OUTDOOR FIREWORK DISPLAYS AND INSPECTIONS

STATE FIRE MARSHAL DIVISION
BOB REXEISEN
DEPUTY STATE FIRE MARSHAL

Announcement of Exits

MSFC 408.2.2 requires that theaters, motion picture theaters, auditoriums and similar assembly occupancies in Group A used for noncontinuous programs, make an audible announcement at least 10 minutes prior to the start of each program to notify the occupants of the location of the exits to be used in the event of a fire or other emergency.

POST Statement

The State Fire Marshal Division is a continuing education sponsor as approved by the Board of Peace Officer Standards and Training. This course Outdoor Firework Displays and Inspections, Course Number 09272-0023 has been approved by the POST Board for continuing education credit. Peace officers who successfully complete this course will receive 4 hours of continuing education.

The sponsor of this course has a written policy for the investigation and resolution of allegations of classroom discrimination. This policy applies to all faculty, instructors, administrative staff, and students. A copy of the policy may be obtained from the sponsor by contacting the State Fire Marshal Division at 651/201-7200.
Introductions

Purpose
Provide Police, Fire officials and AHJ’s with a working knowledge of outdoor pyrotechnic displays and the permitting process

Disclaimer
Actual pyrotechnic display reports and investigations will be used for training purposes
Topics To Be Covered

- MN Statutes
- Operator Certification
- Definitions
- Permit Process
- Lunch
  - On Site Pre-Display Inspection
  - On Site Post-Display Inspection
  - Explosives Permits

Minnesota Statute

INTRODUCTION

MN Statute 624.20-25

Fireworks regulations
Use, possession and sales
Display requirements and permit fees
Operator requirements
Post display reports
Seizure of illegal fireworks
Violations (legal and criminal wording)
MN Statute 624.20

Regulation:
Fireworks – Substance, article or combination thereof that produces an audible or visual effect by combustion, explosion, deflagration, or detonation and includes blank cartridges, toy cannons, toy canes, firecrackers, torpedoes, skyrockets, roman candles, daygo bombs, sparklers and anything else defined as “fireworks”

MN Statute 624.20

Does not include paper caps containing 25/100 grains of explosive or other toy caps containing 20/100 grains of explosive
Does not include sparklers containing not more than 100 grams of composition or multi-tube devices with 75 grams of composition per tube, 500 grams of composition per device
- “If it flies through the air or explodes, it’s illegal in Minnesota”

MN Statute 624.20

Does not include snakes, glow worms, party poppers, etc containing not more than 25/100 grains of explosive
Must be 18 to purchase and verified by ID
License fees
$100 maximum annual fee for multi-item retailers
$350 maximum annual fee for firework retailers
MN Statute 624.20
Cannot impose extra fees, restrictions, bonds or other measures

MN Statute 624.21
Use, possession and sales:
It’s illegal to use, possess or sell fireworks that are illegal within the state
Does not include those with permits or are otherwise required to possess for use and testing

MN Statute 624.22
Display requirements
May only be conducted by someone certified by the state
Must be sponsored by a public or private organization
Must submit outdoor permit within 15 days to city clerk or county auditor
Unless contracted, all indoor permits must go to SFMD
MN Statute 624.22
Fire Chief / County Sheriff are the only ones authorized to approve pyrotechnic permits
Fire Chief / County Sheriff must immediately process application
AHJ may not “sit” on permit

MN Statute 624.22
Operator requirements
Certification
Responsibilities of the operator
Ensure display is organized and operated IAW MN Statute
Reports
Certification renewal
Suspension, revocation or refusal to renew
Database

MN Statute 624.23
- Construction of statute
- Nothing prohibits lawful possession, transportation or commerce of fireworks
MN Statute 624.24
Officers may seize illegal fireworks
State fire marshals, sheriffs, police officers, or local fire marshals may seize illegal fireworks
Dispose of yourself or contact disposal agency

MN Statute 624.25
Violations
Explosive fireworks greater than 35 gross pounds - $3,000 fine, one year in jail or both
Explosive fireworks less than 35 gross pounds - $1,000 fine, 90 days in jail or both
Other than explosive fireworks - $1,000 fine, 90 days in jail or both

Operator Certification

INTRODUCTION
Certification Requirements

Applicant must show:
Proof of age - 21 for operator, 18 for assistant
Experience - 5 safe displays as an operator or assistant, at least 1 within the last year (Apprenticeship)
Must show experience in the classification which they are applying for

Application

Submit application
Take the test, 70% passing score for each section, reciprocity options
Applicant must wait 30 days to retest
Certification fee of $100
Approval or denial within 30 days
Certificate is valid for 4 years
Renewal requires 3 safe displays during the previous 4 year period
Suspension, Revocation or Refusal to Renew

- Submit a fraudulent application
- Caused or permitted a fire or safety hazard to exist or occur during the storage, transportation, handling, preparation, or use of fireworks
- Conducted a display of fireworks without receipt of a permit required by the state or a political subdivision

Suspension, Revocation or Refusal to Renew

- Conducted a display of fireworks with assistants who were not at least 18 years of age, properly instructed, and continually supervised
- Otherwise failed to comply with any federal or state law or regulation, or the guidelines, relating to fireworks

Definitions
Aerial Shell

A device containing pyrotechnic composition, a burst charge, and a time fuse. The aerial shell is generally propelled into the air from a mortar by an attached black powder lift charge.

Assistant

- A person who works under the supervision of the operator.
  - Loader
  - Ready Box Tender
  - Spotter

Barrage

- A rapidly fired sequence of aerial fireworks, typically chain fused
Black Match

- A fuse made from string that is impregnated with black powder and is used for igniting or connecting fireworks devices.

[Image: http://www.pyrouniverse.com/show/fusing/burningbm.jpg]

Break

- Individual burst from an aerial shell

Single Break

- Fuse
- String Loop
- Shell Casing
- Stars
- Burst Charge
- Time Fuse
- Lift Charge

Multi Break

Cake (Multi-Shot Device)

- A chain-fused device that propels a series of aerial shell, comet or mine effects into the air.

Chain Fusing

- A series of 2 or more fireworks devices fused to fire in rapid sequence from a single ignition.

Comet

- An aerial fireworks device consisting of a single pyrotechnic pellet that is ignited and propelled from a mortar. A comet is self-consuming as it rises into the air and can be designed to split apart.

Consumer Fireworks

- Wire or wood sparklers of not more than 100 grams of mixture per item
- Other sparking items which are nonexplosive and nonaerial and contain 75 grams or less of chemical mixture per tube or a total of 500 grams
Discharge Area

- The area immediately surrounding the location where fireworks are ignited for an outdoor display.

Display Fireworks

- 1.3G Explosives
- License required to possess, manufacture, or use

Display Site

- The complete area where a display is conducted, including the discharge area, the fallout area, and the required separation distance between the discharge area and spectator viewing or vehicle parking areas.
Electronic Ignition

- A technique used to ignite fireworks using a source of electric current.
- Electrical Firing Unit
- Nail Board
- Electric Match

Electric Match

- An electric device that contains a small amount of pyrotechnic material that ignites when current flows through the device.

Fallout Area

- The designated area in which hazardous debris is intended to fall after a pyrotechnic device is fired.
Finale

- A rapidly fired sequence of fireworks (barrage) typically fired at the end of a display.

Flame Effect

- The combustion of flammable solids, liquids or gases to produce thermal, physical, visual or audible phenomena before an audience.
  - NFPA 58, LP-Gas
  - NFPA 160, Flame effects before an audience

Gerb

- A cylindrically shaped heavy tube solidly filled with pyrotechnic composition. When ignited, it releases a spray of sparks with a predictable duration, height and pattern.
  - Labeled as time by # of feet (4x40)
Ground Display Piece

- A fireworks device that functions on the ground or mounted securely above the ground (as opposed to an aerial shell that functions in the air) and may include gerbs, wheels, and set pieces.

Lance

- A thin cardboard tube packed with color-producing pyrotechnic composition used to construct ground display pieces.

Lift Charge

- The composition that propels (lifts) the pyrotechnic device into the air.
- 2FA = Cannon Grade
- 1oz. = 437.5 Grain
- Average BP rifle = 100 Grain
Manual Ignition

- A technique used to ignite fireworks devices using a handheld ignition.
- Fusee
- Portfire
- Quickmatch burns at 98 feet per second

Mine

- A fireworks device designed to project stars and/or other effects or components into the air from a mortar.

Mortar (Gun)

- A tube plugged at one end from which aerial devices are fired.
  - Metal
  - Cardboard
  - High Density Polyethylene (HDPE)
  - Fiberglass Reinforced Epoxy (FRE)
**Mortar Rack**

- A frame containing one or more mortars.

**Mortar Trough**

- Aboveground structure in which mortars are placed and held firmly by backfilling the balance of the mortar trough with sand, soil, or similar fine material.

**Operator**

- The person with overall responsibility for the safety, set up, discharge, and load-out of a fireworks display.
**Ready Box**

- Sturdy fire-resistant container for storage of fireworks devices for use during setup and display

![Ready Box Image](http://www.gwmanufacturing.com.au/images_content/day_box.jpg)

**Set Piece**

- A ground display piece usually consisting of lance and quickmatch or sticky match arranged on a frame to depict a logo or scene. Set pieces may also include additional fireworks devices.

![Set Piece Image](http://www.pyroinnovations.com/2002_flag_set_piece_r.jpg)

**Salute**

- A firework designed to produce an explosive sound as its primary effect.
Wheel

- A revolving fireworks device mounted through its axis to a post. When ignited, the wheel spins and emits colored fire and/or a shower of sparks.

Definitions-Hazardous Conditions

INTRODUCTION

Dud

- A malfunctioning aerial shell that is fired from a mortar but fails to burst in the sky and returns to the ground intact. A dud may burst upon impact with the ground, at a subsequent time or not at all.
Flower Pot

- A malfunctioning aerial shell that bursts within a mortar causing a shower of ignited stars and/or other components to be projected vertically from the mortar in a mine pattern.

Hazardous debris

- Any debris produced or expelled by the functioning of a fireworks device that is capable of causing injury or unpredicted property damage. This debris may include sparks, heavy casing fragments, and un-ignited components.

Low Break

- A malfunctioning aerial shell that bursts significantly below its intended height as it ascends or descends.
**Misfire**

- A malfunctioning fireworks device that fails to function after an ignition source is applied to its ignition point.

**Muzzle Burst**

- A malfunctioning aerial shell that bursts immediately as it leaves a mortar scattering its burning contents in all directions.
INTRODUCTION

Permit Process

Permit Application

Must be submitted 15 days prior to display and must include:
Application
Diagram of display site (site plan)
Description of display
Insurance - required for indoor displays, recommended for outdoor
Any local requirements (cleanup, site maintenance)
Liability Insurance

MN Statute 466.04(6)(7) has raised the maximum single occurrence liability to $1.5 Million July 1, 2009
This is an increase from $1.0 Million set in 2000
Check with LMCIT if city is sponsoring event
Outdoor Pyrotechnic Display Request

- Name of sponsor
- Address of sponsor
- Name of pyrotechnic company or individual
- Contact numbers
- Location of display
- Date of display
- Time of display
- Location of storage
- Manner of storage
- Type of fireworks
- Number of fireworks
- Any other effects
- Operator name
- Certification number
- Assistant names
- Signature blocks
Outdoor Pyrotechnic Display

- Name of company (Sponsor)
- Address of company
- Local agent name (if company is national)
- Contact numbers
- Location of display
- Date of display
- Time of display

- Location of storage
- Manner of storage
- Type of fireworks
- Number of fireworks
- Any other effects
- Operator (shooter) name
- Certification number
- Assistant names
- Signature blocks

Description of Display

ABC PYROTECHNICS, INC
4th OF JULY EXTRAVAGANZA

We plan on providing the ultimate 4th of July Firework show. As part of the presentation, we will be using the following:

- 16" Roman Candles, consisting of:
  - 4" Cannons
  - 12" Saturns
- 3" Shells, consisting of:
  - 2" Cannons
  - 4" Shells

- 25 Big Wheels

- HEDPE mortar fuse

Total time of display: 20 Minutes
Outdoor Pyrotechnic Display Request

- Name of company (Sponsor)
- Address of company
- Local agent name (if company is national)
- Contact numbers
- Location of display
- Date of display
- Time of display
- Location of storage
- Manner of storage
- Type of fireworks
- Number of fireworks
- Any other effects
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- Certification number
- Assistant names
- Signature block

Location and Manner of Storage

- Single shot or reloading?
- How many shows?
- How big is the show?
- Where is the show?
- Where are the fireworks coming from?

Location and Manner of Storage

- Ready boxes must be portable, weather resistant containers that self close in some manner
- Tarps are not ready boxes
- Ready boxes must be 25 feet from mortars
- Assembly and repair of fireworks must be 50 feet from storage area
Outdoor Pyrotechnic Display Request

- Name of company (Sponsor)
- Address of company
- Local agent name (if company is national)
- Contact numbers
- Location of display
- Date of display
- Time of display

- Location of storage
- Manner of storage
- Type of fireworks
- Number of fireworks
- Any other effects
- Operator (shooter) name
- Certification number
- Assistant names
- Signature block

Display Location

- Geographical location
- Must coordinate with site map and aerial shells to be used
- Ground
- Special provisions for:
  - Rooftop, other structure and other limited egress locations
  - Floating vessels and platforms
Display Location

- Geographical location
- Must coordinate with site map and aerial shells to be used
- Ground
- Special provisions for:
  - Rooftop, other structure and other limited egress locations
  - Floating vessels and platforms

Floating Vessel and Platforms

- Permitted to be manned or unmanned, provided the crew maintains control of site
- Platforms must be in control at all times, either self propelled, attached to another vessel or anchored
- Construction shall be of sufficient strength and stability
- Seaworthiness shall not be compromised
Floating Vessel and Platforms
Shelters

Manned platforms shall have a shelter:
- Large enough for all personnel
- Minimum of 3 sides and a roof
- Constructed of at least ¾” plywood or equivalent

Floating Vessel and Platforms
Shelters

Safety shelter separation distance
- 2’ per inch of shell diameter up to 6” shells
- 4’ per inch of shell diameter greater than 6”
- Distance can be reduced if shelter is stronger than required.

Floating Vessel and Platforms
Egress

- Two paths of egress shall be provided
- Only one required from the shelter
- Egress paths shall be clear of obstructions
Floating Vessel and Platforms Operations
- Manual firing permitted if:
  - Shells are preloaded
  - Single break shells not exceeding 6"
  - Platform is twice that required for electric ignition
  - All personnel, except for the shooter, shall be in the shelter

Floating Vessel and Platforms Operations
- No reloading of mortars is permitted
- All personnel must wear USCG approved PFD’s at all times
- Rescue craft shall be ready to retrieve personnel
- Must have communications with the manned platform
- Only necessary personnel permitted on board
- Minimal combustible materials on board

Rooftop Location
- Rooftops, bridges, towers, stadiums, parking decks, other structures and limited egress locations
- Operator shall have special knowledge and experience with these locations
Rooftop Location

- Structure shall have sufficient strength and stability for display
- All sites must have the approval of the AHJ and building owner

Rooftop Location

- Egress shall be provided and kept clear of obstructions
- All openings identified and fragile openings protected from damage

Rooftop Location

- Intakes covered or AHU’s shut down
- Sewer vents covered
- No overhead towers or antenna within 25 feet
- Building owner, operator and AHJ must inspect roof for any additional protection
Rooftop Location

- Fireworks shall be secured away from public with a defined path
- All mortars must be preloaded
- Discharge site and shelter same as floating platforms
- Spotters must be placed to observe any roofs or structures within the display site
- Discharge site requires additional calculations

Floating Vessels, Platforms and Rooftop Size Requirements

- The minimum size for the floating vessels, platforms or rooftops that are manned shall be based on the area for the setup of the display site plus the area for the safety shelter
- Minimum size shall be calculated based off of the display

Floating Vessels, Platforms and Rooftop Calculations

- **Minimum Barge Area**
  
  \[
  \text{Minimum barge area} = M + C + G
  \]
  
  where:
  
  - \( M \) = the area needed for mortars
  - \( C \) = the area needed for cakes and multi-tube devices
  - \( G \) = the area needed for ground displays

- **Mortars**
  
  \[
  \text{Minimum display setup area} = \sum_{n=1}^{N} M_n \times D_n
  \]
  
  where:
  
  - \( M_n \) = number of each mortar size from 1 to \( n \)
  - \( D_n \) = inside diameter (in inches) for each size mortar
Floating Vessels, Platforms and Rooftop Calculations

• Cake and Multi Tube
where:\n$$C(n) = \sum_{i=1}^{n} 2 \times C_i \times F_i$$

- $C_n$ = number of each cake and multi-tube size from 1 to n
- $F_n$ = footprint (in ft) for each size cake and multi-tube device

• Ground Display
where:\n$$G(n) = \sum_{i=1}^{n} G_i \times A_i$$

- $G_n$ = number of each type of ground item from 1 to n
- $A_n$ = footprint (in ft) occupied by each type of ground display item

Floating Vessels, Platforms and Rooftop Calculations

- Mortars:
  $$\text{Mortars} = \text{number of mortars} \times \text{shell diameter}$$

  $$= 2 \times \frac{(10 \times 3) + (50 \times 4) + (30 \times 6) + (10 \times 8)}{2}$$

  $$= \frac{30 + 200 + 180 + 80}{2}$$

  $$= \frac{490}{2}$$

  $$= 245 \text{ ft}^2$$

- Aerial Shells consisting of:
  - 10 Battle in the clouds, 4'
  - 10 Atomic pattern, 4'
  - 10 Brocades, 3'
  - 10 Butterflies, 6'
  - 10 Chrysanthemums, 8'
  - 10 Coconut shells, 6'
  - 10 Cracksles, 6'
  - 10 Crowns, 4'
  - 10 Dahlia, 4'
  - 10 Draw-out, 4'

Floating Vessels, Platforms and Rooftop Calculations

- Cake and multi tube up to 3'':
  $$C(3'') = \sum_{i=1}^{n} 2 \times C_i \times F_i$$

  = 2 times # of each device times the footprint for each size device

  = $2 \times 3 \times \text{ft}^2 \text{ of cake or multi tube device}$

  = $2 \times 3 \times (2 \times 2')$

  = $2 \times 3 \times 4$

  = $24 \text{ ft}^2$

(3) 30 shot finale with 2.5'' mortars
Floating Vessels, Platforms and Rooftop Calculations

- Ground display = \( G(l) = \sum c_i \times A_i \)

- Number of each type of ground display times the footprint of each device in ft.

No ground displays

Floating Vessels, Platforms and Rooftop Calculations

- Minimum site area = Minimum base area (ft²) = \( M + C + G \)

- Mortars + Cake + Ground Displays

- 245ft² + 24ft² + 0ft²

- 269ft²

- 269ft² + safety shelter

- (3) 30 shot finale with 2.5" mortars

Display Location

- Geographical location

- Must coordinate with site map and aerial shells to be used

- Ground

- Special provisions for:
  - Rooftop, other structure and other limited egress locations
  - Floating vessels and platforms
APPLICATION OF CODES

Site Plan

- Should include:
  - Discharge site location
  - Display site location
  - Location of buildings, roads, waterways
  - North arrow
  - Firework storage location
  - Spectator locations

ONE MAJOR PROBLEM...
Display Site

Display site – The immediate area where a fireworks display is conducted, including the discharge site, the fallout area, and the required separation distance from the mortars to spectator viewing areas, but not spectator viewing areas or vehicle parking areas.
Display Site

Display Site vs. Fallout Area

Basically the same thing
Take care of the display site and you won’t have issues with the fallout area
Fallout area only is important if limiting fallout locations
Causes a lot of confusion between AHJ’s and NFPA 1123 committee members

Display Site

- The area including the discharge site and separation from spectator viewing area
- For aerial shells, minimum required radius of 70 feet per inch of mortar
  1” or less is 75 feet
  1.5” is 105 feet
  2” is 140 feet
  2.5” is 175 feet
- For comets and mines, 35 feet per inch of shell, half the distance required in NFPA 1123, Table 5.1.3.1
Display Site

- No spectators or spectator parking allowed in display site
- Structures may be within display site with AHJ and owner approval provided the building is evacuated
- Distances from the point of discharge of any firework to a healthcare, detention or correction facility shall be at least twice required under Table 5.1.3.1

Display Site

- FACILITY. A building or use in a fixed location including exterior storage areas for flammable and combustible substances and hazardous materials, piers, wharves, tank farms and similar uses.

Discharge Area

- Single and multiple areas
- Usually located near the middle of the display site (1/3 Offset)
- Should be located on flat, even terrain free of combustible materials
- No overhead obstructions within 25 feet of aerial devices
Discharge Area

- Ground display piece may or may not be in the discharge area
- Low hazard potential, 75 ft radius
  - Gerbs, fountains, lances, mines
- Greater hazard potential, 125 ft radius
  - Large wheels, comets
- Firework preparations must be at least 100 feet from public access

<table>
<thead>
<tr>
<th>Mortar Size</th>
<th>Diameter</th>
<th>Site Vertical</th>
<th>Special Hazards</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>25</td>
<td>150</td>
<td>46</td>
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</tr>
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</table>

Geometry 101

NFPA Language and Table

NFPA Table

NFPA 1123

Table 5.1.3.1

Display Site - Minimum of 70 foot radius per inch of mortar
Angling of Mortars

- Mortars can be angled to allow wind to carry debris and effects from spectator viewing area
- Mortars should be moved as equal distance to the angle of the mortars – 10% angle means mortars are moved 10% back (doesn’t usually occur when multiple shell sizes are used)

<table>
<thead>
<tr>
<th>Angle Size</th>
<th>Mortar Shell</th>
<th>Angled Shell</th>
<th>Mortar Size</th>
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<tbody>
<tr>
<td>in</td>
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</tbody>
</table>

Display Site – Combination Angled and Vertical

- Does not reduce overall size of display site
- Does not change location of display site
- Total shift may be up to 1/3 of diameter of display site
- If mortars move 1/6 closer to spectators from center, fallout zone shifts 1/6 farther from center
- Designed to angle mortars due to terrain or other factors
- Mortars are to be moved closer to the spectators and aimed away from the spectators

1/3 Offset
### NFPA 1123

**Table 5.1.3.1**

<table>
<thead>
<tr>
<th>Distance to Mitigate (feet)</th>
<th>Vertical Mortar</th>
<th>To</th>
<th>Distance of Site Vertical Mortars</th>
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<tr>
<td>1/3 Offset</td>
<td>Vertical Display</td>
<td>65</td>
<td>Vertical Mortar x 1/3 Offset</td>
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<td>Vertical Mortar</td>
<td>65</td>
<td>Vertical Mortar x 1/3 Offset</td>
</tr>
</tbody>
</table>

#### 1/3 OFFSET

- 560 feet (vertical site radius)
- 370 feet (near side site radius)
- 750 feet (far side site radius)
- 1120 feet (site diameter) - 370 feet = 750 feet

### Vertical Display

- Minimum distance to boundary
- Vertical mortars and center of fallout area, center of circle
- Ground displays (if any)

Main spectator area
As with all codes, you can be as rigid or flexible as you feel comfortable (language vs. intent). There is nothing preventing you from following the letter of the code. If uncomfortable with location or display site, reduce shell size or relocate. Designate fallout areas, if needed.
On-Site Pre-Display Inspection

Introduction

- Shall be done every time
- Shall be done prior to issuance of permit
- Should also be conducted at the start of the setup and the day of the show

FD Access

- Fire lanes clear
- Fire hydrants unobstructed (and operational)
**Fire Extinguishers**
- Charged in good condition
- Located in designated and identifiable locations
- Safety seals in place
- No signs of physical damage
- Directions clearly marked
- Pressure gauge operational
- Complies with NFPA 10

**Exits**
- Clear and unobstructed
- Exit route in a safe direction

**Electrical Wiring**
- Extension cords in good condition and rated for the use
- Electrical devices away from water, fuel and pyrotechnics

*Static electricity should also be considered*
Preparation of Fireworks

- Assembly, minor repair, installation of fuses or electric match and similar activities shall not be considered manufacturing to include set piece assembly
- Preparation area must be at least 100 feet from the public
- All fireworks shall be handled carefully when unloaded, prepared, loaded and setup (including cutting fuses)
Shells

- Diameter allows for easy loading and proper fit
- Label displays:
  - Size of shell
  - Description of type
  - Disclaimer
  - Fuse length depends upon ignition type
  - Properly stored for safety and environment

Buried Mortars, Racks or Troughs

- Are they:
  - where they’re suppose to be?
  - in good condition?
  - properly aimed?
  - properly secured?
  - constructed of the proper material?
  - positioned perpendicular to the audience?
  - correct length and diameter?
## Mortar Racks

- Single break shells up to 6”
- Single break shells 7” or 8” permitted:
  - Mortar is not metallic
  - Electric ignition
  - Shell is not chain fused
- Single break shells greater than 8” or multiple break shells not permitted

<table>
<thead>
<tr>
<th>Shell Type</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerial Shells</td>
<td>100</td>
</tr>
<tr>
<td>Battle in the clouds</td>
<td>4”</td>
</tr>
<tr>
<td>Atomic pattern</td>
<td>4”</td>
</tr>
<tr>
<td>Brocades</td>
<td>3”</td>
</tr>
<tr>
<td>Butterflies</td>
<td>6”</td>
</tr>
<tr>
<td>Chrysanthemums</td>
<td>8”</td>
</tr>
<tr>
<td>Coconut shells</td>
<td>6”</td>
</tr>
<tr>
<td>Cradles</td>
<td>6”</td>
</tr>
<tr>
<td>Crowns</td>
<td>4”</td>
</tr>
<tr>
<td>Dahlias</td>
<td>4”</td>
</tr>
<tr>
<td>Draw-out</td>
<td>4”</td>
</tr>
</tbody>
</table>

## Buried Mortars

- Mortars shall:
  - Be buried 2/3 of their length in the ground, troughs or drums
  - Special considerations to paper mortars
  - If water leakage suspected, wrap mortars in bags
  - If reloading, additional precautions against the shifting or pile driving of mortars

- HDPE mortar tubes
Buried Mortars

- Mortars shall be separated by at least their diameter, unless:
  - Shells are 6" or less
  - Electric ignition
  - Unchained

Fill must be clean sand or dirt free of rocks or projectiles

---

Buried Mortars

Reloading

- Mortars up to 6" can be reloaded 7 times
- Does not apply to steel mortars up to 6"
- If seamed steel pipe is used, seams must point away from spectators
- Chain fusing not permitted

100 Aerial Shells consisting of:
- 10 Battle in the clouds, 4"
- 10 Atomic pattern, 4"
- 10 Brocades, 3"
- 10 Butterflies, 6"
- 10 Chrysanthemums, 6"
- 10 Coconut shells, 6"
- 10 Cradles, 6"
- 10 Crowns, 4"
- 10 Dahlias, 4"
- 10 Draw-out, 4"

HDPE mortar tubes
**Reloading**

- Mortars of various size shall not be intermixed.
- HDPE mortars (and possibly other types) can lose significant strength if fired over a short period of time.

100 Aerial Shells consisting of:
- 10 Battle in the clouds, 4”
- 10 Atomic pattern, 4”
- 10 Brocades, 3”
- 10 Butterflies, 6”
- 10 Chrysanthemums, 6”
- 10 Coconut shells, 6”
- 10 Cradles, 6”
- 10 Crowns, 4”
- 10 Dahlias, 4”
- 10 Draw-out, 4”

HDPE mortar tubes

**Chain Fusing**

- If more than 3 shells are linked, protect adjacent mortars.
- Rack requirements:
  - 3” or less mortars – up to 15 mortars per rack
  - 4” mortars – up to 12 mortars per rack
  - 5” to 6” mortars – up to 10 mortars per rack

Does not apply to boxed finale items containing tubes 2.5” or less.

(3) 30 shot finale with 2.5” mortars

**Salute Shells Single Break**

- Maximum diameter of 5” and:
  - Non metal mortars*
  - Shells larger than 3” must be separated by 10 times the diameter
  - Remote ignition (electric) or additional 5 second delay on fuse
  - Shells must be preloaded

* Multi-break shells containing salutes and stars should use steel mortars
### Salute Shells

**Multiple Break**

- Similar requirements to single break
- Individual salutes not exceed 3" and 3 oz. of composition

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### Mortar Length

<table>
<thead>
<tr>
<th>Table A.4.5.8: Maximum Inside Mortar Length in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortar ID</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>10</td>
</tr>
</tbody>
</table>

For M4 units 1 in = 25.4 mm

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### Mortar Diameter
Electric Ignition

- Properly shunted and secured
- Disconnected from the control box while loading mortars
- Distanced at least 75 feet from the mortars
- No safety cap required on fuse

Manual Ignition

- Limited to shells no more than 6”
- Can go up to 8” if mortar is buried ¾ and shooter has additional protection
- Safety cap of different color required on fuse

Site Security

- Discharge area clearly marked
- Display site cleared prior to display, clearly marked and staffed
**AHJ Authority**

- AHJ has authority to stop or suspend display due to:
  - Hazardous conditions
  - Crowd control
  - Inclement weather, or
  - *To correct your mistake*

Show may not continue until corrected

**2008 Investigation Example**

- Permit application
- Insurance forms
- Disclaimer form
- Display site diagram
- Shell summary
  - (50) 1.2" opening shells
  - (1195) 1.2", 0.75" and 0.5" main event shells
  - (50) 2.5" finale shells
INTRODUCTION

AREA CONTROL

- During manually operated displays, the shooter is required:
  - Determine when a shell fails to fire
  - Warn others in the area
  - Ensure mortar is marked

- Shells electrically ignited do not need to be marked when misfire occurs
DISPLAY SITE

- Once OK’d by the operator, a sweep of the fallout zone must be conducted immediately after the display
- In the event of a night display, a second sweep must be completed at first light
- Any dud’s must be handled the same as a misfire

MISFIRES

- Immediately following the display, but no sooner than 15 minutes after any misfires, the mortar shall be flooded with water for 5 minutes prior to the removal of the shell
- Does not apply if misfire was caused by electrical malfunction

SITE CLEANUP

- Though not required, consider cleanup and post-inspection as part of your permit process
Pyrotechnic Incidents

× June 19, 2008 – Waconia, licensed operator prepping aerial shells ignited 4” star shell. Operator received burned to hands, face, legs and suffered pulmonary damage.
Pyrotechnic Incidents

- August 2, 2008 – St. Anthony, 4” aerial shell landed in the highway narrowly missing a motorcyclist
- Investigation found breakdown in communication from the time the permit was first received until after the show
- Improper display site
Pyrotechnic Incidents

- August 13, 2008 – Caledonia, Fire Chief cancels display just prior to the Houston County Fair 150\(^{th}\) celebration
- Investigation found breakdown in communication from the time the permit was first received until the show was cancelled
- Improper separation distances
Pyrotechnic Incidents

- July 4, 2009 – Tofte, Local fire department shooting a show had a mortar fail and ready box explosion
- No one on the fire department had a MN pyrotechnics certification
- Fire Chief charged with 2 counts misdemeanor
Pyrotechnic Incidents

- July 30, 2010 – Cass Lake, Use of illegal fireworks on a pontoon capsized one boat and damaged another
Pyrotechnic Incidents

- June 10, 2015 – Willmar, Local fire department on standby at a dirt track race discharged fireworks given to them by the race sponsors
- No one had a MN pyrotechnics certification, experience, knowledge or a permit
- 1 firefighter seriously injured
Explosives Licensing and Permits

Licenses and Permits

- Explosives License-Issued by SFMD
- Explosives Application and Permit (Storage)-County Sheriff or Police Chief
- Explosives Application and Permit (Use)-County Sheriff or Police Chief

Statutes

- 299F.73-Licenses: State Fire Marshal shall issue all licenses for persons who manufacture, assemble, warehouse or store explosives or blasting agents not for ultimate consumption
- 299F.74-Permit to Possess: No person shall possess explosives or blasting agents without first obtaining either a license or permit
### Statutes

- **299F.75-Permit to Possess Application:** Any person desiring to possess explosives or blasting agents not otherwise licensed shall apply to the County Sheriff or Police Chief of a Statutory or Home Rule Charter City.

### License/Permit to Possess

<table>
<thead>
<tr>
<th>LICENSE REQUIRED</th>
<th>PERMIT REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wholesale/retail sales</td>
<td>Job site storage</td>
</tr>
<tr>
<td>3rd party storage</td>
<td>Manufacture and Use on-site</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Assembly and Use on-site</td>
</tr>
<tr>
<td>Assembly</td>
<td></td>
</tr>
</tbody>
</table>

### MN Rules-Use

- **7500.0560-Explosives User Permit:** Issued by County Sheriff or Police Chief
- 3-part carbon copy form
  - White page: Given to applicant
  - Yellow page: Retained by issuing authority
  - Pink page: Submitted to SFMD
Explosives-Background Checks

- CFR Title 28, Section 25.7
- SFMD uses BCA
- County Sheriff or Police Chief can use
  - MN Crime Information System
  - National Instant Criminal Background Check System
  - DHS Civil Commitment Records

Explosives-Background Checks

- Disqualifiers:
  - Under the age of 18
  - Crimes of violence <10 years
  - Mental illness AND dangerous to the public
  - Controlled substance conviction <2 years
  - Civil commitment unless treatment has been completed

Penalties

- 299F.79-Possession of Components
- 299F.80-Possession of Explosives
- 299F.82-Illegal Transfer
- 299F.83-Negligent Discharge
- 299F.831-Handling while under the influence
Explosives-Common Questions

Q: Am I required to get a license or a permit for storage?
A: Get both.
- There is no cost incurred when getting a license from the SFMD
- There is (typically) no cost incurred when getting a permit from the County Sheriff/Police Chief

Explosives-Common Questions

Q: Are magazines required to be placarded?
A: Depends.
- MSFC 5604.6.5 requires specific signage and requires signs be so placed as to minimize bullets shot at the sign do not hit the magazine
- SFMD and BATFE agree placards may be omitted due to security concerns with local AHJ approval

Explosives-Common Questions

Q: Is Tannerite (Binary Reactive Exploding Targets) lawful?
A: Yes.
- Tannerite (Binary Reactive Exploding Targets) are lawful for use when:
  - Their used in an area where firearms can be lawfully discharged
  - Used by persons who can lawfully possess firearms or the components thereof
References

- MN Statute 624.20-25
- MN Statute 299F.72-299F.831
- MN Rule 7500.01-7500.36
- MSFC Chapter 56
- NFPA 1123, 2010 Ed.

Any Questions?

Robert Rexeisen
Deputy State Fire Marshal
(612)368-4657
Robert.Rexeisen@state.mn.us
firecode@state.mn.us
www.fire.state.mn.us