



4831 South Whipple Street
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www.accu-labs.com

Ph. 773-523-3100 F. 773-523-4008

ENnovate: Lead & Cadmium-Free Bright Mid-Phosphorus Patent Pending Electroless Nickel Plating System with Leveling Capability

The ENnovate Patent Pending System is specifically formulated to produce a lead-free and cadmium free bright nickel-phosphorus deposit at a consistent rate of deposition. The System meets Mil-26074E, AMS 2404B, AMS 2405 and ASTM-B-733-04 (Type IV) specifications.

The ENnovate Patent Pending System offers the following characteristics:

- Lead and Cadmium free **LEVELED** deposits
- Excellent Bath Stability
- Consistent Rate of Deposition of **LEVELED** Deposits
- Consistent Pit-Free Smooth Bright **LEVELED** Deposits
- 1:1 Replenishment
- High Tolerance to Impurities
- Significantly Improved Corrosion Protection
- RoHS, WEEE, & ELV Compliant

TYPICAL DEPOSIT PROPERTIES:

Phosphorus Content	5-9%
Melting Range	1620-1760° F
Density	8.1 grams per cubic centimeter
Hardness	52-56R as plated (66-68R @ 400°C)
Magnetic Properties	Slightly Magnetic
RCA Nitric Acid Test	Fails
Hydrochloric Acid Test	Passes (50% HCl, 3 min. R.T.)
Neutral Salt Spray	150 hours at 1 mil (ASTM B-117)
Electrical Resistance	35-80 micro-ohm/cm

BATH OPERATING DATA:

Solution Make-up Materials Required:

- ENnovate-N (Nickel Component) 7% by volume
- ENnovate-M (Makeup Component) 15% by volume
- DI water to operating volume balance
- 50% Ammonium Hydroxide for pH control



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ENnovate Make-up Procedure (see 10 step tank preparation prior to makeup):

- Add DI water to properly cleaned and passivated tank (fill to half volume)
- Add required amount of ENnovate-M
- Add required amount of ENnovate-N
- Fill tank to working volume with DI water
- Mix thoroughly with solution and slight air agitation
- Heat to 190° F
- Analyze nickel content and adjust to 6.0 g/l (if necessary)
- Check pH and adjust to 4.80 (if necessary)

Recommended Operating Parameters:

Component	Range	Optimum
Nickel Metal	5.10-6.30 g/l	6.0 g/l
Hypophosphite	27.0-33.0	30.0 g/l
pH	4.80-5.20	4.90-5.00
Temperature	185-205° F	190° F
Bath Loading Ft ² /gal	0.10-1.0	0.50

Note: pH can be adjusted upward with a 50% solution of ammonium hydroxide; if pH needs to be adjusted downward a solution of 10% sulfuric acid can be used. All additions should be made slowly, with agitation and preferably away from the work in the tank.

Typical Bath Performance:

- Plating Rate-Typically 0.8-0.9 mils/hour with all parameters at optimum (new bath)
- Solution Life (Metal Turnovers)
- Steel 8-10
- Aluminum 4-6 unless a strike is used; see next bullet point.
- Individual applications and practices will affect bath life; contact your Accu-Labs Representative for options to increase bath life.



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Bath Maintenance: To ensure proper operation of the system, the solution chemistry should be maintained using the aforementioned operating parameters. This is accomplished by measuring and monitoring the nickel metal concentration.

Upon determination of the nickel metal concentration, additions of both ENnovate-N and ENnovate-R are made based on the following replenishment guide for a 100-gallon bath:

Nickel %	Nickel Concentration	Additions ENnovate-N	Additions ENnovate-R
100	6.0 grams per liter	None	None
95	5.7 grams per liter	1.3 liters	1.3 liters
90	5.4 grams per liter	2.6 liters	2.6 liters
85	5.1 grams per liter	3.9 liters	3.9 liters
80	4.8 grams per liter	5.2 liters (split)	5.2 liters (split)
75	4.5 grams per liter	6.5 liters (split)	6.5 liters (split)

NICKEL METAL DETERMINATION:

Reagents:

- 0.0575M EDTA
- 50% Ammonium Hydroxide
- Murexide Indicator

Procedure:

- Add 10 ml bath sample to 100 ml DI water
- Add 10 ml ammonium hydroxide solution
- Add 0.2 grams murexide indicator
- Titrate with EDTA from pale yellow to purple (violet) end point
- Record number of mLs of EDTA titrated

Calculation:

- $\text{MLs of 0.0575 EDTA} \times 0.339 = \text{grams/liter nickel or}$
- $\text{MLs of 0.0575 EDTA} \times 5.65 = \% \text{ nickel in bath}$



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Sodium Hypophosphite Concentration:

Equipment

5 ml pipette
250 Erlenmeyer flask
50 ml graduated cylinder
50 ml pipette
50 ml burette

Reagents

0.1N Iodine solution
0.1N Sodium Thiosulfate solution
6N Hydrochloric Acid

Procedure

- 1.) Pipette 5.0 ml of cooled bath into a 250 ml Erlenmeyer flask.
- 2.) Add 30 mLs of 6N hydrochloric acid.
- 3.) Pipette 50 mLs of 0.1 N iodine into the flask.
- 4.) Shake flask well, rinse down sides with DI water, stopper and let stand in the dark for 30 minutes.
- 5.) Titrate with 0.1N sodium thiosulfate to a clear endpoint.

Calculation

$$\begin{aligned}\text{Oz/gal hypophosphite} &= (50 - \text{mLs } 0.1\text{N thiosulfate}) \times 0.141 \\ \text{Gm/l hypophosphite} &= (50 - \text{mLs } 0.1\text{N thiosulfate}) \times 1.06\end{aligned}$$



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PREPARATION OF PLATING TANK

IMPORTANT: Before making up a new solution, it is essential that the following steps be performed. Do not take short cuts.

1. Completely discharge spent solution to waste treatment area as per applicable federal, state and local regulations and permits. If transferring a functioning bath ensure that holding tank is properly prepared and suited for holding until bath is re-used.
2. Remove old filter cartridge(s) or bag(s) and discard. Reseal filter unit for stripping. Completely fill plating tank with nitric acid solution (50% by volume).
3. Circulate the nitric acid solution through all pumps, filter housings, hoses, pipes, air agitation spiders and other surfaces, which normally contact the working electroless nickel solution. NOTE: Do not use air agitation. The air spider should be filled with acid. If possible, allow overnight stripping to ensure complete stripping and/or passivation of stainless steel tanks.
4. Discharge nitric acid back to holding tank for future use.
5. Pump clean water through all the hoses, filters, pumps, tanks, etc., where nitric acid was present. Rinse thoroughly.
6. Fill tank with water to above the nitric acid level and add a small quantity (0.5% typical) of ammonium hydroxide. Circulate this solution for 1-2 hours while turning the air agitator pump on and off. This will ensure that all residual nitric acid is neutralized. Nitric acid is difficult to completely remove by only rinsing.
7. Drain the system, and then rinse thoroughly with clean water. Test the rinse water for nitrate using test paper strips. If no nitrate is found, continue with the next step, No 8. If nitrate is present, continue flushing the system with water and testing until nitrate contamination has been eliminated.
8. A "white glove" test using a clean white cloth or towel is a good indicator of complete removal of residual material from tank wall.
9. Install new filter cartridge, bag, etc.
10. Proceed with new bath makeup or transfer of properly stored existing bath.



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Handling Considerations:

When handling Accu-Labs' ENnovate components proper precautions should be observed. Do not take internally and avoid contact to skin and eyes. Wear clean chemical resistant gear, goggles, gloves, apron, footwear, and face shield. Read MSDS prior to use.

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