

THE MG CHEMICALS COPPER ELECTROPLATING PROCESS

These instructions are for general use of this Electroplating Tank.

Those who are using this tank as part of the MG Chemicals Professional Prototyping Process should follow those instructions instead, available at www.mgchemicals.com/techsupport

REQUIRED INGREDIENTS

ELECTROPLATING TANK KIT

CAT. NO. 41650

Quantity	Description
1	3.3 gallon plastic pail
1	Tank lid
3	Solid Copper Bus Bars (3/8" x 10.5") with wire and connector
1	5" Copper Cathode Hook
1	Package of Nitrile Gloves (CAT. NO. 416-G)

This electroplating tank has been designed for use with the MG Professional Prototyping Process, but it will work with any electroplating system.



IN ADDITION TO THIS TANK, ELECTROPLATING REQUIRES:

OTHER INGREDIENTS

Ingredient	Description
Anodes and Plating Solution	<p>Experienced electroplaters may use this tank with whatever anodes and solution they choose, but for people new to electroplating, MG Chemicals offers ready to use solutions and anodes.</p> <p>Other products required to plate copper using the MG Chemicals system:</p> <ul style="list-style-type: none">• Copper Anode Set• Copper Plating Solution <p>Other products required to plate tin using the MG Chemicals system:</p> <ul style="list-style-type: none">• Tin Anode Set• Tin Plating Solution
Rectifier (0-15V, 0-3A is sufficient for small boards)	<p>A rectifier is required for electroplating, but it does not have to be powerful. Entry level rectifiers with a current capacity of 3 amps have enough power for most prototype pcb's and other small objects that can fit in the MG Electroplating Tank. Some users may find it necessary to use up to 7 amps, which will plate a double sided 4" by 6" board, which is about as large as can be used with this tank.</p> <p>Plating small boards and objects uses currents so low that the risk of electrical shock during normal operation is minimal. However, always be wary of the risk of electrocution when working with open circuits and treat the open bus bars and solution as if they are electrical hazards. Always wear nitrile or rubber gloves when touching any electrified part of the system. Limit the risk by never using a rectifier with current generating capacity greater than 25 amps. Hooking up a large rectifier incorrectly can create a hazard.</p>
Magnetic Stirrer (at least 17cm x 17cm plate surface)	<p>A magnetic stirrer is highly recommended to achieve professional results.</p> <p>It is very important that your magnetic stirrer be of sufficient size so the etching tank can sit on it without being unstable; the plate should be at least 17 cm by 17 cm. It is not difficult to obtain a magnetic stirrer of this size. Do not use a small magnetic stirrer intended for beakers, because the etching tank might easily tip and spill corrosive acids.</p> <p>If you choose to not use a magnetic stirrer, ensure you have designed an effective alternative for agitating the solution during plating.</p> <p><i>These instructions assume the use of a magnetic stirrer.</i></p>

PROCESS OVERVIEW

Electroplating is a straight-forward process with five steps:

- Planning for safety
- Calculating the required current
- Setting up the electroplating tank
- Electroplating
- Cleanup

SAFETY PRECAUTIONS

Plating solutions commonly involve acids and other hazardous substances. These hazards can be mitigated with proper planning, but they must not be taken lightly.

Read through the material safety data sheets for all chemicals used. MSDS's for MG Chemicals' products can be found at www.mgchemicals.com/msds, where all of our MSDS are listed by part number.

Proper planning must be done to ensure that there is adequate ventilation in place prior to beginning the process. A fume hood is recommended. At all times airborne concentrations must stay below the maximum allowed levels listed on the related MSDS. When adequate ventilation is not available, use a half mask with a cartridge suitable for acidic and organic vapors (available at your local industrial safety supply store).

Protective gloves and eyewear must be worn at all times, and a lab coat is strongly recommended because a drop of some of these solutions will easily create a hole in clothing.

Ensure the workplace is a low traffic area and there is no chance of containers being knocked over or bumped.

CALCULATING THE REQUIRED CURRENT

Before placing your board into the tank you will need to calculate the amount of current required.

Start by calculating how much copper area you want to electroplate on your board.

18 amps is required per square foot of copper to achieve a thickness of 0.001" (1.0 mil or 25 microns) in one hour.

The current (i) required to plate a different area of copper to the same thickness is directly proportional to this, so $i = (18 \text{ amps}) * A / (144 \text{ in}^2)$, where A is the surface area to be plated in square inches.

Example

What is the current required to plate a 5" x 3" board, with the circuit covering approximately 40% of the surface area of the top side of the board and 30% of the bottom side of the board?

1. Calculate the surface area being plated
 $A = 5" \times 3" \times 40\% + 5" \times 3" \times 30\% = 10.5 \text{ in}^2$
2. Calculate the required current
 $i = 18 \text{ amps} \times 10.5 \text{ in}^2 / 144 \text{ in}^2 = 1.3 \text{ amps}$

SETTING UP THE ELECTROPLATING TANK

There are three bus bars in this tank kit; the two with red wires are the anode bars, and the one with the black wire is the cathode bar. Insert the anode bars through the left and right sets of holes on the tank, and the cathode bar through the holes in the middle of the tank.



Hang 4 anodes on each anode bus bar, making sure they are evenly spaced across the bars.

Fill the tank with two 4 liter jugs of the appropriate MG Chemicals Electroplating Solution.

Attach the bus bar wires to the rectifier, the red wires from the anode bus bars to the positive (+) terminal, and the black wire from the cathode bus bar to the negative (-) terminal.

Place the etching tank on the magnetic stirrer.



ELECTROPLATING

Hang the object being plated on the hang hook and suspend it from the middle of the cathode bar. Check the placement of the board. The board should be positioned so there is approximately 1 - 2" of solution over the top of the board. Make sure the board is parallel with the anodes.

Drop the stir bar into the solution, aiming for the center of the tank. Turn on the magnetic stirrer and adjust the speed until you create a vortex in the solution.

After the vortex is created, turn on the rectifier and set the current to the level calculated earlier. Do not adjust the voltage.

If you see a voltage and no current, or there is a current but it fluctuates for more than 2 minutes, then there is either a loose connection or significant corrosion on the bus bars and hang hooks. This is very common if the bus bar and hang hook are not removed and cleaned in between uses.

If this occurs, take object being plated out of tank and rinse with tap water and dry quickly with a hair dryer. Check to make sure all connections are tight. If a loose connection is found, tighten the connection and try the electroplating process again. If no loose connection is found, remove the bus bars, hook, and anodes and scrub the contact areas with steel wool or other abrasive cleaner, rinse with water, dry, reassemble the tank, and try the electroplating process again.

Periodically check on the current in the rectifier display to verify it is consistent; periodically verify the magnetic stir bar is functioning normally in the center of the tank (it can slide to the side and agitation will not be optimal). It is critical that both are performing properly.

Never leave the object being plated in solution for more than two minutes if either the magnetic stirrer or rectifier are turned off.

After 1 hour of electroplating, take the board out from the plating tank and rinse right away with tap water. Quickly dry the board with hair dryer.

The two gallons of MG Chemicals Electroplating solutions used to fill the electroplating tank contain enough active ingredients to plate at least 150 square inches with 1.0 mil of copper.

DISPOSAL CONSIDERATIONS

A quick clean up of the electroplating tank and accessories is recommended because the acidic vapors of the plating solution quickly corrode the bus bars and hooks when not in use, and this corrosion prevents current from flowing properly when the tank is reused.

Once finished electroplating for the day, remove all anodes, hang hooks, and bus bars and wash them all with an abrasive pad or abrasive cleaner and warm water. Dry everything quickly using a hair dryer to prevent oxidization.

Keep in mind that copper electroplating solution contains copper ions which are lethal to aquatic life, and must never be disposed of down the drain. Other electroplating solutions also pose significant safety and environmental hazards.

Store used solutions in glass or plastic pails and dispose of in accordance with Federal, State, and local regulations at a reputable waste management company. **DO NOT DISPOSE OF THESE DOWN THE DRAIN.** Waste management companies can usually be found in the local Yellow pages, and local governments commonly offer phone assistance for finding suitable facilities.