



SUBJECT APPLYING CONDUCTIVE COATING TO BULBS
Process Specifications

SUPERSEDED DATE 3/22/49

The standard process for applying conductive coating to inside of kinescopes, oscilloscopes and monoscopes is herein given.

1. MATERIALS

Conductive Coating - as specified on bulb assembly.

A55 Acetone

H7 Hydrofluoric Acid, Technical (5% Solution)

HYDROFLUORIC ACID HANDLING PRECAUTIONS: See S.N. 33-2-7A

** DANGER

2. EQUIPMENT

a. Bulb Rotating Machine - Model No. 799LL - with special clamp to hold 12" bulb and with gauge to indicate lower coating levels.

b. Brush - Newark Brush Co. No. 60708 brush (or equivalent) attached to a brass handle, the overall length of brush and handle combined being about 24". The handle should be bent so that when brush is used inside of a bulb the face of brush will be parallel to sides of bulb. Initially used for 902, 3AP1, 3AP4, 908.

b-1. Brush - Newark Brush Co. No. 60708 brush (or equivalent) held near end of handle by pivots supporting the back of the brush at the middle. The pivots allow brush to tilt according to slope of side of bulb. Brush equipped with bristle support plates. Initially used for 914, 5AP4, 5BP4, 5AP1, & 5BP1.

b-2. Brush (Stripping) - Bristle end of small flat camel hair brush (about 1/2" wide) attached to a handle of suitable length by means of a hinge so that angle of brush with respect to handle can be changed by pulling a wire which is attached to hinge to which brush is fastened. Used for 912 and 914.

b-3. Brush - Pivoted brush (like item b-1) on handle which is hinged 4" below brush pivots and normally held in line with handle by means of a coil spring. A wire with a loop or ring at end permits hinge to be pulled down to change angle of brush with respect to handle. Initially used for 7AP4.

b-4. Brush - Slide rod operated hinged brush for 9" bulbs. Overall length handle, hinge and brush - 32"; handle length to hinge 24"; hinge length 5-1/4"; three brushes (bristle area per brush 3/8" x 1-5/8") and to end on flat spring 5-1/2" long; middle of spring attached to end of hinge. Initially used for 9AP4.

b-5. Brush - Slide rod operated hinged brush for short 9" bulbs. Overall length 35"; handle length to hinge 30-1/4"; hinge length 3-1/2". Single brush (bristle area - 2-1/2" x 9/16"; bristle length 7/16") pivoted, near middle of back, to end of hinge. Initially used for 9AP4 and 9BP4.

b-6. Brush - Slide rod operated hinged brush for 12" bulbs. Overall length - 40"; handle length to hinge - 30"; hinge length - 6-5/8"; 3 brushes (3/8" x 1-5/8" bristle area) end to end on flat spring 6-1/4" long; middle of spring attached to end of hinge. Initially used for 12AP4.

b-7. Brush - Pivoted brush (like b-3) on handle which is hinged 3" below brush pivots and held in position by a slide wire attached to a handle. Used initially for FB39-1/2-1A & FB56-8 assemblies.



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 TO CATHODE-RAY BULBS BY BRUSHING

2. EQUIPMENT (Cont'd)

Note: Due to the different wall curvatures of the bulbs and the total areas to be coated, different brushes must be used. In general, the size of the brush to be used varies with the size of the bulb, except in certain neck coating operations where neck diameters are small, completion of coating must be done with a smaller size brush.

c. Rotating Baking Machine - Consisting of a 16-head turret, first 4 positions for drying and preheating inside of bulb with heated air, the next 8 positions for baking in gas heated oven, next 2 positions for annealing and remaining 2 positions for cooling and unloading. Four burners for heating flushing air as it passes to the heads are mounted below the turret. An upright sheet metal shield is mounted between each head on the turret. For flushing bulbs with filtered air, each head is equipped with an air inlet to which can be attached a shoulder insert plus a single jet or set of 3 jets made of aluminum or stainless steel tubing. The I.D. of the tubing should normally be about 3/8". Each jet should have a number of pairs of diametrically opposite holes, of approx. 1/8" diameter, along sides at its upper end and should be baffled about 1/4" from the top end with a circular shield. The shield prevents hot air from top of jet from blowing directly against fluorescent screen in a bulb supported over jet. The vertical spacing between pairs of holes should be about 1" and the jet tube should contain holes down to a level corresponding to that of the OD line of bulb when a bulb or bulb assembly is supported over a jet so that inner bulb face is about 2" above jet shield. Holes should be staggered, this being usually done by drilling alternate pairs of holes at right angles to each other.

A filter, such as a Staynew Mod. CPH-0 pipe line filter, must be used to filter air supplied to jets, the filter being connected to a 60-65 lb. air line.

Note: The air filter should be cleaned at least once per day of operation by opening drain valve and allowing air to blow thru a clean cloth held under drain nozzle until dirt or an oil smudge no longer settled on the cloth.

Each head is equipped with a 2 vertical metal rods with supports to which bulb holders may be attached. Bulb holders are made of "Transite" blocks cut suitably to position 1 large, 2 medium or 3 small bulbs over air jets.

Baking temperatures are read from 4 thermocouples, 2 each at 4th and 9th positions. Baking temperatures specified shall be those as read with two thermocouples almost in direct contact with diametrically opposite sides of a bulb at level of lower edge of fluorescent screen and in a plane which passes thru axis of bulb and makes an angle of about 35° to 40° with a radial plane thru axis of bulb holder (or bulb) and axis of turret, the location of thermocouple farthest from center of machine being at right of radial plane.

SCALE—

DIMENSIONS IN

UNLESS OTHERWISE SHOWN.

DIMENSIONS SHOWN WITHOUT TOLERANCES ARE DESIGN CENTERS

BEA-35 DS

* CHANGE
 ** ADDITION
 *** DELETION

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2. EQUIPMENT (Cont'd)

- d. Vertical Gas Baking Oven - The oven must be equipped with vertical jets, made of aluminum or stainless steel tubing, for blowing a stream of filtered air into each bulb. The construction of jets should be essentially the same as that of jets described in Sec. 2c. Air may be filtered through an Allen filter or through a DeVilbiss filter. Filters should be blown out daily. Candles in Allen filters should be replaced at intervals of 6 weeks or less and inserts in DeVilbiss filters should be replaced as often as necessary to insure effective filtering.
- e. Reflector type electric heaters (800W) suspended, face downward, on adjustable brackets on stands. A heater is required for each jet.
Air filter - Such as an Allen filter, on a 60-65 lb. air line.
Note: The Allen filter should be blown out daily and the Alundum candle should be replaced at least after every 6 weeks of use or whenever it is found to be dirty.
Bulb holders and clamps and their supporting stands.
- f. Evaporating dish and cover such as 6" watch glass.
- g. Swabs, trimming rods, beakers, etc.
- h. Leakage test equipment - Use 3000 to 7000 V. d.c., from high voltage rectifier, and microammeter (approx. 100 µa).
- i. Continuity test equipment - Voltmeter, 'B' battery (4.5V), and leads (one with tinfoil tipped extension wire).
- j. Spark coil.

3. COATING PROCEDURE

A. PRECAUTIONS

- 1. The screen material or pattern in top of bulb must be kept clean at all times and must not be scratched or otherwise marred.
- 2. If protruding bristles on brush cause streaks in coating, trim off bristles with a pair of scissors.
- 3. Thin coating material with distilled water.
- 4. Cover receptacle containing coating material after operation is stopped or interrupted.
- 5. At close of working periods or when coating operation is otherwise interrupted or stopped, clean brush by washing in water and then acetone.
- 6. The following precautions apply specifically to the 5TP4, 5WP11, and 5WP15 bulbs:
 - (a) Graphite coating shall flow 5-6 inches on a 60° inclined glass plate. Plate must be clean and dry.
 - (b) Coating consistency shall be checked every four hours and after every addition of new coating to the agitator. A record shall be kept of date, time, length of flow, and operator. Coating may be thinned by addition of water or thin coating. To thicken coating allow to stand, then decant excess water from top of jar.
 - (c) Agitator shall be cleaned at least once per day - preferably at end of each shift.

11-494-7-60 PCL10942-121/bw



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SUPERSEDED DATE 8/5/42

3. COATING PROCEDURE (Cont.)

Note: The coating should be applied sufficiently uniform to leave no sizeable bare streaks. The presence of fine streaks is permissible, providing they do not meet and form continuous bare steaks which completely sever the coating. During use the coating material in the evaporating dish should be frequently mixed by stirring. To avoid streaked coating, particularly at the upper limit, the brush should be wiped with a clean cloth to remove the dried coating material which causes the difficulty.

B. Applying Coating to Inside of Bulb Assemblies

Note: Before applying conductive coating, if anode lead connector coating or silver stripes are specified for the bulb assembly, apply the former by process 34-17-11D and the latter by procedure given in Item 4.

1. Shake conductive coating preparation and pour a quantity into an evaporating dish.
2. Mount bulb vertically (neck down) in a bulb rotating machine in all cases except with bulb for 912 and bulbs with diameters larger than 5", which should be set at 60° angle with the vertical.
3. Set gauge to indicate lower limit to which bulb should be coated. An experienced operator can estimate location of upper limit without use of gauge or gauge mark.
4. Rotate bulb at 65 R.P.M. or other rate of speed if desirable.
5. a. Remove fluorescent material from side walls of bulb and trim screen. A light smudge on the sides in a bulb is permissible.
- **b. P7 Types only: Clean silicate ring from inside of bulb by using a hinge type brush dampened with a 5% solution of hydrofluoric acid.
6. Use suitable brush for application of conductive coating in bulbs. See note following 2B-6.

At start of operation, i.e., to apply coating to inside of first bulb, saturate entire brush with coating preparation and shake off excess material; to coat succeeding bulbs wet the end of brush only each time it is to be used. Brush should contain material sufficient for one complete application on bulbs up to 5" diameter, inclusive. In the application of coating to larger type bulbs and also with conductive coating such as P9 or equivalent, the brush must be moistened more than once to complete the coating. Do not allow brush to become too wet, as coating will run down sides of bulbs, which is objectionable. Coating which is too thin will also run. Proceed with operation as follows:

- a. (General Procedure) - Insert brush into bulb, being careful not to apply coating on bulb below level of lower gauge, and move brush toward top of bulb. When brush reaches upper coating limit hold brush in position against glass until upper edge of coating has been evenly applied. Then coat remainder of surface by gradually withdrawing brush handle until lower gauge limit has been reached and bulb has rotated sufficiently to allow lower edge of coating to be evenly formed. Remove brush from bulb carefully so as not to get coating on bulb below lower limit.

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3. COATING PROCEDURE (Cont'd)

6. (Cont'd)

Bake as per schedule given on bulb assembly, Item (a) being baking temperature and time, Item (b) the flushing air pressure and Item (c) the distance from end of air jet to screen **and air pipe numbers which items may not be present in some cases. (See Item 7)
→
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**(See page 6 a for tabulation of air pipe numbers)

Note: When bulb assemblies have neck assemblies and/or deflecting plate leads coming through sides of tube instead of through base, windows for these leads must be left in coating, and necks must be spliced to bulbs. These procedures are described in following items b, c, and d.

b. (Initially used for FB72-30E assembly). Proceed as in (a) but coat only to where window begins as determined by gauge. Drop brush down about 1" and start coating again until lower limit is reached. Then stop machine and connect upper and lower coatings with a suitable brush, leaving two 1" sq. windows in coating diametrically opposite. Bake as per schedule.

c. (Initially used for 914 type). Coat bulb as in B6a, then bake as per schedule. Splice neck and bulb on glass working lathe, sealing in deflection plates during this operation. Apply connecting stripes of specified width between coating on bulb and that part of neck which is to be coated using 2b2 brush. Stripes should appear midway in clear spaces between deflection plates lead beads and should overlap 1" on the coating area in both bulb and neck. Dry in reflection type heater for 2 min. with hot air at a temperature of 75° to 85°C flowing freely from holes in air jets. Apply coating to inside of neck in essentially the same manner as the bulb. Upper edge of coating should extend to about 1-1/2" of seal. The length of the coating should be such as to obtain the specified distance from the edge of screen in the top of bulb. Bake as per schedule.

d. (Initially used for 912 type). When item (c) cannot be followed in coating neck due to construction of plate assembly, coat bulb as in item B6a and bake as per schedule. Coat neck in essentially the same manner as bulb. One edge of coating should extend to within 3/4" from large end of neck and length of coated surface should be such as to obtain the specified distance from edge of screen to lower edge of coating. Bake as per schedule.

When specified on FB assembly, polish neck coating to a smooth surface with rod (at least 3/4" dia.) covered with silk or rayon. Splice neck and bulb on glass working lathe. The deflection plates are sealed in during this operation.

Connect coating in bulb and neck by painting 3/4" width stripes of the specified coating material midway in the clear spaces between deflection plate lead beads, overlapping the stripes 1" on the coating in both the bulb and neck. Bake as per schedule.

3-474-1-60 PCL7697-121BH

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SUPERSEDED DATE 4/10/47

3. COATING PROCEDURE (Cont'd)

6. (Cont'd)

e. (Initially used for FB39 1/2-1A and FB56-8 asslys). To coat upper rim of bulb except for 2 small windows, one above contact button and the other to its right, do not rotate bulb, i.e. sweep brush back and forth beginning with a straight upper edge and working down to below button contact. Then start rotating and coating remainder of bulb and neck to lower limit. Bake as per schedule.

** Note: Standard inspection instructions are specified on p.6. The following instructions apply only to 5TP4, 5WP11, and 5WP15 bulbs.

- (1). Check upper and lower edges of coating with contour gage showing limits given on bulb assembly. Reject bulb if coating is out of limits or if edges are **ragged** and/ or uneven. (The lower edge may be trimmed with a moist, clean cloth.)
- (2) Inspect coating in neck and cone by holding bulb up to direct light. Check coating both by outside appearance and by looking down neck,
- (3) Reject bulb if coating shows:
 - (a) Blistered, peeling, or loose areas anywhere in cone or neck.
 - (b) Bare streaks in cone forming a continuous line or break longer than 1/3 of bulb circumference or more than 1/16" wide.
Permissible breaks must be covered with aluminum.
 - (c) Windows in cone larger than 1/4" x 1/4". Permissible windows must be covered with aluminum.
 - (d) More than one bare streak in neck of bulb more than 1" long and 1/16" wide and/ or more than one bare spot larger than 1/8" x 1/8", except that neither is permissible in lower 3/4" area of coating.
- (4) There shall be no open or breaks in the aluminum when viewed under normal room lighting.



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 TO CATHODE RAY BULBS BY BRUSHING

SUPERSEDED DATE 12/16/43

3. COATING PROCEDURE (cont.)

6. (cont)

f. Inspection

1. Check upper and lower edges of coating with **contour gage showing limits according to bulb assembly. Reject bulb if out of limits or if edges are ragged and uneven. The lower edge may be trimmed with moist clean cloth.
- *2. Inspect coating in cone or neck by holding bulb up to direct light. Reject if coating shows:
 - a - Blistered or peeling areas anywhere in cone or neck.
 - b - Bare streaks to form a continuous line or break around bulb anywhere in cone or neck which width shall not exceed 1/16" or reach 3/5 of bulb circumference.
 - c - One or more vertical bare streaks in neck of bulb more than 1" long and 1/16" wide.
 - d - One bare spot at CD line larger than 1/8" x 1/8".
 - e - Windows in cone or neck larger than 1/4" x 1/4" except if otherwise standardized by type.
3. Bulbs with defective coating may be reclaimed by washing by 34-17-4A Schedule 16B

4. PROCEDURE FOR THE APPLICATION OF SILVER PASTE STRIPS

Where specified, this item precedes the graphite coating and is performed in like manner with the exception that coating is applied with a stripping brush similar to b-2 but using a smaller artists camel hair brush, and dried by flushing with low pressure air.

- a. Pour approx. 1 cc silver paste into a flat wide mouth jar.
- b. Add approx. *2 drops * acetone and mix with glass stirring rod.
- c. Try brushing paste on glass with camels hair brush. Add paste or thinner as required so as to brush smoothly and yet not run.
- d. Mark off stripe boundaries as specified in FB asslys on outside of bulb with china marking pencil.
- e. Put bulb in revolving chuck.
- f. With copper free acetone swab clean inside surface of bulb between boundaries.
- g. Dip camels hair brush in paste and coat inside surface within boundary marks - upper strip first.
- h. Trim off any paste outside boundaries with acetone swab. Important! No trace of paste must remain between stripes and inner edges must be perfectly straight and even.
- i. Dry bulb on low pressure air (filtered) drying rack. Silver will have a dull appearance when dry.
- j. Bake bulb at 325°C for 1/2 hr. to remove oil from coating.
- k. Apply conductive coating and bake as specified in the first part of this notice. NOTE: Conductive coating must overlap by at least 1/16" but must not completely cover silver stripes.

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SUPERSEDED DATE 3/16/44

4A. INSPECTION OF CONDUCTIVE COATING AND SILVER STRIPES

- a. There must be no sharp point or points along the lower edge of the top silver stripe or along the upper edge of the bottom silver stripe. No smears of silver along these edges are acceptable, and no lumps or projections along the silver stripe inside the bulb are acceptable.
 - b. Silver stripes must be completely opaque. Bulb should be inspected by holding it up to a strong light. No lines or light streaks must show in the silver stripes. If such lines are visible, silver must be repaired.
 - c. Conductive coatings must be completely joined to silver stripes and must overlap by at least 1/16 inch but must not completely cover silver stripes. No lines must be visible in upper conductive coating for at least an inch above the silver-graphite joint. Inspect for lines by means of strong light as in item 2.
 - d. No lines must be visible in lower conductive coating when examined against strong light. Lower coating must be completely opaque.
 - e. Glass between silver stripes must be thoroughly clean. No spots of silver, graphite coating, or other material will be accepted. Clean glass with clean cloths and acetone. This is very important. Any specks of material on this glass which are visible when bulb is held up to light will be considered cause for rejection.
5. CHECK FOR LEAKAGE BETWEEN ANODE AND DEFLECTION PLATES in bulb assemblies that have windows in conductive coating for deflection plate leads.

Test for leakage between second anode lead and each deflection plate by application of 3000 V. D.C. and a 100 ua microammeter in series in the circuit. If current exceeds 10 ua between any plate lead and second anode lead, the clear space around plate lead should be treated from the outside with a spark coil. If this does not correct the trouble the spaces must be cleaned on inside with a swab saturated with acetone. Initially used for 912 and 914 types.

→ **AIR PIPE NUMBERS
(Referred to on p.5)

<u>Number</u>	<u>Length</u>	<u>No. & Size of Holes</u>	<u>No. Pipes/Head</u>
1	24"	10-0.120"	1
2	20-3/8	8-0.120	1
3	16-1/4	12-0.120	8
4	16-1/8	10-0.120	3
5	16	10-0.120	4
6	16	10-0.120	2
7	13-1/2	8-0.082	1



RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION

6/17/49 TUBE DEPT. STANDARDIZING

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SUBJECT APPLICATION OF CONDUCTIVE COATING TO CATHODE-RAY BULBS BY BRUSHING

DATE Aug. 5, '42 PAGE 7

STANDARDIZING NOTICE

34-17-11

SUPERSEDED DATE 1/12/42 P. 6

- 6. CHECK FOR SECOND ANODE COATING CONTINUITY in bulb assemblies that have windows in conductive coating for deflection plate leads.

Make continuity test on conductive coating by connecting one lead of continuity tester to No. 2 anode lead on bulb and contacting the coating inside of bulb neck with tinfoil on the wire extension on other lead of tester. With normal conductivity the voltmeter should register full voltage (4-1/2 V) of battery which is used in making continuity test. If voltage reading is zero (0) or extremely low, it is probable that there is an open or a poor silver contact at the bead. Open contacts rarely occur but should one be found, repair contact by painting inside of bead with second anode coating and rebake bulb. Initially used for 912 and 914 types.

Note: Close ends of bulbs which are not to be used immediately after completion of coating operation.

- 7. BAKING IN VERTICAL OVEN

Heat oven gradually to temperature and bake for period as specified on bulb assembly. Shut off burners at end of baking period but continue flushing with air as bulb cools. Allow oven to cool to 200° C. before removing bulbs.

Note: For flushing monoscopes use carbon dioxide instead of air to prevent oxidation of ink lines on printed pattern in bulb.

STANDARDIZING SECTION
RESEARCH & ENGINEERING DEPT.

MSa, CSw-39