

A Guide for the Use of Pyrotechnics on Stage



FOREWORD

Pyrotechnics are dangerous. With planning and care they can be used safely in entertainment.

This book is not, and cannot be, a step-by-step set of instructions for the planning and operation of a pyrotechnic system. There are far too many variations to be so precise. It is hoped this guide will provide both ideas and warnings that will be helpful in providing a framework upon which you can plan a layout and operating method that will be as safe as possible in your circumstances.

This guide was written for use with hardware supplied by Gradav Hire and Sales Ltd, and only covers cartridge effects and maroons. For other effects we advise consulting the manufacturer for further information.

Everyone in your team working with pyrotechnics should read this guide. It is important that everyone directly involved should be aware of safe operating procedures. Vigilance by all members of the team is an important factor in the safe operation of Pyrotechnics.

Each box of pyrotechnics has a Product Safety Data Sheet and a Pyroflash Products Sheet. Please read them. If you believe that any of the information/instructions in this guide are at variance with the manufacturer's advice, always give precedence to the manufacturer's advice.

Always use the manufacturer's hardware when detonating pyrotechnics.

Only people aged 18 or over should handle or fire Pyrotechnics.

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GLOSSARY

For clarity we have adopted the following terms for use in this guide.

| | |
|----------------------|---|
| <i>Firer</i> | The person operating the detonator. |
| <i>Effect</i> | The pyrotechnic device to be fired. |
| <i>Device</i> | The hardware used to hold and/or connect the Effect |
| <i>Control Point</i> | Where the detonator is sited. |
| <i>Detonator</i> | The control box used to fire the Effect |
| <i>Loader</i> | The person responsible for loading the Effect |

HARDWARE



(left to right) 6-way Detonator, Angled Flash Box, Standard Flashbox and 2-way Detonator

DETONATOR

The only device to fire pyrotechnic *Effects*. The *Firer* should retain the arming key. Never leave the key unattended. Never leave the arming key in the *Detonator*.

STANDARD FLASH BOX

Always use upright.

To load, align the pins with the contact holes and then press the cartridge fully home.

Keep cable extended when re-connecting after loading.

ANGLED FLASH BOX

May be attached to Set. Adjust cartridge angle to give desired effect.

To load, align the pins with the contact holes and then press the cartridge fully home. Please note that *Effects* for use in the Angled Flashbox have a narrower pin spacing than *Effects* intended for use in the Standard Flashbox.

Keep cable extended when re-connecting after loading.

See the Appendix for details of how to install and use the Cartridge fixing clamp

HARDWARE



Confetti Cannon



Bomb Tank & terminal lead

BOMB TANK

The robust construction results in a 40kg piece of hardware. Take care when lifting!

Always use upright with the lid secured by the rods.

Only one maroon in the Bomb Tank at any one time.

When considering the *Safety Zone* allow for flying debris in addition to the blast.

To load, remove the safety rods and lift the top clear. Select a maroon and thread the lead out wires through vent holes and connect them to the bare wire terminals of the terminal cable. Refit the top and re-secure with the safety rods. Remember to secure in place by screwing the nuts onto the threaded ends. .

Keep cable extended when re-connecting after loading.

CONFETTI CANNON

Always use upright. Never attempt to pack under the base to incline the barrel. There is a considerable recoil and the Cannon and its contents could go anywhere!

Only one maroon in the Cannon at any one time.

When considering the *Safety Zone* allow for the Confetti/Glitter's trajectory. Ensure that the "fall out" lands away from heat sources.

To load, insert maroon in the cup in the base. Feed the lead out wires through the small hole in the body, adjacent to the terminal box. Connect to the terminals. Fit a wad so that it sits on the top of the cup and the brackets on the barrel. Put confetti on top of the wad.

Keep cable extended when re-connecting after loading.

STORAGE

Regardless of storage container used, store in a cool dry place.

All *Effects* should be stored in their original packaging, with lid closed.

It is always good practice to restrict access to *Effect* stocks to those directly concerned. If the storage container is secured inside another - a cupboard perhaps - then the outside of this container should be marked to show the contents include explosives. A 'No Smoking' marking should also be present.

Never store other products with *Effects*.

Do not smoke when handling *Effects*.

OUTDOOR TESTING

Before you use an *Effect* for the first time, it is best to conduct an outdoor test. Use a suitable location with a *Safety Zone* of 10metre radius. Check that the *Effect* produces the desired effect. Use these observations when determining the size and shape of the *Safety Zone*.

Take all the safety precautions as detailed elsewhere in this guide.

Only people aged 18 or over should handle or fire Pyrotechnics.

LAYOUT

Visibility

It is most important that the *Firer* of the system has a clear line of sight to all the *Devices*. It is also best if the *Detonator* is placed conveniently close to the *Devices*. Where the *Detonator* is placed at the rear of the Audience, perhaps in a control room or with the lighting or sound control, it is very difficult for the *Firer* to judge that the cast are sufficiently upstage (or downstage) of the *Device*.

Often Bomb Tanks are sited away from the stage, and line-of-site operation is not possible from the *Control Point* used for other *Devices*. An extra *Detonator* should be used in this case, with line-of-sight from the extra *Control Point*. Indeed whenever you cannot have line-of-site operation of all the *Devices* from one *Control Point* you should use extra *Control Points & Detonators*.

Safety Zones

It is generally agreed that a *Safety Zone* centred on the *Device* be adopted. This distance may be reduced between the *Device* and Set. The construction of the Set and the nature of the *Effect* should be considered when planning the placement of the *Device*. Never reduce the *Safety Zone* for people.

Product Safety Data Sheets are provided in each box of *Effects* by the manufacturer (Le Maitre). These contain a description of the effect produced. Use this information when planning the *Safety Zones*, ideally in conjunction with outdoor testing as described in the previous section.

Some *Effects* throw hot debris into the air. Allow enough height to avoid damage.

There are other *Effects* that throw streamers etc. The trajectory of each projectile needs to be considered, for it is almost inevitable that the *Safety Zone* needs to be extended.

Bomb Tanks and Confetti Cannons use maroons. Both will need a good overhead clearance. It is not unknown for the blast to dislodge tiles in suspended ceilings.

Remember to apply the safety zones to anyone in the pit.

Cable Runs

It is as easy to trip over pyrotechnic control cable as cable performing any other task! Route cables away from aisles and doorways.

We recommend that the Loader disconnect the cable away from the *Device*, and reconnect after loading. Provision of cable breaks in accessible places may affect the cable run(s).

Negotiation

If the Director's requirements cannot be met without compromising safety, then you must discuss matters with the Director. You may be able to change moves, make alterations to the Set or re-site the *Device(s)* so that you provide the effects required without lowering safety. Never agree to fire *Effects* unless you are satisfied that it is safe to do so.

RIGGING

Do not start to rig until you have carefully planned what you are going to do.

Only use those cables supplied.

Never use tie-lines or ways in multi-core cables for control cable purposes.

Do not install any *Effects* until the whole system has been connected together, and only then may loading take place. Follow the procedures in the Loading section of this guide.

Begin by putting the *Detonator* in place. Ensure that the arming key is not in the *Detonator*, but is under the control of the *Firer*. Set all output selector switches to 'OFF'.

Starting at the *Detonator*, connect the cable for the first *Device* to the appropriate output and work out until the *Device* is connected and in position.

Repeat for all *Devices* in the system.

It is important that each output from the *Detonator* connects to the expected *Device*. Running control cables individually, and working from the *Detonator* to the *Device* will help to avoid wrong connections.

Never leave the arming key unattended.

Never leave the arming key in the *Detonator* unless a cue is imminent, and the *Firer* is present.

LOADING

Do not smoke while handling pyrotechnics.

Never load earlier than is necessary.

The *Firer*, or a designated assistant, should remove only those types of *Effects* required for immediate use from the secure storage. It is good practice in theatrical performances to remove only those types of *Effects* that are required for the forthcoming Act.

Never put *Effects* in your pocket. Use the boxes in which the *Effects* were supplied to transport them to the loading point. Keep the boxes closed unless removing *Effects*.

Where practical, the *Loader* should carry the *Detonator* key. This should prevent accidental firing using the *Detonator* during the loading process.

If the *Loader* is not carrying the firing key, then they should check with the *Firer* that the key has been removed from the *Detonator* before commencing to load.

Unplug the *Device* from its control cable.

Remove the *Effect* from the box and insert/connect to the *Device*.

Close the box and move it away from the *Device*.

Only when you have moved away from the *Device*, and are facing away from the *Device*, should you reconnect the device to the control cable.

Repeat for each *Device*.

Report to the *Firer* when the *Devices* are loaded.

Return all *Effects* to the safe storage. Close/secure as necessary.

INSTRUCTION

All persons using the performance area should be made aware that pyrotechnics are being fired. They should also be informed of the nature of the *Effects*, their locations and when they are to be used.

It is best that this instruction be conducted on a formal basis, and not rely on 'word of mouth' to spread the information around the company and crew.

Pay particular attention to ensuring that anyone on-stage when the *Effects* are fired are well briefed. It may be that rehearsals to clarify these matters would be worthwhile.

Before handling, loading or firing *Effects* ensure that everyone directly involved has read, and understood, this guide. It is important that they also understand that this guide is not exhaustive and that they should always exercise caution where the pyrotechnics system and the *Effects* are concerned.

Make it clear to everyone that once set, they should not move any *Devices*, but should inform the *Firer* if they believe that adjustment is needed. He can make any alterations that are required, or will know not to fire until the situation is under control.

OPERATION

Check that all output selectors are set to 'OFF'

When the standby cue for the *Effect* arrives:

Ready the output(s) for the next cue by switching the appropriate output selectors to 'ON'

Insert the Arming Key and switch to 'ON'. The power indicator should light .

ONLY IF ALL PERSONS ARE OUTSIDE THE SAFETY ZONE

AND

IF YOU CAN SEE THE DEVICE CLEARLY AND CANNOT SEE ANY OTHER

REASON TO SUGGEST THAT FIRING WOULD BE UNSAFE

MAY YOU press the shrouded fire button.

Turn the Arming Key to 'OFF'

Remove the Arming Key if another cue is not imminent.

Set all output selectors to 'OFF'.

Repeat these steps for each cue.

Ensure that the Arming Key is removed before the *Firer* leaves the *Control Point*.

MIS-FIRE

In the case of a mis-fire; isolate the *Device* using the Output Selector.

When it is convenient and when it is safe to do so :

Try to fire the *Effect* as above.

If the *Effect* still fails to fire

Wearing protection for the eyes and hands, remove the *Effect* and place it in its original packaging.

To dispose of the suspect *Effect*, submerge in a large bucket of water and gently pierce the paper membrane to allow water to enter the *Effect*. Leave soaking outside in a secure area for a minimum of 48 hours. Then dispose of in accordance with local regulations.

APPENDIX



Le Maitre Projection Cartridge Fixing Clamp Le Maitre Part No. 1110

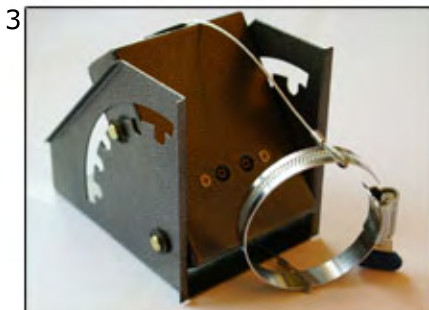
The Le Maitre Fixing Clamp serves 2 purposes, first it is to hold the effect cartridge securely into the variable angle pod. The second use is to secure the cartridge and prevent the cartridge from ejecting from the angle pod when the cartridge is fired. It is imperative that the fixing clamp is used with all new style projection cartridges.



Open the jubilee clip and remove one of the wire loops.



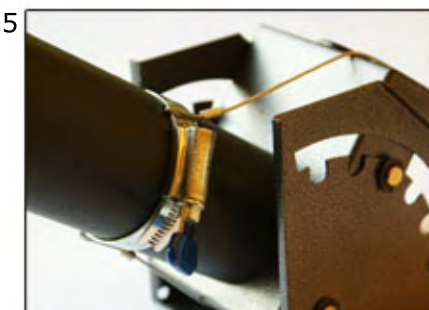
Place the wire loop under the main body of the variable angle pod.



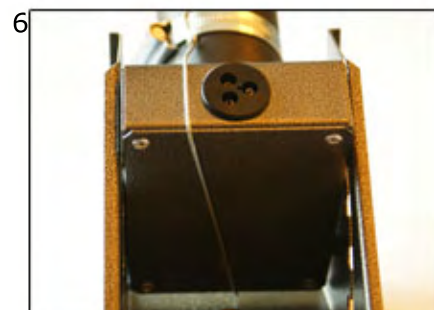
Place the Jubilee clip back through the loop and close the jubilee clip.



Pull the jubilee clip up the cartridge to tension the wire and tighten.



Tighten the clip as tight as you can without deforming the tube, the wire loop will press into the tube this is ok.



When correctly installed, the wire should be tight like this.



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