

Technique...

Page 1



Mixing with Screens



Figure 1: A weighing station for weighing out the components before mixing.

Introduction:

The most quick and effective way to mix pyrotechnic compositions together is to pass the ingredients through a screen several times. Most common pyrotechnic mixtures do not need to be finely ground together into an intimate mixture, with meal powder being one of the few exceptions. Almost all star formulas are mixed by screening except in cases where friction sensitivity makes screening prohibitive. Even sensitive mixtures are often partially screened, leaving out one of the chemicals responsible for the sensitivity to friction and then mixing it in by hand afterwards.

This article describes the basic procedure for screening that all beginners need to become familiar with before proceeding to make pyrotechnic devices. The screens shown here can be made as described [here](#).

Preparation:

The first step to producing a pyrotechnic formula is to weigh out the proper amounts of each ingredient that is required. Formulas are specified in parts by weight rather than by volume, so a scale is required. The units measured by the scale are arbitrary, so any type of scale will work as long as it is accurate in the range you intend to measure. For example, mixing black powder requires 75 units of KNO_3 , 15 units of charcoal and 10 units of sulfur. These units can be pounds, ounces, grams or whatever you want to use.

The parts in a formula can be scaled up or down if desired, as long as they are all multiplied or divided by the same number. So the black powder example could also be 7.5 pounds KNO_3 , 1.5 pounds charcoal and 1 pound sulfur. Scaling in the other direction and changing units, we could have 750 g KNO_3 , 150 g C and 100 g S.

The easiest way to scale your formulas up or down in order to obtain a specific batch weight is to use the auto-calculated fields in the formula database found on this website. Entering a value in any field of the



Figure 2: Running individual components through the screen.



Figure 3: Alternating between two buckets when screening with a bucket screen.



Figure 4: Screened chemicals after one pass through the screen.



Figure 5: The white specs of stubborn strontium carbonate particles remain after screening is complete.

formula will auto-calculate the correct values for all other fields. The most typical scenario is to enter the total batch size you want to mix, then let the calculator scale all the individual component weights. The resulting formula sheet is then printed out and used as a reference when mixing.

Figure 1 shows a weighing station where chemicals are weighed out and added to a mixing bucket. Note the central clip holding the single formula to be mixed (a passfire formula printout, naturally!). Avoid mixing from tabular formula lists that display multiple formulas in a single table, as this greatly increases your odds of weighing out the wrong value by looking at the wrong column.

It is often a good idea to screen the individual ingredients separately before screening them all as a group. This is because many oxidizers have clumps that need to be worked out, and occasionally you will get something so hard that it will not pass through the screen. You will then have to weigh this chunk and replace it with an equal weight of chemical that will pass the screen. Other chemicals like parlon or charcoal frequently have large particles that are too big to fit through the screen and must be discarded and replaced if necessary.

The use of rubber gloves is a good idea when screening chemicals, and is mandatory if the chemicals are poisonous or toxic. I prefer disposable latex gloves which can be purchased in boxes of 100 for about \$10. These can be rather thin and will tear at the finger tips if you don't keep your nails cut though. Some people prefer thicker rubber gloves that are reusable. I prefer to just throw the disposable gloves away each time rather than having to clean the gloves afterwards. This hobby generates enough of a mess to be cleaned as it is, no need to add another item to the cleanup pile!

A respirator is another mandatory item, even for non toxic chemicals like charcoal. While charcoal and aluminum are not poisonous, they are very fine particles that easily become airborne and can damage your lungs. The respirator you use should be high quality with removable filters and a rubber mask that fits snug with no gaps. To test the air tightness of your respirator, place your hands over the ends of the filters to block the airflow then try to breathe in. You should not be able to suck in any air. This is a good test to perform before using the respirator each time, as the exhaust valve can sometimes get stuck open and render the mask useless.

[More...](#)





Mixing with Screens...

Page 2



Figure 6: Screen box placed on a sheet of newspaper.



Figure 7: A one pound batch of composition ready to be pushed through the screen.



Figure 8: Pushing the chemicals through the screen with a gloved hand.

Mixing:

Figure 3 shows a typical setup when mixing with bucket type screens. Two five gallon buckets are used in conjunction with a screen made from the top of a 5 gallon bucket. Material is poured from one bucket into the screen and screened into the other bucket. Then the screen is placed onto the empty bucket and the process is repeated.

The powder is pushed through the screen using your palm in a circular motion, tapping the screen with your finger tips occasionally to get clogged material to drop through. If you are screening a very large batch, you may not be able to fit the entire batch into your screen all at once. In this case you can screen the powder in several increments.

Figure 6 through 9 shows the setup for screening with a box type screen. The screen box is placed on a sheet of paper to catch the material falling through the screen, then the screen itself is placed on top of the box. The larger working area of the box screen makes it easier to work with compared to the smaller bucket screens, even when screening small batches. Once the material is pushed through the screen, the box is lifted and the newspaper is used to transfer the material back into a container for the next screening.

Because screening is such a dusty process, it must be done outdoors to avoid making a mess in your shop. It helps to work on a table because this is a rather tedious process that is not easy to do sitting down on the ground.

Screening is so effective at mixing the chemicals that you typically do not need to push the chemicals through the screen more than three or four times to get a good mix. Figure 4 and 5 shows how well the chemicals have mixed after just one pass through the screen. Note the small white specs of strontium carbonate in Figure 5. These are tiny clumps that seem to be a typical characteristic of strontium carbonate, and they will not go away regardless of how many times you screen the material. Some people ball mill the strontium carbonate to reduce



Figure 9: Screenshot powder is transferred back into a bucket using the newspaper.

these tiny clumps, but they do not seem to effect the performance or quality of color, so most people just leave them as-is with no consequence.

If you are mixing a formula that contains a large flake component such as flake aluminum or coarse charcoal, you will have to leave out the coarse material and screen everything else. The coarse material is then stirred into the batch by hand after the other components have been screened together.

NOTE: Never screen Flash or any other perchlorate or chlorate compositions containing fine powdered metals.

If you have a perchlorate or chlorate formula that contains a fine powdered metal such as magnesium or dark aluminum, screen everything but the metal and then mix the metal in using the diaper method or by stirring it in by hand.

The diaper method of mixing a formula looks similar to Figure 9, with the powder to be mixed sitting on a sheet of paper. The powder is then rolled back and forth and turned in on itself by pulling up the corners of the paper. This produces much less friction than screening and is the only safe way to mix flash compositions. 🔥