CASWELL BRONZE ELECTROLYTE MANUAL

Manual for electrolyte and complete kit

The step-by-step plan in this manual is written for the complete kit, in which all necessary materials are included. If you only have the electrolyte, you can use this step-by-step plan as an example.

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Quick Start

Use this step-by-step guide as a quick reference once you've read the manual all the way through.

1. **Degrease workpiece with an alkaline degreaser.**
2. **Rinse thoroughly with clean water.**
3. **(optional) remove any rust/contamination mechanically.**
4. **(optional) etching / activating – then rinse thoroughly.**
5. **Prepare the electroplating bath.**
6. **Check the electrolyte level and place a mark.**
7. **Wrap anodes in PP anode filters.**
8. **Hanging anodes in 2:1 ratio opposite each other in the bath.**
9. **Turn on circulation or air agitation.**
10. **Hang workpiece with unvarnished copper wire on the nylon rod.**
11. **Black minus wire on the workpiece, red positive wire on the anodes.**
12. **Calculate area in cm^2.**
13. **Setting current: approx. 0.15 A per 10 cm^2 total area.**
14. **± 2-3 minutes decorative – 30-40 minutes for a thicker layer.**
15. **Spray the workpiece above the bath with demi/di water.**
16. **Rinse well again with clean water.**
17. **Dry at room temperature or with blow dryer/heat gun on low setting.**
18. **(optional) Protect: Apply sealer, clear coat (1K/2K) or wax/oil in thin layers according to product label.**
19. **Close bath with lid.**

Important information

WHAT IS Bronze Electrolyte

Bronze electroplating is a dark, copper-like finish that is often seen on decorative parts and of course, baby and children's shoes.

For the best color, it is best to apply bronze to copper.

Works at room temperature; Optimal operation around 27 °C.

The electrolyte is suitable for the direct bronze plating of:

- Zinc
- White metal
- Nickel
- Copper
- Steel
- Tin
- Lead
- Stainless steel
- Aluminium treated with zincate

Required equipment

The following materials are required for the use of the bronze electrolyte:

(these materials are included in the kit and can be ordered separately on the webshop)

Always work in a well-ventilated room or use an extraction system.

Needed for the tank

- **Tanks/baths**: acid-resistant PVC, PE or PP. Large tanks should be reinforced to prevent bulging. Also suitable: steel tanks with rubber or plastic (pp/pvc) inner lining.
- **Stainless steel anodes**: stainless steel 316.
- **Anode filter**: polypropylene filters to limit contamination of the bath.
- **Thick titanium wire**: hang the anodes in the electrolyte with this.
- **(filter) pump**: use a circulation pump or filter pump for agitation and filtration for a smooth, clear bronze deposit. Minimum throughput: one tank turnover per hour.
    - The pump can be replaced by a filter pump where you replace the sponge in the housing with a 5 or 10 µm polypropylene filter cloth for continuous filtering.
    - Filter parts must be acid-resistant (PE, PP or stainless steel 316). Do not use cellulose filters.
- **Agitation**: Required to avoid roughness, burning, or streaking. Possible via air pump or circulation pump.
- **Hanging system**: hang workpiece on a nylon or copper rod with copper wire or wire hooks.
- **Power supply**: adjustable DC power supply.

Additional

- **Sinks**: tank or container with demi/di water for rinsing between steps. (not supplied in the kit)
- **Workpiece wire**: unpainted copper wire for hanging small parts.
- Anode connection cable
- **Filter Media**:
    - Liquid filters.
    - PP filter media (5–10 µm). (not supplied in the kit).
- **Personal protection**: chemical resistant (nitrile, pvc or neoprene).
- **Heating (optional):** immersion or aquarium heater to bring the electrolyte to the ideal process temperature; use chemically resistant version (PP/PTFE/titanium) with thermostat, never run dry. (not supplied in the kit)

Bronze Rinse Aid System

The bronze electrolyte does not use a glazing agent.

Temperature of the electrolyte

The electrolyte works at room temperature.

- Working temperature from 21 °c.
- Ideal temperature is 27 °c.

Heating the electrolyte

- **Immersion heater**: for PP/PE plastic baths, a glass or titanium immersion heater with thermostat is suitable. Preferably choose a titanium immersion heater and place it in a place with current.
- **Water jacket**: put the pp/pe process tank in a larger container with warm water and regulate it with an immersion heater.
- **Increase room temperature**: a warm workspace reduces the cooling of small baths.

Preparation

Metal cleaning, degreasing & etching

Use an alkaline degreaser. It removes oil, grease, coolants and tensiles, polishing paste and similar contamination. This type of cleaner is recommended as a standard step before metal surface treatments.

- Examples (practically available): st. Marc, blue wonder, dasty
- Professional: kärcher rm 31, zep industrial purple degreaser

Apply generously, leave on briefly and then rinse thoroughly with clean water.

Perform a **waterbreak test** : a clean surface allows water to flow evenly. In the event of grease or other contamination, the water will break up.

Rust removal

Make sure that the object to be treated is completely free of rust, dirt and grease. This is very important to get a good result. Parts that are rusty can be derusted with:

- Mechanical processing
- Galvanizing shop metal activator (flash rust)

Etching services, metal

Remove oxide and get an active, clean metal surface.

Zinc

- Sulfuric acid 5–10% at room temperature, 3–8 seconds; then rinse.
- Citric acid 5–10% at 40–60 °C, 20–40 seconds; then rinse.
- Galvanizing shop metal activator 30–120 g/l, 20–40 seconds; then rinse.

White metal (pewter/tin alloy)

- No sulfuric acid.
- Citric acid 5–10% at 40–60 °C, 20–40 seconds; then rinse.
- Galvanizing shop metal activator 30–120 g/l, 20–40 seconds; then rinse.

Nickel

- Sulfuric acid 10–20% for 10–30 seconds; then rinse.
- Citric acid 5–10% at 40–60 °C, 30–60 seconds; then rinse.
- Electrolytically activate in 10% sulfuric acid at 2–5 a/dm², 10–30 seconds; then rinse.

Copper

- Sulfuric acid 10–20% at room temperature, 5–20 seconds; then rinse.
- Citric acid 5–10% at 40–60 °C, 30–60 seconds; then rinse.
- Galvanizing shop metal activator 30–120 g/l, 30–60 seconds; then rinse.

Steel / iron

- Sulfuric acid 10–20% at room temperature, 10–60 seconds; then rinse.
- Citric acid 5–10% at 40–60 °C, 30–60 seconds; then rinse.
- Electrolytically activate in 10% sulfuric acid at 2–5 a/dm², 10–30 seconds; then rinse.

Tin

- Citric acid 5–10% at 40–60 °C, 20–40 seconds; then rinse.
- Galvanizing shop metal activator 30–120 g/l, 20–40 seconds; then rinse.

Lead

- Citric acid 5–10% at 40–60 °C, 20–40 seconds; then rinse.
- Galvanizing shop metal activator 30–120 g/l, 20–40 seconds; then rinse.

Stainless steel

- Mechanical pre-treatment: sanding/blasting to break through passive layer.
- Citric acid 5–10% at 40–60 °C, 60–120 seconds; then rinse.
- Electrolytic activation in 10% sulfuric acid at 2–5 a/dm², 20–60 seconds; then rinse.
- For best adhesion, a nickel interlayer is recommended.

Aluminium treated with zincate

- Do not etch in acid.
- Apply Zincate treatment according to label (30–60 seconds); rinse.

Do not use hydrochloric acid in this step; often too aggressive.

Do not let dry between steps; directly through to the bath to prevent oxidation.

Acid neutralization

Residual acid from the etching agent can cause oxidation if it is not properly rinsed and neutralized.

If you are going to electroplate immediately after an acidic pre-treatment, do not neutralize but rinse thoroughly and go straight to the bath.

- Dissolve 1–2 tablespoons of baking soda in 2 litres of water.
- Briefly immerse the object in the solution a few times and leave it in the solution for 10-30 seconds.
- Then rinse it thoroughly with clean water.

Do not allow to dry between steps.

Preparing the bronze bath

- Prepare the box provided.
    - Make sure it is dust-free and clean.
- Attach the separate circulation pump to the bottom or side of the bucket or place it in loosely.
    - The loose parts in the box of the pump do not need to be used.
- Carefully pour the electrolyte into the bath. (watch out for splashes)
    - Mark the waterline with a marker.
    - The water from the electrolyte can evaporate by heat - when you have finished the electroplating process, fill the bath with distilled or demi water up to the marked line.
- Wrap the anode filters around the anodes and attach them with an elastic band.
    - This prevents contamination of the bath.
- Hang the anodes, opposite each other, in the bath so that they hang in the electrolyte.
    - By bending the anode and hanging it in the bucket by the edge.
    - A hole has been drilled through the anode, with which the anode can be hung in the electrolyte with the included thick wire. Try to prevent the wire from hanging in the electrolyte as well.
- Connect the anodes with the included connection cable.
- Make sure the power supply is off and connect the red positive wire of the power supply to the anodes.
- Attach the nylon staff to the bucket. The objects are hung on this.
    - Cut 2 v-shaped notches in the rim of the bucket with a pair of wire cutters where you can put the nylon rod.
    - Use tape to attach the ends of the wand to the bucket.
    - Drill 2 holes at the top of the bucket and put the staff through them.

Tip. Provide an extra drip tray under the electroplating tank, or put the tank in a larger tank. If it ever leaks, the electrolyte will leak into the collection tank and not over the workplace or floor.

Calculating area and setting current

The bronze electrolyte operates at ± 0.15 amps per 10 cm².

Calculating surface examples

- Slab (both sides): 2 × length × width (cm²)
- Cube (all sides): 6 × side × side (cm²)
- Cylinder (side only): 3.14 × diameter × length (cm²)
- Cylinder (total, with both ends): 3.14 × diameter × length + 2 × 3.14 × (diameter/2) × (diameter/2) (cm²)
- Disc (two faces): 2 × 3.14 × (diameter/2) × (diameter/2) (cm²)
- Disc edge: 3.14 × diameter × thickness (cm²)

Breaking down complex shapes

There is no need to calculate the exact surface; An estimate is sufficient.

- If the power supply is much too low, you will get a dull, salmon-colored finish.
- If the food is much too high, dark burn marks will appear on corners of the object.

Divide the part into simple pieces (plates, cylinders, discs), calculate each piece separately and add up the results.

Example of splitting:

- One dumbbell = two discs + one cylinder
- One bolt = shaft (cylinder) + head (disc + edge)

Anode & cathode ratio

The ideal ratio between the surface of the anode and the object is 2:1. The anode surface is therefore twice as large as the workpiece.

Only include the **anode surface facing the workpiece** (the back contributes little in small arrangements).

Example: For a workpiece of 250 cm², you need an anode area of about 500 cm² .

If there is too little anode surface, the anode current density increases, causing the cell voltage to rise and more oxygen gas to be produced. This can lead to local pH shift at the anode, faster aging/oxidation of organic additives, and process issues such as haze/shrouding, streaking/banding, roughness, and edge burn due to unfavorable power distribution.

Set up flow

Calculate the total area of the object in cm².

The sum is: (area in cm² ÷ 10) × 0.15 ampere

Example with an object of 280 cm²:

- 280 cm² ÷ 10 = 28
- 28 × 0.15 amps = 4.2 amps on the power supply.

This is a starting value that often works well. Is the object not shiny everywhere, or do you have dark corners that seem burnt? Due to circumstances such as working temperature, conductivity of the object and the electrolyte, distance of object to anode and the condition of the electrolyte, the ideal value may deviate from this. Go up or down in small increments (e.g. 0.05 amps per 10 cm²) and assess the result after 15–30 minutes to determine the best value for your bath.

Testing with a calibration plate

With a new bath, you can first use a dummy plate as a calibration plate. Take one or more copper plates with a fixed value, for example 20 cm².

- Starting value: 0.15 a per 10 cm² → for 20 cm² = 0.30 a total.
- Electroplated for 15–30 min, assessing gloss/opacity, and watching for burning.
- Adjust the current in increments of 0.05 A down or up; After each step, test again for 15–30 minutes.
- Choose the best adjustment and convert it to a guideline in a per 10 cm².
- Example: best = 0.34 a per 20 cm² → 0.17 a per 10 cm².
- Apply to part of 280 cm²:
    - 280/10 = 28
    - 28 × 0.17 A = 4.76 A (rounding is allowed).

THE ELECTROPLATING PROCESS

Before you start the process, you first set the power supply. Make sure the red positive wire is disconnected.

- Turn on the power supply and turn the ampere knob all the way to the lowest setting.
- Turn the voltage knob (volts) all the way up to the highest position.
- Turn off the power supply again.

As a result, the power supply will automatically supply the necessary voltage required by setting the calculated ampere for the surface of the object.

By adjusting the power supply to 0 amps, you cannot accidentally turn on the power supply with a setting that is too high, which can cause the workpiece to burn.

Step-by-step plan for bronze plating

1 - Hang the object and connect the power supply

- Turn on the circulation pump.
- Attach copper wire to the workpiece (long enough to hang from and fully submerge).
- Hang the workpiece on the nylon rod in the electrolyte. Attach the copper wire to the wand with the clips provided.
- Attach the black wire (min) from the power supply to the copper wire of the workpiece.
- Attach the red wire (plus) of the power supply to the stainless steel anodes.

2 – Set up flow and start the process

- Calculate the surface of the object in cm².
    - Use 0.15 amps per 10 cm² as the starting value.
    - Example: 250 cm² object
        - 250 ÷ 10 = 25
        - 25 × 0.15 A = 3.75 A
- Turn on the power supply and set to the calculated current. The process starts now.

3 - Time and thickness

- 2-3 minutes: decorative layer of bronze with clear coat or a sealer over it.
- 30-40 minutes: decorative layer that will be polished.

4 - Removing and rinsing

- Remove the workpiece from the bath.
- Spray it well with a water spray with demi/di water over the bath. This will cause most of the electrolyte to run back into the bath.

5 - Drying

- Let the object dry or use a heat gun/hair dryer on low setting.
- Do not use compressed air from a compressor (risk of oil/water impact and rings).

The object is now ready and can be treated with a patina, another metal or a coating, lacquer or other sealer of your choice.

Dummy plating

The first few times you use the bath, contamination may come from the electrolyte or anode. This can be visible on the result.

To remove any contamination from the bath or anodes, it is recommended to bronze a piece of dummy metal before starting your own project. For example, hang a 25 cm² piece of copper in the bath and let it electroplated for 30 to 60 minutes at 0.5 amps. This will remove any contamination.

Protecting the bronze

After the process, protect the finish with a sealer for extra protection of the bronze.

Sealers

- **Galvanizing shop deep seal**: maintainable transparent, water-repellent and rust-resistant oil-based sealer for bronze and other metals; protects and deepens the color.
- **Galvanizing acrylic sealer**: clear lacquer layer for hard, glossy protection.

Lacquer

- **Clear coat**: (1k or 2k) provides a hard, durable protective layer.

Wax or oil

- **Wax** provides a thin, maintainable protective layer with a natural look.
- **Light oil** or a product such as **wd-40** provides temporary protection.

Application

- Clean and degrease the workpiece.
- Apply thin layers; Allow each layer to dry according to the product label.
- For outdoor or high loads: choose a sealer or 2k clear coat instead of just wax or oil.

Maintenance, contamination & filtering

Dirt in the bath is usually caused by dust, metal particles, loosened oxides or organic contamination from degreasers or the poor preparation of objects.

Most solid contamination sinks to the bottom and has little influence on the electrolyte.

Refilling evaporated water

After use, heating can cause the distilled water to evaporate. Top this up with distilled or demi water up to the marking line that you placed when filling the bath.

Filtering (solid particles)

Pour the electrolyte into:

- Included filters
- 5 or 10 µm polypropylene fine filter

Activated carbon (organic pollution)

Due to the organic ingredients, this electrolyte cannot be filtered with activated carbon.

Dissolved metal ions

Mechanical filtering does not remove dissolved metal concentrations. If the bath is contaminated with another metal, remove it with a dummy: hang a piece of metal, for example a 20 cm² copper plate, in the electrolyte and let it galvanize at 0.3 ampere for a few hours.

Replace

Electrolytes with a lot of organic contamination or dissolved metal ions are not always easy to repair. Replacing is then the best choice.

Storage

The bronze electrolyte is slightly alkaline – pH value 7.6.

Store the electrolyte in the electroplating bath sealed with a lid or in sealable, chemically resistant bottles. Label content and date.

Will the bath not be used for more than a day? Remove the anodes and pump from the bath and rinse them in a container of clean water.

Save pump

Rinse the pump well with clean water before storing it.

You can put the pump away in a bowl of clean water.

Storing anodes

Rinse anodes with clean water and dry, or put away wet in clean (di) water to limit deposits.

Do not leave in the bath when stationary for a long time.

If the anodes are visibly oxidized/dirty, clean lightly mechanically (e.g. Scotch-brite) and rinse thoroughly.

Only put them back after rinsing well.

Waste & disposal

Never pour anything down the sink. Collect all process fluids and rinse water as chemical waste.

Save

- Use closed HDPE canisters or screw-top bottles (chemical resistant), preferably un-approved.
- Always label: content, date, contact.
- Place bottles or jerry cans in a drip tray/tub.
- Cool, dry, out of sunlight; out of reach of children/pets.

Don't save

- No beverage bottles, glass jars without protection, open buckets or metal cans.
- No fragile PET/PP bottles of consumer products.

Solid residues

Drain used filters, anode sludge, cloths and gloves, then collect separately in a sturdy, sealable bag/bucket and dispose of as chemical waste.

Drain

- Take everything to the municipal RCA collection or an approved processor. Do not mix waste streams to "dilute".
- Electro-winning: bronze can be plated with iron/steel (e.g. nails) to very low residual concentrations.
- Precipitation: Bronze metals (cu, sn) can be precipitated by raising the pH to 10–11 with sodium hydroxide or decreasing it to 3–4 with hydrogen sulfite, after which sludge can be separated.

What to avoid at all costs

- Do not mix with bleach or ammonia (dangerous reactions).

Technical characteristics

Electrolyte	Bronze electrolyte
Metal	Bronze
Works on	Zinc, white metal, tin, nickel, copper, steel, lead, stainless steel, aluminum treated with zincate
Tanks/baths	• Acid-resistant PVC, PE or PP. • Steel tanks with rubber or plastic (pp/pvc) inner lining. • Large tanks must be reinforced to prevent bulging.
Anode	• Stainless steel 316 • Optimal ratio: 2:1 anode:object
Anode filter	5-10 µm polypropylene filter (bags)
Anode hook	• Titanium pendant/basket. • Do not use as a hook: steel/stainless steel.
Recommended Flow Density	0.15 amps per 10 cm² - (1.5 a/dm²)
PH value	7,6
Rinse aid	Does not use rinse aid
Time	2+ minutes
Agitation	Pump or air (no unfiltered compressor air due to oil/water)
Operating Range Temperature	+21 degrees °C
Optimal temperature	± 27 degrees °C
Shelf life	Long shelf life with proper maintenance
Metal issued by	Electrolyte
Filter media	• 5-10 µm polypropylene filter • 5-10µm PP Filter Cartridge • Diatomaceous earth (only for an external filter installation)

Problems and solutions

Problem	Cause	Solution
Start/electric		
No deposit	No power / poor contact	Checking electrical connections and power supply; hanging wire/contact cleaning.
Poor adhesion / blisters	Insufficient cleaning/activation	Waterbreak test; degreasing again and activating short acid; then immediately bronze.
Current/distance/agitation		
Dark/white borders (HCD)	Current too high	Reduce current or build it up in steps.
Red layer in depths (LCD)	Current too low	Increase current within working range.
Uneven deposit/shading	Awkward anode/cathode geometry or spacing	Repositioning anodes; auxiliary anodes/screens; make distance uniform.
Stripes / banding	Insufficient or irregular agitation	Increase agitation/circulation; move the workpiece slowly.
Finish/appearance		
General dullness	Too low temperature or insufficient agitation	Heat to ±27 °C; improve agitation.
Milky after varnishing	Place time too long	Shorten the place time (decorative ±2–3 min; thicker 30–40 min).
Roughness / particle inclusions	Particles/sludge in the bath	Continuous filtering (5–10 µm) to clear.
Suckers / "tree formation"	Too high local current density	Reduce current; anodes further away or screens; improve agitation.
Chemistry/bath condition		
Color or speed change	Bronze content too low	Draining the bath and creating a new one.

Problem	Cause	Solution
Waterline dropped → concentrations increased	Evaporation/level loss	Top up with demi/di-water until marking; Checking parameters again.
Rinse/Dry		
Stains after electroplating/rinsing	Insufficient flush / long transfer time	Increase flush/flow; Spray directly over the bath and work quickly.
Other electrical		
Unstable outlet / alternating current	Unstable power supply / thin hanging wire	Set power supply stable; suitable hanging wire; check cables/clamping.

Warning!

The electrolyte is slightly alkaline – pH value 7.6. Avoid contact with eyes, skin and clothing. Wear eye protection (goggles, goggles, or face shield), protective rubber gloves, and aprons when preparing solutions and while working with the solutions. Do not mix the electrolyte with cyanide or alkaline materials, or other chemical substances. The electrolyte is toxic when used internally.

- Do not work with the electrolyte or other products without first reading and understanding the safety information.
- The safety data sheet can be found on the product page or can be requested from verzinkshop.nl by e-mail: info@verzinkshop.nl
- Do you have any questions? Contact us via:
  - Mail: info@verzinkshop.nl
  - Whatsapp or call: +31 6 28090022
  - Www.verzinkshop.nl

Safety

- Always wear a dust mask, respirator, gloves, and apron when necessary.
- Always treat any chemical as if it could kill you.
- Always label buckets and storage containers with a permanent marker so that you and others know what's inside.
- Never pour water into acid; it can heat up and explode. Always pour acid into water.
- Never leave electroplating baths or other systems that use power unattended. These products may cause a short circuit and cause a fire.
- Never come into direct contact with chemicals. They can cause serious burns or other damage and are very dangerous substances if not treated with respect.
- Never think you can get away without taking safety precautions! That is not possible!
- Never leave the lids off the tanks when not in use.
- Always work safely and ensure good protection and ventilation.
- The safety data sheet can be found on the product page or can be requested from verzinkshop.nl by e-mail: info@verzinkshop.nl

Disclaimer

Did you find an error or something unclear in the manual? Please let us know via info@verzinkshop.nl

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