887 Electroless Nickel

High-Phosphorus Deposition for Superior Corrosion Resistance

Product Code 887

1. PERFORMANCE

OVERVIEW

887 is an advanced electroless nickel-plating process specially formulated to deposit a semi-bright, high phosphorus-nickel alloy (10–12 wt% P) exhibiting high intrinsic corrosion resistance. Recommended for oil and gas, printing, aerospace, and chemical processing applications where superior corrosion resistance, low-stress deposits, and functional lubricity are required. 887 is supplied as a multi-component liquid system consisting of 887 M and 887 N for make-up, with 887 N and either 887 RH (ammoniated) or 887 R (non-ammoniated) used for replenishment.

FEATURES & BENEFITS

EXCEPTIONAL CORROSION RESISTANCE 10–12 wt% phosphorus deposit is virtually non-porous and passes nitric and hydrochloric acid tests, delivering proven protection in oil & gas, chemical processing, and aerospace environments.

NON-MAGNETIC & LOW-STRESS DEPOSIT Semi-bright alloy is non-magnetic and exhibits minimal internal stress, preserving fatigue performance and dimensional integrity on precision-critical components.

RELIABLE, HIGH-THROUGHPUT DEPOSITION Achieves controlled deposition rates up to 0.6 mils/hr (15 µm/hr), with consistent phosphorus content maintained across bath life to support demanding production schedules.

VERSATILE RACK & BARREL CAPABILITY Compatible with both rack and barrel plating across a wide loading range (0.1–0.5 ft^2/gal), minimizing process re-engineering when transitioning between part geometries.

WEAR, LUBRICITY & BRAZING SUITABILITY As-plated deposit provides natural lubricity and abrasion resistance; the narrow eutectic melting range (880°C) makes 887 suitable for precision brazing applications.

STABLE BATH WITH FLEXIBLE REPLENISHMENT Long bath life supported by a straightforward multi-component replenishment system; choose between ammoniated (887 RH)

or non-ammoniated (887 R) options to match your process chemistry requirements.

OPERATING PARAMETERS

Parameter	Optimum	Range
Nickel Concentration	0.8 oz/gal (6.0 g/l)	0.77–0.83 oz/gal (5.8–6.2 g/l)
pH	4.6–4.8	4.6–5.1
Operating Temperature	188°F (87°C)	185–192°F (85–89°C)
Bath Loading	0.3 ft²/gal (0.7 dm²/l)	0.1–0.5 ft²/gal (0.25–1.25 dm²/l)
Plating Rate	0.4 mils/hr (10 µm/hr)	0.4–0.6 mils/hr (10–15 µm/hr)

2. PROCESS SETUP & OPERATIONS

EQUIPMENT REQUIREMENTS

Tank: High-density, natural, un-pigmented polypropylene recommended for installations below 500 gallons. A twin-tank setup is ideal: one tank in service, one held in reserve. Transfer the solution to the reserve tank when nickel buildup occurs in the plating tank, then strip and clean before returning it to service. A nitric acid tank of similar size is a necessary part of this arrangement.

Heaters: PTFE steam coils, Type 316 stainless steel heat exchanger, or electric immersion heaters fabricated from Type 316 stainless steel or PTFE are recommended.

Filtration: Filter continuously through 5-micron or smaller filter bags or cartridges using non-metallic pumps at a rate of 10 solution turnovers per hour. Transfer the bath completely to a storage tank once per day; rinse the plating tank with clean water, or treat with 50% nitric acid if nickel particles are present.

Agitation: Mild, clean air agitation from a low-pressure blower is recommended. Mechanical, reciprocal agitation may also be used. Always agitate during heating to prevent localized over-heating and solution plate-out.

MAKE-UP COMPONENTS

Material	Quantity	Notes
887 N	7% by volume (70 ml/l)	Nickel replenisher
887 M	15% by volume (150 ml/l)	Nickel source for make-up
Deionized Water	78% by volume (780 ml/l)	Balance to final volume

MAKE-UP PROCEDURE

TANK PREPARATION

IMPORTANT: Before making up a new solution, the following steps must be performed. Do not take shortcuts.

1. Completely discharge spent solution to the waste treatment system in accordance with all applicable federal, state, and local regulations and permits.
2. Remove old filter cartridge(s) or bag(s) and discard. Reseal the filter unit for stripping. Fill the plating tank completely with 50% by volume nitric acid solution.
3. Circulate the nitric acid solution through all pumps, filter housings, hoses, pipes, air agitation spiders, and other surfaces that normally contact the working electroless nickel solution. Do not use air agitation during this step; ensure the air spider is filled with acid. Allow overnight stripping if possible to ensure complete stripping and/or passivation of stainless steel tanks.
4. Discharge the nitric acid back to a holding tank for future use.
5. Pump clean water through all hoses, filters, pumps, tanks, etc. that contained nitric acid. Rinse thoroughly.
6. Fill the tank with water above the nitric acid level and add a small quantity of ammonium hydroxide. Circulate for 1–2 hours while cycling the air agitator pump on and off to neutralize all residual nitric acid.

7. Drain the system and rinse thoroughly with clean water. Test rinse water for nitrate using test paper strips. If no nitrate is detected, proceed to the next step. If nitrate is present, continue flushing and testing until contamination is eliminated.
8. Install new filter cartridge, bag, or equivalent.

SOLUTION MAKE-UP

9. Fill the clean tank to one-half of its final volume with distilled or deionized water.
10. While mixing, add the required amount of 887 M.
11. While mixing, add the required amount of 887 N.
12. Add distilled or deionized water to final volume and mix well.
13. Adjust pH, as required, to within the operating range (4.6–4.7) by carefully adding ammonium hydroxide to raise pH, or dilute sulfuric acid to lower it.

REPLENISHMENT & MAINTENANCE

Replenishment should be based on regular analysis of nickel and sodium hypophosphite. 887 N replenishes nickel metal; the optimum concentration is 8.96 fl.oz/gal (70 ml/l), corresponding to a nickel concentration of 0.8 oz/gal (6.0 g/l). To increase nickel by 0.133 oz/gal (1 g/l), add 1.50 fl.oz/gal (11.7 ml/l) of 887 N. One solution turnover (MTO) is achieved when 8.96 fl.oz/gal (70 ml/l) of 887 N have been added.

887 RH replenishes the reducer and is used with ammoniated, pH-self-regulating systems. 887 R replenishes the reducer but contains no ammonia. Either product should be added at the same rate as 887 N. The optimum concentration of 887 R (or 887 RH) is 8.96 fl.oz/gal (70 ml/l); the acceptable range is 7.16–9.5 fl.oz/gal (56–74 ml/l).

For optimum deposit properties and plating rate, maintain the solution using an auto-analyzer/controller or by frequent manual analysis: (1) Check and adjust nickel concentration to 100% activity [0.8 oz/gal (6 g/l)] using 887 N. (2) Determine sodium hypophosphite content at least once per shift in duplicate and adjust to 100% activity [8.96 fl.oz/gal (70 ml/l)] using 887 R (or 887 RH). (3) Measure pH using a calibrated pH meter with 4.0 and 7.0 buffers; cool the sample to room temperature before measuring. Adjust pH using 20% by volume sulfuric acid or 15% by volume ammonium hydroxide/potassium carbonate solution.

Recommended pH ranges by bath age (MTO):

Bath Age	pH Range
0 – 1.5 MTO	4.60 – 4.70

Bath Age	pH Range
1.5 – 2.5 MTO	4.70 – 4.80
2.5 – 3.5 MTO	4.80 – 4.85
> 3.5 MTO	4.85 – 4.90

REPLENISHMENT SCHEDULE

Nickel Analysis	Nickel Strength	887 N Addition	887 R (or RH) Addition
0.80 oz/gal (6.0 g/l)	100%	—0—	—0—
0.76 oz/gal (5.7 g/l)	95%	0.45 fl.oz/gal (3.5 ml/l)	0.45 fl.oz/gal (3.5 ml/l)
0.72 oz/gal (5.4 g/l)	90%	0.90 fl.oz/gal (7.0 ml/l)	0.90 fl.oz/gal (7.0 ml/l)
0.68 oz/gal (5.1 g/l)	85%	1.34 fl.oz/gal (10.5 ml/l)	1.34 fl.oz/gal (10.5 ml/l)
0.64 oz/gal (4.8 g/l)	80%	1.79 fl.oz/gal (14.0 ml/l)	1.79 fl.oz/gal (14.0 ml/l)
0.60 oz/gal (4.5 g/l)	75%	2.24 fl.oz/gal (17.5 ml/l)	2.24 fl.oz/gal (17.5 ml/l)

NOTE: Always avoid operating the 887 bath below 80% nickel activity. If this occurs, make adjustments in several small additions during the shift. Do not maintain the solution at operating temperature if work is not being processed, as this will cause breakdown of reducer and stabilizer components. Do not heat the solution above 195°F (91°C).

When using potassium carbonate for pH adjustment, make additions slowly with stirring to prevent eruption of the solution due to carbon dioxide liberation. After approximately 6–7 metal turnovers, a white

crystalline precipitate (potassium sulfate) may form, especially during cooling. This is normal for aged solutions using potassium carbonate; simply decant the precipitate.

ANALYTICAL METHODS

A sample should be sent to Accu-Labs periodically to serve as a check against in-house analysis results.

ANALYSIS OF NICKEL (887 N)

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

14. Pipette a 5 ml sample of the electroless nickel bath into a 250 mL flask.
15. Add approximately 50 mL deionized water.
16. Add approximately 5 mL of 50% ammonia solution.
17. Add a rice-grain-sized amount of Murexide indicator.
18. Titrate with 0.0575M EDTA standardized solution to a magenta-colored endpoint.
19. Calculate: Nickel metal (oz/gal) = mL of 0.0575M EDTA × 0.09; Nickel metal (g/l) = mL of 0.0575M EDTA × 0.674. Optimum 887 N concentration is 8.96 fl.oz/gal (70 ml/l), corresponding to 0.8 oz/gal (6.0 g/l) nickel. Operating range: 0.73–0.87 oz/gal (5.5–6.5 g/l).

ANALYSIS OF REDUCER (887 R or 887 RH)

Reagents: 50% Hydrochloric Acid; 0.1N Iodine Standard solution; 0.1N Sodium Thiosulfate standard solution; Iodine/Starch indicator.

20. Pipette a 5 mL sample of the electroless plating solution into a 250 mL iodine flask.
21. Add approximately 30 mL of 50% hydrochloric acid.
22. Add 50 mL of 0.1N iodine/iodate solution. Stopper the flask, swirl, and let stand for 60 minutes in a dark cupboard. NOTE: If the solution is colorless at 60 minutes, the iodine was insufficient; repeat using 100 mL of 0.1N iodine.
23. After 60 minutes, titrate with 0.1N sodium thiosulfate, adding indicator near the end of titration. Complete titration to a colorless endpoint.
24. Calculate: 887 R (or RH) [fl.oz/gal] = (50 – mL sodium thiosulfate) × 1.06. Operating range for 887 R (or RH): 26–33 g/l.

NITRATE CONTAMINATION CHECK

Nitrate contamination causes slow plating rates and lower-than-normal phosphorus content. Ion-selective test papers (e.g., EM QUANT strips, VWR Cat. No. EM 10050-1) can detect nitrate in the plating

solution and make-up water in the range of 10–500 mg/l. Contamination most often occurs after tank etching with nitric acid when the system is inadequately rinsed.

3. HANDLING & COMPLIANCE

SAFETY & HANDLING

Wear eye protection and appropriate personal protective equipment when working with or handling this product. Avoid direct contact with this material; do not inhale associated mists, vapors, or dusts. Ensure all applicable health, environmental, and safety regulations and standards (OSHA, NIOSH, ACGIH, NFPA) are met. Consult the product Safety Data Sheet (SDS) prior to use.

WASTE TREATMENT

This material must be disposed of in accordance with all applicable federal, state, and local regulations and permits. Consult the SDS for additional regulatory information. The information provided herein is general in nature and may not apply to each application.

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