

## Louisville WFO Tornado Machine Plans

These instructions for the tornado machine displayed at the Louisville WFO office are a bit different from the instructions that the Huntsville WFO produced. The reason for this is that this tornado machine was constructed differently with the main change being that this tube is 'standalone' and does not sit on a base. To compensate, a lower compartment was made to house the fog machine in the bottom. Otherwise, this tornado machine operates in a very similar fashion to others at different offices. This machine was designed to give the public a representation of what a tornado looks like.



The cost to build this basic tornado machine should not exceed \$500.00. Separate instructions for adding a thunder and lightning simulator are below and will add extra costs. The first and most important item to find will be the large piece of PVC pipe that will serve as the chamber tube. A straight pipe or a corrugated pipe can be used, this office decided to use a corrugated pipe. The best bet to find a large piece of PVC pipe will be to check local companies to see if they have a scrap piece or check with a local plumbing company. We used 18" diameter corrugated PVC pipe from a plumbing company with walls that are  $\frac{3}{4}$ " thick.

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## Materials List:

5' X 18" Corrugate PVC Pipe (Chamber Tube)

1 ½" Diameter PVC Pipe

1 ½" Diameter PVC Elbow Pipe

4' X 4' sheet of PVC

Jigsaw

Sealant foam

Marker

Silicone caulk

12 Elbow brackets

Drywall screws

Machine screws

Bucket

Drain

Exhaust fan

Incandescent cabinet light

Duplex electrical receptacle

Switch & dimmer lights

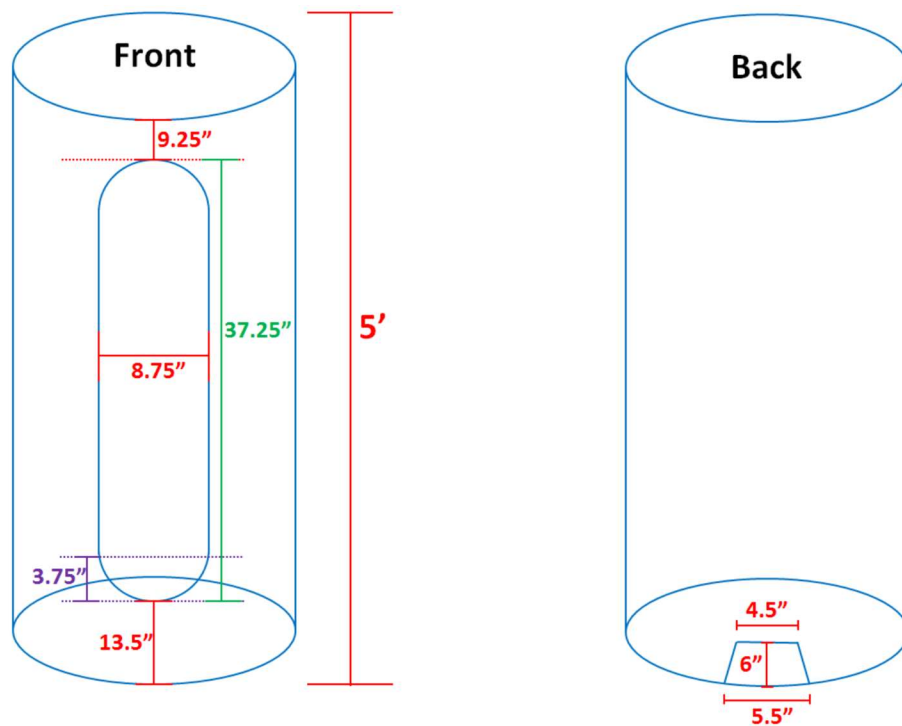
Oil-based paint

## 1) Creating a Viewing Port

- A. The first thing that will need to be done in order to create the viewing port is for an outline to be marked on the pipe so you will know where to cut.
- B. To start the outline, draw a central, straight line down the length of the PVC pipe as this will be the alignment mark.
- C. Next, you will need to decide how big you want your viewing port to be. You will not want to go any bigger than  $\frac{1}{5}$  of the circumference, because at this point you will start seeing the effects of the air movement outside of the chamber on the tornado. The width of our viewing chamber is  $8\frac{3}{4}$ ".
- D. Regardless of the width you choose it is time to start drawing out a rectangle for the viewing chamber. To do this mark two parallel lines equidistant to the alignment line. For example, our viewing port is  $8\frac{3}{4}$ " in width so two lines were made  $4\frac{3}{8}$ " from the alignment line.
- E. To make the next two sides of the rectangle you will need to decide how far along the vertical axis you want the viewing port to be. It is important to leave space at the top and bottom for the compartments. Our viewing port sits  $13\frac{1}{2}$ " from the base and  $9\frac{1}{4}$ " from the top rim. Two parallel horizontal lines at these distances were marked and now a rectangle has been made.
- F. Next, it is necessary to create some curvature at the top and bottom ends of the viewing port. To do this, it is recommended that you use a string and a pencil. Go to the horizontal line that is  $9\frac{1}{4}$ " from the top rim and find the alignment. Once you find the alignment mark,

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follow the alignment line down  $4\frac{3}{8}$ ". Here will be the center point of a circle with radius  $4\frac{3}{8}$ " that can be drawn. Cut a string to  $4\frac{3}{8}$ " length and tie a pencil to one end of the circle. Place one end of the string at the center point and rotate the other end of the string in a circle with the pencil, drawing a perfect circle. (Note: It is only necessary to draw the upper semicircle.) Now, repeat this process at the bottom end of your rectangle only this time you will only draw the lower semicircle.



- G. While you're in the process of marking portions of the pipe to cut, turn the pipe to the backside and cut a small area at the bottom of the pipe to help drain out water from the fogging machine. The size of this area is up to your discretion. For reference, ours is a rectangle roughly 5" wide by 6" tall.

## 2. Cutting Out the Viewing Port

A. Now that the lines have been drawn, it is time to cut out the viewing port. The best thing to use in cutting through the PVC pipe is a jigsaw.

B. If you use corrugated PVC like we did, once you cut away the viewing port there will be holes in the corrugation. To fill these in use some sort of sealant foam. (e.g. GreatStuff™) After the foam hardens, it will become necessary to sand away the rough edges.

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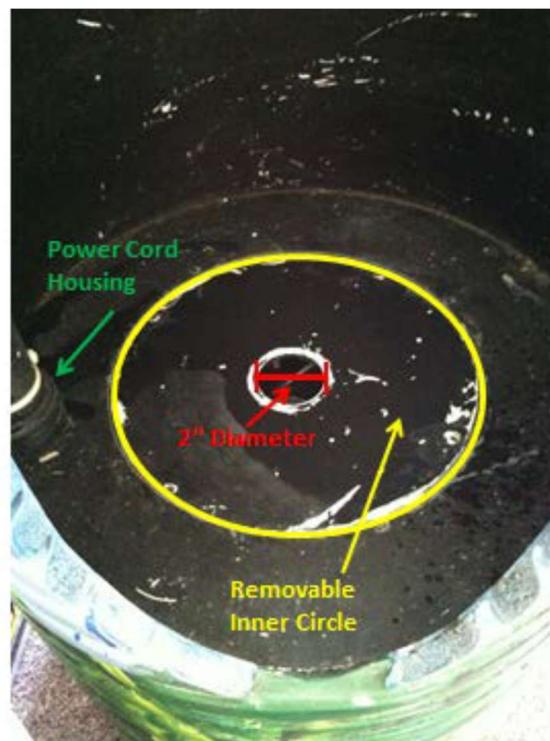
**Above: Sealant foam filling in the holes in the corrugation.**

### 3. Building the Bottom Compartment

- A. Now that the frame of the tornado machine has been constructed, it is time to build a compartment to house the fogging machine.
- B. Take a 4' X 4' sheet of PVC material and cut it into four 2' X 2' pieces.
- C. Three of these 2' X 2' PVC pieces will be used to cut out the top of the bottom compartment as well as the top and bottom of the top compartment.
- D. The PVC pipe shell may not be a perfect circle so instead of measuring to cut, it is necessary to trace and cut.
- E. Place the shell on top of the 2' X 2' sheet of PVC and using the viewing port, trace a circle around the inside of the PVC shell onto the sheet.

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- F. Cut the circle out using a jigsaw and this will be the top portion of the bottom compartment. Repeat the last three steps for both portions of the top compartment.
- G. Before installing the top of the bottom compartment, it is necessary to make a few more cuts in the PVC. The first cut will be a removable inner circle so that you will be able to access the fogging machine. We cut a circle that was 10 5/8" in diameter. Once you cut your inner circle, save this piece as it will be drilled back into the PVC sheet.
- H. Now it is necessary to cut a small, permanent circle in the removable inner circle. This will allow moisture to escape from the bottom compartment. The circle we cut in the middle was 2" in diameter.



- I. Now that we have done our cutting, it is time to place the compartment in place. Take the outer circle of the top and place it in the bottom of the PVC shell. The top of the circle should be even with the bottom of the viewing port. Once this is in place, mount this to the shell using four elbow brackets at 0, 90, 180, & 270 degrees around the circle. After successfully mounting this, it is necessary to seal the perimeter of the circle with silicone caulk to keep the compartment water tight.
- J. Next, using some of the extra PVC sheet we will need to cut a ring out so the removable inner circle can be mounted. The size of this circle can vary, as long as a lip can be created for the removable inner circle to be drilled into place. It is recommended that the lip extends at least 1" beyond the opening in the top compartment. Use machine screws to mount this lip on the underside of the top of the compartment.

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- K. With the lip in place, the removable inner circle can be drilled in place using drywall screws as well.
- L. Next, the fogger machine will need to be placed in the lower compartment. It will need to be placed into some kind of holding compartment. This is another item that does not need to have an exact size. We used a plastic bucket that was large enough to house the fogger machine and had a lip around the edge so that drywall screws could be used to mount the bucket into the bottom of the compartment top.



- M. After mounting this bucket into the bottom compartment, it is necessary to install a drain so that excess moisture can be drained off easily. Make sure to line the drain up with the back of the pipe and the rectangle that was cut to allow for draining.



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## 4. Building the Top Compartment

- A. The top and bottom shelves of the top compartment can be traced and cut out just like the top shelf of the bottom compartment in steps 3: C, D, E, & F.
- B. Next, it is time to determine at what height the shelf will sit in the compartment. Measure 8" down from the top of the PVC tube and make a few marks around the inside of the tube to serve as markers.
- C. Before mounting the bottom shelf of the top compartment, it is necessary to cut out an inner circle that will allow for intake into the exhaust fan. You will want the diameter of the inner circle to be  $\frac{1}{2}$ " smaller than the diameter of the exhaust fan you choose to use. For example, the diameter of our exhaust fan is around 11  $\frac{1}{2}$ " in diameter so the diameter of the inner circle to cut out is 11".
- D. Once you have found the appropriate diameter to cut, use a jigsaw and cut out the inner circle. Now the bottom shelf is ready for mounting.
- E.
- F. In order to mount the shelf, use four elbow brackets once again. The brackets will be mounted at 0, 90, 180, and 270 degrees. Make sure that the bracket mounted at 0 degrees is aligned with the center of the viewing port and this will ensure that none of the brackets will interfere with the exhaust tube running from the fan. First, mount the elbow brackets on the shelf. Once these are mounted, place the shelf inside the PVC tube and begin slowly sliding it down to the 8" mark made in step B. With the shelf now in place, pick one of the elbow brackets and pre drill the top hole for a screw. Then run a  $\frac{1}{2}$ " screw into the pre drilled hole and the shelf will be supported.
- G. Now use a level to make sure the shelf sits straight. As the shelf is leveled continue drilling the screws into the elbow brackets until the shelf is secured in place.
- H. Now it is time to place the fan into the top compartment. . The fan we used is just a bathroom exhaust fan and this can be centered and drilled into the top compartment. It is important to locate the exhaust on the fan and make sure that this is pointed to the left side of the PVC tube, where the 1  $\frac{1}{2}$ " diameter pipe will be placed
- I. The exhaust will be flowing out of the fan and into a circular pipe. One of the most important things here will be to find a way to get the air into the pipe. For example, our fan's exhaust was actually a square which required us to do some customization. We took a 1  $\frac{1}{2}$ " diameter PVC elbow pipe and placed it over top of the exhaust. Then, sealant caulk was used to fill in any gaps.

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- J. Now it is time to install the 1 ½” diameter PVC pipe along the side of the inside of the tornado machine. Before installing this pipe, it is necessary to drill cut the pipe to 37.25” (or the length between your top and bottom compartment) and drill holes 1/8” in diameter spaced ¾” apart down the length of the pipe. Make sure the bottom of this PVC pipe is capped so that no air flow will be wasted.
- K. AFTER you have fitted the PVC elbow and PVC pipe, it is time to secure the fan into place. Screw the fan into the bottom of the top shelf.
- L. Another item that can be mounted to the bottom of the top compartment is a light to illuminate the viewing port. We used a simple incandescent cabinet light, and cut a small hole in the compartment to run power to the supply.
- M. The next item to be mounted will be a duplex electrical receptacle that will power the fan, fogger machine, and light. This can be mounted anywhere, as long as the placement of the receptacle will allow the power switches to be mounted somewhere on the top of the top compartment.
- N. On the top of the machine, install a power switch that is wired to turn the duplex receptacle on and off. Then, two dimmer switches should be wired that will control both the fogger machine and the fan.

Now, your tornado machine has been created. You may wish to customize the apparatus now and here are a few tips to do so. You will want to use a can of black spray paint to paint the inside of the tornado machine black to make the appearance look better. If you are wanting to paint the outside of the tornado machine, be sure to sand down the outside of the PVC pipe, apply a few coats of primer, and then used oil-based paint to cover the pipe. The following instructions are for adding the thunder and lightning simulator to your newly built tornado machine.



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## Tornado Machine Lightning Simulator Upgrade Plans

The upgraded tornado machine includes a lightning simulator. The lightning simulator provides an output to a strobe light and sound system to enhance the tornado machine. A PVC cap was also added to protect the lightning simulator during transport. The upgrade will run approximately \$300.



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## Materials List:

Lights Alive Firefly Lightning Simulator (lightsalive.com) different models available, the base FF-151 model will work fine.

12" PVC Solvent Weld Cap

Radio Remote Receiver with Remote Key Fob Transmitter (We found ours on E-Bay)

Mini Strobe Light

Sound System Cables with Headphone Jack Connector or Adaptor

Speaker(s)

Machine Screws

Marker

Sandpaper or File

Jigsaw

Drill

Drill Bits

## 1) Preparing the Lightning Simulator.

- A. Make a template of the bottom of the lightning simulator with the position of the screws.
- B. Remove the top of the tornado machine and mark it using the template.
- C. Drill holes in the tornado machine top for the simulator screws, simulator power cord, and strobe light power cord into the top.

## 2) Preparing the PVC Cap for Installation

- A. Mark the PVC cap for a 5" by 3 ½" opening.
- B. Using a jigsaw cutout the access hole.
- D. Using either sandpaper or file smooth any rough edges.
- C. Drill four pilot holes into the cap to attach it to the top of the tornado machine.
- E. Make a template of the PVC cap and mark the position of the pilot holes on the top of the tornado machine.
- F. Drill holes in the tornado machine top for the PVC cap.
- G. Paint PVC cap.

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### 3) Installing the Strobe Light

- A. Drill a hole for the power cord in the top of the viewing port on the tornado machine.
- B. Cut about 6" off the power cord and pull the remainder into top compartment.
- C. Mount the strobe light inside the tornado machine.

### 4) Putting It All Together

- A. Using slightly longer screws attach the simulator to the top.
- B. Cut the plug off of the simulator power cord and run it through the tornado machine top.
- C. Install the remote receiver using the instructions included by the manufacturer.
- D. Pull strobe light power cord through tornado machine top, reattach plug, and plug into lightning simulator.
- E. Plug sound system cable into lightning simulator audio output (headphone jack).
- F. Attach the PVC cap to the tornado machine top using machine screws.
- G. Wire the lightning simulator into the input power.
- H. Reattach the tornado machine top.