### Table Of Contents

- Introduction To Electroplating ........................................ 3
- Safety Procedures .......................................................... 5
- Some Things You Might Need ........................................... 7
- Setting Up Your Plating Kit ............................................. 8
- Making up the tanks ...................................................... 9
- Zero Waste Discharge System ....................................... 11
- Heaters ...................................................................... 11
- Setting Up A Workshop .................................................. 12
- Repairing Pitted Metals .................................................. 15
- Preparing Your Parts For Plating .................................... 19
- Anode Setup & Positioning ............................................. 25
- Wiring Up The Parts ...................................................... 28
- Hydrogen and Air Entrapment ......................................... 29
- Understanding DC Power .............................................. 29
- Making Plating Solutions and Acid Pickles ....................... 33
- The Waterbreak Test ..................................................... 38
- Strike Coats & Compatible Metals ................................... 38
- Metals Chart .................................................................. 39
- Caswell Inc Product Instructions .................................. 41
- Nickel Electroplating Kit ............................................. 41
- Flash Copper Plating ................................................... 45
- Bright Acid Copper Plating Instructions ......................... 49
- Decorative Chrome Plating .......................................... 53
- Hard Chrome Plating .................................................. 58
- Copy Cad® & Zinc Plating ............................................ 96
- Chromate Processes .................................................... 101
- Yellow Chromate ...................................................... 101
- Olive Drab Green Chromate ....................................... 102
- Black Chromate ........................................................ 103
- Blue/Clear Chromate .................................................. 104
- The LCD Anodizing Aluminum System ......................... 105
- Inexpensive Fade Anodizing ........................................ 114
- Type III Anodizing ........................................................ 122
- Electroless Nickel/Krome Plating ................................. 123
- Boron Nitride Electroless Nickel .................................. 132
- PTFE Electroless Nickel ............................................... 135
- Black Krome Tank Plating Kit ...................................... 137
- Reprochrome® Plating Kit .......................................... 139
- Copy Chrome Plating Kit ............................................ 141
- Nickel Electroforming Kit .......................................... 144
- Brass Electroplating Kit .............................................. 147
- Bright Acid Tin Plating ............................................... 149
- Electroless Tin Plating Kit .......................................... 151
- Bronze Plating Kit ..................................................... 152
- Gold Plating ............................................................ 154
- Gold Tank Plating ...................................................... 154
- Gold Brush Plating ..................................................... 156
- Silver Tank Plating .................................................... 157
- Caswell Plug N’ Plate® Kits ......................................... 160
- Rub On Silver Plating ................................................... 164
- Black Oxidizing Of Steel ............................................ 165
- Metal Pickles ............................................................. 166
- Plating Plastics And Non Conductors ............................ 167
- Bronzing Baby Shoes .................................................. 169
- Plating Lead, Pewter, Fishing Lures ............................... 170
- Waste Disposal & Emissions ....................................... 171
- Technical Support ....................................................... 176
- Calculating Surface Areas .......................................... 177
- Index ........................................................................ 180
The Caswell Plating Manual X

Introduction

It’s been over 15 years since Caswell Inc launched our first web site, and almost 20 since we wrote our first manual aimed at the small electroplating market. With this, our TENTH major version of this book, we are launching into the E-Book format, and completely rewriting the book.

This manual is a reference book. We suggest you read the entire book before proceeding, and then you will need to refer to specific sections depending on the job you are trying to achieve. It would be ideal to be able to write this book in a 1-2-3 step fashion, but there are so many variables, it would be impossible to cover them all.

Despite that, in this version of the manual, we are attempting to clarify the setup and operation steps of our plating kits, using more pictures and flowcharts.

Since our last version of the book, we have added many new products and made improvements to many others. This updated manual reflects these changes.

With any sort of coating process, challenges are bound to arise due to the many different types of metals, alloys and operating parameters that you could experience. After nearly 20 years of operation, we have seen and solved nearly every imaginable problem that the small scale plater, anodizer or coater can experience. Most of that knowledge is recorded in the pages of this book. The remainder is readily available on the Internet, on our Finishing Forum and Technical Support Site.

We have also started offering an Online Electroplating Course on Nickel Plating. This E-Class walks you through all the steps to nickel plate

Over the years we’ve also developed a number of on line tools that you will find useful.


Don’t get disheartened if your first few plating jobs don’t come out perfectly. Remember that surface prep is 95% of the job, cleaning is 4% and the plating step is the remainder. Keep detailed notes of your plating parameters, especially the surface area of the parts and the amperage used. Reread the appropriate section of this book, check our Technical Support Site and Finishing Forum and if you’re still stuck, give us a call.

I hope you enjoy the manual, and good luck plating.

Lance Caswell
Caswell Inc
Introduction To Electroplating

Electroplating is the depositing of positively charged metal particles (ions) moving through a solution by electricity, attracting them onto an object that has been given a negative charge.

There are two basic types of electroplating. Tank/Immersion Plating and Brush Plating.

Tank Plating

Tank plating usually consists of a container full of a chemical solution (electrolyte), anodes (usually made from the metal being plated), and the part you plan on electroplating (the cathode). The electrolyte contains ions of the metal being plated. So, for example, a zinc plating setup will consist of a liquid contains dissolved zinc, zinc anodes and the part you want to plate. In this setup, the zinc is sacrificed from the anodes as the plating is done, so the anodes will eventually need to be replaced.

In some tank setups, stainless or lead anodes are used, and the metal being plated is depleted from the electrolyte. For example, in a gold plating setup, a stainless steel anode can be used, and when the gold electrolyte is exhausted, would need to be replaced. This eliminates the need for costly gold anodes.

DC power, at varying amperages, is applied to the setup. Positive to the anodes and negative to the part, which is hung with copper wire into the liquid. The amperage used varies based on the type of plating being done. For example, nickel plating using 70 milliamps (0.07 amps) per square inch of part surface area. Chrome plating requires a whopping 1.5 amps per square inch. Refer to the Surface Area Calculator and Power Supply Calculator links on the previous page for assistance with this.

Plating times vary from a few seconds in the case of gold or silver plating, where costly precious metals are used up as little of possible, to several hours or days in the case of build up coatings like acid copper, hard chrome or nickel sulfamate. These coatings are meant to either electroform complete parts using electroplating, or build up tolerances on wear surfaces like bearings or shafts.

Brush Plating

Brush plating is usually used when the parts are very small (1 sq inch or less), or you need to plate a section of a larger part, like a car emblem which is still on the vehicle.

Brush plating consists of a small metallic wand, with some absorbent material wrapped around one end, and a small quantity of electroplating solution.

The wand is connected with a wire to a DC power source. The negative is connected to the part being plated, usually with an alligator clip.

The wrapped end of the wand is dipped into the plating solution, then brushed over the polished and cleaned part.
Getting Started

Practice makes Perfect. The best platers keep notes! Recording your successes and failures is the best way of learning, and practice really does make perfect. If it isn't working, you are probably doing something wrong! Check your procedures with the manual and try again. If you can't fathom it out, make a note of what you did and then give post your problem on the forum. You’ll get answers there quickly.

We suggest that you start off with some scrap metals for your first efforts. Short lengths of copper pipe are great for practicing on. Save each piece so that you can apply another plate to it when you set up the next tank.

Try some different finishes like wire brushing, emery sanding, bead blasting or buffing and polishing. Practice your buffing skills on these bits of pipe, then plate all of them! You will immediately discover the benefits of good preparation, and then understand that 'show quality finishes' have little to do with the actual plating. It's all in the prep.

Your first plating job can be plating your tank bars. A good nickel plate applied to these copper pipes will dramatically reduce any corrosion forming on them.

You should start off using ONLY ONE KIT AT A TIME. If, for example, you have a TRIPLE CHROME KIT, don’t set up all the tanks, because you’ll be tempted to flit amongst the processes. It is imperative that you master ONE SKILL at a time. DO NOT progress to another kit until you are quite satisfied you are producing good plating.

We suggest, that with a Triple Chrome kit, you set up the nickel tank first and learn that process. Once mastered, the other kits will be much easier to understand.

Select some pieces of ½” diameter copper pipe, cut them to 5” lengths, this will give you a total surface area of 8 square inches. By learning to plate using these items, you’ll have a constant sized product to practice on.

For most plating setups, the requirement is 1 amp per 16 sq inches, so you’ll need ½ an amp to plate these pipes. When chroming, you’ll need 1 amp per sq inch, or 8 amps for these pipes.

Try different finishes, sand blasting, polished, wire brushed, just dirty, etc. and see what they come out like. Buff the finish vigorously, to see it improve (hopefully) and to see if it is well bonded.

Try plating over the nickel plated pipe with copper.

Experiment until you get a satisfactory result.
Safety Procedures

Although none of our products use poisonous cyanides, many kits contain corrosive materials, flammables and can be harmful if mishandled.

It is important to treat any chemical with great respect, read the MSDS, wear appropriate safety gear, prevent spills and keep all chemicals away from other people, especially children.

GHS

The United States and OSHA are in the process of adopting a GHS (Globally Harmonized System) of hazardous materials warnings. All of our product labels have been updated with GHS symbols and terminology, so you should familiarize yourself with these.

<table>
<thead>
<tr>
<th>GHS Pictograms and Hazard Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Oxidizers" /></td>
</tr>
<tr>
<td><img src="image" alt="Flammables" /></td>
</tr>
<tr>
<td><img src="image" alt="Explosives" /></td>
</tr>
<tr>
<td>![Acute toxicity (severe)]</td>
</tr>
<tr>
<td><img src="image" alt="Corrosives" /></td>
</tr>
<tr>
<td><img src="image" alt="Cases Under Pressure" /></td>
</tr>
<tr>
<td><img src="image" alt="Carcinogen" /></td>
</tr>
<tr>
<td><img src="image" alt="Respiratory Sensitizer" /></td>
</tr>
<tr>
<td><img src="image" alt="Reproductive Toxicity" /></td>
</tr>
<tr>
<td><img src="image" alt="Target Organ Toxicity" /></td>
</tr>
<tr>
<td><img src="image" alt="Mutagenicity" /></td>
</tr>
<tr>
<td><img src="image" alt="Aspiration Toxicity" /></td>
</tr>
<tr>
<td><img src="image" alt="Environmental Toxicity" /></td>
</tr>
<tr>
<td><img src="image" alt="Irritant" /></td>
</tr>
<tr>
<td><img src="image" alt="Dermal Sensitizer" /></td>
</tr>
<tr>
<td>![Acute toxicity (harmful)]</td>
</tr>
<tr>
<td><img src="image" alt="Narcotic Effects" /></td>
</tr>
<tr>
<td><img src="image" alt="Respiratory Tract" /></td>
</tr>
<tr>
<td><img src="image" alt="Irritation" /></td>
</tr>
</tbody>
</table>

MSDS

MSDS (Material Safety Data Sheets) are available on all our products on our web site at http://support.caswellplating.com. If you don’t see the MSDS you need, just e-mail us at techsupport@caswellplating.com.

It’s important to read and understand the MSDS before opening, mixing or using the product. You should also have the MSDS on hand, in case of an emergency.
Fumes

The major problem with any larger plating operation is the emission of fumes from the tanks during the plating process. Fortunately, we do not have to deal with this in the same way as the commercial platers, due to our 'miniature' systems.

In the case of nickel, copper, Copy Cad, Copy Chrome and zinc plating, the fumes are hardly noticeable, and do not pose any major health risk. However, the chrome, SP Degreaser, anodizing and de-plating tanks do give off unpleasant, and potentially dangerous fumes. These need to be considered and controlled.

We suggest you manufacture a small fume hood and/or install a fan system to move the fumes away from yourself. An ideal ready made inexpensive hood is a kitchen stove fume hood. The use of a respirator is also advisable.

Our Chrome kits have a fume control system. This comprises of a bag of plastic balls and an EPA compliant mist suppressant which is mixed into the Chrome Activator.

The plastic balls are placed in the chrome tank, and they float on the surface of the chrome. The Chrome Activator is also added to the tank. The mist suppressant in the Activator is a commercial 'oil' which fills the gap between the balls. The combination of these two items, virtually eliminates all fumes from the tank. The balls also hold the heat in. Additional balls may be purchased for use in the pickling tanks.

You should use goggles, gloves and an apron while using your plating operation.

Spills

When setting up your workspace, you should consider a catastrophic spill as inevitable. Plan for all of your solutions spilling onto the floor. Place empty containers of sufficient capacity under your plating tanks. Have absorbent available, to ensure no solutions reach a drain or water source. Keep a box of Sodium Bicarbonate (Baking Soda) handy. Sprinkle on the spill to neutralize the acid. Then mop and flush.

Disposal of chemicals

Most plating chemicals contain heavy metals. They should not be flushed down drains, even in small quantities. Disposal laws vary from town to town, state to state, so check with your local authorities.

When you finally dispose of the chemicals, you should evaporate off as much water as possible, place the remaining sludge in a plastic container, and take it to a 'transfer station', telling them what the chemical is. They will usually dispose of it for you at no charge, considering the small quantity, preferring to do this than let them be flushed!

SP Degreaser is only a caustic solution and is drain safe, so can be flushed into a sewer system.

Spent acid solutions from the preparation tanks can be used to clean up concrete or neutralized with baking soda. Ask the supplier of these materials for correct disposal procedures.