hands

USER'S MANUAL

Class 7.2.2 Fireworks

110 Centre Street
Prescott, ON K0E 1T0
Tel: 613-423-PYRO (7976)
Toll Free: 800-268-5034
www.handsfireworks.com

HF-BOOK - V1.0

SHELL FIRING INSTRUCTIONS

LOCATION

Firing area should be free of obstructions along the flight path of climbing pyrotechnics. Fireworks location should provide a clear view of the sky 300-600ft / 92-183m above the firing area.
Place shell storage boxes of each size a minimum of 8m away from their respective mortars. Ensure that the shell boxes are well covered with a fire resistant material. Do not mix different sized shells in the same box.
Adhere to ERD specified Firing Distances for distance to spectator and fall out zone.

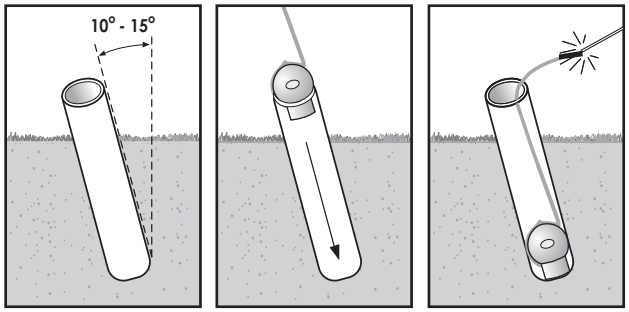
STABILIZATION

Shells are projected into the air using a mortar of the corresponding diameter. Mortars should be embedded in ground or sandboxed to over half of their height. Mortars should not be buried in wet ground for long periods of time. When the ground is too wet sandboxes are recommended.

Mortars for single shells of the same size may be grouped but should be separated at least the distance equal to the mortar diameter. For shell selections that offer trios or pairs of favourite shells (joined together with quickmatch) the mortars should be positioned at least 3" apart but no more than 12" apart. Mortars may be angled 10-15° off perpendicular and away from the spectators. To protect the firework set up from moisture damage cover with plastic sheeting. Remove the plastic prior to firing.

PREPARATION

If shell is equipped with tracer, please remove cellophane cover to expose prime prior to placing in mortar. The shell should be inserted into a clean mortar. (Be sure that any paper or burning debris has been lifted from the bottom of the mortar prior to loading). The correct sized mortar is the one that provides a sliding fit for the shell. (Be sure that the top side of the shell and the quickmatch fuse is UP). A portfire holder should be used to ensure that no airspace exists between the shell and the base of the bottom of the mortar. Shells that are matched together should be loaded and fired at the same time.



SINGLE SHELLS

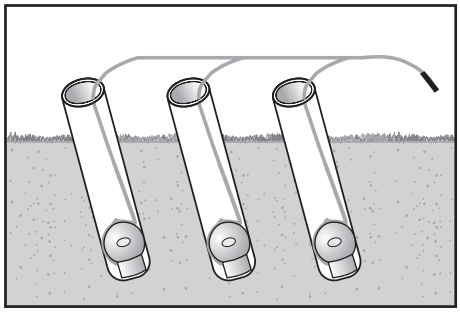
FIRING

Hand Firing: Connect the portfire and the portfire holder. Remove the safety sleeve to expose the black match. The matched trios or pairs have only one safety sleeve that will expose one section of the black match that connects to the multiple of shells. Do not lean over the firework item(s) when igniting. Fully extend arm and touch the end of the black match with the glowing end of the portfire.
The matched trios and pairs have half second timing delays that provide a slightly rippled effect when they are fired. Upon ignition, quickly distance yourself from the item(s).

Electrical Firing: For ease of electric match installation, 76mm report shells and shells above 102mm now have a plastic electric match holder installed. At the site, with the shell(s) installed in the appropriate mortar(s), insert the electric match, complete with shroud(the plastic tube protecting the head of the electric match) into the hole of the electric match holder. To secure in position, hook the lead wires around the arms of the electric matchholder.

SAFETY NOTES

HANDS recommends that hard hats, face, eye and ear protection be worn by all firing crew members. Each member of the firing party should thoroughly read instruction sheets.
Ensure that crowd control is in effect and that barriers are securely in position. If an item fails to ignite, do not approach it for 30 minutes.
** After the display and again during daylight hours, be sure to search the firing area and neighbouring land for "live" firework debris. Live findings should be collected, reported to HANDS Fireworks and destroyed under supervised conditions. **



MATCHED TRIO OF SHELLS
OR MATCHED FLIGHTS

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INSTRUCTIONS FOR MID LEVEL CAKES

LOCATION

Firing area should be free of obstructions along the flight path of climbing pyrotechnic effects. Fireworks location should provide the audience with a clear view up to 250'/77m above the firing area, 300'/92m separation from spectators, 20' separation from simultaneously fired items, 30' separation from sequentially fired items.

STABILIZATION

Embed cakes to half the height of the tubes, firmly in ground. Ensure the unit is level. If it is a "fanned" item, there are arrows indicating the angle of fire of the tubes on the appropriate sides or ends of the carton. Angled tubes must not point towards spectators or firing crew. Orientation of the fanned item constructed as illustrated above is correct for spectators located in the background and firing crew in the foreground and NOT to the left or right.

PREPARATION AND FIRING

The cakes are outfitted with a foil cover to protect them from moisture. This cover should be left intact and the pyrotechnic effects will fire through it.

Hand Firing:

The fuse with the red safety sleeve is the hand-firing ignition fuse. For hand firing, remove the red safety sleeve to expose the end of the fuse. Do not lean over the item when igniting. With portfire and holder, fully extend arm and touch the exposed end of the fuse with the glowing end of the portfire. Quickly distance yourself from the item.

Electrical Firing:

An electric match must be added on site. For ease of electric match installation, a plastic, electric match holder has been attached to the fuse with the red safety sleeve. Insert the electric match complete with shroud (the plastic tube protecting the head of the electric match) into the hole of the electric match holder. To secure in position, hook the lead wires around the arms of the electric match holder.

IMPORTANT CAUTION:

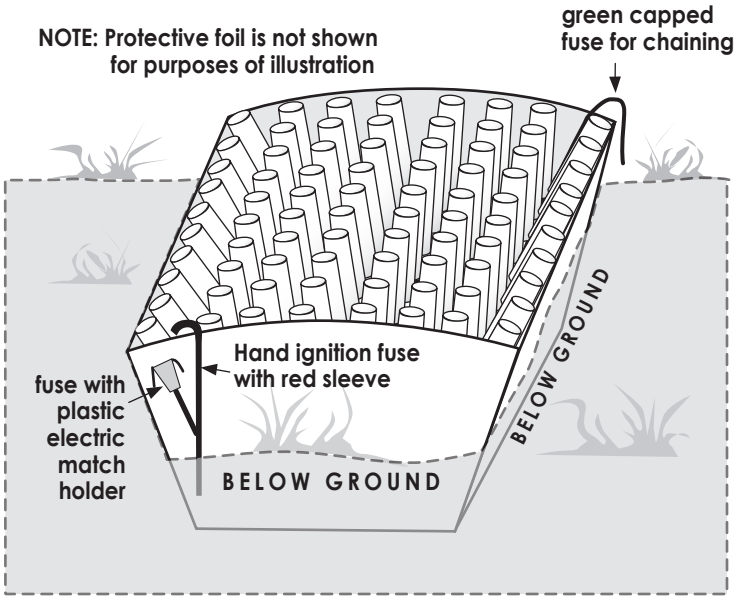
The plastic match holder may be tucked under the protective foil covering the top of cake. To use, pull the holder out and attach the electric match as described above. If not using, you **must** pull the plastic, electric match holder from inside the cake and tape it down. Ensure a red plug is in the holder. If it has fallen out, tape across the opening. Failure to do so could cause improper firing.

SAFETY NOTES

HANDS recommend that hard hats, face, eye and ear protection, gloves and safety boots or shoes be worn by all firing crew members. Each member of the firing party should thoroughly read instruction sheets. Ensure that crowd control is in effect and that barriers are securely in position.
If an item fails to ignite do not approach it for 30 minutes. *** After the display and again during daylight hours, be sure to search the firing area and neighbouring land for "live" firework debris. "Live" findings should be collected, reported to HANDS Fireworks and destroyed under supervised conditions***

DESIGN NOTES

Cakes are effective when fired singly or in rapid succession. The cakes will perform for 30 to 60 seconds and effects will climb up to 250'/77m, depending upon the construction and size of the unit.



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MINE SHELL INSTRUCTIONS

LOCATION

Firing area should be free of obstructions along the flight path of climbing pyrotechnics. Fireworks location should provide a clear view of the sky 300-600ft / 92-183m above the firing area.
Adhere to Explosives Branch specified Firing Distances for distance to spectator and fall out zone.

STABILIZATION

Mine shell effects are projected into the air using a mortar of the corresponding diameter. All mortars intended for use should be set up during daylight hours in advance of firing time. Mortars should be embedded in ground or sandboxes to over half of their height. Mortars should not be buried in wet ground for long periods of time. When the ground is too wet sandboxes are recommended.
Mortars for mine shells of the same size may be grouped but should be separated by a distance at least equal to the mortar diameter. To protect the fireworks set up from moisture cover with plastic sheeting. Remove the plastic prior to firing.

PREPARATION

The mine shell should be inserted into a clean mortar.
(Be sure that any paper or burning debris has been lifted from the bottom of the mortar prior to loading). Failure to do so may lead to premature ignition of the mine shell.
The correct size mortar is the one that provides a sliding fit for the mine shell. (Be sure that the top side of the mine shell and the fuse is UP). A portfire holder should be used to ensure no airspace exists between the shell and the base of the bottom of the mortar.

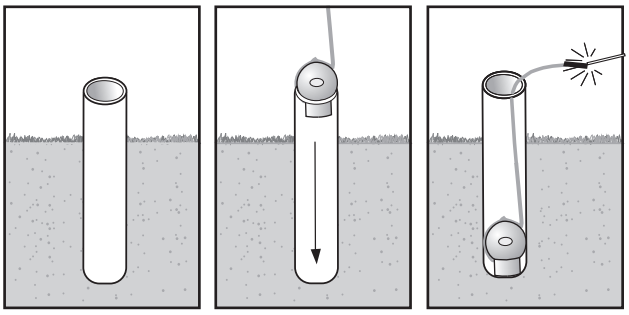
FIRING

Hand Firing: Connect the portfire and the portfire holder. Remove the safety sleeve from the mine to expose the fuse. Do not lean over the firework item(s) when igniting. Fully extend arm and touch the end of the black match with the glowing end of the portfire.
Mine shell fuses are configured with a 2-6 second delay. Upon ignition, quickly distance yourself from the item(s).

Electrical Firing: For ease of electric match installation, mine shells now have a plastic electric match holder installed on the item(s).At the site, with the shell(s) installed in the appropriate mortar(s), insert the electric match, complete with shroud(the plastic tube protecting the head of the electric match) into the hole of the electric match holder. To secure in position, hook the lead wires around the arms of the electric match holder.

SAFETY NOTES

HANDS recommend that hard hats, face, eye and ear protection be worn by all firing crew members.
Each member of the firing party should thoroughly read instruction sheets.
Ensure that crowd control is in effect and that barriers are securely in position. If an item fails to ignite, do not approach it for 30 minutes.
** After the display and again during daylight hours, be sure to search the firing area and neighbouring land for "live" firework debris. Live findings should be collected, reported to HANDS Fireworks and destroyed under supervised conditions. **



INSTRUCTIONS FOR MID LEVEL SLICE CAKES

LOCATION

Firing area should be free of obstructions along the flight path of climbing pyrotechnic effects. Fireworks location should provide the audience with a clear view up to 250'/77m above the firing area, 300'/92m separation from spectators, 20' separation from simultaneously fired items, 30' separation from sequentially fired items.

STABILIZATION

Embed cakes to half the height of the tubes, firmly in ground. Ensure the unit is level. Arrows indicating the angle of fire of the tubes are located on the appropriate sides or ends of the carton. Angled tubes must not point towards spectators or firing crew. Orientation of the fanned item constructed as illustrated above is correct for spectators located in the background and firing crew in the foreground and NOT to the left or right.

PREPARATION AND FIRING

The cakes are outfitted with a foil cover to protect them from moisture. This cover should be left intact and the pyrotechnic effects will fire through it.

Slice Cakes are configured for Electrical firing only.
Electric matches must be added on site. A plastic, electric match holder has been attached to the fuse for each row. Insert the electric match complete with shroud (the plastic tube protecting the head of the electric match) into the hole of the electric match holder. To secure in position, hook the lead wires around the arms of the electric match holder.

IMPORTANT CAUTION:

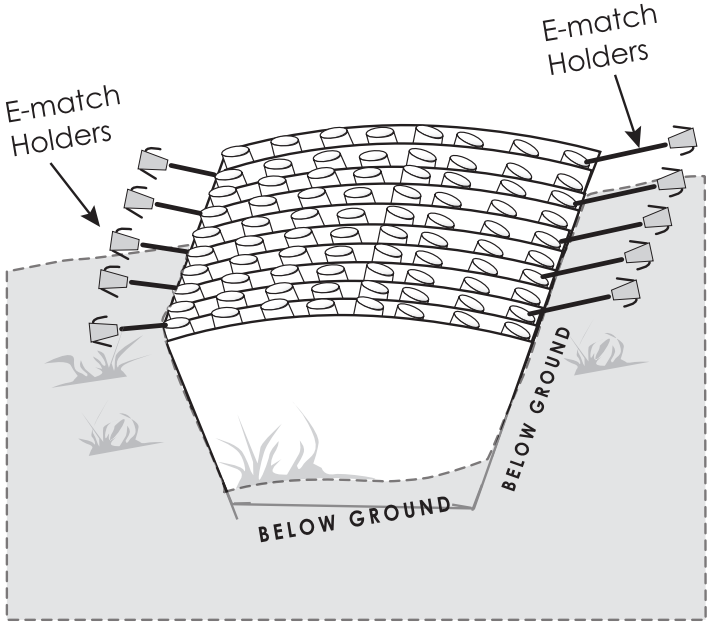
The plastic match holder may be tucked under the protective foil covering the top of cake. To use, pull the holder out and attach the electric match as described above.

SAFETY NOTES:

HANDS recommends that hard hats, face, eye and ear protection, gloves and safety boots or shoes be worn by all firing crew members. Each member of the firing party should thoroughly read instruction sheets. Ensure that crowd control is in effect and that barriers are securely in position.
If an item fails to ignite do not approach it for 30 minutes. *** After the display and again during daylight hours, be sure to search the firing area and neighbouring land for "live" firework debris. "Live" findings should be collected, reported to HANDS Fireworks and destroyed under supervised conditions***

DESIGN NOTES

Cakes Slices are effective when fired singly from multiple locations. Each row is fused to fire separate from one another. The cakes slice will perform for 2 to 5 seconds and may fire either left to right or simultaneously depending on the effect. Effects will climb up to 250'/77m, depending upon the construction and size of the unit.



hands

MONTMORENCY FALLS

LOCATION

Firing area should be free of obstructions along the path of falling showers.
Fireworks location should provide the audience with a clear view of up to 50'/15m above the area.
Ensure a 1-5m separation from simultaneously fired items and 5-9m separation from sequentially fired items.

STABILIZATION

The unit consists of shower tubes wired to a length of rope and joined together at the bottom of each tube with quickmatch. Ensure that the quickmatch has not loosened or detached from the tubes.
The unit must be tautly strung between two upright structures (poles or extension ladders) separated by 9m for a Montmorency Falls. The upright or supporting system must be securely planted in ground to accommodate the weight of the set up and the effect of any wind. The falls should be secured at least 5.4m above the ground. The rope provided with the unit may be tied directly to the supports or it may be run through pulleys that have been attached to the supports.
When positioning the unit, it is necessary to ensure that the showers are aligned – parallel to each other and perpendicular to the supporting rope. The length of quickmatch that drops towards the ground should be tied to the support units at regular intervals to prevent damage caused by movement in the wind and to allow for proper control of the match end at the time of firing.

FIRING

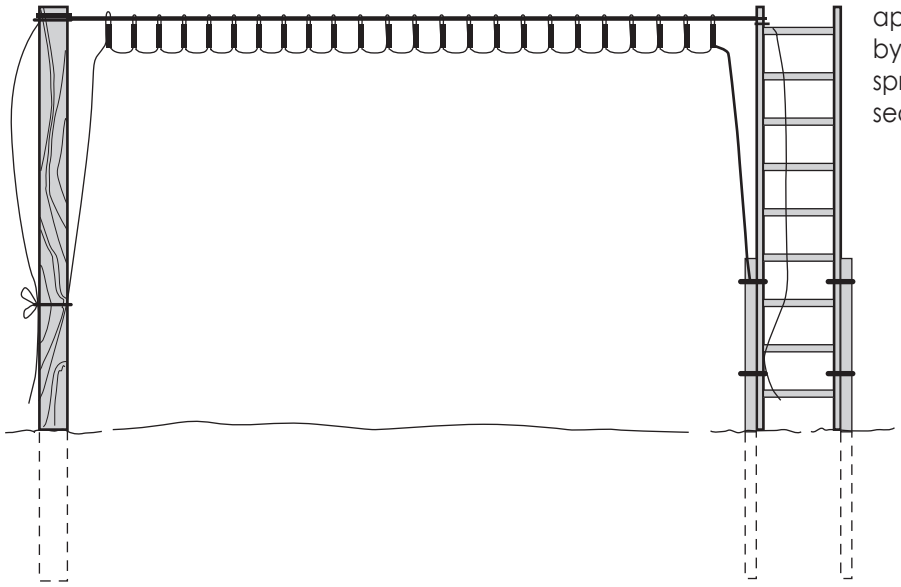
Hand Firing:
This unit is prepared for hand firing and may be fired at both ends for assured ignition.
Remove the paper safety cap to expose the length of black match. Do not hold the quickmatch.
Connect the portfire and the portfire holder. Extend arm fully and touch the quickmatch with the glowing end of the portfire. Quickly distance yourself from the unit.
Electric Firing:
Slightly open fuse and place e-match complete with shroud on top of the black match. Fold over once and tape closed.

SAFETY NOTES

Hands Fireworks recommends that hard hats, face, eye and ear protection, gloves and safety boots or shoes be worn by all firing crew members.
To protect the unit from moisture damage, cover with plastic sheeting. Remove the plastic prior to firing.
Do not stand near the falls once it has been ignited. If the item fails to ignite, do not approach it for 30 minutes.
*** After the display and again during daylight hours, be sure to search the firing area and neighbouring land for "live" firework debris. Findings should be collected, reported to Hands Fireworks, and destroyed under supervised conditions. ***

DESIGN NOTES

The falls should be set up to face the spectators to provide a performance that may be fully appreciated. The Montmorency Falls will drop a curtain of silver approximately 5m. The showers are introduced by a rainbow of colour flares that transform to a spray of silver. The effect lasts approximately 60 seconds.



FIRING STYLES

TO ELECTRICALLY FIRE

Stabilize the item in the recommended fashion.

Uncoil and fully extend the length of e-match wires. Remove the plastic protector, to expose the leads of the electric match. Untwist and separate the two leads. Attach one of the e-match leads to the bared end of a wire that will run to the battery location.

Attach the second of the e-match leads to a second wire that will run to the battery location.

At the battery location bare the ends of the wire that run from the firework item location.

When ready to fire simultaneously touch the bared end of the first wire to the positive terminal of the battery system and bared end of the second wire to the negative terminal of the battery system.

Once the unit has ignited, shield yourself from the firework action. If an item fails to ignite, do not approach it for 30 minutes.

TO ADAPT AN ITEM TO ELECTRICAL FIRING

If an item is prepared for hand firing only, it may be adapted by adding an electric match(e-match). Gently slip the end of the e-match complete with shroud into the paper wrapping of the quickmatch. Ensure that the e-match comes into contact with the black match. Fold once and apply masking tape to the newly created junction to ensure that the contact between the e-match and the black match is secured. Continue with the electrical firing procedure as previously outlined.

ELECTRICAL FIRING OF MULTIPLE OF ITEMS

Items that are to be fired simultaneously but from different locations should share the same 2 wires creating two complete systems (one positive and one negative) that then run to the battery location.

To create the system with 20 gauge wire – run one wire from the battery location and pass by each of the items to be fired simultaneously. Cut the wire once you have reached the item that is located the farthest distance from the battery location. Bare the end of this wire and join with a twist to one of the e-match leads. At each of the other firework locations, cut through the wire, bare the wire on both sides of the cut. Twist together the cut pieces and one of the e-match leads from each firework item. Repeat this entire procedure – run a second wire from the battery location, pass by each firework item, and attach the second squib lead to the cut and bared ends of this second length of wire. There should be two lengths of wire that complete 2 systems. Both wires should reach the battery location and each wire should be bared.

When ready to fire, touch one wire to the positive terminal and the other wire to the negative terminal and hold (count of 3).

To create the circuit with 14 gauge wire follow the same procedure as above but in lieu of cutting the wire at each location it is possible to simply strip away the plastic coating to expose the wire underneath. The appropriate e-match wire can then be wrapped around this bared wire and the connection is complete.

To ensure secure connections and to prevent the possibility of open connections causing a short in the circuit, you may wish to apply electrical tape to each of the connection points.

COMMON REASONS FOR IGNITION FAILURE

1. **The resistance of the line is too great.**
   This can be alleviated by decreasing the lengths of lines or by increasing the applied voltage or by decreasing the number of e-matches on a line.
2. **Both e-match wires are hooked to the same line.**
   Trace the path from the battery system location and ensure that each e-match is attached to the two lines of wire intended for the simultaneous firing.
3. **E-match wires or firing line is shorted somewhere along the line.**
   Ensure that the connections between e-match and wiring lines are not touching each other or any other conductor of electricity.
4. **E-match lead has untwisted and the connection has broken between the e-match and the wiring line.**
   Check connections prior to firing and secure junctions with electrical tape.

TO ADAPT AN ITEM FOR HAND FIRING

If an item is prepared for electrical firing only, it may be adapted for hand firing by cleanly cutting the quickmatch or igniter cord length 5cm above the e-match and fuse junction. Once cut, the igniter cord is ready for firing. The quickmatch fuse must have 15cm of the paper sleeve removed to expose the black match. If the quickmatch fuse is too short an extra length may be added. Be sure to establish contact between the existing black match and the black match of the new length. Then apply masking tape to seal the joint. Expose 15cm of blackmatch on the added length and ignite with the glowing end of a portfire as normal.

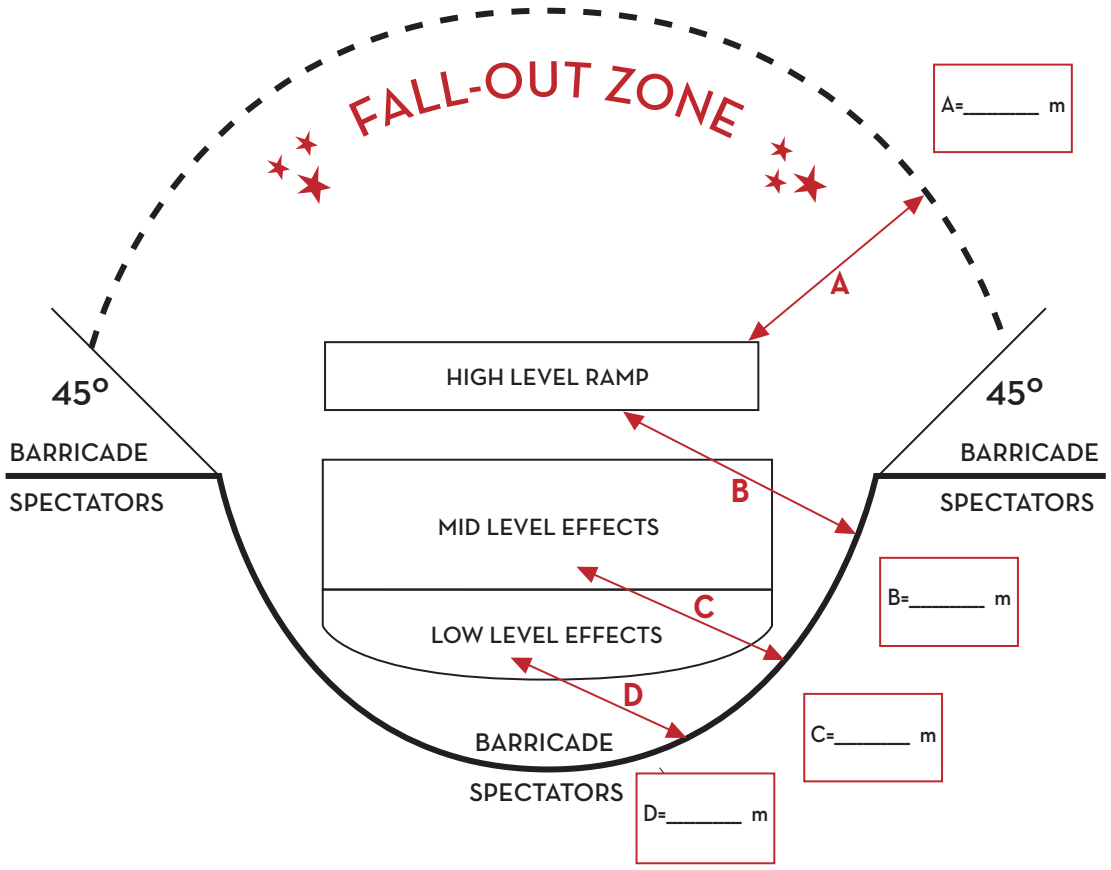
DISPLAY FIREWORKS SITE DIAGRAM

Hands Fireworks
110 Centre Street, Prescott, Ontario K0E 1T0
T 613-423-PYRO (7976) or 800-268-5034 F 613-423-7978
www.handsfireworks.com

PLEASE DETAIL THE SITE CONDITIONS ON THE DIAGRAM PROVIDED BELOW.

Indicate the distance relationship between the firing area and the crowd control barriers, the spectator location, the firework debris 'fall-out zone', the prevailing wind direction and the flight path of ascending fireworks. Also please indicate the distance to neighbouring buildings, structures, streets, parking lots, hydro/telephone lines, towers, trees or any other obstructions that may exist.

If your site plan varies from the one shown here, note that all minimum distances must be adhered to.



* NOTE: Please refer to the Firing Distances chart for acceptable distances.

SUPERVISOR'S NAME: _____

SUPERVISOR'S SIGNATURE: _____ SHOW DATE: _____

VOLTAGE REQUIREMENT

Maximum 2 wire circuit length Solid Copper Wire		Maximum number of squibs (Parallel Firing)													
20 gauge	14 gauge	1	2	3	4	5	6	7	8	9	10	11	12	13	14
50	200	6V	6V	6V	6V	6V	12V	12V	12V	12V	12V	18V	18V	24V	X
75	300	6V	6V	6V	6V	6V	12V	12V	12V	18V	18V	24V	24V	X	X
100	400	6V	6V	6V	6V	12V	12V	12V	18V	18V	24V	X	X	X	X
125	500	6V	6V	6V	12V	12V	12V	18V	18V	24V	X	X	X	X	X
150	600	6V	6V	12V	12V	12V	18V	18V	24V	X	X	X	X	X	X
175	700	6V	6V	12V	12V	18V	18V	24V	24V	X	X	X	X	X	X
200	800	6V	12V	12V	12V	18V	18V	24V	X	X	X	X	X	X	X
250	1000	6V	12V	12V	18V	18V	24V	X	X	X	X	X	X	X	X
300	1200	6V	12V	12V	18V	24V	X	X	X	X	X	X	X	X	X
350	XXX	6V	12V	18V	24V	24V	X	X	X	X	X	X	X	X	X
400	XXX	12V	12V	18V	24V	X	X	X	X	X	X	X	X	X	X
500	XXX	12V	18V	24V	X	X	X	X	X	X	X	X	X	X	X
600	XXX	12V	18V	24V	X	X	X	X	X	X	X	X	X	X	X

Note: The "X" denotes conditions that should not be considered.

Based on Voltage(V) = Ampheres(I) x Resistance(R)

Resistance is total of ematch resistance, wire resistance, connection resistance.

Example: 2 e-match line
Resistance - 4.0 ohms
Voltage = 2 x 0.5 amps x 4.0 ohms = 4 volts.

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DISPLAY FIREWORKS
FIRING DISTANCES

Hands Fireworks
110 Centre Street, Prescott, Ontario K0E 1T0
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www.handsfireworks.com

OBLONG SITE WITH MAXIMUM 15° ANGLED MORTAR
OR
CIRCULAR SITE WITH VERTICAL MORTARS

Includes any Projection-Type Article such as: Aerial Shells, Roman Candles, Mines and Cakes

OBLONG SITE
15° Angled Mortars & Articles
Note: make appropriate wind adjustment

Size (mm)	Spectator Distance (m)	Fall-Out Zone (m)	Total (m)
Up to 30	45	35	80
to 50	65	60	125
to 60	70	80	150
to 80	75	95	165
to 102	80	130	210
to 127	100	165	265
to 155	125	200	325
to 180	145	230	375
to 205	165	260	425
to 255	205	330	535
to 305	250	400	650

OR

CIRCULAR SITE
with Vertical Mortars
Note: make appropriate wind adjustment

Radius to Spectators (m)	Total (m)
50	100
75	150
90	180
95	190
115	230
145	290
175	350
205	410
230	460
290	580
350	700

NEW REGULATORY REQUIREMENTS:

Please remember.....

- The Explosives Regulatory Division (ERD) highly recommends that all display shells from 102mm to 155mm be fired ELECTRICALLY.
- It is now mandatory that all sizes of Salute shells and all sizes of display shells above 155mm are fired ELECTRICALLY.

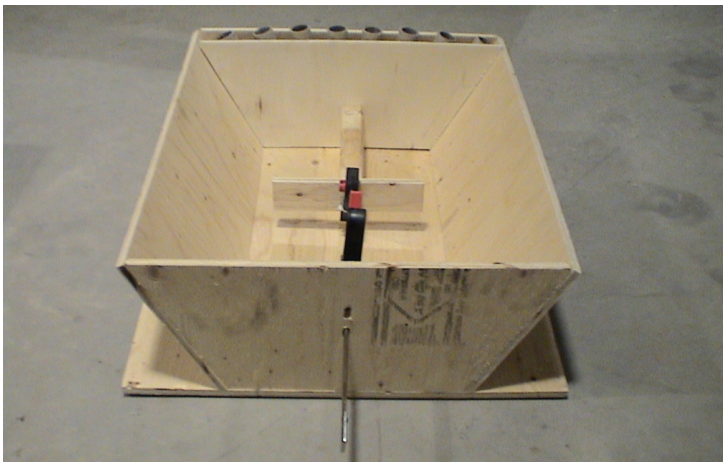
INSTRUCTIONS FOR MID LEVEL CAKE SLICES

LOCATION

Firing area should be free of obstructions along the flight path of climbing pyrotechnic effects. Fireworks location should provide the audience with a clear view up to 250'/77m above the firing area, 300'/92m separation from spectators, 20' separation from simultaneously fired items, 30' separation from sequentially fired items.

STABILIZATION

Cake slices must be secured to ensure the slice will not shift or rock. Hands recommends a specially designed form fitting box. Place each slice into the box and secure with either expansion clamps or sand bags. Ensure the box is level and on a stable surface. An example of a form fitting box is shown below. Build plans or finished box may be obtained from HANDS. Arrows indicating the angle of fire are located on each cake slice. Fanned items must not be pointed towards spectators or firing crew.



PREPARATION AND FIRING

The cake slices are outfitted with a foil cover to protect them from moisture. This cover should be left intact; the pyrotechnic effects will fire through it. Cakes slices are configured for electrical firing only.

Electrical Firing :

An electric match must be added on site. For ease of electric match installation, a plastic, electric match holder has been attached to the fuse with the red safety sleeve. Insert the electric match complete with shroud (the plastic tube protecting the head of the electric match) into the hole of the electric match holder. To secure in position, hook the lead wires around the arms of the electric match holder.

SAFETY NOTES:

HANDS recommend that hard hats, face, eye and ear protection, gloves and safety boots or shoes be worn by all firing crew members. Each member of the firing party should thoroughly read instruction sheets. Ensure that crowd control is in effect and that barriers are securely in position.

If an item fails to ignite do not approach it for 30 minutes.

*** After the display and again during daylight hours, be sure to search the firing area and neighbouring land for "live" firework debris. "Live" findings should be collected, reported to HANDS Fireworks and destroyed under supervised conditions***

DESIGN NOTES

Cake slices are effective when fired singly or in rapid succession. Spacing cake pans at 25'-30' apart will allow for effect overlap at the apex. Slices will perform for 2-5 seconds and may fire either left to right or simultaneously depending on the effect. Effects will climb up to 250'/77m, depending upon the construction and size of the unit.