



## ***Generic Close Proximity Product Types:***

### ***Pyrotechnics Used Before A Proximate Audience***

**Purpose:** The purpose of this document is to provide generic descriptions and performance characteristics of commonly available proximate pyrotechnic devices used in the live entertainment industry.

**Applicability:** This document is applicable to pyrotechnic operators, venue managers, event producers, Authorities having Jurisdiction (AHJs) and others desiring a basic introduction to the nomenclature, description and functioning of proximate pyrotechnic devices.

### ***Disclaimer***

The terms and nomenclature used in this document are terms commonly used in the theatrical and proximate pyrotechnic display industry and are intended to provide an overview of the general descriptions and performance characteristics of commonly available proximate pyrotechnic devices used in the live entertainment industry. This document is not intended to be all encompassing. The descriptions and performance characteristics do not apply to certain types of productions. For example, the motion picture and television productions special effects standard industry practices, where the audience is not proximate to the pyrotechnics, and nomenclature are unique, are not intended to be included in the scope of this document.

The names of the items listed herein are generic descriptions of typical products. Each manufacturer's product names are often specific to that manufacturer and may differ from the generic descriptions. This list is not intended to include all of the products used in proximate pyrotechnics but rather to define the most commonly used products. While significant effort has been made to assure the correctness of the information contained in this document, no assurances are given that the information contained herein is free of error. This document has been prepared as of March 1, 2009, and APA assumes no obligation to update this document should it become aware of changes.

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## Introduction:

The described articles herein most often fall within the UN standard for UN0431 Articles, pyrotechnic or less frequently UN0336 consumer fireworks. However, there are many items that may match the descriptions listed here which are classified as some other UN standard number that may be used in a close proximity venue.

## Labeling

Labeling conventions vary among manufacturers. All items may include the name of the manufacturer/distributor, the address of manufacturer/distributor and the trade name of the product. Specific information concerning the performance characteristics may be indicated on the label or be obtained directly from the manufacturer. For example, the typical labeling convention for gerbs is to list the duration followed by the height of effect. For example, a 1/2x15 would be a one-half second effect, 15 ft high.

## Performance Characteristics

Product performance characteristics can vary based upon such variables as age of the product, the environmental conditions, discharge angle, altitude, and other factors. An on-site demonstration/test with the most similar possible show conditions is the best way to determine actual product performance within any venue.

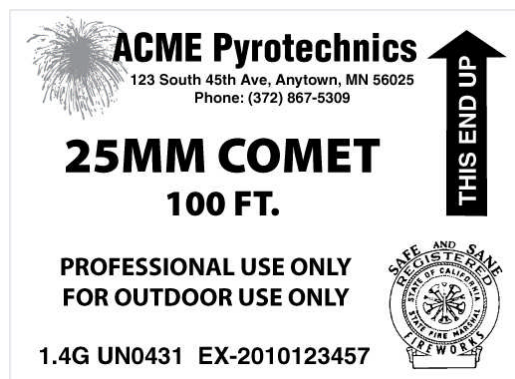
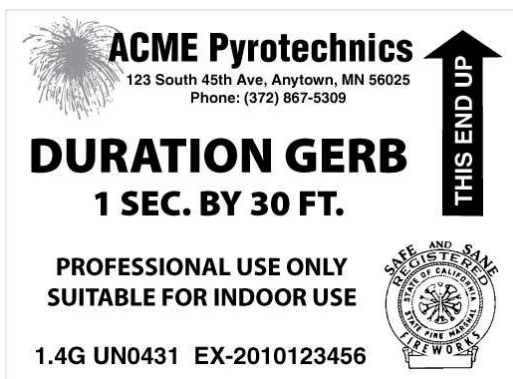
## Duration

Items do not always list the duration of effects. Typically gerbs/fountains, flares, falls, wire rockets, saxons and multi-shot mine or comet items list the duration on the label. For single shot mine and comet effects the duration is dependent on several factors and not listed on the label. These factors include the pyrotechnic composition and its speed of consumption, the mass of the projectile, and the shape and size of the tube. Likewise, many items such as airburst, flash trays, spark effects, flash effects, mortar hits, etc. are instant, very short effects and will not have a duration listed on the label. Specific product performance information is available from the manufacturer or distributor.

## Height

Domestic manufacturers typically list the height of each device in feet. However, many products from Europe and Asia list the height in meters. The height may be the maximum height of the device or may be the typical height of the device depending on the manufacturer. It is the responsibility of the professional end-user to know whether the heights listed on a label are performance heights or clearance heights.

## EXAMPLE LABELS:



## **Composition/Finished Products**

Most manufacturers consider specific chemicals used in the various pyrotechnic compositions proprietary. However, all manufacturers supply the users of their products with MSDS sheets, which list the specific health and safety hazards associated with the chemical compositions and the device performance. In addition, the granting of EX numbers by the USDOT and the use of UN numbering protocols certify that all compositions and finished products meet the standards acceptable for use in commerce and transportation within the US.

## **Device Fixtures/Hardware**

A wide variety of fixtures for mounting these products exist. Although some manufacturers do provide mounting fixtures, most often the fixtures are fabricated and provided by the end user. Typical materials used are aluminum, steel, wood, tape and screws, PVC, HDPE and ABS. The object of these purpose-built fixtures is to securely mount the devices to a hard flat surface, maintain the desired firing angle, hold the device in place, and provide sufficient support for the forces encountered in the discharge of the device and/or neighboring devices. Some devices such as airbursts are designed to be free hanging and are often not discharged in a holder. Other devices such as binary concussions require a rather substantial fixture for discharge (typically a solid steel cylinder with a hole bored in the center). A few items require the use of a mortar that would be typically used in a traditional fireworks display. However, the majority of products are distributed in self-contained tubes or canisters that act as force containment and directional control for the device. This type of self-contained device only requires a solid mounting surface and a way to stabilize the device. Ultimately, it is the responsibility of the professional end-user to ensure that he/she is using proper mounting/discharging hardware.

## **Permits and Licenses**

Permit and license requirements vary based on the location of the display. It is the responsibility of the end user to obtain, verify and provide the appropriate permits and/or licenses for the display and to provide a qualified and (if required) licensed individual for a safe and compliant display. In the United States, many states and cities require special operator and/or company licenses or certificates for the use of proximate products due to the particular performance characteristics and proximity to the audience and performers that these products entail. Some cities and states require a permit for the importation or storage of proximate products. Often display specific permits have insurance requirements, product performance information, MSDS information, detailed diagram requirements, and/or other information required to obtain the permit. Permits and licenses are not a guarantee of the suitability or safety of a display. The most accurate way to determine the proper use of pyrotechnic devices can include a demonstration of the proposed devices in the venue and under the most accurate representation of the conditions at the time of display. It is the responsibility of the on-site professional pyrotechnician to ensure the safe discharge of any pyrotechnic device.

*Source: Proximate Pyrotechnics Committee, American Pyrotechnics Association*

*Reference: National Fire Protection Association, NFPA 1126 Standard for the Use of Pyrotechnics*

*Before a*

*Proximate Audience, 2006 Edition.*

*Question & comments may be directed to:*

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***P.O. Box 30438***

***Bethesda, MD 20824***

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## Glossary of Proximate Pyrotechnic Devices with Illustrations

### Airburst:

A pyrotechnic device designed to mimic an outdoor aerial firework shell without producing burning fallout. Unlike outdoor aerial shells, airbursts are suspended from overhead rigging and fired "in place" versus being launched from a mortar into the air. The effect is a very fast omni-directional burst of sparks that are intended to burn out before reaching the ground. They also create a popping sound that varies in loudness. This effect can either be made using binary powders or purchased pre-made from vendors.



Small, Medium, and Large Airburst

### Airburst Paper Based – Pre-Made:

These devices use flame-resistant confetti or streamers and a small pyrotechnic charge. When fired, the charge propels the confetti/streamers in all directions.



Paper Based Airburst

### Airburst Harness:

An assembly consisting of a plurality, usually three, of electric matches with leads of varying length terminating in a telephone modular type plug. Not to be confused with spreader cable, loom or wire harness to which an electric match would be attached.



Airburst Harness

## Glossary of Proximate Pyrotechnic Devices with Illustrations

### Binary Powder:

A two-component powder which when separate, are a flammable solid and an oxidizer. Bottles are usually labeled “A” (oxidizer) and “B” (fuel). When mixed together, they become a pyrotechnic composition.

Effects vary, including but not limited to: Airburst, Concussion, Flash, Smoke, Fast and Slow Sparkle and Sparks.

Most binaries are used in specific hardware to control their effect, such as flash pots, sparkle pots and concussion mortars. However, when used for making airburst, binary powders are usually assembled in self-consuming plastic film or flash paper capsules or bags.



Binary Powders



Loading Binary Powders into hardware

### Comet:

A device containing a single pellet of self-consuming pyrotechnic composition. The comet is propelled into the air via a lifting charge producing various colors, glitter and crackle effects. Typically, proximate audience comets do not exceed 2 inches (50mm) in diameter and are self-contained devices including the effect, lift charge, mortar and igniter.

### Crossette Comet, Split Comet:

A single pellet of pyrotechnic composition that has a cavity in the center of the pellet containing a small amount of bursting charge. When fired, this device functions similar to a standard comet with the addition of breaking into several smaller pieces, usually 4, forming an “X” or cross pattern at its apex. Typically, crossette comets do not exceed 1.75 inches (45mm) in diameter and are self-contained devices including the effect, lift charge, mortar and igniter.



One example of a Comet or Crossette tube

## Glossary of Proximate Pyrotechnic Devices with Illustrations

### Electric Match:

An Electro-Explosive Device (EED) that is used to remotely initiate other pyrotechnic devices by means of an electrical current.



Coiled Electric Match



Electric Match with safety shroud covering match head

### Flame Mortar:

(Also known as Flame Projector, Flame Column, Flame ball)

This Pyrotechnic device often utilizes a smokeless powder based composition and produces a rising column or rolling ball of fire in various colors. This device produces very little smoke and minimal debris. Duration of the effect is based on the quantity of composition loaded, the particulate size of the composition, and the diameter of the tube. Typical duration does not exceed 5 seconds. This is a pyrotechnic device not to be confused with other flame effects using gaseous or liquid combustible substances. This effect can be prepackaged in a tube or can 1 inch to 4 inches (25mm to 102mm) in diameter or packaged in other types of containers. In addition, this device can be assembled on site using an appropriate mortar or containment device.



Short and Tall Flame Projector

## Glossary of Proximate Pyrotechnic Devices with Illustrations

### Flare:

A cylindrical tube device, which contains a pressed pyrotechnic composition. Upon ignition, the device produces a bright flame in various colors and durations. Typically stage flares range from 2" to 6" (50mm to 152mm) in length and ½" to 1" (13mm to 25mm) in diameter. Effect duration is typically from several seconds up to 60 seconds or longer.



One example of a flare

### Flash Paper, Flash String, Flash Cotton:

These are different forms of nitrated cotton (cellulose nitrate, nitrocellulose). The material is stored and transported either wet with water or alcohol. These materials burn rapidly when ignited with very little smoke or ash. Uses include magician hand flashes, ignition of ice fountains and various other pyrotechnic effects.



Flash Paper



Flash Cotton



Flash String

## Glossary of Proximate Pyrotechnic Devices with Illustrations

### Flash Tray:

(Also known as Flash Tube\*, Flash Curtain, Split Mine)

\*See Flash Pot/Flash Tube description under separate heading below.

Typically a preloaded cylindrical cardboard tube 6" to 18" (152mm to 457mm) in length with a longitudinal slit cut from end plug to the opposing end plug. Inside the tube is a pyrotechnic composition that, upon ignition, produces a fan pattern flash and or spray of sparks and/or stars.

The effect pattern produced, while wide in the side-to-side axis, is very narrow and controlled in the front to back axis. Duration of the effect is short and does not usually exceed 1.5 seconds



One example of a Flash Tray or Curtain

### Flash Tubes, Pre-loaded Flash Pot:

\*See note for Flash Tray above:

A cylindrical tube, typically 2" to 4" (50mm to 102mm) long by 1/2" to 1" (13mm to 25mm) diameter. The device emits a bright flash and puff of smoke, sometimes with a bang and/or spray of sparks.

Note that some manufacturers interchange the terms "Flash Tube" and "Flash Tray". It is best to refer to the specific manufacturer for device description and performance specifications.



Flash Tube



## Glossary of Proximate Pyrotechnic Devices with Illustrations

### Gerb:

A pyrotechnic fountain that produces a controlled spray (plume) of sparks.

Most produce either silver or gold sparks.

Other variations include changing from gold to silver (transformation) or have a color flame in addition to the spark plume. Still others have a crackle or glittering effect.

Typical devices range in size from approximately 1/2" to 2.5" (13mm to 64mm) diameter and 2" to 8" (50mm to 204mm) long. The gerb composition is usually contained between a clay plug at the bottom and a clay nozzle (choke) at the discharge end. For special applications, color-producing salts may be added to the mix to give a contrasting flame of 6" to 18" (152.4mm to 457.2mm) height at the nozzle. Gerb labels usually list the performance parameters with the duration in seconds listed first and height in feet or meters listed second.



Gerb, fast

### Gerb, Fast:

Gerb with duration of 1/4 sec to 1 sec. Most have a non-removable electric match pre-installed from the bottom of the device.



Gerb, Duration

### Gerb, Duration:

Gerb with duration greater than 1 second and up to 30 seconds. Most duration gerbs have the electric match installed into the top of the device.

## Glossary of Proximate Pyrotechnic Devices with Illustrations

### Waterfall Gerb (also Falls, Cascades):

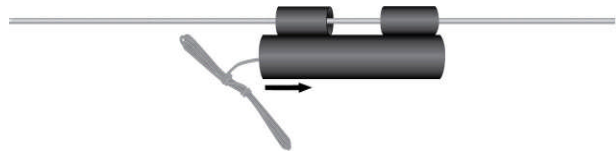
A pyrotechnic fountain producing a falling plume of sparks usually arranged in a line to mimic a waterfall. Falls are typically hung from overhead rigging in an inverted (up side down) configuration. Paper tube construction, typically  $\frac{3}{4}$ " to 1" (19mm to 25mm) diameter, charged with a pyrotechnic composition producing silver or gold sparks.



Waterfall Gerbs suspended from pipe

### Line Rocket (Grid Rocket):

A line rocket is a tube device designed to produce thrust. The device is attached to a carrier design to slide freely on a metal cable. Upon ignition, the line rocket quickly travels the length of the cable. The cable is strung taut from initiation point to termination point. The cable termination point often has a "catcher trap" to prevent the spent tube from traveling back up or down the cable. The device is initiated using an electric match and the electric match is attached in such a way as to fall free of the device upon ignition. Duration of the effect varies but is usually not longer than 5 seconds.



Line Rocket, in carrier, mounted on cable

### Ice Fountain (Dream Star):

Gerb type device usually with no choke containing a pressed composition of nitrocellulose and titanium that produces a low smoke and lower height fountain effect than a conventional gerb. Typical heights are from 6" to 36" (15.3cm to 91.5cm) and durations of up to 45 seconds. Sizes range from  $\frac{1}{2}$ " to 1" (13mm to 25mm) in diameter and 4" to 6" (102 to 153mm) long.



Ice Fountain

Igniter: See electric match

## Glossary of Proximate Pyrotechnic Devices with Illustrations

### Match Tape:

A type of fast-burning fuse typically used to ignite multiple pyrotechnic devices. When ignited the match tape rapidly burns with little residue, transferring fire to the connected pyrotechnic devices. Match tape is typically comprised of a trail of fine-grained powder sandwiched between 2 strips of cellophane tape, which can be adhered to multiple devices and ignited with a single electric match.



Match Tape

### Mine:

A device containing multiple pellets (stars) of self-consuming pyrotechnic composition. The stars are propelled into the air via a lifting charge, producing various colors, glitter and crackle effects in an inverted cone pattern. Typically, proximate audience mines do not exceed 4 inches (102mm) in diameter and are self-contained devices including the effect, lift charge, mortar and igniter.



Mine

### Mine Comet:

A self-contained device that contains both a mine and a comet effect within a single tube. The device exhibits characteristics of both items listed above.



Mine Comet

### Mortar Hit (also known as Fireball Effect):

This device produces a bright flash, heavy smoke and often a rolling ball of fire. The device is sometimes designed to produce noise in conjunction with the visual effect. It is often pre-packaged in a canister or tube but can be assembled on site. Size varies depending on desired effect but typically ranges from ½" to 5" (13mm to 127mm) in diameter. Larger variants of this device are often quite energetic and should be contained or mounted in an appropriate holder. Effect duration is intended to be very short, usually less than 1 second.



Mortar Hit

## Glossary of Proximate Pyrotechnic Devices with Illustrations

### Multi-Shot Devices, Timed:

A multiple shot device designed to produce a succession of effects. Each tube is typically .6" to 1.38" (15mm to 35mm) in diameter. A single igniter initiates the first effect, with subsequent effects being ignited by the time fuse. The number of tubes, tube spacing and speed of the time fuse used determine the overall duration of the device. The type of effects typically used can be comets, mines, small aerial devices, crossette comets, audible effects or any combination of effects. Often multiple igniters may be used to alter the overall duration of the device.



Multi Shot Device, Timed



Multi Shot Device, Timed

### Multi-Shot Devices, Instantaneous:

A multiple shot device designed to produce a barrage of effects. The device specifications are similar to multi-shot devices, timed, except all devices fire simultaneously.



Multi Shot Device, Instantaneous

## Glossary of Proximate Pyrotechnic Devices with Illustrations

### Pyrotechnic Smoke Effects:

#### Smoke Cartridge

A pre-packaged device that uses pyrotechnic material to create a plume of white or colored smoke. Duration and output will vary greatly depending on device used.



One example of a smoke cartridge

#### Smoke Cookie™

A compressed disc of pyrotechnic composition that produces a cloud of white or colored smoke upon ignition.



Smoke Cookie™

### Robotics or “Spark” Effects:

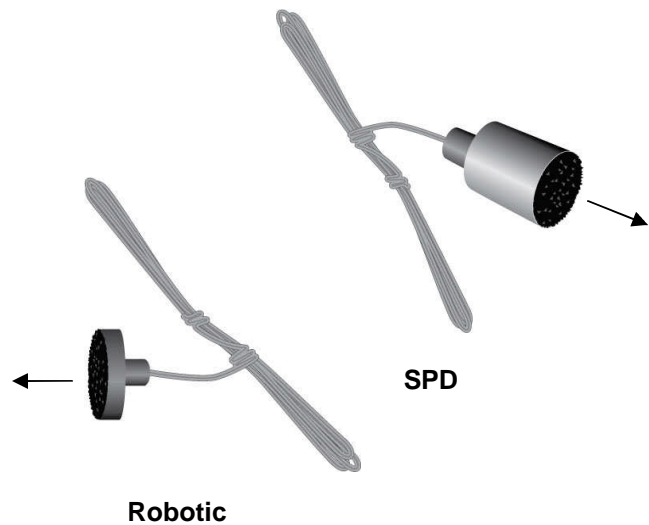
( Also know as SPD/DSC™):

Also known as Bullet Hits, Spark Hits or Spark Producing Devices.

A pyrotechnic device, which simulates a short circuit in an electrical panel.

These devices produce a spray of sparks that can vary in size from about 2 feet to 10 feet (.61m to 3m) in diameter and 6 inches to 15 feet (.15m to 4.6m) in height.

Such devices are not to be confused with bullet hits used in a motion picture or television production, which are intended to create the illusion of a bullet striking a costume, prop or scenery and function by exploding.

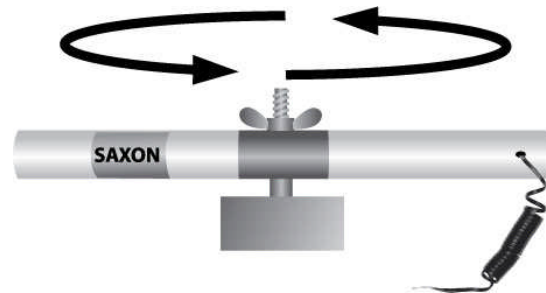


## Glossary of Proximate Pyrotechnic Devices with Illustrations

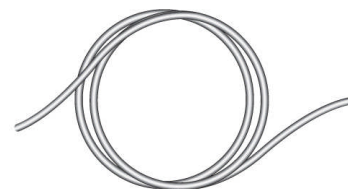
### Saxon

( Also known as Pinwheel)

A device that produces a revolving shower of sparks spinning around a fixed axis. Device is usually mounted to a stand or holder with an axle or shaft with a keeper or pin to lock the device to the shaft. The device may spin in any plane from the vertical to horizontal. The device often consists of 2 'gerb' type devices joined end to end, typically with a spacer between the devices and a hole for the axle or shaft mounting. Alternate configurations include gerb devices set at angles to the rotation point and attached to a wheel causing the wheel to rotate. The wheel has a collar in the center to accommodate the axle or shaft for mounting. Gerbs may have colored flame tips that create a band of color within the spray of sparks. Duration of the effect is usually between 15 and 30 seconds.



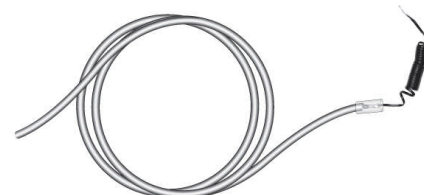
Saxon mounted on fixture



Shock Tubing



Shock Tube Igniter



Shock Tube w/ Igniter attached

### Shock Tubing:

A hollow, flexible thermoplastic tube usually .12" (3mm) in outer diameter. When shock tube is initiated, light (flame), and a pressure wave travel along the length of the tube at very high speed. The pressure wave creates a loud noise at the terminal end of the tube. The use of shock tube in entertainment pyrotechnics is limited usually to the visual simulation of a lightning strike.

### Shock Tube Initiator:

A type of igniter that is more energetic than a conventional electric match used to initiate shock tubing. Other types of shock tube initiators include shot-shell primers and plasma spark generators.

### Strobe Pot/Flicker Flare:

Pre-packaged tube device that produces multiple flashes at the output end of the tube in various colors.



Strobe Pot / Flicker