385 High-Speed Bright Mid-Phosphorus EN

High-Brightness, High-Deposition-Rate Mid-Phosphorus Electroless Nickel System for Decorative Finishes

Product Code 385 System (385-M, 385-N, 385-R)

1. PERFORMANCE

OVERVIEW

ACCU-LABS 385 System is specifically formulated to produce an extremely bright nickel-phosphorus deposit at a consistent high rate of deposition. The system is recommended for applications requiring a highly decorative finish and moderate corrosion resistance, and is engineered for exceptional bath stability, high tolerance to contaminants, and low operating cost. 385 is supplied as a multi-component liquid system consisting of 385-M for initial make-up only, 385-N as the nickel component used for both make-up and replenishment, and 385-R as the replenishment co-component — with 50% ammonium hydroxide for routine pH adjustment on steel substrates (potassium carbonate for aluminum) and 10% sulfuric acid available for downward pH correction.

FEATURES & BENEFITS

EXTREMELY BRIGHT DECORATIVE DEPOSIT	Produces an extremely bright as-plated nickel-phosphorus deposit (7–9% P) — meets the cosmetic requirements of decorative hardware without a post-plate brightening or polishing step.
HIGH DEPOSITION RATE	Plates at approximately 1.0 mil/hour with all parameters at optimum in a new bath — supports practical cycle times on production thicknesses without sacrificing brightness.
EXCEPTIONAL BATH STABILITY	Engineered for exceptional stability at the 180–200°F (opt 190°F) operating window — reduces bath-decomposition events and supports consistent run-to-run performance.
HIGH CONTAMINATION TOLERANCE	Higher tolerance to typical drag-in contaminants than rate-matched legacy mid-phosphorus baths — supports longer effective bath life in real-line operating conditions.

LOW OPERATING COST	Combination of low operating cost per micron of deposit and competitive metal-turnover life (6–10 MTO on steel) — favorable cost-per-square-foot for decorative production.
STEEL AND ALUMINUM PROCESS PATHS	Defined pH-control strategies for steel (50% NH_4OH) and for aluminum (K_2CO_3, with or without an alkaline strike) — one system covers both substrate families with documented metal-turnover expectations for each.
STRUCTURED REPLENISHMENT TABLE	Replenishment of 385-N and 385-R is driven by an EDTA-titrated nickel-metal value, with a 100-gal-basis dosing table spanning 100% → 75% of optimum nickel concentration — operators get a deterministic dosing target rather than a judgement call.
STANDARDIZED TITRATION CONTROL	Nickel-metal concentration tracked by 0.0575 M EDTA titration with murexide indicator and ammoniacal buffer; (mL of EDTA × 0.339) = g/L Ni — a familiar EDTA wet-chemistry method needing only standard plating-shop lab reagents.

OPERATING PARAMETERS

BATH 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	0.10–1.00 ft²/gal	0.50 ft²/gal

TYPICAL DEPOSIT PROPERTIES

Deposit Property	Typical Value
Phosphorus Content	7–9% by weight

Deposit Property	Typical Value
Melting Range	1620–1760° F
Density	8.1 g/cm³
Hardness (as plated)	550 HK_{100}
Magnetic Properties	Slightly magnetic
Nitric Acid Test	Fails
Hydrochloric Acid Test	Passes
Neutral Salt Spray (ASTM B117)	Up to 100 hours to first corrosion

pH ADJUSTMENT REAGENTS

Adjustment	Substrate	Reagent
Raise pH	Steel	50% by volume ammonium hydroxide (NH_4OH)
Raise pH	Aluminum	Potassium carbonate (K_2CO_3)
Lower pH	Any	10% by volume sulfuric acid (H_2SO_4)

NOTE: Plating rate is approximately 1.0 mil/hour with all parameters at optimum in a new bath. Deposition rate falls progressively over the metal-turnover life of the bath; observed rate against a reference part is a routine bath-health signal alongside the EDTA-titrated nickel value.

2. PROCESS SETUP & OPERATIONS

EQUIPMENT REQUIREMENTS

385 is run as a hot, mildly acidic electroless nickel bath at 180–200°F (optimum 190°F). Use tank construction appropriate for hot EN service — properly cleaned and passivated stainless or compatible polymer-lined steel. The tank must be cleaned and passivated before initial make-up; this is essential to prevent uncontrolled plate-out on the tank walls. Provide slight air agitation during operation. Heating must hold the bath within the 180–200°F window; avoid overshoot. Filter the working bath through a clean, EN-compatible filter to remove particulates. Provide local exhaust ventilation over the tank. Use rack and basket materials that are inert to hot EN service; substrate-specific pre-treatment lines (clean / pickle / strike) feed the 385 tank per the typical EN sequence for steel or aluminum.

MAKE-UP COMPONENTS

Material	Quantity	Notes
385-M	15% by volume	Make-up only — not used in replenishment
385-N	7% by volume (make-up); per replenishment table (maintenance)	Nickel component — used in both make-up and replenishment
385-R	Per replenishment table (maintenance only)	Replenishment co-component — used during maintenance, not in initial make-up
Deionized Water	Balance to working volume	DI water only; tap-water hardness will load the bath
50% Ammonium Hydroxide (NH_4OH)	As required for pH	Used to raise pH on steel substrates
Potassium Carbonate (K_2CO_3)	As required for pH	Used to raise pH on aluminum substrates

Material	Quantity	Notes
10% Sulfuric Acid (H_2SO_4)	As required for pH	Used to lower pH if required

MAKE-UP PROCEDURE

NEW SOLUTION MAKE-UP

1. Confirm the tank has been properly cleaned and passivated prior to make-up.
2. Add DI water to the tank to approximately half of the final working volume.
3. Add the required amount of 385-M (15% by volume of the final working volume).
4. Add the required amount of 385-N (7% by volume of the final working volume).
5. Fill the tank to working volume with DI water.
6. Mix thoroughly and engage slight air agitation.
7. Heat the bath to operating temperature of 190°F.
8. Analyze nickel content by EDTA titration (see Analytical Methods) and adjust to 6.0 g/L using 385-N as required.
9. Check pH and adjust to the 4.70–5.10 window (optimum 4.90) using 50% NH_4OH for steel, K_2CO_3 for aluminum, or 10% H_2SO_4 to lower pH.

CAUTION: 385 is a hot mildly acidic EN bath operated at 180–200°F. Wear chemical-resistant gloves, chemical goggles or full face shield, apron, and footwear when making up, handling, or maintaining the bath. Avoid skin and eye contact; do not take internally. Add 50% NH_4OH carefully and away from face during pH adjustment. Provide local exhaust over the tank. Read the SDS prior to use.

BATH MAINTENANCE

Maintain the 385 working bath by measuring nickel metal concentration on a regular cycle and adding 385-N and 385-R according to the replenishment table below. 385-M is NOT used in replenishment.

REPLENISHMENT TABLE (100-GALLON BASIS)

Nickel %	Nickel Concentration (g/L)	385-N Addition (liters)	385-R Addition (liters)
100%	6.0	None	None
95%	5.7	1.3	1.3
90%	5.4	2.6	2.6
85%	5.1	3.9	3.9
80%	4.8	5.2	5.2
75%	4.5	6.5	6.5

Doses are stated as liters of 385-N and 385-R required per 100 gallons of bath to return from the indicated nickel-percentage state to 100% (6.0 g/L). Equal 385-N and 385-R doses across the table.

SOLUTION LIFE (METAL TURNOVERS)

Substrate / Process Path	Solution Life (Metal Turnovers, MTO)
Steel	6–10
Aluminum — NH_4OH pH adjust	5–7
Aluminum — K_2CO_3 pH adjust	7–9
Aluminum — with alkaline strike prior to plate	6–10

Individual applications and practices will affect actual bath life. Track MTO from new bath to end of life to forecast scheduled change-out.

ROUTINE MAINTENANCE TASKS

1. Measure nickel-metal concentration by EDTA titration on each shift (or at the line's established cycle).
2. Adjust nickel concentration to 6.0 g/L using the replenishment table.
3. Verify pH and adjust to the 4.70–5.10 window with the substrate-appropriate reagent.
4. Maintain temperature at 180–200°F (optimum 190°F).
5. Maintain working level with DI water for evaporative loss.
6. Filter the bath as needed to remove particulates; inspect filter housing on regular cycle.
7. Inspect deposition rate on a reference part periodically; declining rate at in-spec composition is a bath-aging signal.

NOTE: 385-N and 385-R are added in equal volumes across the entire replenishment-table range; the line can dose them simultaneously or as paired discrete additions to the same target nickel concentration.

ANALYTICAL METHODS

Nickel-metal concentration in the 385 working bath is determined by EDTA titration with a murexide indicator in an ammoniacal buffer.

NICKEL METAL DETERMINATION (EDTA / MUREXIDE)

Reagents:

1. 0.0575 M EDTA standard solution.
2. 50% by volume ammonium hydroxide (NH_4OH) solution.
3. Murexide (ammonium purpurate) indicator powder.

Procedure:

1. Pipette 10 mL of the operating bath sample into a clean flask containing 100 mL of DI water.
2. Add 10 mL of 50% ammonium hydroxide solution.
3. Add 0.2 g of murexide indicator.
4. Titrate with 0.0575 M EDTA from pale yellow to a purple (violet) endpoint.
5. Record the volume of EDTA titrated (mL).

Calculation:

Nickel concentration (g/L) = mL of 0.0575 M EDTA × 0.339

Nickel concentration (%) = mL of 0.0575 M EDTA × 5.65

NOTE: The EDTA endpoint is a sharp color shift from pale yellow to purple/violet. Titrate slowly near the endpoint to avoid overshoot; with practice the assay is reproducible to a fraction of a milliliter on a 10 mL bath aliquot, well within the resolution required to drive the replenishment table.

3. HANDLING & COMPLIANCE

SAFETY & HANDLING

When handling Accu-Labs 385 components, proper precautions should be observed. Do not take internally and avoid contact with skin and eyes. Wear clean chemical-resistant garments, chemical goggles or full face shield, gloves, apron, and footwear when handling, making up, or maintaining the bath. Avoid inhalation of mists, vapors, or dusts — provide local exhaust ventilation over the tank, particularly given the 180–200°F operating temperature window and the use of 50% ammonium hydroxide for pH control. Handle 50% NH_4OH, potassium carbonate, and 10% sulfuric acid per their respective safe-handling guidelines. Ensure that all applicable health, environmental, and safety regulations and standards (OSHA, NIOSH, ACGIH, NFPA) are met. Read and review the current Safety Data Sheet (SDS) thoroughly prior to use.

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