Enerox™ Nickel Additive E 44

Product Code: 2850007
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INSTRUCTIONS FOR BRIGHT NICKEL PLATING USING ENE™ NICKEL ADDITIVES

The Ene™ Bright Nickel Plating Process is designed and formulated to produce high quality bright nickel deposits. The system features a high rate of brightening and levelling, excellent low current density brightness and coverage with good nickel activity and chrome receptivity. The process can be used over a wide variety of suitably prepared substrates and can be used with air or mechanical agitation.

BATH COMPOSITION AND OPERATING CONDITIONS

The exact composition and operating condition of the plating bath will vary somewhat depending on the requirements for a particular installation. It is influenced by a variety of factors, such as, the basis metal being plated, the shape of the parts processed, the thickness of nickel being deposited and the current densities being used. The following bath composition and operating conditions will meet most installation requirements:

	Range	**Preferred**
Nickel Sulfate	20-50 oz/gal	38.0 oz/gal
Nickel Chloride	6-16 oz/gal	10.0 oz/gal
Boric Acid	5-6.5 oz/gal	6.0 oz/gal
Nickel Additive C-9	3.0 – 5.5 % by volume	4.0 % by volume
Nickel Additive S-11	1.25 -2.5% by volume	2.0 % by volume
Nickel Additive E-44	0.2 -0.5% by volume	0.25% by volume
Anti Pit EM-1 or EA	0.2 -0.5% by volume	0.25 % by volume
Total Nickel Metal	0-15 oz/gal	10 oz/gal
Temperature	120-150°F	140°F
pH	3.5 – 5.5	4.6
Current Density	20-100 ASF	30-60 ASF
Agitation	Air or mechanical	

FUNCTIONS OF BATH CONSTITUENTS

Nickel Sulfate: Main Source of nickel ions from which the metallic nickel is deposited at the cathode.

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Nickel Chloride: Source of chloride ions which facilitate anode corrosion and improve solution conductivity; secondary source of nickel ions.

Boric Acid: Buffering agent; stabilizes pH of cathode film.

FUNCTIONS OF BATH CONSTITUENTS (continued)

Nickel Additive C-9: Stress reliever and ductilizing agent. In conjunction with other addition agents, it maintains deposit brightness and levelling. C-9 is consumed by electrolysis at the rate of 1 gallon per 18,000-25,000 ampere hours of plating. It is removed, to some degree, by batch carbon treatment. Continuous filtration of the solution through a little carbon pack removes only a slight amount of the C-9 Additive.

Nickel Additive S-11: Auxillary brightener; in conjunction with other additives, maintains brightness and levelling. Maximizes effectiveness of addition agent S-11. S-11is consumed by electrolysis at the rate of 1 gallon per 8,000-12,000 ampere hours of plating. Normal carbon treatment does not remove any appreciable quantities of Additive S-11.

Nickel Additive E-44: Brightening and levelling agent. Consumed by electrolysis at the rate of 1 gallon per 8,000-12,000 ampere hours. Is not removed to any large degree by activated carbon treatment. Small amounts of E-44 can be lost by absorption in anode bags and on carbon pack. Electrolysis at very low current densities consumes additive E-44 rapidly. Excessive concentrations of Additive E-44 produces dark, striated and stressed nickel deposits.

Nickel Additives EM-1 and EA: Anti-Pit agents; prevents gas pitting and can control, to a slight degree, grease pitting. Additive EM-1 is intended for mechanically agitated systems and Additive EA is for air agitated systems. Both materials are removed by activated carbon treatment.

PREPARATION OF A NEW PLATING BATH

A new nickel should be made up in a clean storage tank which has been cleaned free of grease, dirt, etc. The storage tank as well as the plating tank, filters, anodes, etc. should be leached overnight with a solution of 0.25% by volume of sulfuric acid plus 0.1% nickel additive EM or EA at 140 F.

1) Fill the clean, leached storage tank 2/3 full of clean water and heat to 140 F.

2) Add the required amounts of nickel sulfate and nickel chloride, agitating the solution to thoroughly dissolve the salts. Note: Liquid nickel sulfate and chloride can also be used for make-

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up. In this case, begin with an initial water volume to allow for the volume increase from the added liquids.

3) Adjust pH of solution with nickel carbonate or caustic soda to 5.2.

4) Add 1 quart of 30% hydrogen peroxide (diluted 4:1 with water) per 100 gallons of solution being prepared.

5) Add 1 gallon Nickel Additive EA per 1000 gallons of solution being prepared.

6) Add activated carbon at the rate of 2 Ibs/100 gallons of solution. Stir solution thoroughly as carbon is added and then several times over the course of a few hours. Allow solution to settle overnight.

7) Filter the solution into the cleaned, leached plating tank, making sure that filtrate is perfectly clear and no carbon is bypassing the filter into the plating tank.

8) Heat the solution to 1400F. Add the required amount of boric acid with agitation and bring solution to operating level with water.

9) Adjust pH with diluted C.P. sulfuric acid to 4.0.

PREPARATION OF NEW PLATING BATH (continued)

10) Clean and repack filter with filter aid. Coat filter with a packing of activated carbon and filter aid (2 oz of each per 100 gallons of solution.)

11) Electrolyze (dummy) bath at low current density 2-5 ASF using corrugated cathodes until recessed areas on dummy cathodes are a light nickel color. Use clean corrugated sheet steel for dummies. Preplate the dummy at normal plating current densities to get a uniform nickel deposit on them before reducing the current density to the 2-5 ASF. Maintain bath at 140°F and continue filtering during dummying.

12) Add required amounts of nickel additives and adjust pH to 4.4-4.6.

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EQUIPMENT AND PROCESS REQUIREMENTS

Tanks: Plastic or rubber lined steel plating and storage tanks are recommended. The plating tank should be insulated from electrical stray currents and electrical grounding.

Heating: Steam coils made of titanium, karbate, tantalum or teflon are satisfactory. Quartz, titanium or teflon coated electric immersion heaters can also be used. Controls should be provided in the heating system to allow for a constant temperature range.

Agitation: Agitation (mechanical or air) is important in producing optimum bright nickel plating. Agitation allows the use of high current densities, improves levelling, reduces burning and decreases pitting. Air agitation should be supplied by a low pressure air blower (air compressors are not to be used) capable of generating a flow of one cubic foot per minute per lineal foot of air pipe. Blower pressure should be at least 1 ounce per square inch per inch of solution depth. The blower should be equipped with a suitable air filter at the intake.

Air coils should be constructed of suitable rigid plastic (PVC) pipe. The coils should be level and the holes drilled and arranged to provide a uniform, vigorous air pattern throughout the tank. Valving to regulate air velocity and distribution is recommended on the air lines. For cathode rod agitation, work bar movement should be 10-25 feet per minute.

Filtration: Continuous filtration of the plating bath is essential for good quality bright nickel plating. The filter should be capable of turning the plating solution over at least once an hour. The filter, chamber, impeller, hoses, etc. should be constructed of material compatible with the bright nickel plating solution. Filter pads, disc, cartridges, etc. should be of a fine enough mesh to insure clear, particulate free filtrate. The filter should be packed with a coating of activated carbon and filter aid. Three to five pounds of activated carbon per 1000 gallons of solution is a suitable charge for a week's production. An additional 1 lb. activated carbon per 1000 gallons of solution can be added on a daily basis. Fresh carbon can be added until the flow drops off to an ineffective rate. At that time, the filter should be cleaned and repacked. The activated carbon should be mixed with an equivalent amount of filter aid when coating the filter.

Filter intake hoses should be positioned near the bottom of the tank away from any air lines. The outlet hose should be positioned near the top of the bath but below the solution level and should not impinge on the work or anodes.

Anodes: Anodes can be either 99% rolled depolarized or carbon-type nickel, 99% cast carbon-type nickel, or S rounds and electrolytic squares contained in titanium baskets. To prevent roughness in plating, all anodes should be bagged. Anode bags may be made of cotton, dynel,

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polypropylene or nylon. Anode bags should be soaked overnight in a hot 2 oz/gal solution of soda ash to remove

EQUIPMENT AND PROCESS REQUIREMENTS (continued)

Sizing or other foreign material which might be present. Note: Anode bags may shrink as much as 20% in size, so provision should be made for this possibility when sizing anode bag requirements.

Anode area should be sufficient to prevent polarization. Total anode area should be such that the anode current density stays below 10 Amps per square foot.

HEALTH AND SAFETY

Nickel solutions and salts may be irritating to skin and eyes. Nickel salts and solutions may cause "nickel itch" and may be harmful if swallowed.

Consult appropriate Material Safety Data Sheets on all the materials utilized in this process.

Avoid contact of these materials with skin and eyes. Wear goggles and suitable protective clothing when handling these materials.

In case of skin contact, flush affected area thoroughly with clean water. For eye contact, flush with water for 15 minutes and get medical attention. Launder contaminated clothing before reuse.

WASTE TREATMENT

Nickel plating effluents and solutions can require neutralization, precipitation and collection of the nickel metal. Observe all local, state and federal requirements for the treatment of nickel containing solutions.

WARRANTY

THE QUALITY OF THIS PRODUCT IS GUARANTEED ON SHIPMENT FROM OUR PLANT. IF THE USE RECOMMENDATIONS ARE FOLLOWED, DESIRED RESULTS WILL BE OBTAINED. SINCE THE USE OF OUR PRODUCTS IS BEYOND OUR CONTROL, NO GUARANTEE EXPRESSED OR IMPLIED IS MADE AS TO THE EFFECTS OF SUCH USE, OR THE RESULTS TO BE OBTAINED.

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