.)*

8.7.6 Life safety and other systems that have been disarmed or disengaged as specified by 6.4.3 and 8.1.6 shall be restored to normal operating condition as soon as the likelihood of false alarms from the use of pyrotechnics has passed.

8.7.7 The fire watch required by 8.1.6 shall remain present until the restoration of normal operating conditions has been verified.

Annex A Explanatory Material

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

A.1.2.2 NFPA 1126 does not address the potential health hazards of smoke from pyrotechnic reactions, ordinary combustion smoke, or concurrently used theatrical effects such as chemical fogs, dusts, or noise.

A.1.3.1 The circumstances of each show or attraction can be unique and can require individual evaluation when determining the need for protective systems. Factors such as the experience and qualifications of the operations and maintenance personnel, clearance distance between show elements and nonparticipants, visual conditions, and magnitude of the potential hazards are to be weighed in the development and presentation of the production.

A.1.3.6.3 While this standard applies where pyrotechnics are loaded or displayed on the ramp or as part of ground displays at distances less than those specified in NFPA 1123, it does not apply when an aircraft is airborne per the FAA waiver as outlined in 14 CFR 91.119(b) or 14 CFR 91.119(c). The requirements in 14 CFR 91.119(b) and 14 CFR 91.119(c) are that aircraft operate at a minimum of 500 ft (152 m) or 1000 ft (305 m) from the crowd lines and that aircraft do not overfly the audience areas as part of the routine. Once the aircraft has returned to the ground, unfired and misfired devices should be handled in accordance with this standard.

A.1.3.6.4 For information and guidance on ground-based effects in air shows, refer to International Council on Air Shows (ICAS) *Guidelines for the Use of Pyrotechnics and Special Effects at Air Shows,* and NFPA 495.

A.1.3.11 For information on the manufacture, transportation, storage, and use of explosives, see NFPA 495.

A.1.3.14 For information on training uses for pyrotechnics, see NFPA 1403.

A.1.3.16 For information on flammable and combustible liquids, see NFPA 30. For information on storage and handling of liquefied petroleum gases, see NFPA 58.

A.1.3.18 For information on model rockets, see NFPA 1122.

A.1.3.23 For information on the individual or combined use of solid, liquid, or gaseous fuels in the entertainment industry, see NFPA 160. For information on flammable and combustible liquids, see NFPA 30. For information on storage and handling of liquefied petroleum gases, see NFPA 58. For information on the installation of fuel gas piping systems and equipment, see NFPA 54.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.1 Aerial Shell. Comets and mines are not aerial shells. The shells are most commonly 3 in. to 6 in. (76 mm to

152 mm) outside diameter and are fired from mortars. Upon firing, the fuse and lift charge are consumed.

A.3.3.6 Binary System. These items are shipped as separate ingredients: an oxidizer and a fuel. The ingredients do not become a pyrotechnic material until they are mixed.

A.3.3.9 Comet. A comet is not an aerial shell or mine. Comets frequently leave a trail of sparks as they rise in the air, and they sometimes burst into smaller fragments at their zenith. A comet is self-consuming as it rises into the air and can be designed to split apart.

A.3.3.12 Electric Match. 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. For the purposes of this standard, the term *electric match* also refers to other similar technologies in which an electric current is used to produce a high temperature for ignition purposes. [**1123,** 2014]

A.3.3.13 Electrical Firing System. In an electrical system, the electrical firing system is the source of electric current used to initiate electric matches or other devices. Generally, the electrical firing system has 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 pyrotechnics.

A.3.3.14 Fallout Area. The fallout area is defined as a circle that, in turn, is defined by the fallout radius.

A.3.3.15 Fallout Radius. The line is defined by two points. The first point is at 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.

A.3.3.17 Flammable. Flammables can be solids, liquids, or gases exhibiting these qualities.

A.3.3.21 Fuel. Examples of fuels include sulfur, aluminum powder, iron powder, charcoal, magnesium, gums, and organic plastic binders. Fuels are an ingredient of pyrotechnic materials.

A.3.3.23 Hazardous Debris. This includes, but is not limited to, hot sparks, heavy casing fragments, and unignited components. Materials such as confetti, lightweight foam pieces, feathers, or novelties are not to be construed as hazardous debris.

A.3.3.24 Holder. The purpose of a holder is to maintain the position of a pyrotechnic device. Holders hold preloads, which are self-contained. A holder is not to be construed to be a mortar.

A.3.3.25 Hybrid Flame Effect. Special effects that use any of the fuels allowed by NFPA 160, but are initiated or directly ignited by means of a pyrotechnic device are common examples of a hybrid flame effect. One example of a hybrid flame effect is one that uses a pyrotechnic device or igniter to provide the initial flame to light a supervised pilot burner, which, when ignited, can be then proven by a conventional flame safeguard or other means. Often this hybrid configuration is used where the pilot burner is in and/or around water or spray, and conventional ignition means have been determined to be unreliable or to utilize voltages or currents that provide a risk of hazard to persons in and around the water. In other instances, this configuration might be used for added reliability, operational integration, or simply for convenience. In any of these instances, the pyrotechnic igniter is used under the requirements of NFPA 1126 and is installed, maintained, and operated to meet the requirements of both NFPA 1126 and the AHJ. The flame effect itself, regardless of the fuel it uses, is designed, installed, maintained, and operated to meet the requirements of both NFPA 160 and the AHJ.

A second example of a hybrid flame effect is one that utilizes a combustible dust, initially aerosolized and propelled out the end of the burner nozzle by a charge of compressed air and ignited as it passes through a field of burning metal sparks generated by yet another pyrotechnic device. Dust or powder fuel is an acceptable flame effect material under this standard. What causes this effect to be classified as a hybrid flame effect is that the pyrotechnic ignition device(s) falls under the purview of NFPA 1126. (Note that if a gas pilot burner, or even a burning brand were used to ignite an aerosolized powder, this flame effect would not be considered hybrid and would fall entirely under the scope of NFPA 160.)

A third example is an often-used flame effect that is typically limited to outdoor use and utilizes flammable or combustible liquid as a fuel. This would be an acceptable flame effect material under NFPA 160. The fuel is contained in a nonporous bag and placed inside a suitable open-topped container that serves as a "mortar" or burner nozzle. Upon firing, the liquid is freed from the bag, lifted from the barrel, and aerosolized by means of a substantial black powder lifting charge. A second pyrotechnic device might or might not be used to ensure ignition of the fuel at the mouth of the container. What causes this effect to be classified as a hybrid flame effect is that the aerosolizing and igniting charges fall under the purview of NFPA 1126, or, depending upon the particular composition and quantity of the charge in use, possibly NFPA 1123 or NFPA 495. Additionally, the storage and/or handling of the liquid fuel would be governed by the requirements of NFPA 30. (Note that if a compressed air charge was used to aerosolize the liquid and a gas- fired pilot burner or even a burning brand was used to ignite the aerosol, this flame effect would not be considered hybrid and would fall entirely under the scope of NFPA 160.)

A.3.3.26 Ingredient. Such a chemical is not itself a pyrotechnic material.

A.3.3.27 Isolated Power Supply. An an ungrounded generator, an ungrounded dc-to-ac converter, or commercial power supplied through an isolation transformer.

A.3.3.28 Lift Charge. The lift charge usually consists of a Black Powder charge.

A.3.3.30 Mine. A mine is not an aerial shell or comet.

A.3.3.33 Performance. The enactment begins and progresses to its end according to a script, plan, or other preconceived list of events. A performance can include encores.

A.3.3.34 Performer. Performers can include, but are not limited to, actors, singers, musicians, and acrobats.

A.3.3.35 Permittee. The permittee can vary from jurisdiction to jurisdiction. The pyrotechnic operator is not necessarily the permittee.

A.3.3.37 Producer. Generally, the producer is an employee of the promotion company, entertainment company, festival, theme park, or other entertainment group.

A.3.3.38 Production. There are two types of productions: fixed and touring.

A.3.3.42 Pyrotechnic Material (Pyrotechnic Special Effects Material). Such a chemical mixture consists predominantly of solids capable of producing a controlled, self-sustaining, and self-contained exothermic chemical reaction that results in heat, gas, sound, light, or a combination of these effects. The chemical reaction functions without external oxygen.

A.3.3.43 Pyrotechnic Operator. The operator is also responsible for storing, setting up, and removing pyrotechnic materials and devices after a performance.

A.3.3.48 Special Effect. For example, smoke might be produced to create the impression of fog being present, or a puff of smoke, a flash of light, and a loud sound might be produced to create the impression that a cannon has been fired.

A.3.3.49 Support Personnel. 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.

A.5.1.1 Binary systems are usually supplied in fuel and oxidizer packages, which are intended to be mixed as single units of fixed size.

A.6.2.4 Where the standards impose different requirements, the most stringent requirement should be the one used, unless otherwise approved by the AHJ.

A.6.3.3 Advance notice should be given no less than 24 hours prior to an event. In some instances, the authority having jurisdiction can waive the 24-hour time period for advance notice.

A.6.4.1.1 The AHJ should invite the local responding fire companies to witness the demonstration so they are familiar with the potential hazards involved.

A.6.5 See Annex C for additional requirements on licensing pyrotechnic operators.

A.7.1(4) Pyrotechnics intended for indoor use can be used outdoors.

A.7.2.1(4) Chemicals and compounds that are not recommended for indoor use other than in trace quantities include, but are not limited to, antimony, arsenic, cadmium, chromium, lead, mercury, nickel, selenium, zinc, and their compounds; naphthalene; or any dye rated as a carcinogen.

Pyrotechnics intended for indoor use can be used outdoors.

A.8.1.1 Attempting to extinguish pyrotechnic fires is not recommended. Fire extinguishers should be chosen to fight potential secondary fires.

A.8.1.1.1 It is often helpful, depending on the type of effect, to have one or more water sprayers (atomizers) sized according to the effect to be present for minor occurrences.

A.8.1.6.1(3) A fire watch is a qualified person or persons in attendance during all times when fixed fire detection systems are intentionally taken out of operation, and should be acceptable to the authority having jurisdiction. The fire watch should be familiar with the operation of all fire and life safety systems in the building and be able to notify emergency responders.

A.8.2.1.2 Deliberate destruction of properties or portions of the set, where destroyed as part of the special effects, should not be construed as property damage.

A.8.3 The source used for testing match continuity should be separate from the firing power supply and must be strictly incapable of producing more than 25 mA. Electromagnetic induced currents in firing circuit wiring can be reduced by utilizing one or more of the following methods:

(1) Use of twisted pair
(2) Use of shielded wire, with the shield bonded to earth ground
(3) Running the wire through metal conduit that is bonded to earth ground
(4) Shunting as near to the electric match as practical

Firing power sources used for firing pyrotechnic devices should be restricted to the following:

(1) Batteries
(2) Low-voltage dc power supplies
(3) Transformers incorporating an electrostatic shield between the primary and secondary winding, with the shield connected to ground

The firing power source, be it ac or dc, and regardless of the voltage level, should be grounded and fused such that a ground fault in the firing circuit cannot cause unintentional ignition. Firing circuit design should be such that neither ignitor lead is electrically connected to the firing power source until ignition is intended. It should not be permitted to wire one side of multiple match terminals together, then to switch current to the other terminal of the ignitor. Switching of one line is permitted if there is only one ignitor in the system or if there is only one match per firing power source. Suggested firing circuit is shown in Figure A.8.3.

A.8.3.2.1 A show control system can be used to sequence a dedicated pyrotechnic system, but the show control system cannot initiate the pyrotechnic system directly.

A.8.3.4 Common techniques include a key-operated switch or similar device. Switches should have labels under or above each switch. The labels should use either letters or numbers.

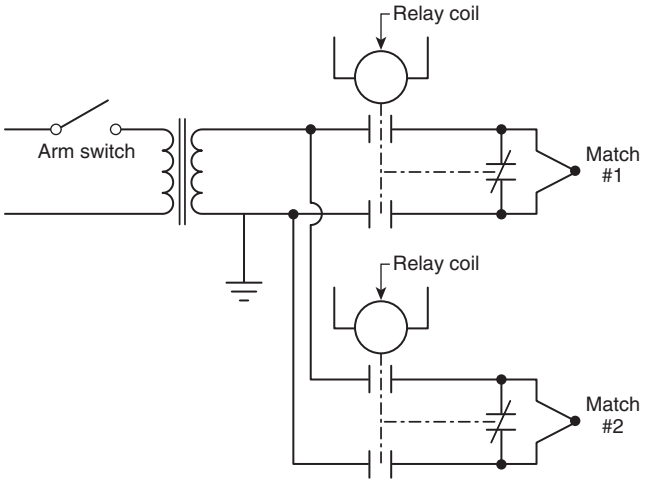

FIGURE A.8.3 Suggested Firing Circuit. Note that the relay contacts shown can be replaced by solid state switching devices. (Circuitry for test currents is omitted for clarity.)

A.8.3.5.2 For shows that will require direct communications, a safety meeting should take place to determine signals and or communications for stopping or postponing the show due to safety concerns. Those present at the meeting should be the operator and the AHJ as well as other necessary support personnel.

A.8.3.6 Warning lights should be used for warning support personnel of the presence of concussion special effects.

A.8.4.1 A pyrotechnic device with a 10 ft (3 m) fallout radius should be separated from the audience by a minimum distance of 20 ft (6 m).

A.8.5.7 Protective clothing should include long-sleeved shirts and long pants made of 100 percent cotton, leather, or other materials with equivalent flammability, melting, thermal, or static-reducing protective characteristics.

Annex B Inspection Requirements

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

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

(1) Access
- Fire lane kept clear
- Hydrants not blocked
- Fire department connections clear
- Standpipe connections clear
- At least two fire extinguishers provided
- Extinguishing equipment charged and in good working order
- Warning signs

(2) Exits
- All designated exits clear
- Exits visible

(3) Pyrotechnic materials and devices
- Proper and current license in the possession of the pyrotechnic operator
- Permit on site
- Fire department briefed on proposed activity
- Proper ventilation

(4) Electrical
- Cords and connections in good condition
- Power supply operational and in good condition
- Pyrotechnic firing mechanism in good working order

(5) Flameproofing
- Set and scenic materials treated for flame retardance
- Burlap or other protective materials used for rigging treated for flame retardance

Annex C Licensing Requirements for Pyrotechnic Operators

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

C.1 Pyrotechnic Experience. A license should be granted only to an individual who has actively participated in the setup and loading of at least five performances where pyrotechnic special effects were used. (The issuing office can substitute an alternative number of performances.)

C.2 Formal Requirements. A license should be granted only to an individual who has met at least one of the following requirements:

(1) Successful completion of a comprehensive written examination covering this standard and state laws pertaining to the use of pyrotechnic special effects
(2) Receipt of a competency certificate from a national organization that promotes the safe use of pyrotechnic special effects
(3) Possession of a license for the use of pyrotechnic special effects issued by another state

C.3 Provisions for License Renewal. A license should not be renewed unless the applicant's record proves active participation in at least three pyrotechnic special effect performances during the past 4 years and that those performances were conducted in a safe manner. The pyrotechnic uses can be of either the indoor or outdoor type.

C.4 27 CFR Part 555.62. A license or permit issued under this part confers no right or privilege to conduct business or operations, including storage, contrary to state or other law. The holder of a license or permit issued under this part is not, by reason of the rights and privileges granted by that license or permit, immune from punishment for conducting an explosive materials business or operations in violation of the provisions of any state or other law. Similarly, compliance with the provisions of any state or other law affords no immunity under federal law or regulations.

Annex D Glossary

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

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

D.1.1 Articles Pyrotechnic (as Defined in Part 555.11 of 27 CFR). Pyrotechnic devices for professional use similar to consumer fireworks in chemical composition and construction but not intended for consumer use. Such articles meeting the weight limits for consumer fireworks but not labeled as such and classified by U.S. Department of Transportation regulations in 49 CFR 172.101 as UN0431 or UN0432.

D.1.2 Alternating Current (ac). An electrical current that reverses direction in a circuit at regular intervals. Almost all electrical current supplied from wall outlets or sockets is alternating current.

D.1.3 Black Match. A fuse made from thread impregnated with Black Powder and used for igniting pyrotechnic devices.

D.1.4 Blank Cartridge. A cartridge constructed from a cartridge case equipped with a percussion primer and filled with various loads of smokeless powder or other propellant. Weapons using blank cartridges often are used in conjunction with bullet hits.

D.1.5 Body Hit Effect. The effect of a bullet hit that simulates impact from a weapon as it strikes a person.

D.1.6 Bridgewire. A fine wire that either heats up or explodes when an electric current is applied. It is used to fire pyrotechnic devices.

D.1.7 Bullet Hit. A small explosive charge attached to a person's clothing or body, or to an inanimate object, to simulate a slug from a weapon as it strikes a person or object.

D.1.8 Bullet Hit Effect. The effect of a bullet hit that simulates impact from a weapon as it strikes an object.

D.1.9 Colored Smoke. An aerosol of special dyestuffs of chemical reactants dispersed by pyrotechnic heat or explosion.

D.1.10 Color Pot. A tube containing pyrotechnic materials. It produces a colored flame when ignited.

D.1.11 Concussion Flashpowder. Flashpowder intended to be used in a concussion mortar to produce a loud concussive effect.

D.1.12 Consumer Fireworks (formerly known as "Common Fireworks"). Any small fireworks device designed primarily to produce visible effects by combustion that complies with the construction, chemical composition, and labeling regulations of the U.S. Consumer Product Safety Commission, as set forth in 16 CFR 1500 and 1507. Some small devices designed to produce audible effects are included, such as whistling devices, ground devices containing 50 mg (0.8 gr) or less of explosive composition (salute powder), and aerial devices containing 130 mg (2 gr) or less of explosive composition (salute powder) per explosive unit. Consumer fireworks are classed as Explosives 1.4G and described as Fireworks UN0336 by the U.S. Department of Transportation.

D.1.13 Deflagration. A rapid chemical reaction in which the output of heat is sufficient to enable the reaction to continue and accelerate without input of heat from another source. Deflagration is primarily a surface phenomenon, with most reaction products flowing away from the unreacted material along the surface at less than supersonic velocity. The effect of a deflagration under confinement is an explosion. Confinement of the reaction increases pressure, rate of reaction, and temperature and, in some cases, can cause transition into a detonation.

D.1.14 Det Cord. A flexible detonating cord. It is a highly explosive material encased in a plastic-covered cord resembling a clothesline.

D.1.15 Detonation. An extremely rapid chemical reaction in which the pressure generated is sufficient to cause the formation of a shock wave, which causes the reaction to continue. Detonation is a phenomenon with reaction products flowing in the direction of unreacted materials at supersonic velocity. The effect of a detonation with or without confinement is an explosion.

D.1.16 Detonator. Any device containing an initiating or primary explosive that is used for initiating detonation. The term includes, but is not limited to, electric blasting caps (instantaneous and delay types), blasting caps for use with safety fuses, detonating cord delay connectors, and nonelectric caps that use a detonating cord, shock tube, or any other replacement for electric legwires. A detonator also could be an explosive or device initiated by a primer and used to initiate another explosive that is less sensitive and larger.

D.1.17 Direct Current (dc). An electrical current that flows in one direction. Most frequently, direct current is supplied by a battery.

D.1.18 Display Fireworks (formerly known as "Special Fireworks"). Large firework articles designed to produce visible or audible effects for entertainment purposes by combustion, deflagration, or detonation. This term includes, but is not limited to, salutes containing more than 130 mg (2 gr) of explosive composition (salute powder), aerial shells containing more than 60 g (2.1 oz) of total pyrotechnic and explosive composition, and other display pieces that exceed the limit for classification as consumer fireworks. Display fireworks are described as Fireworks UN0335 and classed as Explosives 1.3G by the U.S. Department of Transportation.

D.1.19 Explosion. The rapid production of hot gases at a high pressure as the result of a chemical reaction and the sudden release of the energy to cause strong dynamic stresses in the surroundings. The term usually refers to the effects of a detonation of initiating explosives and high explosives but also applies to the effect of a deflagrating propellant explosive in certain circumstances such as heavy confinement. The term also describes a mechanical phenomenon in which failure of the container results in a sudden release of pressure from within a vessel.

D.1.20 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 18 USC 40, "Importation, Manufacture, Distribution, and Storage of Explosive Materials," and also includes any material classified as Explosive 1.1, 1.2, or 1.3 by the U.S. Department of Transportation, "Hazardous Materials Regulations."

D.1.21 Fireworks. Any composition or device for producing a visible and/or audible effect by combustion, deflagration, or detonation and that meets the definition of "consumer" or "display" fireworks as set forth by 49 CFR 171 to end, U.S. Department of Transportation,"Hazardous Materials Regulations."

D.1.22 First Fire. The ignited mixture used with pyrotechnic devices and loaded in direct contact with the main pyrotechnic charge. A pyrotechnic first-fire mixture is compounded to produce a high temperature and hot slag. The mixture is readily ignitible and capable of igniting the underlying pyrotechnic charge.

D.1.23 Lycopodium. The spores produced by the genus of mosses called lycopodium. This powdery, organic, yellow material can be agitated and dispersed mechanically into a cloud and then ignited by a spark, pilot flame, or electrical heating device. Although not a pyrotechnic material, this material is used by special effects operators to produce fire effects or in conjunction with other pyrotechnics to create a special effect.

D.1.24 Nonelectric Detonator. A detonator that does not need electric energy to function.

D.1.25 Photoflash Flashpowder. A loose pyrotechnic mixture that yields a very large amount of light for a small fraction of a second on exploding.

D.1.26 Quick Match. Black match that is encased in a loose-fitting paper sheath. Although exposed black match burns slowly, quick match burns extremely rapidly and almost instantaneously. Quick match is used in fuses for aerial shells and for simultaneous ignition of a number of pyrotechnic devices, such as lances in a ground display piece.

D.1.27 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.

D.1.28 Salute Powder. See D.1.31, Sonic Flash.

D.1.29 Smoke Pot. A pyrotechnic device used to create smoke during a production.

D.1.30 Soft Detonator. A detonator with a higher velocity than a bullet hit, but with no metallic elements or jacket. It is essentially a blasting cap without a metal jacket.

D.1.31 Sonic Flash (Salute Powder, Extra-Fast Flash, Concussion Flashpowder). Flashpowder specifically formulated to produce a loud concussive effect.

D.1.32 Sparkle Flashpowder. A flashpowder that produces a bright flash of light and a shower of sparks when ignited.

D.1.33 Sparkle Pot. A pyrotechnic device intended to contain and control the discharge of sparkle flashpowder.

D.1.34 Squib. A device consisting of an electric match plus a base pyrotechnic charge. It usually is contained in a thin metal tube and often has a hole or slit to direct the flame produced when fired. Squibs are regulated in a manner similar to blasting caps. Squibs are not usually used in fireworks, although electric matches often are incorrectly called squibs.

D.1.35 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.

D.1.36 Theatrical Flashpowder. A pyrotechnic material intended for use in theatrical shows. Theatrical flashpowder produces a flash of light when ignited. Typical theatrical flashpowders burn more slowly than salute powder and also might produce a shower of sparks. Theatrical flashpowder is not intended to produce a loud report.

Annex E Informational References

E.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

E.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 30, *Flammable and Combustible Liquids Code*, 2015 edition.

NFPA 54, *National Fuel Gas Code*, 2016 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2014 edition.

NFPA 160, *Standard for the Use of Flame Effects Before an Audience*, 2016 edition.

NFPA 495, *Explosive Materials Code*, 2013 edition.

NFPA 1122, *Code for Model Rocketry*, 2013 edition.

NFPA 1123, *Code for Fireworks Display*, 2014 edition.

NFPA 1403, *Standard on Live Fire Training Evolutions*, 2012 edition.

E.1.2 Other Publications.

E.1.2.1 ICAS Publications. The International Council of Air Shows (ICAS), 751 Miller Drive, SE. Suite F-4, Leesburg, Virginia 20175.

Guidelines for the Use of Pyrotechnics and Special Effects at Air Shows, 2008.

E.1.2.2 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Title 14, Code of Federal Regulations, Part 91.119, "Aeronautics and Space, Minimum Safe Altitudes: General."

Title 16, Code of Federal Regulations, Parts 1500 and 1507, U.S. Consumer Product Safety Commission, “Federal Hazardous Substances Act Regulations.”

Title 27, Code of Federal Regulations, Part 555.11, Bureau of Alcohol, Tobacco, and Firearms, “Orange Book.”

Title 27, Code of Federal Regulations, Part 555.62, “State or Other Law.”

Title 49, Code of Federal Regulations, Parts 171 to end, U.S. Department of Transportation, “Hazardous Materials Regulations.”

Title 18, U.S. Code, Chapter 40, “Importation, Manufacture, Distribution, and Storage of Explosive Materials,” 1970.

E.2 Informational References. (Reserved)

E.3 References for Extracts in Informational Sections.

NFPA 1123, *Code for Fireworks Display*, 2014 edition.

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