ACCU-LABS INC.

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A2LA Accredited ISO/IEC 17025:2005 Certificate # 2558.01

393 Mid-Phosphorus Bright Electroless Nickel Plating System

The 393 System is specifically formulated to produce a bright nickel-phosphorus deposit at a consistent high rate of deposition. The 393 System is recommended for applications requiring a bright, pore free and stain free functional finish with moderate corrosion resistance. The 393 System is available in non-self regulating and self regulating pH packages.

The 393 System offers the following characteristics:

- Exceptional Stability
- Consistent Rate of Deposition
- High Tolerance to Contaminants
- Low Operating Cost

TYPICAL DEPOSIT PROPERTIES:

Phosphorus Content	7%-9% Typical Weight Percentage
Melting Range	1620-1760° F
Density	8.1 Grams per Cubic Centimeter
Hardness	550 HK_{100} as plated
Magnetic Properties	Slightly Magnetic
Nitric Acid Test	Fails
Hydrochloric Acid Test	Passes
Neutral Salt Spray	Up to 100 hours to first corrosion

BATH OPERATING DATA:

Solution Make-up Materials Required:

- 393-M (Make-up Only) 15% by volume
- 393-N (Nickel Component) 7% by volume
- DI water to operating volume
- 50% Ammonium Hydroxide Solution for pH control especially for steel substrates
- Liquid Potassium Carbonate for pH control especially for aluminum substrates
- NOTE: For Self Regulating processes the 393-RH will usually maintain sufficient pH. However, since conditions vary within each plating operation, there may be a need to add a small amount of ammonium hydroxide or liquid potassium carbonate to the Self Regulating baths to maintain the desired pH. Contact your Accu-Labs Representative for more information.

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Accu-Labs 393 makeup procedure:

- Add DI water to properly cleaned and passivated tank (fill to half volume)
- Add required amount of 393-M
- Add required amount of 393-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
- Check pH and adjust to *4.70-5.10

Recommended Operating Parameters:

Component	Range	Optimum
Nickel Metal	5.10-6.30 g/l	6.0 g/l
Hypophosphite	27.0 – 33.0 g/l	30.0 g/l
pH	*4.70-5.10	4.90
Temperature	180-200° F	190° F
Bath Loading Sq Ft/Gal	0.10-1.00	0.50

Note: pH can be adjusted upward with a 50% solution of ammonium hydroxide for steel or liquid potassium carbonate for aluminum. If pH needs to be adjusted downward a solution of 10% sulfuric acid can be used. * For applications requiring additional corrosion protection the pH can be lowered to and maintained at 4.50.

Typical Bath Performance:

- Plating Rate-Typically 1.0 mils/hour with all parameters at optimum (new bath)
- Solution Life (Metal Turnovers)
  - Steel 6-10
  - Aluminum
    - Ammonium Hydroxide pH adjust 5-7
    - Potassium Carbonate pH adjust 7-9
    - With Alkaline Strike prior to plate 6-10
    - Individual applications and practices will affect bath life

Bath Maintenance: To ensure proper operation of the 393 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 393-N and 393-R (Non-Self pH Regulating) or 393-RH (Self pH Regulating) are made based on the following replenishment guide for a 100-gallon bath:

Nickel %	Nickel Concentration	Additions 393-N	Additions 393-R	Additions 393-RH
100	6.0 grams per liter	None	None	None
95	5.7 grams per liter	1300 mls	1300 mls	1300 mls
90	5.4 grams per liter	2600 mls	2600 mls	2600 mls
85	5.1 grams per liter	3.9 liters	3.9 liters	3.9 liters
80	4.8 grams per liter	5.2 liters	5.2 liters	5.2 liters
75	4.5 grams per liter	6.5 liters	6.5 liters	6.5 liters

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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:

- Mls of 0.0575 EDTA x 0.339 = grams/liter nickel or
- Mls of 0.0575 EDTA x 5.65 = % nickel in bath

Handling Considerations:

When handling Accu-Labs 393 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. Accu-Labs recommends reading the MSDS prior to use.