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TECHNICAL DATA

E-Brite™ Ultra Cu

Non-Cyanide, Non-Pyrophosphate Alkaline Copper Plating

E-Brite Ultra Cu plates directly on steel, copper, brass, stainless steel, zincated aluminum, electroless nickel and most new high quality properly prepared zinc diecastings in both rack and barrel installations. Leaded alloys can be plated in rack lines. **E-Brite Ultra Cu** is free of chelating agents.

It eliminates necessity of striking in cyanide copper. One bath serves as both strike and plate bath.

It the meets requirements of **MIL-C-14550 B** and **AMS 2418J**.

E-Brite Ultra Cu eliminates potential health and environmental liability and the high cost of waste treating the cyanide.

Accidental drag-in of **E-Brite Ultra Cu** into an acid copper solution poses no health hazards due to evolution of poisonous cyanide gas as with cyanide copper.

The solution does not have to be treated for carbonates as with cyanide solutions.

E-Brite Ultra Cu produces a fine grained, smooth, dense and ductile copper deposit which is non-porous with excellent bonding properties. The plate may be buffed easily for a high luster.

It has excellent throwing and covering power, especially in low current areas and is superior to cyanide copper in these properties.

It is used as a preplate strike for nickel, acid copper, tin, solder and silver plate.

The **E-Brite Ultra Cu** plate is an excellent heat treat stop-off and EMI shield.

It is also an excellent decorative finish for buttons, rivets, etc. The copper plate can be readily blackened or oxidized for a variety of attractive antiqued finishes such as those found on wall plates, lighting fixtures and builder's hardware.

It does not contain strong chelators. It does not have a negative effect on typical waste treatment systems. **E-Brite Ultra Cu** plates while dissolving the copper anodes rather than plating out of the solution as is the case with other processes. Therefore, it offers lower operating costs.

The **E-Brite Ultra Cu** bath is stable and does not have to be periodically dumped and recharged as with other non-cyanide alkaline copper processes which are based on pyrophosphate.

E-Brite Ultra Cu is supplied as a liquid concentrate. Tap water can be used to make up the bath, however, deionized or soft water is preferred.

It is extremely easy to control with only one (1) liquid maintenance addition agent, **E-Brite Ultra Cu "E",** versus as many as five (5) agents with other processes.

Zinc diecast surfaces must be properly cleaned with **EPI's E-Kleen 163** soak cleaner and **E-Kleen 122/173** electrocleaner followed by activation with **E-Pik 211** acid salt formulation or **E-Pik 216** acid activator. Other cleaners and acid salts cannot be used on zinc diecast surfaces. **E-Prep 280 NCZ** zincate is the only recommended zincate for aluminum surfaces.

PLATING SPECIFICATIONS

	RACK PLATING		BARREL PLATING	
	Optimum	Range	Optimum	Range
Concentration				
E-Brite Ultra Cu	New Bath Make-up 40% by volume (30% by volume zinc die-cast)	30-50% by volume (25to 40% by volume zinc die-cast)	40% by volume (30% by volume zinc die-cast)	30-50% by volume (25to 40% by volume zinc die-cast)
E-Brite Ultra Cu "E"	10% by volume	Thereafter maintained at 40 times copper concentration in oz/gal.	10% by volume	Thereafter maintained at 40 times copper concentration in oz/gal.
E-Brite Ultra Cu "pHA"	8% by volume	5 to10% by volume	8% by volume	5 to 10% by volume
Copper Metal	1 oz/gal (0.72 oz/gal for zinc die-cast)	0.8-1.2 oz/gal (0.6 to 0.9 oz/gal for zinc die-cast)	1 oz/gal (0.72 oz/gal for zinc die-cast)	0.8-1.2 oz/gal (0.6 to 1.2 oz/gal for zinc die-cast)
pH	9.6	9.2 to 10.0	9.8	9.5 to 10
Temperature	120°F	100 to 140ºF	120ºF	100 to 140ºF
Cathode-Current Density	10 ASF	5 to 25 ASF	4 ASF	2 to 8 ASF
Voltage		1 – 6 Volts		15 to 18 Volts

Anode-Current Density Minimum of 10 ASF in order to corrode the anodes and maintain the copper concentration in the bath.

Agitation Vigorous air mandatory for rack lines and also helpful in barrel lines. Use low pressure, large volume blowers only – not compressed air. In-tank filter systems do not produce sufficient solution agitation to be used with **E-Brite Ultra Cu** and must not be used for agitation or filtration. Air agitation aids in producing a brighter finish while helping to avoid burning in the high current density areas.

Plate Thickness Minimum of 0.0002 inches for strike

Rectification: Rack: 9 volts, Barrel: minimum of 15 volts
It is recommended that the parts go into the solution "live".

EQUIPMENT AND OPERATION

Copper Anodes: Oxygen free, CDA 101 or 102 only. Use bar or balls. Do not use phosphorous containing anodes. Oxygen free, CDA 101 or 102 Anodes from Univertical and Outokumpu are acceptable.

Insoluble Anodes: With some installations it may prove to be helpful to use a mix of copper and graphite or stainless steel (304 or 316) anodes in order to plate down too high of a copper concentration or to maintain 10 ASF on the copper anodes in order to

dissolve the copper into the solution. In most rack installations a mixture of graphite or stainless steel and copper anodes is advantageous. Use only high density, pure graphite extruded or molded anodes – grade JC-1.

Anode Baskets: Titanium only.

Anode/Cathode Ratio: 1.5:1 **Note:** In barrel plating it is important to have the proper ratio. Calculate the maximum cathode area before setting up the process and ensure that the anode area equals the maximum cathode area. Also it is required that the anode area be such that the anode current density is sufficient to corrode the anodes.

Anode Bags: Normally not required except for heat treat stop off plating or other high build applications. Bags must be thoroughly leached in hot water prior to use to avoid contaminating the bath with sizing compounds. Cotton, Dynel, or polypropylene bags may be used.

Carbon: **EPi**'s **E-Carb Powder** and **E-Carb Granular** have been tested to be compatible with **E-Brite Ultra Cu** process. Please note that you may have to use up to 10 times more of granular carbon vs powder carbon to achieve the same results, therefore powder is recommended.

Filtration: Continuous 5 micron, 2-3 turns per hour. New filter cartridges must be soaked in hot water then flushed with hot water prior to use. An **E-Carb** activated powder carbon pack must be maintained on the bath – one pound per 100 gallons – change weekly. When plating heavy copper (one (1) mil or more) a 1 micron filter is recommended. When used for heat treat stop off plating, a 1 micron filter must be used. In tank filter systems must not be used.

Racking: Positive, firm racking with good contact is recommended. Wiring parts can lead to difficulties as can hanging parts on hooks. This is especially true for plating zinc diecastings.

Heating: Teflon coated electric heaters are recommended. Scorching the solution must be avoided. D rated heaters should be used. Stainless steel or titanium heaters may be used. Also 316 stainless steel, titanium or Teflon steam coils.

Tanks: Mild steel lined with rubber, koroseal or polypropylene or a drop in plastic liner. All plastic tanks may be used. Large polypropylene tanks must be reinforced. New plastic tanks and liners must be leached with a 2% Potassium or Sodium Hydroxide solution for 2 days followed by cold water rinsing.

Ventilation: Not required, but it is a good practice as with all heated plating solutions.

PH Control: An electronic pH meter must be used. If pH falls, add **E-Brite Ultra Cu "pHA"**. If pH goes over 10.0 or above a recommended level, add dilute (10%) sulfuric acid.

Rinsing: Whenever possible, 2 or 3 stage counter current flow rinses are recommended immediately prior to the **E-Brite Ultra Cu** bath. It is especially helpful following acid dips to reduce the amount of dissolved metals being dragged into the **E-Brite Ultra Cu** bath which can produce poor plating results. A soft water rinse prior to the bath will improve performance.

NOTE: When **E-Brite Ultra Cu** is used to replace cyanide copper in a plating line, it has been found that is very difficult to completely destroy residual cyanide. That is why a new drop-in plastic tank liner is recommended or a new tank be used. Anodes previously used with cyanide must be replaced. Anode bars, anode baskets, bus bars, racks and barrels must be free of residual cyanide. The equipment must be washed with 5% sodium hypochlorite or 3% hydrogen peroxide solutions. Do not neglect heating and filtration equipment. Rinse thoroughly with cold water and then rinse with dilute 1 to 2% sulfuric acid solutions**. When destroying cyanide, forced ventilation must be used at all times to prevent toxic cyanide fumes from accumulating. Personnel should be equipped with self contained breathing apparatus.**

New racks and barrels are recommended.

PLATING ADDITIVES

E-Brite Ultra Cu: Liquid concentrate used in make-up of new baths and replenishment. Contains the copper metal and the other balanced components of the bath.

E-Brite Ultra Cu "E" : Liquid electrolyte replenisher. Periodic adds over time to complex copper dissolved from anodes. Adds determined by Hull Cell tests or by **EPI**.

E-Brite Ultra Cu "pHA": Liquid pH adjuster and buffer to control pH. Additions determined by pH measurement with an electronic pH Meter. It is added to raise the pH upon bath make-up and when the pH decreases from acid drag in. If necessary, the pH may be lowered by adding dilute (10%) Sulfuric Acid. But this must not be done on a continuous basis. It is required that the source of the alkaline contamination be eliminated.

REPLENISHMENT OF PLATING SOLUTION

E-Brite Ultra Cu concentrate has a copper concentration of 2.4 oz/gallon. If the copper concentration in the bath decreases, additions of **Ultra Cu** concentrate are required to replenish the copper and the other balanced components in the working solution. The strength of the working solution is monitored by determining the copper concentration. If additions are required frequently, the anode area must be adjusted to dissolve the copper anodes. A mixture of copper and stainless steel or graphite anodes may be required. When a new solution is prepared and plated the copper concentration should be determined every day and if it continually decreases or increases the anode area must be adjusted with copper and inert anodes to dissolve the copper.

E-Brite Ultra Cu "E" electrolyte is added initially at 10% by volume and on a regular basis (daily) to complex the copper dissolved from the anodes and to replace drag-out. Its consumption will depend upon drag-out, copper metal content and metallic contamination in the bath. The proper concentration of **Ultra Cu "E"** must be maintained for maximum adhesion to the base metal. Periodic adds are required over time based on ampere hours, Hull Cell test or **EPI**'s lab recommendations. A metering pump controlled by amp-hours is recommended for adding **Ultra Cu "E"**. If the copper metal concentration of the bath increases, 4% by volume **Ultra Cu "E"** must be added to the bath for each 0.1 oz/gallon increase in copper concentration. A loss of adhesion will occur if sufficient **Ultra Cu "E"** is not maintained.

E-Brite Ultra Cu "HCD" is an infrequently used high current density booster used most often in rack installations. It must be used at 4% by volume in rack baths when plating copper as a mask for heat treat stop off. It is added to the bath based on Hull Cell tests or as determined by **EPI**'s lab. It will slow down the plating rate and therefore is not used as a general rule in rack plating, but the grain size will be greatly reduced as will the burn in the HCD. **Ultra Cu "HCD" (must not be used when plating zinc diecastings).**

E-Brite Ultra CU "PHA" is a pH adjuster and buffer used when charging a new bath to adjust the pH to the range of 9.2-10.0. Additions are determined by pH measurement with a pH meter. It is normally used at 5 to 10% when charging a new bath, depending upon how much **Ultra Cu** and **Ultra Cu "E"** were used in making up the bath. A new bath will have a pH of 8.2 upon make up before adding the **Ultra Cu "pHA"**. It is also added to a bath to maintain the pH if acid is dragged into the bath.

Note: In most strike installations, an **E-Brite Ultra Cu** bath is maintained with the single maintenance additive **E-Brite Ultra Cu "E"**.

METAL SURFACE PREPARATION

Unlike cyanide baths, the **E-Brite Ultra Cu** solution does not offer any cleaning. Therefore it is extremely important to do a thorough cleaning with an **EPI** compatible cleaner.

1. Steel, copper, and brass surfaces should be thoroughly cleaned with a hot **E-Kleen 102**, **163**, or **196** hot alkaline soak cleaning solution followed by a water rinse and then electrocleaned in **E-Kleen 120, 127** or **129** solution for steel, **E-Kleen 173** for copper and brass, followed by a water rinse and then activation in either a dilute hydrochloric/muriatic or sulfuric acid solution. If adhesion problems arise with difficult-to-plate steel surfaces, a warm, 100 to 120°F solution of **E-Pik 211** or a 140°F, 25% sulfuric acid activation solution is required.
2. Stainless steel surfaces require activation after cleaning with cathodic (direct) d.c. current in either a 25% sulfuric acid solution or an **E-Pik 211** or **E-Pik 215** acid salt solution.
3. Freshly plated electroless nickel and sulfamate nickel surfaces require a dip in a sulfuric acid solution at a pH of 3.0. Do not allow surfaces to age prior to plating with **E-Brite Ultra Cu.**
4. Zinc diecast surfaces must be properly soak cleaned with **EPI's E-Kleen 163** and then anodically (reverse) cleaned in an **E-Kleen 122/173** solution. The **E-Kleen 163** is used at a 10% by volume concentration as a soak cleaner and the **173** at 6 oz/gal as an Electrocleaner or **122** at 10% by volume. Immersion times in the soak and electrocleaning solutions should be as short as possible, so as not to open up pores in the diecast surface - - 1 to 2 minutes for soak and 30 seconds for electrocleaning. Temperature: 120 - 130°F.

Following cleaning, surfaces must be rinsed and then activated in a dilute (1 to 2 oz/gal) solution of **EPI's E-Pik 211** acid salts or a 2% by volume solution of **EPI's E-Pik 216** Zinc Diecast Deoxidizer and Surface Conditioner. Here again, immersion times should be kept short (30 seconds) to avoid the development of a black smut which will cause blistering. Overactivation should be avoided to eliminate opening up the pores of the diecast surfaces.

5. Aluminum surfaces are cleaned with **E-Kleen 163** soak cleaner. **E-Pik 232** is used for a heavy etch. Aluminum surfaces must be properly zincated with **EPI's E-Prep 280 NCZ**, non-cyanide zincate. **E-Prep 280 NCZ** was specifically formulated to be compatible with **E-Brite Ultra Cu** and is the only zincate to be used prior to **E-Brite Ultra Cu. E-Pik 210** is used to deoxidize the aluminum surface after cleaning and etching.

ADHESION EVALUATION

Check adhesion by running a Hull Cell panel at 1 amp for 5 minutes for rack and 1/2 amp for 5 minutes for barrel. Apply masking tape lengthwise, along the middle of the panel, and bend the panel back on itself through the middle of the masking tape. Then, bend back to flatten the panel. The tape is snapped off the LCD end. There should not be any loss of adhesion -- not even in the low current density area. If there is a loss of adhesion, add **E-Brite Ultra Cu "E"** to the Hull Cell in one (1) percent increments until loss of adhesion is eliminated. Then, add the same percentage to the bath. Or, plate a 1 amp, 5 minute Hull Cell panel, rinse with water and plate bright nickel over it at 2 amps for 10 minutes. Then bend the panel at the bottom corner of the LCD area. There should be no loss of adhesion in the LCD--first 1" of the panel. The same can be done with tin plating. If there is a loss of adhesion, add **E-Brite Ultra Cu "E"** in 1% increments as above. It may require as much as 5% **E-Brite Ultra Cu "E"**. Loss of adhesion will develop on a Hull Cell panel prior to occurring in a production bath enabling the Hull Cell panel test to predict loss of adhesion. Zinc galvanized steel Hull Cell panels should be used to evaluate the adhesion to zinc diecast surfaces.

Adhesion of the copper plate and also nickel or tin plates over the copper on zinc diecastings can be checked by heating the part to 300°F for 1/2 hour and then quenching in room temperature water. There should be no loss of adhesion or blistering.

Contamination: Lead (<50 ppm), cyanide (<50 ppm), dissolved iron, zinc, silver and organics are contaminants. The bath will plate with a black smut in the MCD and HCD areas with lead contamination, and with a red brick color with cyanide contamination. A smutty brick red plate will occur in HCD with high dissolved iron contamination (3-4,000 ppm).

Cyanide contamination is removed by treating with hydrogen peroxide (1 pint 35% peroxide per 100 gallons of bath). Dilute the peroxide with 50% water before adding to the bath with strong air agitation. This should not be done on a regular basis, the source of cyanide contamination must be found and eliminated.

Silver (30 ppm) and zinc (400+ ppm) contamination will cause a loss of adhesion when plating on die-cast zinc surfaces.

Silver contamination comes from using poor quality copper anodes containing in excess of 0.0025% silver. Silver is removed with dummy plating.

Zinc contamination comes from poor rinsing before the **Ultra Cu** tank when plating zinc die-cast surfaces. Zinc contamination in baths used to plate diecast zinc can be removed with low current density dummy plating.

Initial contamination of a solution with zinc can be overcome by adding **E-Brite Ultra Cu "E"** to the bath. Three (3) to 6% by volume of **Ultra Cu "E"** per 400 to 1000 ppm contamination will take care of

the problem. Contamination as high as 2000 ppm of zinc can also be taken care of with an **Ultra Cu "E"** addition but preferably it should be dummy plated out at low current density.

Lead contamination comes from being dragged into the **Ultra Cu** solution due to poor rinsing of dissolved lead from acid dipped leaded steels and leaded brass and from parts dropped into the solution.

Iron contamination comes from dissolved iron from an acid dip being dragged into the **Ultra Cu** solution due to poor rinsing and from parts dropped into the solution.

Lead and iron contamination may be removed by high current density dummy plating onto corrugated steel plates covered with leached anode bags. As the metal contamination plates onto the cathode it will be sloughed off from the steel and be collected in the bags. The sloughed off material must be removed from the bags every hour or so to avoid re-dissolving the lead or iron. Rinse the powdered material off the cathodes and out of the bags to keep it out of the tank. The initial effect of iron contamination can be overcome by adding **E-Brite Ultra Cu "E"**. Iron is usually plated out continuously in the HCD area. But when excessive iron contamination causes a loss of adhesion - it must be dummy plated out.

Organic contamination from drag-in of wetting agents causes a discolored, dull, chalky, and brick red deposit which is removed by peroxide and batch carbon treatment. Do not use an organically inhibited acid prior to an **E-Brite Ultra Cu** bath. The inhibitor will be carried into the bath causing a loss of adhesion in the LCD area.

METALLIC COPPER ANALYSIS

1. Pipette a 5 ml sample of the plating solution into a 250 ml Erlenmeyer flask. Add 25 ml distilled or deionized water.
2. Add 2 to 3 grams Ammonium Persulfate – let stand for 10 to 15 minutes. (Swirl a few times while waiting.)
3. Add approximately 5 ml of concentrated Ammonium Hydroxide. Solution will be a clear, deep blue.
4. Add 50 ml distilled or deionized water.
5. Add 4-6 drops 0.1% Pan Indicator. (Do not add more than 6 drops, as it can affect the end point.)
6. Solution should be purple or pale red in color.
   Titrate with 0.1M EDTA solution to a yellow-green end point.

   Calculation: **oz/gal of copper =** (ml of EDTA) x 0.170

WASTE TREATMENT

Copper from **E-Brite Ultra Cu** rinse water by itself or mixed with other metallic rinse waters is precipitated by conventional Sodium Hydroxide treatment with **EPI Coagulants** and **EPI Polymers.** A spill of **E-Brite Ultra Cu** requires treatment with lime. Sometimes, using a small addition of lime to the hydroxide treatment will increase the effectiveness of the precipitation.

Trouble Shooting

PROBLEMS	POSSIBLE CAUSES	REMEDIES
Discolored plating, chalky, brick red to black and sometimes peels off.	Organic contamination dragged in from cleaners or due to poor cleaning and rinsing.	Change carbon filters or peroxide/carbon batch treatment. Improve cleaning and rinsing.
	Cyanide contamination - from previous copper cyanide process or from a cyanide zincate or plating processes in the vicinity.	Temporary treatment with peroxide. HCD dummying. Trace and eliminate the sources of cyanide - such as cracked racks.

Non-adherent plating, particularly in LCD areas or upon bending.	Low **E-Brite Ultra Cu "E"**	Add **E-Brite Ultra CU "E",** 1 to 2% by volume at a time - check Hull Cell plating results, then add to bath.
	Poor cleaning and surface preparation.	Ensure proper soak, electroclean and acid or acid salt along with good, counter-flow rinsing.
Copper plating adhesion okay but copper and nickel plated parts, upon bend testing fail - problems more particular to barrel plating	Low **E-Brite Ultra Cu "E"**	Add **E-Brite Ultra Cu "E"**, 1 to 2% by volume at a time and check Hull Cell plating results. Carry out adhesion tests.
	Low pH	Add **E-Brite Ultra Cu "PHA"** to raise pH to 9.8.
	Copper metal too high	Lower the copper metal by plating out of bath using graphite or stainless steel anodes or a combination of copper and graphite and/or stainless steel anodes.
Dark, spongy deposits in HCD areas accompanied by poor adhesion in LCD areas.	Iron contamination	Use a good 2-3 stage counter flow rinse after acid pickling and before plating to minimize acid and iron contamination to the plating bath. HCD dummy plate to remove iron. Remove fallen parts – fish out of plating bath tank bottom with a magnet.
Black non-adherent plating in HCD areas.	Lead contamination from leaded brass or leaded steel parts being plated	HCD dummy plate to remove lead on a periodic basis. Improve counter current flow rinsing to avoid drag in of dissolved lead. Check for parts dropped into tanks.
	Note: **E-Brite Ultra Cu** should not be used to barrel plate over pure lead. Example: bullets	
Burned deposits in HCD areas	Too much current	Lower Current
	No or insufficient air agitation.	Ensure good vigorous air agitation.
	Too low temperature	Raise temperature to 120 to 140°F.
	Too low copper metal (below 0.5 oz/gal)	Raise copper metal to at least 0.8 oz/gal for zinc die-cast, 1.0 oz/gal for other substrates by adding **E-Brite Ultra Cu.**
	Low **E-Brite Ultra Cu "HCD"** concentration if being used in a particular bath.	Add **E-Brite Ultra Cu "HCD"**.

Blistering/loss of adhesion on zinc die-cast surfaces	Silver or zinc contamination	Change anodes to remove silver. Dummy plate out the zinc at low current density.

CAUTION

Do not work with the **E-Brite Ultra Cu** solutions or other **EPI** products without first reading and understanding the **MATERIAL SAFETY DATA SHEET** furnished by **EPI**.

Packaging

One (1), 5 and 55 gallon non-returnable containers.

IMPORTANT NOTICE! For Industrial Use Only

The following is made in lieu of all warranties, expressed or implied, including the implied warranties of merchantability and fitness for purpose: seller's and manufacturer's only obligation shall be to replace such quantity of the product as proved to be defective. Before using, user shall determine the suitability of the product for its intended use and user assumes all risk and liability whatsoever in connection therewith. **Neither seller nor manufacturer shall be liable either in tort or in contract for any loss or damage, direct, incidental or consequential arising out of the use or the inability to use the product.**

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