

1060 Electroless Nickel

Lead-Free, Cadmium-Free Semi-Bright Mid-Phosphorus Plating with Self-Regulating pH

Product Code: 4894 (1060-M), 4895 (1060-N), 4893 (1060-R)

1. PERFORMANCE

OVERVIEW

Acculabs Ennovate 1060 is a lead-free and cadmium-free semi-bright mid-phosphorus electroless nickel plating system, specifically formulated to produce a semi-bright nickel-phosphorus deposit (5–8% P) at a consistent high rate of deposition throughout bath life. The 1060 System meets MIL-26074B, AMS 2404B, and AMS 2405 specifications, and is RoHS, WEEE, and ELV compliant. A unique chemistry delivers long bath life of 9 to 10+ metal turnovers (MTO) on steel, with pH-self-regulating performance and a 1:1 replenishment ratio between 1060-N (nickel) and 1060-R (reducer), simplifying bath maintenance while delivering pit-free smooth semi-bright deposits with high tolerance to impurities.

FEATURES & BENEFITS

LEAD- & CADMIUM-FREE COMPLIANCE

Deposits are free of lead and cadmium and meet MIL-26074B, AMS 2404B, and AMS 2405 specifications, supporting RoHS, WEEE, and ELV requirements for regulated end markets.

HIGH DEPOSITION RATE THROUGHOUT BATH LIFE

Delivers a typical plating rate of 0.6–1.0+ mils/hour throughout bath life, supporting demanding production schedules with stable, repeatable deposit thickness from a fresh bath through end-of-life.

EXTENDED BATH LIFE

Unique chemistry delivers 9 to 10+ metal turnovers on steel and 5–8+ on aluminum, reducing solution change-out frequency and waste-treatment burden compared with conventional mid-phosphorus systems.

SEMI-BRIGHT, PIT-FREE DEPOSITS

Produces consistent pit-free smooth semi-bright deposits with 5–8% phosphorus content and excellent corrosion resistance, validated by passing 50% HCl for 3 minutes at room temperature and 100 hours neutral salt spray at 1 mil (ASTM B-117).

**PH SELF-REGULATING
WITH 1:1
REPLENISHMENT**

Self-regulating pH chemistry combined with one-to-one volumetric additions of 1060-N and 1060-R simplifies bath control and reduces operator intervention compared with multi-component manual systems.

**HIGH START-UP
ACTIVITY & IMPURITY
TOLERANCE**

High solution start-up activity and tolerance to impurities deliver predictable bath performance and minimize downtime when bringing new bath make-ups online.

TYPICAL DEPOSIT PROPERTIES

Property	Typical Value
Phosphorus Content	5–8%
Melting Range	1620–1760° F
Density	8.1 g/cc
Hardness	52–56R as plated (66–68R after 1 hour at 400°C)
Magnetic Properties	Slightly Magnetic
RCA Nitric Acid Test	Fails
Hydrochloric Acid Test	Passes (50% HCl, 3 min., R.T.)
Neutral Salt Spray	100 hours at 1 mil (ASTM B-117)
Electrical Resistance	35–80 micro-ohm/cm

OPERATING PARAMETERS

Parameter	Optimum	Range
Nickel Metal	6.0 g/l	5.10–6.30 g/l
Hypophosphite	30.0 g/l	25.0–35.0 g/l

Parameter	Optimum	Range
pH	4.90	4.70–5.10*
Temperature	190° F	185–205° F
Bath Loading	0.50 sqft/gal	0.10–1.0 sqft/gal
Plating Rate	0.6–1.0+ mils/hour	0.6–1.0+ mils/hour throughout bath life

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. *As the bath ages, the operating pH range typically increases to 4.70–5.50+ at 2–3 metal turnovers (MTOs). Solution life: 9–10+ MTO on steel; 5–8+ MTO on aluminum. Individual applications and practices will affect bath life; contact your Acculabs representative for options to increase bath life.

2. PROCESS SETUP & OPERATIONS

MAKE-UP COMPONENTS

Material	Quantity	Notes
1060-M	25% by volume	Makeup component (includes nickel)
Deionized Water	Balance to working volume	Used to fill operating volume
50% Ammonium Hydroxide	As required	For pH control (raises pH)
Potassium Carbonate	As required	Alternative for pH control (raises pH); add slowly with stirring

MAKE-UP PROCEDURE

SOLUTION MAKE-UP

1. Add DI water to a properly cleaned and passivated tank, filling to half volume.
2. Add the required amount of 1060-M (25% by volume).
3. Fill tank to working volume with DI water.
4. Mix thoroughly with solution and slight air agitation.
5. Heat to 190° F.
6. Analyze nickel content and adjust to 6.0 g/l by adding 1060-M (see note below).
7. Check pH and adjust to 4.70–5.10.

NOTE: 1060-M is a single-component solution make-up product that contains the required nickel for start-up. 1060-M is used for makeup only. If required, use small additions of 1060-M to adjust the nickel in a fresh made-up solution. Adding 0.25% by volume of 1060-M increases the nickel content by 0.06 grams per liter (or 1% nickel).

REPLENISHMENT & MAINTENANCE

To ensure proper operation of the 1060 system, the solution chemistry should be maintained using the operating parameters above. This is accomplished by measuring and monitoring the nickel metal concentration. Upon determination of the nickel metal concentration, one-to-one by volume additions of both 1060-N and 1060-R are made based on the replenishment schedule below for a 100-gallon bath.

REPLENISHMENT SCHEDULE

Nickel %	Nickel Concentration	1060-N Addition	1060-R Addition
100%	6.0 g/l	None	None
95%	5.7 g/l	1.1 L (0.3 gal)	1.1 L (0.3 gal)
90%	5.4 g/l	2.3 L (0.6 gal)	2.3 L (0.6 gal)
85%	5.1 g/l	3.4 L (0.9 gal)	3.4 L (0.9 gal)
80%	4.8 g/l	4.5 L (1.2 gal)	4.5 L (1.2 gal)

Nickel %	Nickel Concentration	1060-N Addition	1060-R Addition
75%	4.5 g/l	5.7 L (1.5 gal)	5.7 L (1.5 gal)

NOTE: Reducer should be maintained at 25–35 g/L. Regular analysis and maintenance of nickel activity between 90 and 100% with equal-volume additions of 1060-R should keep the reducer within this range. If reducer is found to be below the optimum range, additions of up to 6 mL/L may be added; if more than this is required, please contact your Accu-Labs representative before proceeding. Each 6 mL/L addition of 1060-R increases reducer by 2.7 grams per liter. Reference: 1 Liter = 33.8 fl oz; 1 gallon = 128 fl oz = 3.8 liters.

ANALYTICAL METHODS

ANALYSIS OF NICKEL (1060-M)

Reagents: 0.0575M EDTA standardized solution; 50% Ammonium Hydroxide; Murexide Indicator.

1. Add 10 ml bath sample to 100 ml DI water.
2. Add 10 ml ammonium hydroxide solution.
3. Add 0.2 grams murexide indicator.
4. Titrate with EDTA from pale yellow to purple (violet) end point.
5. Record number of mls of EDTA titrated.
6. Calculate: mls of 0.0575 EDTA $\times$ 0.338 = grams/liter nickel; or mls of 0.0575 EDTA $\times$ 5.62 = % nickel in bath (100% equals 6 g/L nickel).

ANALYSIS OF REDUCER (1060-R)

Normally, replenishment additions of 1060-R, based on the analysis for the nickel metal, will keep the concentration of reducer at its proper level. However, the consumption of reducer may not always be the same rate; therefore, it is advisable to run occasional analyses to ensure that it is in the recommended range of 25–35 g/L. If it is not within the recommended range, replenish using 1060-R as outlined below.

Reagents: 6N AR-grade hydrochloric acid; 0.10N potassium iodate-iodide solution; 0.10N sodium thiosulfate solution.

1. Pipet a 5 mL sample of the solution into a 250 mL iodine flask.
2. Add 30 mL of the 6N HCl, using it to rinse down the neck of the flask.
3. Pipet 50 mL of the 0.10N potassium iodate-iodide solution.

4. Stopper flask. Add a little DI water to top of flask.
5. Set in the dark for exactly 45 minutes.
6. Carefully remove the stopper.
7. Titrate immediately with 0.10N sodium thiosulfate; color change is from brown to colorless.

Calculate: (50 – mLs of thiosulfate) × 1.06 = grams per liter reducer (hypophosphite); or (50 – mLs of thiosulfate) × 0.393 = % hypophosphite (100% equals 27 g/L hypophosphite).

3. HANDLING & COMPLIANCE

SAFETY & HANDLING

When handling Accu-Labs 1060 components, proper precautions should be observed. Do not take internally and avoid contact with skin and eyes. Wear clean chemical-resistant gear, goggles, gloves, apron, footwear, and face shield. Read the Safety Data Sheet (SDS) prior to use, and ensure all applicable health, environmental, and safety regulations and standards (OSHA, NIOSH, ACGIH, NFPA) are met.

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