

# **Micro-Mark<sup>®</sup>** ***PRO-ETCH*<sup>™</sup>**

#83123

## **A True Photoresist Metal Etching System**

# **Instruction Manual**

Available only from

**Micro-Mark<sup>®</sup>**  
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MM101117

## PRODUCT LIABILITY DISCLAIMER

Buyer assumes all risk and liability whatsoever resulting from use of this product.

### WARNING!

This Photo-etch system requires you to use chemicals that are potentially dangerous. For your own safety and the safety of others, please read and understand these instructions completely before use. If you are not comfortable using such chemicals and/or are unable to adhere to the safety precautions described below and on the chemical bottles themselves, do not use this system.

### General Safety Instructions

#### WARNING!

KEEP ALL CHEMICALS CONTAINED HEREIN OUT OF REACH OF CHILDREN. CAUSES SEVERE BURNS.  
USE ONLY AS DIRECTED. INGESTION CAN BE HARMFUL, EVEN FATAL.  
AVOID CONTACT WITH SKIN, EYES AND MUCOUS MEMBRANES.

#### CAUTION!

Use with adequate ventilation. Use of rubber gloves, eye protection and rubber/plastic apron is recommended. Do not take internally. Store only in original container. If chemicals are decanted temporarily to other containers, mark containers with contents. For medical emergencies, call a poison control center. For your local center, call 1-800-222-1222.

#### FIRST AID

##### Metal Etchant Solution

Contains Ferric Chloride  
( $\text{FeCl}_3$ ) CAS Number 7705080

Solution will stain clothes, skin and utensils.

- EYES:** Remove contact lenses. Flush with clear water for 15 minutes.  
Get medical attention immediately.
- SKIN:** Flush with clear water for 15 minutes.
- INHALATION:** Move to fresh air. If not breathing, use artificial respiration.  
Get medical attention immediately.
- INGESTION:** Do not induce vomiting. Give one or two 8 oz. glasses of water.  
Get medical attention immediately.

##### Developer/Stripper

Contains Sodium Hydroxide (Lye)  
CAS Number 1310730

- EYES:** Remove contact lenses. Flush with clear water for 15 minutes.  
Get medical attention immediately.
- SKIN:** Flush with clear water for 15 minutes.
- INHALATION:** Move to fresh air. If not breathing, use artificial respiration.  
Get medical attention immediately.
- INGESTION:** Do not induce vomiting. Give one or two 8 oz. glasses of water.  
Get medical attention immediately.

## You Made the Right Choice

Congratulations on your purchase of the Pro-Etch photo-etch system. We hope its use will be a fun and rewarding experience. With this system, you'll be able to make model parts and hundreds of other items that would take days to make with other tools...if they could be made at all. Almost any part that can be made from a flat piece of metal can be made with the Pro-Etch system. You can even create 3 dimensional objects by careful design and by folding the metal to create the object. Think of a corrugated shipping box. It starts out flat, but, by placing score lines in the correct places and by folding on these lines, a 3 dimensional object is created. In the photo-etching process, these score lines are lines that are etched half way through the metal, making the line weaker and easier to bend. Besides model parts, some other items made with this system include: holiday decorations and tree ornaments, nameplates, jewelry, bookmarks, business cards, dollhouse picture frames, wind chimes and much, much more. Let your imagination run wild!

### Start by checking the contents of your Pro-Etch system. It should contain the following items:

|                                     |                                     |                                    |
|-------------------------------------|-------------------------------------|------------------------------------|
| 2 Sheets Ink Jet Film, 8-1/2" x 11" | 1 Tubing Pinch Clamp                | 1 Acrylic Rod with Holder attached |
| 2 Plexiglass Sheets                 | 1 1/8" ID Rubber Tube               | 1 Aerator                          |
| 1 Roll Dry Photoresist, 12" x 19"   | 1 Air Pump                          | 1 Plastic Tweezer                  |
| 1 Instruction Manual                | 1 Sodium Hydroxide Solution, 16 oz. | 1 Plastic Apron                    |
| 1 Laminator                         | 1 Polishing Pad, 2" x 2"            | 1 Pair Latex Gloves                |
| 2 White Carrier Sheets              | 1 Utility Brush                     | 1 Plastic Goggle                   |
| 1 Ferric Chloride Solution, 16 oz.  | 1 .005" Brass Sheet                 | 1 Small Measuring Cup              |
| 1 Etching Tank with Lid             | 1 .005" Stainless Steel Sheet       | 1 Black O Ring                     |
| 4 Spring Type Clamps                | 2 Plastic Trays                     | 1 Plastic Sheet, 7" x 11"          |

### Some Additional Items You'll Need

In addition to the items contained in the Pro-Etch system, you will also need the following household items:

|                            |  |
|----------------------------|--|
| Paper Towels               | Plastic painter's pails or household buckets (2) |
| Masking or cellophane tape | Access to hot water                              |
| Scissors or metal shears   | 100 watt soft white light bulb and               |
| Hobby knife                | adjustable lamp holder/socket with reflector     |

*As you progress, you may find these other optional items helpful:*

|  |   |
|--|---|
| <b>Photo-Etch Shear, Micro-Mark #84903</b>                                   | <b>Tin Snips, Micro-Mark #86488</b>                         |
| <b>Binocular Magnifier, Micro-Mark #18108</b>                                | <b>Etch Buddy Phot-Etch Bending Tool, Micro-Mark #86143</b> |
| <b>Pliers and tools for metal bending, Micro-Mark #84825, #60399, #80338</b> | <b>Flitz Metal Polish, Micro-Mark #60436</b>                |

### How the Pro-Etch Photo-Etch System Works

You create artwork in a drawing program on the computer. You then print out the artwork with an ink jet printer onto the special film we include. Next you laminate the included photoresist material to the metal you want to etch. The film you printed on is then placed over the laminated metal and exposed to the noonday sun for 15 seconds or for 10 minutes under a 100 watt light bulb. The Ultraviolet rays from the sun or bulb harden the photoresist in the areas that are clear on the film. The black areas of the artwork block the ultraviolet rays and therefore the photoresist under the black areas is not hardened. The exposed laminated metal is then placed in a developer which removes only the unhardened photoresist. Next, the metal is placed in an etching tank with Ferric Chloride etchant. Those areas with the hardened photoresist protect the metal and will not be etched. The remainder of the metal is removed by the etchant.

### A Word About Size

Your artwork, and subsequently the metal you etch, is limited to approximately 4" wide x 6" high. These limitations are governed by the width of the photoresist laminator and the width and depth of the etchant tank. The thickness of the metal is limited to about .015", because of the roller clearance in the laminator. In most cases, you would never reach these limitations anyway. In fact, we recommend staying with a maximum size of about 3" x 3" x .010" thick. The 3" x 3" size allows you to place the metal in the etchant tank horizontally, which gives better results with fine lines. With larger sizes, the metal stands vertically.

Also, if you want to etch sizes over 3" x 3", you need to supply your own larger exposure frame (clear plastic sheets — be certain the plastic lets UV light pass through) and fill the etchant tank with at least one additional bottle of etchant. The .010" thickness is the maximum you would need for most model parts and for the other items mentioned before (except for jewelry). There can also be a problem with thicknesses over .010", because the metal is in the etchant tank for such a long time that it begins to etch sideways (called "undercutting" the resist). That's not problem with simple designs and heavy lines, but when you get down to very fine lines and complicated designs, it is. Theoretically, you can etch designs in much thicker metal, but it is not practical to etch all the way through. So, try to stay with smaller sizes and thicknesses, but, by all means, go ahead and experiment. That's part of the fun.

## Step 1. Creating the Artwork

If you want certain areas to etch half way through and other areas to etch completely through, two pieces of artwork must be produced...one for the front side of the metal and one for the back. You create the back by making an exact duplicate of the front, and then by making changes to the duplicate. This is explained in more detail below. If all areas of your artwork will be etched completely through, you have two choices: 1. use the identical artwork for both sides of the metal (recommended, because the metal will be etched half way through from both sides) or 2. laminate the entire back side of the metal with photoresist (the metal will be etched through from one side only).

Almost any computer drawing program can be used to create your own designs for etching as long as it lets you draw boxes, ovals, circles, straight and curved lines, and lets you add text. For very complicated designs, you may want to use a program like Adobe Illustrator, Daneba Canvas, Corel Draw or one of the many CAD (computer aided design) drawing programs available. Some pretty good CAD and drawing programs are even available as freeware or shareware on the internet. You can also use clip-art that you find on the internet or use press-on letters, lines, tape and other designs that you apply to the clear film. Unfortunately, with press-on graphics, you will only be able to etch from one side of the metal, since registration of the front and back sides would be almost impossible. More on registration later. For this instruction manual, we will concentrate only on artwork printed on the clear film included in your Pro-Etch system.

The finest line you will be able to etch successfully is approximately 1/2 point (about .007"). Anything finer would require commercial equipment costing thousands of dollars. Please keep this in mind when creating your artwork.

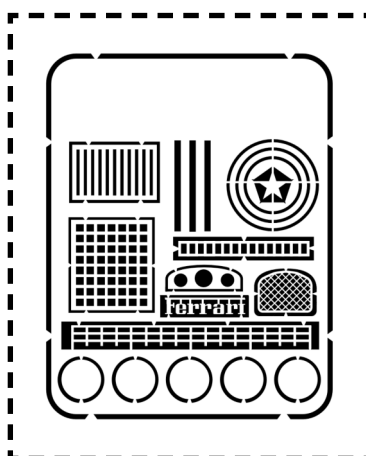
**Fig. 1** shows the artwork created for this instruction manual. It is representative of the type of artwork you can create, but in no way limits graphics that can be etched. It includes circles, curved lines, straight lines and text. **The white areas will not etch.** The ship model railing (above the 5 circles) was created by first drawing a black box, and then drawing white lines inside the box. You can also draw black lines on a white background and then use the "invert" command in your drawing program. The Ferrari logo above the railing is for the



**Fig. 1**



**Fig. 2**



**Fig. 3**

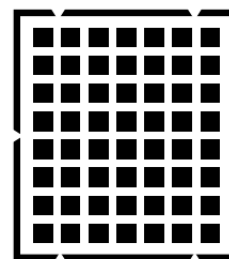
The dashed line indicates the perimeter of the metal that will be etched. It is for reference only and should not be part of the artwork.

trunk lid of a Testarossa model. Don't forget, **everything in black will etch.**

Because the printed side of the film must face the photoresist coated metal during UV exposure, all text must be flipped horizontally so that it reads correctly on the etched metal. **Fig. 2** shows our artwork after the text has been flipped. Note that Micro Mark, PRO-ETCH and Ferrari have been flipped. This is the final artwork that will be printed on the film and will be developed onto the front side of the metal to be etched.

We now need to create the artwork that will be developed onto the back side of the metal as shown in **Fig. 3**. This was made with the "duplicate" and "flip horizontally" commands in the drawing program. Some programs and printers refer to "flip horizontally" as mirror image. We did this for front and back registration purposes, which we'll cover in a later step. After flipping horizontally, several of the graphics were removed with the "cut" command, since we don't want these graphics to etch from the back side. During etching, the etchant removes half of the metal from the front and half from the back. Wherever there are identical graphics on both sides, the metal etches through completely. For example Micro Mark, Pro-Etch, the arrows, and the interior of the circles will etch only half way through.

We also added some graphics to side two. For example, **Fig. 4** shows an enlarged view of the grating. Note the small triangles added to the perimeter of the grating. These will hold the grid to the background during etching and, since they are only on the back side, they will etch half way through the metal. After etching, these triangles will be trimmed with a photo-etch scissor to remove the grid from the background. Without the triangles, the parts would fall out of background and into the etchant tank during etching. Note that other items also have triangles and lines to hold the parts to the background. The black border around the grating will etch through (except the triangles) and create a smooth, even frame.



**Fig. 4**

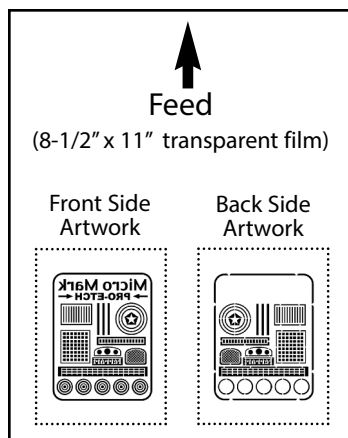
## Step 2. Printing the Artwork

During the development of the Pro-Etch system, we experimented with both laser printers and inkjet printers and found that today's ink jet printers are far superior for printing on clear film. We also found that the clear films available for laser printers would not give you the high resolution required for photo-etching. The film included with your Pro-Etch system was specially developed for printing high resolution, dense black images with ink jet printers only. **Do not attempt to use this film in a laser printer. It is not compatible with the high heat generated by laser printers.** Also, we do not recommend any of the ink jet films available at office supply stores. They simply will not produce the high resolution required for fine line photo-etching.

Most newer ink jet printers will work well. However, the only way to determine if yours can produce fine-enough results is to print a sample on the film: Images should print solid opaque black with clean sharp edges.

If your ink jet printer and software is capable, always print with the following settings: Best Quality, High Density Ink, and Transparency Film as the paper type. If you have a photo printer, select Photo Paper instead of Transparency Film. Some printers also allow you to select High Gloss Film as the Photo Paper and High Resolution Photo as the quality. If your printer allows these options, select them also.

Set up your page so that the artwork prints at the bottom of the page, as shown in **Fig. 5**, keeping in mind the border set-up of your document. This will allow you to use the rest of the film for additional artwork. The dotted line indicates where to trim the film with scissors. (**Note:** dotted line shown is for reference only and does not print). The film should be about 1/4" larger than the artwork all around, except at the top of the front side, which should be about 3/4". This will aid in registering the front with the back in a later step.



**Fig. 5**

If necessary, due to computer memory limitations, you can create the front in one document and the back in another document. Then run the film through the printer twice; once for each document. Be careful where you place the artwork on the page so that you don't overprint one on the other.

After you are satisfied with your artwork, make a printout on plain paper as a test. Examine the test printout carefully and make any changes as required. Then print onto the film. **Be certain to print on the dull side of the film. The dull side has a very fine textured coating that allows the ink to stick and dry quickly.** Put the printed film aside for five minutes before handling or running through the printer again. **Note: The film and ink are NOT waterproof.**

## Step 3. Registering the Front and Back Artwork

With a scissor, cut out your front and back artwork from the film. Don't forget to leave about 3/4" at the top of the front artwork. Tape the front artwork to an exterior glass window in daylight with the printed side facing you, as shown in **Fig. 6**. Next, put a piece of tape along the top edge of the back side artwork and place it on top of the front side with the printed side facing away from you, as shown in **Fig. 7**. Adjust the back side artwork so that it is in perfect alignment (registration) with the front side and press on the tape.

If you have a binocular magnifier, now is a good time to use it. When you are in perfect alignment, the two pieces of artwork will appear as one. If it's not perfect, simply remove the back side film and try again. Then remove the front side from the glass with the back side still attached. The laminated metal will be placed between the front and back in a later step in preparation for exposure to UV light. Place the front and back films in a safe place and remember to keep the film dry.



**Fig. 6**



**Fig. 7**

## Step 4. Preparing the Metal and Photoresist

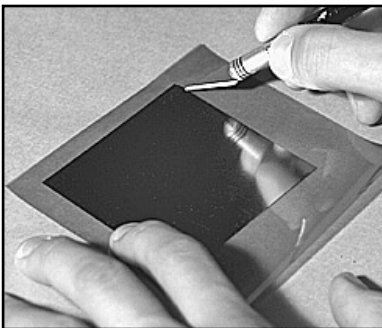
Using a scissor or shear, cut a piece of the metal you are going to etch from one of the larger pieces supplied. Mark the metal with a ruler and the point of a hobby knife first. The metal should be about 1/2" larger than your artwork around all four sides. Turn on the laminator now so it will heat up during this step. Also, cut 2 pieces of the white laminator carrier sheet about 1/2" larger all around than the metal.

**WARNING: The photoresist is very sensitive to light. Do not remove it from its protective tube and poly bag in sunlight, fluorescent light or very bright incandescent light.**

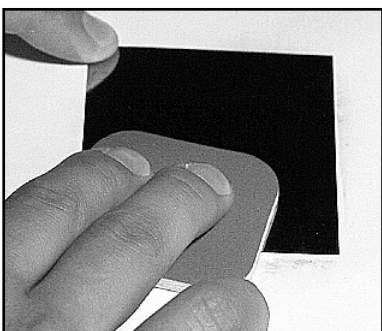
A standard 60 watt bulb in a ceiling fixture won't bother the photoresist if it is exposed for just a few minutes; however, if you really want to play it safe, use a yellow bug bulb. Remove the photoresist from the black bag and tube and, with a scissor, cut 2 pieces from the roll that are about 1/4" larger all around than the metal. Return the remainder of the photoresist to the tube

and bag. Place the metal over the photoresist and, with a hobby knife, trim the photoresist to the same size as the metal, using the metal as a pattern, as shown in **Fig. 8**.

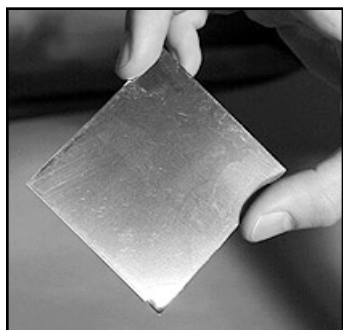
After trimming the photoresist, place it between sheets of scrap paper to protect it during the metal preparation. Place the metal on the piece of 7" x 11" flat plastic sheet (included). Dip the included polishing pad in clean water and burnish one side of the metal with the grain until it is bright and clean, as shown in **Fig. 9** (don't use anything except water). Repeat for the other side. At this point, handle the metal by the edges only. Run warm water over the metal and wipe with a very wet cloth, sponge or paper towel to remove any grit. After cleaning, water should cover the metal in a sheet, as shown in **Fig. 10**. If the water beads up, as shown in **Fig. 11**, it requires further cleaning.



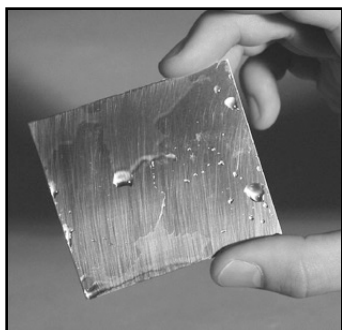
**Fig. 8**



**Fig. 9**



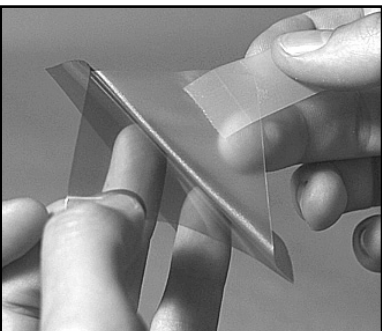
**Fig. 10**



**Fig. 11**

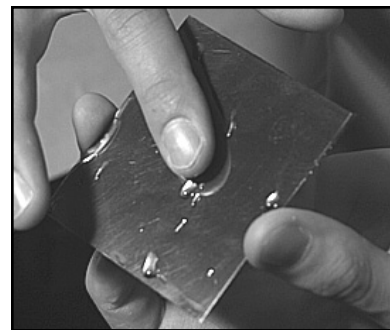
### Step 5. Laminating the Photoresist to the Metal

Once the metal is clean and very wet, you are ready to laminate. Take a piece of the photoresist and remove the protective film from the dull side (concave surface of the roll), as shown in **Fig. 12**. Use a piece of tape in one corner to aid in removal. Immediately place the photoresist on one side of the metal. If the metal was wet enough, you can slide the film into position. If necessary, in most cases you can remove the film,

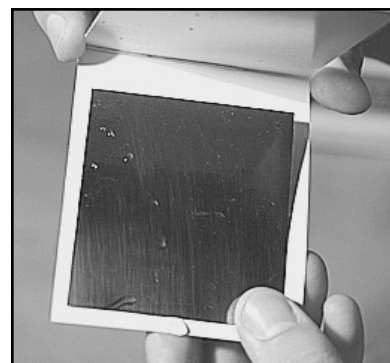


**Fig. 12**

re-wet the metal, and try again. Squeegee the top of the film from the center to the edges with your finger to smooth it out and to remove any air or water bubbles under the film, as shown in **Fig. 13**. This action will also remove most of the excess water, but the film should not be completely dry. Repeat for the other side of the metal. After both sides are coated with the photoresist, place the metal between the 2 pieces of carrier sheet you previously cut (glossy side in contact with the photoresist), as shown in **Fig. 14**. If the laminator's ready light is on, feed the carrier sheet with the metal into the laminator.



**Fig. 13**



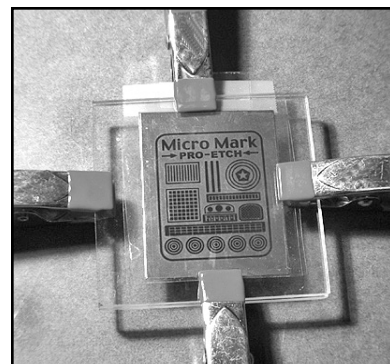
**Fig. 14**

After it exits the laminator, flip it over and rotate it 90°, then feed it through a second time. Remove the metal from the carrier and examine it carefully. The surface should be smooth without any bubbles, lines or other defects. If there are defects, you will have to strip the photoresist, (see **Step 13**) clean the metal and re-laminate. If the lamination looks good, return it to the carrier for about 10 minutes. **Note:** The carrier will have marks on it from the edges of the metal and the pressure of the laminator. If your next job fits inside these marks, you can use the carrier again; otherwise, make up a new carrier.

### Step 6. Preparing for Exposure to UV light

For proper exposure, the film and laminated metal must be held in tight contact with each other. Your Pro-Etch system includes 2 pieces of 3/16" thick Plexiglass for this purpose. Prepare the Plexiglass by removing the protective film from both sides of each piece. To keep it clean, lay one piece on a clean sheet of paper or cloth. Handle the Plexiglass by the edges only.

Remove the laminated metal from the carrier sheet and gently slip it between the front and back artwork film. Keep the artwork centered on the metal, then place the metal and film on top of the Plexiglass. Take the second piece of Plexiglass and lay it on top of the metal. Clamp everything together with 4 spring clamps...one on each of the 4 edges, as shown in **Fig. 15**.



**Fig. 15**

## Step 7. Exposure to UV light

Exposure to the sun, or to a standard 100 watt light bulb, will harden the photoresist wherever there is no ink on the film (the clear areas). Exposure time under the sun, at noon, on a bright cloudless day is approximately 15 seconds for **each side**. Add about 5 seconds more for each hour before or after noon. For example: at 11am or 1pm expose for 20 seconds. Don't expose before 9am or after 3pm. Exposure time with a standard 60W incandescent bulb is approximately 10 minutes **each side**. Use a lamp holder/socket with a reflector to position the bulb about 4" from the top surface of the Plexiglass. Successful exposure will be identified by the photo resist turning a darker shade of blue.

After exposure, remove the metal from between the front and back artwork film. You should see an image of the artwork on the photoresist. Cover the laminated metal to protect it from light while you prepare for development of the photoresist.

## Step 8. Preparing the Developing Solution

At this time, you should be wearing your apron, gloves and eye protection and have adequate ventilation. Fill the small measuring cup to the top with warm water and pour into a plastic tray marked "developer." Measure out **1/4 oz.** of the Sodium Hydroxide solution using the measuring cup and add it to the water. Stir gently with the included brush. Keep the container covered when not in use.

## Step 9. Developing the Photoresist

Developing the photoresist is probably the most critical step in the process. If left in the solution for too long, the hardened areas will soften. If not left in long enough, the areas you want to etch will still have photoresist on them and will not etch properly. The timing described below will be accurate in most cases, but, depending on your design, you may have to increase or decrease the development time.

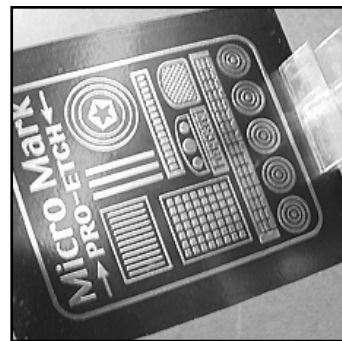
**Remove the remaining layer of protective film from the photoresist.** Use the tape in the corner method as described in a previous step. **Be certain to remove the protective film from both sides.** Now place the metal flat down in the developing solution as shown in **Fig. 16**. Let soak for about 30 seconds. Flip the metal over and soak for another 30 seconds. Then gently brush the entire surface of the photoresist on both sides with the included brush until you start to see the bright metal shining through.



**Fig. 16**

Continue brushing both sides for about an additional minute after you see bright metal. Remove the metal from the solution and rinse under running water for a few seconds while rubbing with your fingertips. Examine the photoresist carefully. Lines should be crisp and sharp without any ragged

edges. If not, return the metal to the developing solution for another 20 or 30 seconds. Remove, rinse and examine again. When fully developed, the artwork will appear to have a slightly embossed look after rinsing, as shown in **Fig. 17**. If there are any white spots on the photoresist, cover them with ink from a Sharpie marker (only Sharpie brand works). Place the developed metal in a safe place while you prepare for etching. Pour the solution in a toilet and flush. Rinse the container with water. Make a new solution each time you develop.

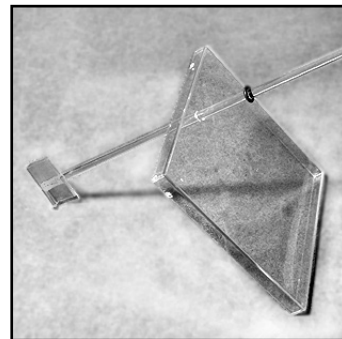


**Fig. 17**

## Step 10. Preparing the Etchant Tank

To assemble the tank, you will need the following items: etchant tank and lid, air pump, rubber tube, O ring, pinch clamp for rubber tube, aerator and acrylic rod with plastic holder on the end. The air pump creates the necessary agitation and adds air to the tank for better, quicker etching.

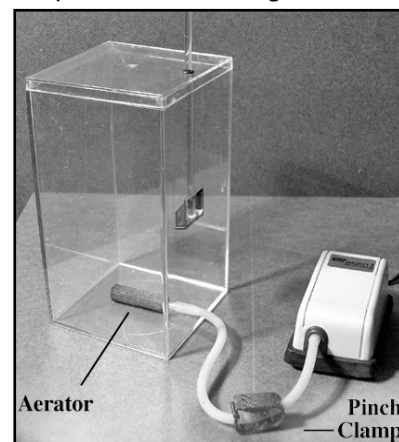
Insert the end of the holder rod through the hole in the lid from the bottom side. Slip the O ring over the end of the rod and slide it down half way, as shown in **Fig. 18**.



**Fig. 18**

With scissors, cut a sharp angle on one end of the rubber tube to create a point. The other end should be cut square.

Attach the aerator to the square cut end of the tube. Wet the tube with water and feed the pointed end through the hole near the bottom of the tank from the inside out. Pull the tube from the outside until the aerator is in the center of the bottom of the tank. Slip the pinch clamp over the end of the tube. Cut the pointed end square and attach it to the port on the air pump. The set up should look like **Fig. 19**. The tube will seal the hole in the tank.



**Fig. 19**

## Step 11. Preparing a Place to Etch

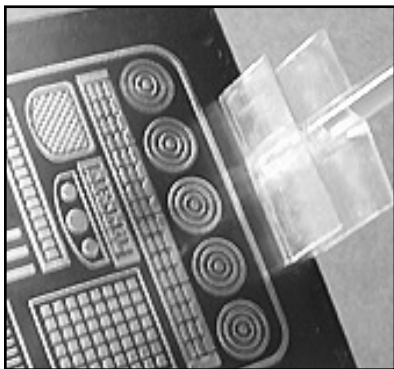
Etching should take place in an area away from other activities. In fact, if possible, do the etching outdoors. Access to a 110–120 volt AC outlet is required for the air pump.

Set up a work table or bench that is covered with several layers of newspaper. Place the following items on the bench: etchant tank and air pump, bottle of Ferric Chloride, roll of paper towels, 2 painter's pails or buckets 3/4 filled with warm water. A small fan is also recommended to provide adequate ventilation. One of the pails of water is for rinsing the metal during the etching process; the other should be kept nearby for emergency use should you need to dilute an accidental spill. Set up the etchant tank in the center of the bench with the air pump on one side and a pail of water on the other.

## Step 12. Etching the Metal

The life of the etchant is determined by the amount of etching it has to do. If your design requires a lot of etching and/or you are etching thick metal, the etchant will be exhausted rather quickly. With .005" thick metal in a size similar to our sample shown, you can expect about 10 etches before you notice that it is taking longer and longer to etch. Heating the etchant will extend its useful life. When etching begins to take an inordinate amount of time, replace the etchant with a fresh bottle. The spent etchant should be poured into in an old plastic container similar to a windshield washer fluid gallon container so you can bring it to your local hazardous waste disposal site. **Be certain to mark the container with a permanent marker to indicate its contents, such as "POISON — Ferric Chloride — hazardous waste".**

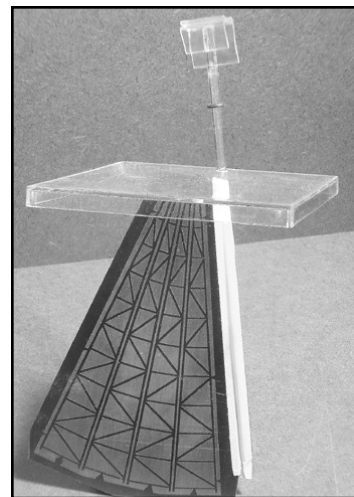
Before handling the etchant solution, be sure you are wearing a plastic apron, rubber gloves and eye protection and have adequate ventilation. For best results and shorter etching time, the solution should be warm. To heat the solution, place the plastic bottle in a microwave oven\* for 1 minute on high OR pour it into a glass bottle with a plastic or plastic lined cap. Write a description of the contents on the bottle with a permanent marker. Then place the glass bottle into a pot of very hot water or heat with a hair dryer.



**Fig. 20**

Insert the metal to be etched into the holder at the end of the plastic rod, as shown in **Fig. 20**. (**Note:** After a few uses, the slot in the holder may become too loose to hold thin metal. If it does, heat gently with a hair dryer and hold closed with a clamp until it cools). The side to be etched half way should face **UP**.

Longer pieces of metal can be taped to the rod with masking or cellophane tape as shown in **Fig. 21**. Now place the metal into the tank.



**Fig. 21**

Make sure the pinch clamp on the tube is closed so that the solution cannot reach the air pump. Lift the tank lid and pour in the heated etchant. Lower the metal into the etchant with the plastic rod and re-cover the tank. The metal should be about 1/2" below the surface of the etchant. Hold the rod at the correct depth by sliding the O ring up or down. Plug in the air pump and immediately open the pinch clamp.

After 5 minutes of etching, close the pinch clamp and unplug the air pump. Lift the lid, rod and metal out of the tank as one unit and dip into the pail of water. If the shiny metal is now dull, the etching is working, which means your development time in **Step 9** was correct. Return the metal to the tank and continue etching. If the metal is still shiny, the development time should have been longer and you will probably have to strip the photoresist (see **Step 13**) and try again.

**Note: The following instructions are based on designs with very fine lines similar to our sample design.** If your design is simpler with heavier lines, the amount of rinsing and turning can be cut in half. Since every etching job is different, only trial and error will give you the best results until you become more familiar with the process. Time in the etchant tank can vary from a few minutes to over an hour. After your first etching job, most of the instructions in this manual will become second nature to you.

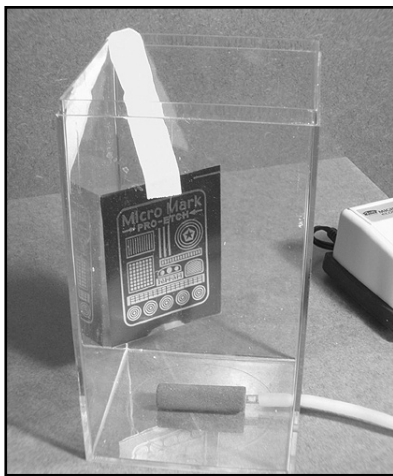
After each 5 minutes of etching, turn the lid and metal 90 degrees. After 10 minutes, close the pinch clamp and unplug the air pump. Lift the lid, rod and metal out of the tank as one unit and dip into the pail of water. Rinse and brush all etchant off the metal with the included brush, especially where it collects in very fine lines. This removes spent etchant so that fresh etchant can reach the metal. Now remove the metal from the holder and turn 180 degrees. Insert the metal back into the holder on the edge opposite the edge it was originally and continue etching. This is necessary because the metal next to the holder etches more slowly. Monitor the etching process until the metal is etched through. Then close the pinch clamp, unplug the air pump and remove the metal.

**Note:** in some artwork that contains both heavy lines and thin lines, the etching speed from one area to another can vary.

**\*WARNING:** It is recommended that the microwave oven be dedicated to shop use only and not used for kitchen/food use. We also suggest placing the bottle in a container that would capture any liquid that may escape from the bottle should leakage occur from any kind of mishap.



During your monitoring of the process, if 80–90% of the metal is etched through, but there is a small area that still needs further etching, try to continue etching with only those areas submerged in the etchant. One method is to remove the metal from the holder and apply a long piece of tape to the area that is finished etching. Then hang the metal from the corner of the tank so only the the unetched area is submerged, as shown in **Fig. 22**. Cover the tank and continue etching.



**Fig. 22**

When you are finished etching, rinse the metal under warm water until all etchant is removed. Then disconnect the tube from the pump (**be certain the pinch clamp is closed**) and carefully pour the etchant back into the original plastic bottle for storage. Rinse all etching components with warm water until clean. The rinse water in the pail is quite dilute, so it can be disposed of in a toilet.

### Step 13. Removing Hardened Photoresist with Stripper

After etching, you'll notice that the hardened photoresist is still on the metal. With a permanent marker, label the second tray "sodium hydroxide stripper." Then pour **undiluted** Sodium Hydroxide Solution from the bottle into the second tray. Pour only enough to cover the bottom to a depth of 1/4". Place the metal in the tray and soak until the photoresist is lifted off the metal. Gently brushing the surface may help. Remove the metal, rinse under water, trim as necessary and you're done. Depending on your design, the stripper can be used 2 or 3 times, but will take longer to strip with each use. We recommend that new solution be used with each etching session. Pour spent solution into a toilet and flush.

### Polishing Brass, Copper and Stainless Steel for Photo-Etching

We suggest you try the following only after you've completed several successful etching sessions following the instructions above.

The polishing pad we include for burnishing metal is sufficient in most cases to give you a nice bright finish, especially if you are making small model parts. Stainless steel comes very close to chrome in appearance and looks great on model cars. If you are painting the metal after etching, the polishing pad is more than sufficient. In some cases, you may want a shinier finish...on jewelry for example. Since it is pretty difficult to polish the metal after etching, it should be polished before laminating. Here's how we did it on brass: (Don't forget to wear

gloves and other protective gear). We burnished the brass with Micro-Mesh (Micro-Mark no. 81601) in succeeding finer grits up to 12,000. Then we used a buffing wheel charged with jeweler's rouge. The metal was cleaned with some diluted Sodium Hydroxide and polished with metal polish. Then it was cleaned again with household ammonia. After this process, we could not get the water to sheet on the surface of the metal, which would indicate the metal wasn't clean. But, surprisingly, the photoresist was laminated successfully and the etching worked perfectly. The jewelry items we made were plated with a Micro-Mark plating kit after they were etched. A spray coat of clear acrylic was then applied to resist tarnish. (The clear acrylic is recommended for all brass, whether highly polished or not, except if it will be painted or soldered). Micro-Mark fixative spray, no. 82858, works great.

Another nice effect is the filling of half-etched areas with thinned paint. When the paint is dry, buff off the excess with the polishing pad and apply clear coating. This works great on brass nameplates.

### Electroplate Small Parts at Home

This new concept in plating small parts is ideal for vintage vehicle restorers, antique collectors and dealers, model builders, gun smiths, clock rebuilders, jewelers, prototype work and plating repair. The system is safe and easy to use: just clip one power supply output lead to your workpiece and the other to the plating wand. Dip the wand into the plating solution, then swab it onto your workpiece. You'll watch in amazement as a gleaming new finish appears before your eyes. Kit includes 120v AC power supply with low voltage output, plating solution, clip leads, plating wand and instructions.

**#83082 Nickel Plating Kit** deposits a solid layer of nickel onto steel, iron, copper and copper alloys (like brass and bronze), and tin. Buffs to a beautiful, rich shine. 16 ounces of solution.

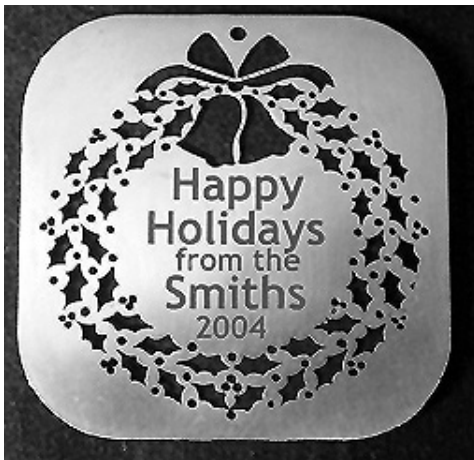
**#83083 Chrome Kit** is ideal for chrome plating small parts made of steel, copper, bronze, brass and tin. Also repairs small damaged areas of existing plating, like a small scratch in an automobile bumper. 16 ounces of solution.



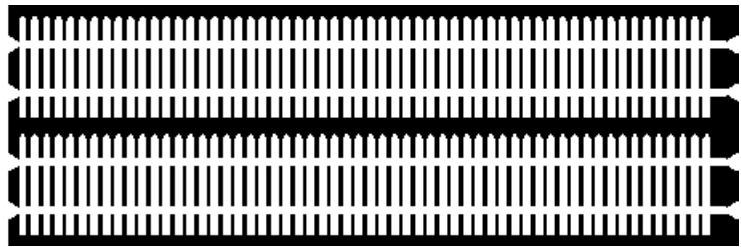
**Check the Micro-Mark catalog or web site  
([www.micromark.com](http://www.micromark.com))  
for additional tools and accessories,  
and for current pricing.**

## Here are some other items made with the Pro-Etch System

Christmas Ornament



HO Scale Picket Fence



Name Necklace



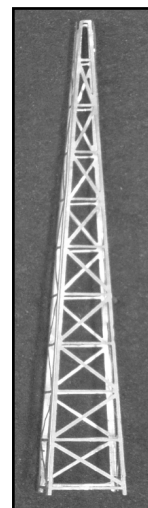
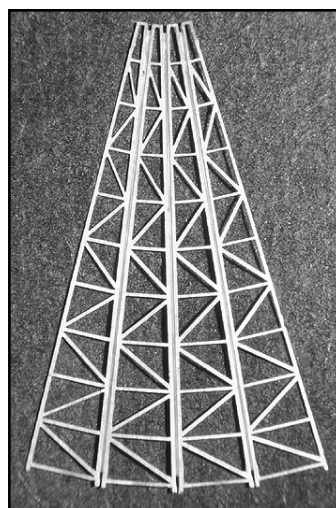
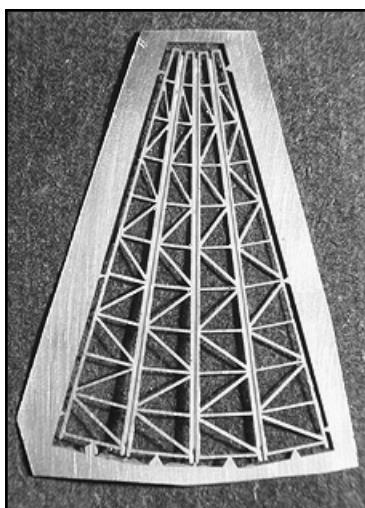
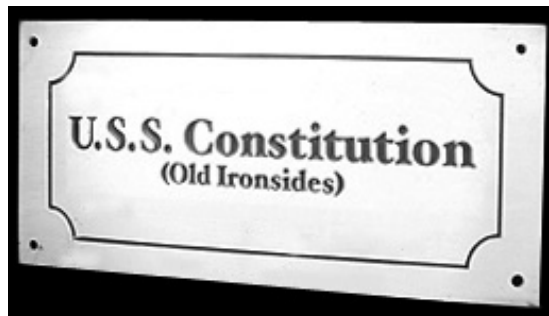
Bookmark



Taurus Zodiac Sign Pendant



Ship Model Nameplate



HO Scale Tower  
Shown before trimming, after  
trimming, and after bending.  
Bends were made on lines  
etched half way through.

## Notes