SUBJECT ELECTROPOLISHING
Process Specifications

MAY 1955

Initially used in Laboratory for deplating or electrolytically polishing stainless steel, nickel and nichrome parts. This process is applicable for reducing or effacing minute projections, scratch marks, etc., on parts such as anodes, deflection plates and apertures, which, during tube operation, are subjected to high voltages. Highly polished surfaces on such parts prevent high voltage gradients, the cause for cold emission.

1. MATERIALS

A32 Phosphoric Acid - H_3PO_4 (85%)
S22 Sulphuric Acid - H_2SO_4 Conc. C.P.
§ Phosphoric Pentoxide - P_2O_5
Tap Water
W7E Distilled Water

** DANGER

PHOSPHORIC AND SULPHURIC ACID SAFETY PRECAUTIONS: See 33-2-7C

§Phosphoric Pentoxide in solution is Phosphoric Acid, therefore refer to 33-2-7C for safety precautions.

2. EQUIPMENT REQUIREMENTS

Glass beakers - 1 liter size or larger depending upon production.
Cathode - 15" x 1" x 1/8" (approx.) lead strip for 1 liter beaker. Size of cathode and position of cathode in beaker not critical.
Holders - Of sizes and shapes depending on parts to be polished. The use of copper in the herein specified solution not being harmful, holders may be made of square tinned copper bus bar wire.
Cooling bath - To keep solution below 30°C or preferably a lead cooling coil inside the beaker.
Timing clock
Source of E.M.F. - 10-20 Amp. d-c.

3. ELECTROLYTE - (Deplating Bath)

Prepare electrolyte by mixing phosphoric and sulphuric acids in the following proportions by volume: H_3PO_4 (85%) - 70%
H_2SO_4 Conc. - 30%

Fill beaker to within about 1" from top. Deplate a piece of scrap metal of the same material for 30 min. to introduce metal ions in the bath before starting to use it. The bath absorbs moisture from the air, particularly if cooled by a water bath instead of a cooling coil. This is indicated by the deplating slowing up. Then add 100g of P_2O_5/liter of bath.

Sulphates are precipitated when the bath is used and the H_2SO_4 is consumed. Once a week send a 100cc sample of bath to Laboratory for determination of ratio of H_3PO_4 to H_2SO_4. Add H_2SO_4 to restore the original 70 to 30% ratio.

4. PROCEDURE

a. Mount dry part on holder, placing the part so that gas can rise and leave freely as the part is treated electrolytically.
b. Lower part (used as anode) into deplating bath, immersing as much of the part as must be polished.
c. Apply current - 4 to 10 amp. per sq. in. of surface.

35/EG

4. PROCEDURE (cont'd)

d. Polish or deplate from 3 to 5 minutes to produce a highly polished surface free of most all visible scratches and pits in the surface and burr on the edges.

e. At expiration of polishing time, cut off current and inspect parts. Continue deplating if surface is not satisfactory. Keep a check on temperature of bath so that it does not rise above 30°C.

f. Rinse parts in a beaker into which hot tap water is flowing.

g. Rinse parts in cold distilled water unless there is a seam or fold in the metal, in which case boil in distilled water in a beaker for about 5 min. CAUTION: After parts have been cleaned do not touch them with bare hands.

h. Dry parts on a paper towel.

i. Place dried parts into a clean container such as a cardboard box with cover.

SCHEDULE #2

Same as Schedule #1 34-34-9A except for the following changes.

1. MATERIALS

M15 Methanol
Trisotium Phosphate
Calgonite
A32 Phosporic Acid, Ortho
S22 Sulfuric Acid, Reagent
W72 Distilled Water
Tap Water

** DANGER

PHOSPHORIC ACID HANDLING PRECAUTIONS: See S.N. 33-2-7C.
SULFURIC ACID HANDLING PRECAUTIONS: See S.N. 33-2-7C.

2. EQUIPMENT

a. Kodak timer

b. Electropolishing bath consisting of 2 lead cathodes 7" x 10" and bakelite aperture holder (Model #L 864-T), and D.C. source capable of delivering 20-30 amps. at 11 volts.

3. ELECTROLYTE

a. Same deplating bath as shown in Item #3, Page 1.

4. PROCEDURE

a. Mount parts in holder (bakelite plate with countersunk holes wherein aperture skirt rests), placing the other bakelite plate with stainless steel contact strip on top. Holes drilled through both sides of fixture allow contact of the solution with disks permitting unimpeded polishing action around the aperture. Fasten the plates together with bolts provided for that purpose.
CAUTION: Tighten uniformly but do not strip threads. Do not use jig if all bolts are not in working order. Non-uniform contact will result in defective polishing.

4. PROCEDURE (Schedule #2 Cont.)

b. Place in bath between cathodes and fasten in earthenware crock.

c. Apply current of 20-30 amps. at approximately 11 volts. Any sparking in apparatus should be called to supervisor's attention to prevent burn out.

d. Polish or deplate for approximately 2 minutes with temperature of solution at 38-54°C.(100-130°F.). Minimum temperature for satisfactory polishing is 38°C. but do not exceed 66°C.

e. At expiration of polishing time remove holder from jig and inspect parts. Continue deplating if burr is not entirely removed from inside aperture.

f. Place parts in stainless steel or Nichrome basket and wash in running tap water for 10-15 minutes.

g. Wash in boiling caustic solution for 10-15 minutes. Solution to be made as follows:

1-5% solution trisodium phosphate with 3 grams of Calgonite per liter of solution.

h. Rinse in running tap water followed with distilled water and finally a mothanol rinse.

i. Dry in oven.

NOTE: The removal of burr by this method must not increase size of aperture by more than 0.002" for apertures 0.040" and above. No burr in hole is permitted but 0.001" is permitted perpendicular to hole. Out-of-round for any part must not exceed that specified in Stdzg. Not. 13-1-1RA, page 0-3.

SCHEDULE #3

Initially for grids in Types 5770 and 9C21(LA35).

Solution: A32 Phosphoric Acid, Ortho - 70% by volume
S22 Sulfuric Acid, Reagent - 30% by volume

** DANGER

PHOSPHORIC ACID HANDLING PRECAUTIONS: See S.N. 33-2-7C
SULFURIC ACID HANDLING PRECAUTIONS: See S.N. 33-2-7C

Lead cooling coil for cathode.
Polarity of work - anode.
Voltage - 20 volts.
Current varies.
Time - 1 to 2 minutes.

NOTE: New solution will not clean properly until it has aged at least 1 day. Age by passing current at 20 volts using dummy moly electrode. (Alternate method: New solution can be made to clean properly by adding 5-10 g./liter of molybdic acid, H_2MoO_4.)