



SUBJECT DULL NICKEL PLATING  
Process Specification

SUPERSEDED DATE 3/3/47

1. EQUIPMENT

- a. Tank - Koroseal lined steel or Pyrex glass.
- b. Heater - Karbate steam coil or hot plate.
- c. Temperature controls - automatic.
- d. Agitator - Cathode, solution, and/or air.
- e. Filter - Periodic or continuous.
- f. Exhaust - Not required.
- g. Power supply - D-C from rectifier or generator.
- h. Contacts - Copper anode and cathode bars; barrel when required.
- i. Electrical instruments - Ammeter, voltmeter, and rheostat.

2. MATERIALS

- N57 Nickel Sulfate, Technical.
- N55 Nickel Chloride, Technical.
- B21 Boric Acid, Granular, Technical.
- N604 Nickel Carbonate, Technical.
- S22 Sulfuric Acid, Reagent.
- C608 Activated Carbon.
- P31 Potassium Permanganate, U.S.P.
- B606C Non-Pitter No. 2 Paste (Udylite).
- W60 Deionized Water (or W7E Distilled Water).
- N53 Nickel Anodes, Rolled Depolarized.
- - Anode Bags.



SULFURIC ACID SAFETY PRECAUTIONS: See 33-2-7C.

3. PREPARATION OF SOLUTION

- a. Composition: Nickel sulfate - - - - - 44 oz./gal.
- Nickel chloride - - - - - 4 oz./gal.
- Boric acid - - - - - 4 oz./gal.
- Non-pitter - - - - - 0.2 oz./gal.

b. Procedure:

- (1) Fill the tank two-thirds full with deionized or distilled water, heat to operating temperature, and dissolve the required amounts of nickel sulfate and nickel chloride.
- (2) Add the required amounts of boric acid and non-pitter.
- (3) Add water to bring the solution up to the operating volume and heat to the specified temperature.
- (4) Stir the solution and filter.
- (5) Send a 100-200 cc. sample of solution to C & P Laboratory for analysis.
- (6) Adjust solution to required limits.

4. SOLUTION OPERATION & CONTROL

a. Limits:

	Preferred	Limits
Nickel as metal	11 oz./gal.	9-13 oz./gal.
Chloride	1.2 oz./gal.	1.0-1.4 oz./gal.
Boric Acid	4 oz./gal.	3-5 oz./gal.
Non-pitter	0.2 oz./gal.	0.1-0.3 oz./gal.
H	1.8	1.5-2.1
P		

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4. SOLUTION OPERATION & CONTROL (Cont.)

Temperature: 45°-55°C. (113°-131°F.)  
 Cathode Current density: 20-60 amp./sq.ft.  
 D-C tank potential: 3-12 volts

Time: 31 minutes to deposit 0.001" nickel at 40 amp./sq.ft.

- (1) Sampling: Submit a 100-200 cc. sample of plating solution each week to C & P Laboratory, making sure that solution is well agitated and up to operating temperature before taking the sample. See S.N. 34-36-1 for standard sampling procedure.

b. Purification:	<u>Contaminant</u>	<u>Purification Method</u>
	Insoluble matter	§Filtration
	Heavy metals	Dummy plating
	Iron	Nickel carbonate
	Organic matter	Activated carbon or potassium permanganate

§If filtration is periodic, the period between filtrations shall be no longer than one week.

c. Notes:

- (1) The plating solution should be balanced as follows:

<u>Defect</u>	<u>Remedy</u>
Low nickel	Add nickel sulfate
Low chloride	Add nickel chloride
Low boric acid	Add boric acid
High pH	Add sulfuric acid
Low pH	Add nickel carbonate

- (2) Dirt pitting is overcome by bagging the anodes and filtering the solutions.
- (3) Brittleness of deposit can be caused by impurities, too low solution temperature, too high current density, and too high pH.
- (4) Higher pH values, higher current densities, and lower temperatures will result in harder deposits. Lower pH values, lower current densities, and higher temperatures will result in softer deposits.
- (5) Agitation of the work or solution will enable considerably higher current densities to be used.
- (6) Boric acid provides the required degree of acidity and acts as a buffering reagent in that it prevents marked changes in the pH value.
- (7) Non-pitting agents are required to obtain a deposit with a fine crystal structure which also is adherent and free of pits.
- (8) The solution should never be operated with less than a 2 to 1 anode to cathode ratio.
- (9) The cathodes (parts) must be completely immersed in the solution at all times.
- (10) After removing the parts from the plating solution they shall be thoroughly rinsed. (The details on types and number of rinses, and drying, are specified in the plating schedules either below or in S.N. 34-1-1P.)

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4. SOLUTION OPERATION & CONTROL (Cont.)

c. Notes: (Cont.)

- (11) Extreme care must be exercised to prevent the introduction of dirt or lint in the solution which may catch on the parts.
- (12) All electrical contact areas should be kept clean.
- (13) Parts should not be allowed to dry between strike and plating but should be well rinsed.
- (14) Barrel Plating: Excessive plating should not be allowed to build up on outside of barrel.

SCHEDULES ON FOLLOWING PAGES → →

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SCHEDULE NO. 1 (Initially for MP6016 flange assembly of 827R)

a. Material: Kovar.

b. Procedure:

1. Mask part with 2 coats of Microstop lacquer (L631A). Allow 1/2 hour between and after coats. Plating should extend 1/4" in all directions from each hole. Sealing surface must not be plated.
2. Rack on small parts rack.
3. Electroclean, cathodic, 4-6 v., 82-93°C. (180-200°F.). See S.N. 34-34-74.
4. Rinse in warm running water with agitation, 38-66°C. (100-150°F.), 30 seconds.
5. Dip in hot 50% solution of hydrochloric acid (A15), 51-66°C. (125-150°F.), 5 seconds.
6. Rinse in running water with agitation, 30 seconds.
7. Nickel strike, 4 amp./part, room temperature, 1 minute.
8. Rinse in running water with agitation, 30 seconds.
9. Nickel plate to thickness of 0.00075", cathode agitation, 2 amp./part (40 amp./sq. ft.), 43-54°C. (110-130°F.), 23 minutes.
10. Rinse in running water with agitation, 30 seconds.
11. Remove masking mechanically taking care not to scratch the sealing surface.
12. Remove final traces of masking with acetone.
13. Rinse in running water with agitation, 30 seconds.
14. Dip in clean acetone (A55), 5 seconds.
15. Dry in oven.
16. Deliver to Inspection.



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SCHEDULE NO. 2 (Initially for MP6007 cathode spring retainer cup of 5831)

- a. Material: 18-8 Stainless Steel.
- b. Plating Surface: 0.5 sq. in.
- c. Procedure:
  1. Mask inside by racking on Bakelite rods. Use 0.050" dia. nickel wire for electrical contact.
  2. Electroclean, cathodic, 6 v., 93°C. (200°F.), 30 seconds.  
See S. N. 34-34-74.
  3. Rinse in warm running water with agitation, 38-66°C. (100-150°F.), 30 seconds.
  4. Dip in hot 50% solution of hydrochloric acid (A15), 51-66°C. (125-150°F.), 5 seconds.
  5. Rinse in running water with agitation, 30 seconds.
  6. Nickel strike, 0.3 amp./part (4.2 amp./14 parts), room temperature, 1 minute.
  7. Rinse in running water with agitation, 30 seconds.
  8. Nickel plate to thickness of 0.00025", cathode agitation, 0.15 amp./part (40 amp./sq. ft.), 2.1 amp./14 parts, 43-54°C. (110-130°F.), 10 minutes.
  9. Rinse in running water with agitation, 30 seconds.
  10. Remove from rods and place in wire basket.
  11. Rinse in running water with agitation, 30 seconds.
  12. Rinse in deionized water.
  13. Dip in clean acetone (A55), 5 seconds.
  14. Dry in oven.
  15. Deliver to Inspection.



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BLACOSOLV SAFETY PRECAUTIONS: See 33-2-11C.  
HYDROCHLORIC ACID SAFETY PRECAUTIONS: See 33-2-7C.

SCHEDULE NO. 3 (Initially for MP6011 envelope master ring of 5831)

- a. Material: Carpenter 883 Tool Steel (5% chromium).
- b. Plating Surface: 0.5 sq. ft.
- c. Procedure:
  1. Degrease in hot Blacosolv.
  2. Rack on about 1/8" dia. copper or nickel wire through non-threaded hole.
  3. Electroclean, anodic, 6 v., 93°C. (200°F.), 1 minute. See S. N. 34-34-74.
  4. Rinse in warm running water with agitation, 38-66°C. (100-150°F.), 30 seconds.
  5. Dip in hot 50% solution of hydrochloric acid (A15), 51-66°C. (125-150°F.), 5 seconds.
  6. Rinse in running water with agitation, 30 seconds.
  7. Nickel strike, 40 amp./part, room temperature, 1 minute.
  8. Rinse in running water with agitation, 30 seconds.
  9. Nickel plate to thickness of 0.00075", cathode agitation, 20 amp./part (40 amp./sq. ft.), 43-54°C. (110-130°F.), 23 minutes.
  10. Rinse in warm running water with agitation, 38-66°C. (100-150°F.), 30 seconds.
  11. Continue without interruption of the cycle with copper plating schedule, S. N. 34-36-60, Sch. 8.

\*\*SCHEDULE NO. 4 (Initially for MP6017 sealing sleeve of cathode-ray tubes)

- a. Material: Iron-Nickel-Chromium Alloy (No. 4 Alloy).
- b. Procedure:
  1. Load into jigs.
  2. Nickel plate, 60 amp./jig (630 parts), 1-1/2 to 2 hours.
  3. Unload jigs and place parts in wire basket.
  4. Wash - W656 (S.N. 34-1-1W).
  5. Rinse in two successive acetone rinses.
  6. Dry in oven.



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BLACOSOLV SAFETY PRECAUTIONS: See 33-2-11C.  
HYDROCHLORIC ACID SAFETY PRECAUTIONS: See 33-2-7C.

SCHEDULE NO. 5 (Initially for MP6020 grid insulator support of 5831.)

a. Material: 27% Chromium Iron Alloy.

b. Procedure:

1. Degrease in hot Blacosolv.
2. Rack on wire or hook rack. Rack through hole in flange.
3. Electroclean, cathodic, 6 v., 93°C. (200°F.), 30 seconds.  
See S.N. 34-34-74.
4. Rinse in warm running water with agitation, 38-66°C. (100-150°F.),  
30 seconds.
5. Dip in hot 50% solution of hydrochloric acid (A15), 51-66°C. (125-150°F.),  
15 seconds.
6. Rinse in running water with agitation, 30 seconds.
7. Nickel strike, 60 amp./part, room temperature, 30 seconds.
8. Rinse in running water with agitation, 30 seconds.
9. Nickel plate to thickness of 0.00075-0.00100", cathode agitation,  
3 amp./part (40 amp./sq. ft.), 43-54°C. (110-130°F.), 27 minutes.
10. Rinse in warm running water with agitation, 38-66°C. (100-150°F.),  
30 seconds.
11. Dip in clear acetone (A55), 2-3 seconds.
12. Dry.
13. Deliver to Inspection.

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★ CHANGE  
★★ ADDITION  
★★★ DELETION

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