

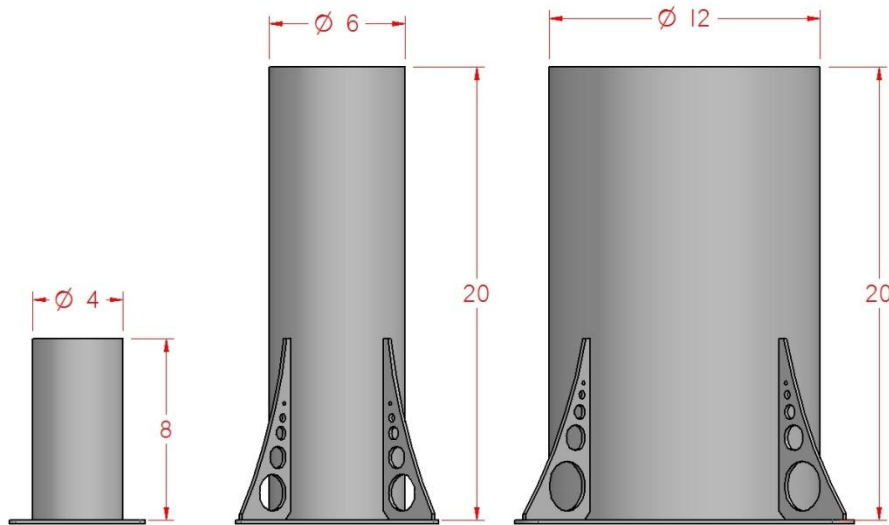
# Liquid Fuel Mines (Gasoline Fireballs)



Northeast Ohio Dukes stunt show, Brookville PA.

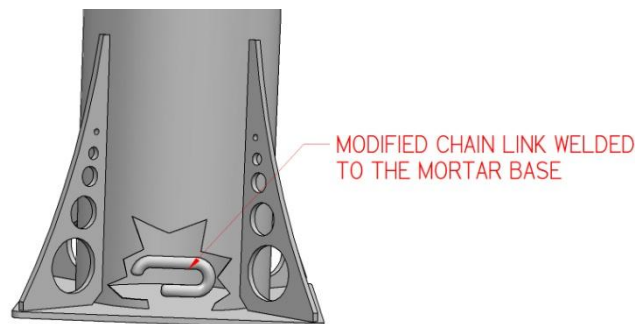
## The Mortar!!

Ok, so we use three different sizes of mortars. We use a 4" dia., 6" dia., and a 12" dia..



These mortars are constructed of steel tubing welded to a square, 3/16" steel plate with steel gussets. The base plate is square because that seems to work best for us. We typically don't have a need for stakes rods or whatever to hold it up. The tube for the 4" mortar is 8" tall while the tubes for the 6" and 12" mortar are 20" tall. We typically use .065 wall, aluminized exhaust tubing for the 4" and 6" mortars. We have a difficult and expensive time finding 12" tubing. So, two of our 12" mortars are 12" x .135 wall tubing. That was a lucky find for us. It was some tubing our company had ordered and then decided they couldn't use it. Another option is empty Acetylene and oxygen tanks you can possibly get at a scrap yard. But, as you can probably imagine, some scrap yards are reluctant to sell those to people due to the possibility of someone getting hurt trying to cut them apart. So anyway, the remainder of our 12" mortars are made of rolled 3/16" A36 steel. The seam has been properly prepped and welded front and back for 100% joint penetration. So, it probably could go without saying, but the tube to base weld and the seam weld in the 12" mortar must be a continuous and liquid tight weld.

So, when installing the powder charge in the bottom of the mortar, we will run the e-match wire thru a modified chain link that has been welded to the base plate of the tubes that has a notch cut out of it. This is a must due to the fact that the charge will float. The notch is so the person charging or loading the mortar doesn't have to thread the chain link, just slide the wire in. Some guys will cut a notch out of a nut, but we felt that there are too many sharp edges that way and the possibility of causing a short exists. The rounded edges of the chain link lend themselves to a reduced risk of that "short" happening.



## The "Charge"

Well, I have heard of some guys using ziplock bags, wrapped in electrical tape with flash and black power. To be honest, we have not tried that approach, so I can't tell you if its good or bad. I can only say what we are doing works pretty good for us. The process we use, allows for the charge to remain in the liquid in the tubes for a very long time without getting wet; days, or maybe even weeks. It's a great feeling to be able to "charge" the mines ahead of time and know that when its time to shoot later in the evening they are going to lift.

We are using PET bottles (Polyethylene Terephthalate, a thermoplastic polymer resin) that we typically purchase online. Below are just some of the companies that have these types of bottles.

[usplastics.com](http://usplastics.com)

[midwestbottles.com](http://midwestbottles.com)

[ebottles.com](http://ebottles.com)

[ebay.com](http://ebay.com)

[sksplastics.com](http://sksplastics.com)

We typically order 1 ounce bottles with caps, 4 ounce bottles with caps and 16 ounce bottles with caps.

For the small charge that we use in the 4" mortar we use 2FA. Now, Terry told us in the class we took that he has had much better luck with 2FG. We couldn't find it, so we are using 2FA. The other thing worth noting is that Terry also stressed that he does not use cheap black powder, he uses Goex. Now, with that being said, we have had pretty good luck with the powder we buy at FireArt out of Clearfield. I'm ashamed to say, I do not have a clue who the manufacturer is. But, probably one of the most important things to mention is you must use a pinch of titanium in the charge. It is a must. You will experience failures without this. Meaning, your liquid will lift into the air and will NOT light. Adding a "pinch" of titanium will always light the fuel/air mixture. And by "pinch", I mean a "pinch". It takes very little in the charge to get the mixture to light. I have a pound of it I ordered from Phils general store on-line and I'm guessing it will last me years. I think I paid around 17 bucks for a lb. of it. Below is a link to his site and a screen shot of what I purchased. I'm not saying this is the place to buy it....I'm just showing you an example of what it is and what to look for.

[http://www.ihaveadotcom.com/cart/index.php?main\\_page=index&cPath=72](http://www.ihaveadotcom.com/cart/index.php?main_page=index&cPath=72)

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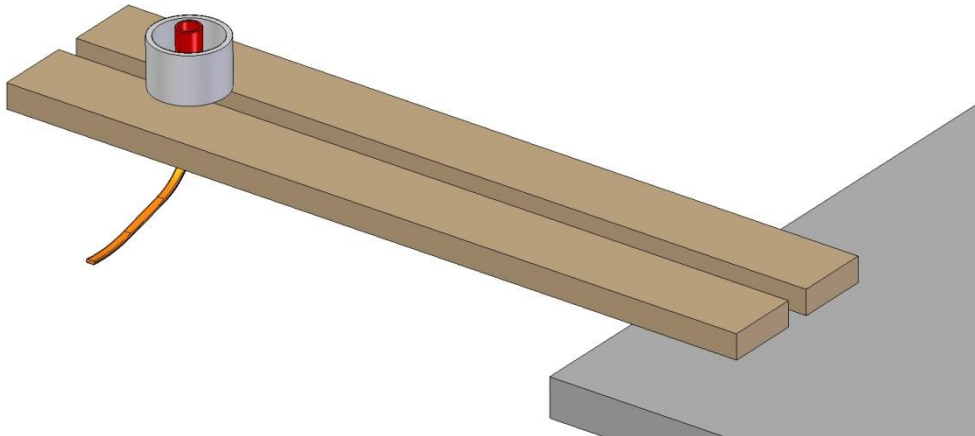
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We then drill a 7/64" dia hole in the lids and insert the e-match. We use Loctite quick set epoxy and apply it between the ematch and the lid. Then place the lid/e-match combo in a contraption like shown below. While the epoxy is setting up, we will fill bottles. Don't forget the titanium!! After it has cured, using either the loctite marine epoxy or the quickset, we apply a pretty good portion of the epoxy to the threads on the bottle, then screw the e-match/cap on the bottle. Then apply another round of epoxy to the area where the wire goes in the top of the lid.

\*Safety note: always be sure to shunt your e-match!!!!



## The fuel

We use regular, low grade gasoline and water. There are others out there that are doing these and they are using different fuels, but we have just used gasoline. Well, we tried some old diesel once and it didn't work out so good. Gasoline, even at today's prices is still cheap and we don't want to carry several different liquids around when they aren't needed. The right powder charge will determine the color of your flame more than adding unnecessary liquids. If you over charge your fuel it will burn bright with no smoke or yellow-orange look.

Over 10 years ago, in an effort of getting residual burn down to a minimum, which Terry needed for indoors venues; he started adding water to his fireballs. This did a couple of things.

1. it appears to burn better
2. He learned from the principle of a sand cannon, used in hollywood to open doors, lift cars, and many other things. Sand is heavy and will push about anything. So he figured water is much heavier than gasoline so it should push the gasoline out of the tube better (like a wad effect). And sure enough, it has worked great without affecting the look of the fireball.

Now, most of the time we have no residual burn. We use about 2 inches of water in the 4" tube and about 5" in the 6", 12" mortars. It does sometimes cover the powder charge and that is fine.

## Aluminum foil covering

Next, because we use fireballs at the beginning, middle, and end of many fireworks shows I use aluminum foil to cover the mortar. We tape down the foil with duct tape so that all the way around the tape is touching the foil AND the mortar. You can also use aluminum foil tape that is used in the HVAC industry, but I find that when wet it can be very hard to stick to the mortar. Flying foil can burn with gasoline residue so I take every effort to keep it down, most of the time successfully. Terry has mentioned that in a lot of his displays, he uses gasoline fireballs within 10 feet of cakes and shells and he has never had anything prematurely light with aluminum foil covering the fireballs.

## The cost

Based on Gasoline @ \$4.00 a gallon, E-match at \$.40, 2FA @ \$9.40

4" Gasoline Fireball		6" Gasoline Fireball		12" Gasoline Fireball	
Item	Cost	Item	Cost	Item	Cost
Gas 24oz	\$0.75	Gas/2 gallons	\$8.00	Gas/5 gallons	\$20.00
2FG 33g or 1.16oz	\$0.68	2FA 130g or 4.59oz	\$2.70	2FA 525g or 18.51 oz	\$10.88
Bottle & Cap	\$0.35	Bottle & Cap	\$0.50	Bottle & Cap	\$0.80
E-Match	\$0.40	E-Match	\$0.40	E-Match	\$0.40
Misc.	\$0.50	Misc.	\$0.75	Misc.	\$1.00
Totals	\$2.68	Totals	\$12.35	Totals	\$33.08
		Misc. = gloves, epoxy, ect.			

## How close can people be to the Gasoline fireball?

Well that depends.

A.5.1 of the NFPA 160 says that the incident radiation should not cause the surface temperature of the exposed skin of a member of the audience to exceed 111 degrees Fahrenheit. So Terry got out his infrared thermometer gun that you could buy at your neighborhood car parts store for around \$50.

Terrys findings with little to no wind on exposed skin.

4"	Gasoline Fireball	@25'	105 degrees f
		@40'	90 degrees f

6"	Gasoline Fireball	@40'	123 degrees f
		@50'	111 degrees f

12"	Gasoline Fireball	@100'	103 degrees f
		@120'	97 degrees f

\*You must do your own testing, in your environment!

Wind and other factors could drastically alter these temperatures.

These are posted for reference only, NOT for a standard of use.

Where can you use Gasoline Fireballs?

That depends. Ultimately it is up to the Authority Having Jurisdiction (AHJ). Pictures and video documentation help a lot for the AHJ to understand the effect, if they have not been exposed to what your doing.