SUBJECT SEALING PROCEDURES - Cathode-Ray Tubes

Supersedes former 18-3-3.

Cathode-ray tube sealing schedules given herein include standard sealing procedures such as:

Neck-to-bulb sealing (except for 1809) and sealing-in of deflection plates - Schedule 1.
Mount-to-bulb sealing - Schedules 2, 3, and 4.

1. EQUIPMENT

Listed below are items of equipment in general use for sealing procedures outlined in sealing schedules in this Stdzg. Notice. Other equipment of features pertaining to equipment required for a particular sealing procedure will be referred to in the sealing schedule affected.

Glass working lathes and necessary fires, chucks, etc.
Cannon burners (gas-air) - Preferably equipped with fingers and graduated index plates to regulate setting of gas and air petcocks within an arc of 90°, i.e., from a closed to a wide open setting.
Hand torches (hydrogen-oxygen).
Glass working tools; Paddles, Reamers, Hooks, Tweezers, Pliers, etc.
Gauges; Template gauges.
Jig mandrels (for holding deflection plate assemblies).
Aligning tools.
Diamond glass cutter.
Rubber hammer.
Air dryers (granular calcium chloride in glass tubes) - For drying blowing-air.
NOTE: Change drying agent at least once every month or more often if necessary due to becoming moist or dirty.
Air filters (alundum filter discs sealed into glass tubes) - Used in blowing-air lines and in vacuum lines.
Vacuum pump, rubber tubing, etc.
Asbestos lined support or rim for holding bulb assembly or sealed-in tube in a cabinet.
Asbestos gloves.
Safety goggles.

2. SEALING SCHEDULES

SCHEDULE 1
(Lathe Sealing)

Sealing necks to bulbs and sealing-in deflection plates at same time - For 904, 905, 907, 909, 912, 914.

Materials Required - Bulb assemblies, neck assemblies or necks, deflection plate assemblies, and second anode assemblies, as specified in Construction Stdzg. Notices.

Equipment - Use horizontal lathe with 4 hydrogen-oxygen burners mounted on carriage. Air from a low pressure line must pass through a dryer and a filter before admitting into a bulb for the purpose of blowing or shaping the seal during glass working operation.

Procedure

a. Place face of bulb against transite inserts in head stock of lathe and tighten chuck jaws to hold bulb in place, aligning bulb at same time so that it will rotate concentrically about its axis.

b. Place mandrel jig into tail stock and clamp end of mandrel securely. Connect rubber tube for admitting air into bulb to mandrel. Place bulb neck into tail stock jaws, tightening the latter lightly on the neck. Mount deflection plate assemblies (and the No. 2 anode assembly in case of type 904) on the mandrel jig to hold parts in specified relation to each other. Move bulb neck to bring its edge against glass beads on plate leads, (or other leads) in chuck. Neck is held loosely.

c. Shift tail stock to bring open end of bulb about 1/8" from glass beads on leads projecting from jig on mandrel.

IMPORTANT: The top upper deflection plate lead in jig of mandrel should always be in line with number on bulb except in case of type 904 when second anode lead should be located 90° to right of bulb number.

d. Start lathe. R.P.M. - Approx. 50.

e. Using cannon burner and approx. 22" length flame (gas and air petcocks opened 25° and 15° respectively) preheat screen and bulb chuck by heating top half of bulb body and all of bulb face until latter feels hot (approx. 100°C.)when touched with fingers. Approx. 1/2 min on first bulb and 1/4 min. on subsequent bulbs.

f. Using cannon burner and 11-12" length flame (gas and air petcocks opened about 25° and 20° respectively) preheat immediate area about adjoining edges of glass and beading for about 20 sec.

(Cont'd. on next page)

2. SEALING SCHEDULES (Cont'd)

SCHEDULE 1 (Cont'd)

Procedure (Cont'd)

g. Turn on hydrogen-oxygen fires on carriage. (Use 2 burners for 904 and 4 burners for other types). The flames should be medium hard, sharp, 5" long, and concentrate in an arc directly on circumference of adjoining bulb and neck ends. When glass becomes molten, the neck will move forward. When edge of neck has moved just past beaded lead, stop lathe and tighten neck. Start lathe. Concentrate fires on adjoining bulb and neck ends again. When glass becomes molten, move tail stock until glass edges unite and form a complete seal. Then back up tail stock until distances, as measured by a template gauge, from reference line to deflection plate leads, to C D line, and to neck end coincide with standardized dimensions. Admit blowing-air into bulb, as required, to prevent softened glass from losing its shape.

h. Turn off all burners exept one, and stop lathe. On remaining burner oxygen only should be turned off to provide a hydrogen flame for maintaining temperature of seal during bead forming operations which follow.

i. Using a hydrogen-oxygen hand torch (flame length about 5-6") soften glass about a deflection plate lead (or about a second anode lead if one is present) and drop a piece of #27 nonex tubing (cut 8mm long) over deflection plate leads. Soften glass at base of tubing and press into bulb. Repeat on remaining leads. On completion of last bead start lathe and again turn on all fires (hydrogen-oxygen) as described in par. g and reshape seal.

j. When seal is properly shaped and bulb and neck are concentric and even, anneal seal by first playing a 11-12" gas-air flame from a cannon burner directly onto seal for 45 seconds and then with an 8" gas flame (gas petcock opened about 25°, air shut off) for 45 seconds.

k. Loosen and tap mandrel jig screws to make sure that plates are free and then withdraw mandrel from neck of bulb assembly.

l. If at this time a mount is not to be sealed into bulb assembly place latter into an asbestos rimmed holder, connect bulb to vacuum, and exhaust to about 10 microns to remove moisture resulting from sealing operation. (An alundum filter should be used in vacuum line and just ahead of rubber adapter (stopper with hole through center) which is used for making connection to inside of bulb neck.) Shut off vacuum and admit air into bulb slowly to avoid damaging the screen.

2. SEALING SCHEDULES

SCHEDULE 2
(Lathe Sealing)

Mount-to-bulb sealing procedure for 904, 905, 907, 909, 9AP4, & 12AP4.

NOTE: If mounts are to be sealed into salvaged bulb assemblied or into bulb assemblies which after completion of No. 1 sealing schedule operations had to be removed from lathe, proceed as herein instructed, beginning with step 'a' under 'Procedure'. If mounts are to be sealed-in as a continuation of sealing precedure given in Schedule 1, omit steps 'a' and 'b' in Schedule 2.

Materials Required - Bulb and mount assemblies as specified.

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If tube-type numbers have not been previously printed and burned-in on necks of bulb assemblies, the printing should be done prior to mount sealing operation in order to burn-in the ink during this operation. For location of tube tube type number refer to 27-1-1A.

Equipment - Horizontal lathe referred to in Schedule 1.

Procedure

a. Place face of bulb against transite blocks on head stock of lathe and tighten chuck jaws to hold bulb assembly in place, aligning latter at same time so that it will rotate concentrically about its axis. The bottom deflection plate nearest in line with bulb number should preferably be aligned with removable jaw on head stock chuck.

b. Measure a mount, of type to be sealed-in, from top of anode to edge of flare.

c. At a distance equal to this measurement plus 1/8" from a point in line with bottom edges of lower deflection plates and toward bottom end of bulb assembly, mark the neck. At this point scratch a line around circumference of neck with a diamond glass cutter.

e. Play a 1 1/4" length fine pointed hydrogen-oxygen flame from a hand torch directly on this point for about four revolutions, apply a wet cloth, and repeat application of heat and wet cloth immediately, continuing until glass is cracked sufficiently to break off clean (more than two repeated applications are seldom required).

e. Thread rubber tube (for admitting blowing-air into bulb assembly during sealing operation) thru center of tail stock and attach it to the exhaust tube on a mount. (Rubber tubing should be clean inside.)

f. Place exhaust tube into tail stock and clamp into a position such that top of anode No. 2 on mount will be as near as possible to bottom edges of deflection plates without touching them. The filament leads should be in line with tube-type number on bulb neck and the distance from end of bulb neck to stem flare inside should be about 1/8". Start lathe - R.P.M. approx. 50.

***Indicates an elimination.

2. SEALING SCHEDULES (Cont'd)

Procedure (Cont(d)

g. Using cannon burner and 22" length (approx.) flame (gas and air petcocks opened 25° and 15°, respectively) heat screened flace of bulb and chuch from a distance of 12" for about 45 seconds.

h. With the same burner and 8" flame (gas and air petcocks opened about 22° and 12°, respectively) preheat lower 1" of neck from a distance of 1 1/2" for 45 seconds.

i. Using only two hydrogen-oxygen burners (on lathe carriage) and hard fires with flame lengths of about 5", heat neck in region of stem flare. (It may be necessary to play fires from stem flare to end of neck.)

j. When the glass begins to become soft, work it down to stem flare with a carbon paddle. Play fire on end of neck to seal it to stem flare. Use blowing-air, as required, to aid in shaping of seal while it is being heated.

k. Using a steel gauge for accuracy, move tail stock back 8.5mm to give required separation of anode from deflection plates and to obtain proper overall length.

l. If necessary, work glass with paddle to form a 30° shoulder on neck to allow it to enter 13mm into a base. Use blowing-air as required.

m. Anneal seal for 25 seconds with a 11-12" flame from a cannon burner (gas and air petcocks opened 25° and 20° respectively). Stop lathe.

n. Remove sealed-in tube assembly from lathe and place into asbestos rimmed holder. Connect exhaust tube to a line leading to a vacuum pump. An alundum disc filter should be used in vacuum line. Evacuate to about 10 microns and test for leaks around each seal with high frequency coil. Shut off vacuum and admit air into bulb slowly to avoid damaging the screen.

2. SEALING SCHEDULES

SCHEDULE 3
(Lathe Sealing)

Mount-to-bulb sealing procedure for 912, 914

Materials Required - Bulb and mount assemblies as specified.

Equipment - Horizontal lathe referred to in Schedule 1.

Procedure

a. Place bulb assembly into tail stock, aligning removable chuck jaws with serial number on bulb so that position of number in relation to removable jaw will be approximately the same as when deflection plates (and second anode in case of 904) were originally sealed-in. Line up bulb assembly so that it will rotate concentrically about its axis. Several adjustments may be necessary before the bulb and its neck rotate evenly.

b. Using an aligning mandrel in tail stock chuck, move latter to insert mandrel between both sets of deflection plates in bulb assemblies other than for type 904, taking care not to strike plates. (Do not use mandrel in bulb assembly for 904, as the use of a mandrel would damage second anode.) To properly align bulb assembly with mandrel it may be necessary to change angle of bulb by padding a jaw (usually removable jaw) on head stock chuck with a thickness of asbestos cloth or paper. Remove mandrel when alignment is satisfactory.

c. Locate, in following manner, a point on bulb neck where neck must later be cut off, before sealing-in the mount.

1. Measure mount, of type to be sealed-in, from top of anode to edge of flare.

2. From lower edge of black coating on bulb neck or from end of second anode and toward end of neck, measure and mark off a distance equal to length of mount minus (1/4" plus distance end of mount (anode) is to extend above edge of black conductive coating or into second anode after sealing-in). For example, if a mount 5" long is to be sealed into a bulb so that end of mount will extend 1/8" into second anode or above edge of black conductive coating the distance from second anode or black conductive coating to the mark should be 5" minus (1/4" + 1/8") or 4 5/8".

d. Start lathe to rotate bulb and, with a diamond point, score or scratch around circumference of neck at designated place.

e. Play a 1 1/4" length fine pointed hydrogen-oxygen flame (from hand torch) directly onto scratch mark for about 4 revolutions, apply a wet cloth on mark and repeat treatment (heating and chilling) until glass is cracked sufficiently to break off clean (more than 3 applications are seldom required). Stop lathe.

2. SEALING SCHEDULES

SCHEDULE 3 (Cont'd)

Procedure (Cont'd)

f. Attach a length of rubber tubing (must be clean and free from particles of dust, dirt, etc., inside) onto exhaust tube, insert tubing thru tail stock, and after lining up No. 1 deflection plate lead on mount with No. 2 deflection plate lead bead on bulb, tighten mount chuck in tail stock and connect tubing to swivel which in turn connects to low pressure air line. (Air dryer and filter in line ahead of swivel.)

g. Shift tail stock to move mount into bulb neck until stem flare is 1/2" inside of neck.

h. Start lathe and with 8" length flame from cannon fire (gas and air petcocks opened about 22° and 12° respectively) preheat neck and flare for 45 seconds. Also preheat bulb face and chuck.

i. Following preheating, turn on 3 hydrogen-oxygen burners with fire setting such that flames will be confined to a sharp line in form of an arc about 1/4 of the circumference of neck on edge of neck.

j. Move back mount to bring flare (end) 1/8" from end of neck. When glass begins to soften, work it down to stem flare with a paddle. Heat end of neck, sealing it to stem flare. Use blowing-air as required to maintain shape of seal.

k. When flare-to-neck seal is complete, pull out mount about 3/8" until No. 1 anode of mount assembly is correctly located with respect to lower edge of conductive coating (or second anode in case of 904). Use blowing-air as required for shaping seal. This operation should produce a shoulder which can be inserted 13mm into a base. (If seal is too short to insert 13 mm into a base, heat shoulder and work glass to required shape and size with a paddle.)

l. Turn down hydrogen-oxygen sealing fires and play 11-12" length flame from cannon burner (gas and air petcocks opened about 25° and 20° , respectively) directly onto shoulder for about 25 seconds.

m. Turn off air on cannon burner and, with an 8" gas flame from burner, held with end 2" from glass, further anneal glass for 1/2 minute. Stop lathe.

n. Remove sealed-in tube and transfer to asbestos rimmed holder and evacuate to about 10 microns and test for leaks around seals with high frequency coul. When bulb is cool enough to handle admit filtered air slowly in order to avoid damage to screen.

NOTE: The sealing operation (steps i to k incl.) should be completed in about 1 1/2 minutes.

2. SEALING PROCEDURES

SCHEDULE 4

Mount-to-bulb sealing procedure for all types other than those listed in Schedules 1, 2 and 3.

A. EQUIPMENT

1. Sealing unit with 8 revolving heads Model No. 701DD, Serial No. 14 with gauges for adjusting sealing length to that specified. Machine indexes every 55 seconds. Use bulb adapter, RE2904, when sealing bulbs with faces larger than 7".

2. Bulb assembly preheating unit such as "3 Nalco" lamps (260W) with reflectors mounted on line support to heat bulb assemblies in trays.

3. Bulb marking equipment Model No. R933 with gauges to adjust equipment for locating etching for specified type. Place proper etching gauge against stationary neck holder and parallel and against either guide which controls movement of bulb face stop and adjust sliding bulb face stop to end of insert guide.

4. Mount preheating unit consisting of circular metal plate, 10" diam. x 1/4" thick, with 12 positions for holding mounts which are made to revolve around a circular element heated with gas-air flame.

5. Annealer unit electrically heated to around 80°C consisting of transite box 13" wide x 18" long x 17" deep with perforated covers made to fit different types of bulbs.

B. ADJUSTMENT OF FIRES ON SEALING UNIT - Fires described below (used for 5BP4) are intended only as a guide for other types until schedules for these types can be revised to conform to present practices.

No fires at loading (also unloading) position.

#1 Fires - Two very soft (carbonizing) flames from fish-tail burners directed at bulb just above bulb flare. Length of flames 4-5" with burners 2" from bulb and with burner nearer #2 position slightly higher. One sharp flame from #693 burner jet at collar of mount pin. Length of flame 2" with burner 3" from mount pin. Mount pin temperature 230°C.

#2 Fires - Two soft preheating fires from fish-tail burners a little higher than those at #1. Flame 5" long with burners 2" from bulb. One sharp flame from #693 burner jet directed at collar of mount pin. Flame 3" long with jet 2 1/2" from mount pin. Mount pin temperature 320°C.

#3 Fires - One medium flame for drying etching from a fish-tail burner 4 1/2" from bulb with flame 5" long. Two soft flames from fish-tail burners, positioned as the soft flames in #2 fires, 2 1/2" from bulb, flames 5" long. One sharp flame at collar of mount pin from #693 jet 3" from mount pin, flame 5" long. Mount pin temperature 420°C.

2. SEALING PROCEDURES

SCHEDULE 4 (Cont'd)

B. ADJUSTMENT OF FIRES ON SEALING UNIT (Cont'd)

#4 Fires - Sealing position - Two 4-burner sets (#693 jets) diametrically opposed. Each set in an arc 2" from bulb and directed at bulb where seal is to be made. Flames (gas-air oxygen) are sharp and 4" in length.

#5 Fires - Cut-off position - Two 4-burner sets (#693 jets) diametrically opposed. Each set in an arc 1 3/4" from bulb. Flames (gas-air oxygen) directed just slightly below seal and at outer edge are very sharp and 2" long. Blowout for cut-off should have a pressure of about 15 psi. Air filter should be cleaned occasionally. Annealer fires to prevent drop in temperature of bulb as machine indexes from #5 fires to #6 fires. Burner 2" from bulb with medium flames 3 1/2" in length. (Stem pull-down occurs during indexing from #5 to #6 fires.)

#6 Fire - One soft flame from fish-tail burner directed at seal. Burner 1 1/2" from bulb with flame 3 1/2" long.

#7 Fires - One soft flame from fish-tail burner 3" from bulb, flame 3 1/2" long, for annealing seal. One very small flame (about 1/2" in length) from fish-tail burner 2" from tubulation to prevent too rapid cooling of exhaust tubulation at seal.

Note: Mount pin temperature on loading position 190°C.

C. PROCEDURE

1. Adjust bulb guide by placing one end of proper gauge in top of proper mount pin and adjust bulb guide so that it touches other end of gauge. With types 3AP1 and 1808, always place the special spacer underneath lower end of mount pin holder before attempting to adjust bulb guide as described above.

2. Insert preheated mount (240-250°C) into sealing spindle a loading position after raising pressure plate slightly to open jaws for exhaust tube. Remove cullet, if present, before this operation.

3. Lower pressure plate to clamp tubulation.

4. Mark preheated bulb with specified design (stamp), after working device twice without bulb to wet stamp with ink.

5. Insert marked bulb into upper part of head with mount, making sure not to touch or bump mount.

6. Raise bulb assembly till face touches bulb guide which has been swung out previously and then clamp in bulb.

71 Swing back bulb guide and raise mount into bulb assembly. As machine indexes load next potition. NOTE: Watch sealing and cut-off positions. Keep each bulb in these positions till each operation is completed. Start of indexing will be indicated by the lighting of the upper lamp (3 sec.) over center of unit. Lighting of lower lamp indicates that upper lamp is about to light.(15 sec.)

C. PROCEDURE (Cont'd)

8. After sealing, place bulb into annealing unit to cool off, for at least 5 min.

PRECAUTIONS

1. Check centering and loading position of mount.
2. Check overall length.
3. Keep fires adjusted so that seals are straight.
4. Anneal seals carefully to avoid strains.
5. Keep mounts clean and dry.
6. Do not have glass too thin above seal.
7. Do not smear etching.
8. Do not use bulb with scratches or imperfect screens.
9. Do not bump mounts when loading bulb assemblies.

→ ** SCHEDULE 5

Mount-to-bulb sealing procedure for types which initially used an FSB19A stem (lead glass) with a J42F1 (lime or lead) glass bulbs.

A. EQUIPMENT

1. Sealing unit with 16 revolving heads Model No. 701MM with insert gauges for adjusting sealing length to that specified on p.3 of 3-1K-( ) and of 3G-4-( ) notices. Index speed 50 sec.

2. Bulb marking equipment Model No. 790A with insert gauges to adjust equipment for locating etching for each specified type. Use 27C-1-1 white monogram ink for etch. Place proper etching gauge against stationary neck holder and parallel and against either guide which controls movement of bulb face stop and adjust sliding bulb face stop to end of insert gauge.

3. Electrically heated preheating unit consisting of a transite box 13" wide x 18" long x 17" deep with perforated cover, the holes of which are provided with mica inserts to hold mount during preheating.

4. Mount preheating unit consisting of a circular metal plate with 16 positions for holding mounts which are made to revolve around a circular element heated with gas-air flame.

B. ADJUSTMENT OF FIRES ON SEALING UNIT

No fires at loading or unloading positions, #16 and #15, respectively.

#1 Position -

a. One medium flame from a #5250 jet directed at top half of mount pin collar with splash toward top of mount pin. Length of flame 4-1/2" with 2" cone from jet 3-1/2" from mount pin. Temp. of top of mount pin 240°C.

b. Two soft carbonizing flames from 1-18A burners in a horizontal plane and approx. 1-1/2" on each side of #525D jet, directed to outer edge of mount pin. Length of flames 3-1/2" long from jets, burner ends positioned vertically 2-1/2" from mount pin.

SCHEDULE 5 (Cont'd)

B. ADJUSTMENT OF FIRES ON SEALING UNIT (Cont'd)

c. An AGF #693 burner enclosed in a brass tube set at a suitable angle so that heat will be directed on stem flare and tubulation. Length of flame (sharp) to be such that end of flame is just visible in holes drilled in middle portion of brass tube.

#2 Position

a. One medium-sharp flame from 525D jet directed at top half of mount pin collar. Length of flame 4 1/2" with 2" cone from jet 2 1/2" from mount pin.

b. Two soft carbonizing flames same as in #1 position.

c. An AGF #693 burner, the same as in #1 position.

d. Two flood fires from 1-18A burners directed at outer edge of bulb neck where seal is to be made and to burn in etching ink. Mount pin temp. 275°C.

#3 Position

Same as in 2nd position except that flame from 525D jet is a little sharper and AGF #693 burner is not used. Mount pin temp. 315°C.

#4 Position

a. Two sharp flames from 525D jets playing on outside edge of mount pin collar. Length of flames 4 1/2" with 1-3/4" cones from jets 3" from mount pin.

b. Two soft flood fires from 1-18A burners, flames 5" long, set just above or on top of 525D jets, with flames lapping around each side of mount pin.

c. Two soft flood fires from 1-18A burners directed at outside edge of bulb neck where seal is to be made and also to burn in etching ink. Mount pin temp. 360°C.

#5 Position

a. Sharp flames from six 525D burners, set in an arc, with flames directed near top of mount pin. Adjust fires so glass begins to take on a red color approx. ten seconds before machine indexes.

#6 Position (Sealing)

Six very sharp flames, gas-air (or oxygen). Length of flames 4" with 1-1/2" cones from 525D jets 2-3/4" from mount pin. Fires from three jets directed at each edge of mount pin <u>for sealing</u> but not to cut-off cullet, if possible.

#7 Position (Cut-off)

Two sets of four flames each from 525D burners using gas-air (or oxygen). Fires from 4 rear burners set in a straight line directed just below seal across the bulb neck and fires from 2 outside burners of front set directed tangentially to impinge on each side of seal to insure a good bond and 2 inside fires of front set directed perpendicularly to neck 3/16" below top of mount pin to cut-off cullet. Flames are 4-1/4" long with 1-1/4" cones from back jets 2-3/4" away and from front jets 3" away.

B. ADJUSTMENT OF FIRES ON SEALING UNIT (Cont'd)

#8 Position - Same as those in #7 position, except that fires are not quite as sharp and 2 center fires of front burners are directed almost tangentially to each side of seal to heat glass enough for specified pull-down.

#9 Position - Two soft annealing flames about 7" long from 1-18A burners, outlets of which are at same angle as sides of mount pin, directed at a tangent to mount pin so that flames wipe the top of mount pin collar and outer edge of each side of mount pin. Ends of burners positioned 5" from mount pin. Adjust fires so glass along seal will retain a very dull red color when machine indexes.

#10 Position - Two A.G.F. #626N burners each encased in an alundum tube, RA98, 5" long and 1" I.D. with sharp flames extending to endsof tubes. Tips of ceramic tube about 5" from mount pin and heat from one tube directed at seal and area slightly above seal and heat of other tube directed at lower part of seal and tubulation.

#11 Position - Two soft carbonizing flames (burner ends in vertical position) from 1-18A directed on a horizontal line with seal at guides running parallel to bulb length. Flames are 6" long with 1 1/2" cones from burner 3" from mount pin.

#12 Position - Two soft carbonizing flames from 1-18A burners directed at a point midway between 11th and 12th positions to prevent too rapid cooling of seal.

#13 Position - No fires.

#14 Position - One sharp flame from 1-18A burner directed at mount pin collar and upper part of mount pin so that mount pin has a temp. of 200°C when it indexes to loading position (16th).

#15 Position - Unloading - no fires.

#16 Position - A movable jet (A.G.F. #693) enclosed in a brass tube used to prevent flare and tubulation from cooling down before machine indexes to #1 position. Length of flame to be such that end of flame is just visible in holes drilled in middle part of brass tube.

C. PROCEDURE

1. Adjust tube sealing length gauge by placing end of proper insert on top of proper mount pin and adjust bulb gauge so that it touches other end of insert.

2. Adjust marking equipment as described above under "Equipment".

3. Straighten lead wires on stem so that they will not interfere when inserted into mount pin.

4. Place stem for at least 5 min. in electrical preheater, maintained at about 100°C.

5. Place stem for at least 5 min. in circular preheater maintained at 180-200°C.

C. PROCEDURE (Cont'd)

6. Insert preheated mount into sealing spindle at loading position. Remove cullet, if present, before this operation. Swing burner so that heat plays on top of flare and tubulation.

7. Mark bulb with specified monogram (stamp), after working device twice without bulb, to wet stamp with ink.

8. Insert marked bulb into upper part of head with mount, making sure not to touch or bump mount.

9. Bring sealing length gauge over top of bulb and raise bulb till face touches gauge and then clamp in bulb. Release bulb gauge only after mount has been raised into bulb.

Note: When sealing tubes that have button contacts, always align button contact of anode with ceramic support nearest getter.

10. Watch sealing and cut-off positions. Keep bulb in each of these positions till each operation is completed. Lighting of lamp indicates that machine will index at end of 9 sec.

PRECAUTIONS

1. Check centering and loading position of mount.
2. Check overall length.
3. Keep fires adjusted so that seals are straight.
4. Anneal seals carefully to avoid strains.
5. Keep mounts clean and dry.
6. Do not have glass too thin above seal.
7. Do not smear etching.
8. Do not use bulb with scratches or imperfect screens.
9. Do not bump mounts when loading bulb assemblies.
10. Make sure that no bulb spacers are missing.

STANDARDIZING SECTION
ENGINEERING DEPT.

SCHEDULE 6

Mount to bulb sealing procedure initially used for 3H,5F, and 7BP7 tube types.

A. EQUIPMENT:

1. Sealing unit with 16 revolving heads Model No. 701MM with insert gauges for adjusting sealing length. Index speed 45 sec.

2. Bulb marking equipment Model No. 780A with insert gauges to adjust equipment for locating etching for each specified type. Use 27C-1-1 white monogram ink for etch. Place proper gauge against stationary neck holder and hold parallel and against either guide which controls movements of bulb face stop, and adjust sliding bulb face stop to end of insert gauge.

3. Mount preheating unit consisting of a circular metal plate with 16 positions for holding mounts which are made to revolve around a circular element heated with gas-air flame.

B. ADJUSTMENT OF FIRES ON SEALING UNIT

No fires on loading and unloading positions

1. Position (Load) Mount pin temperature 270°C on entering; 250°C on leaving residual heat from position #15.
(Mount pin temperature taken with thermocouple on top edge of mount pin).

2. Position (Pre-heating)
   (a) Heat applied to neck of bulb with RA98 Alundum Norton burners, moderate fire 150°C. (temperature reading obtained with thermocouple suspended at point where neck revolves.
   (b) Direct flame on collar of mount pin adjust #525D American Gas Burner for hard flame, so as to attain a temperature 230°-240°C on leaving. Reading taken on top of pin.

3. Position
   (a) Heat applied to neck of bulb same as position #2 temperature 300°C.
   (b) Hard flame from #525D burner directed at mount pin collar raises temperature to 280°-290°C. on leaving.

4. Position (Pre-heating)
   (a) Heat directed on neck of bulb by two RA98 burners raise temperature 400°C (moderate fires). Temperature reading obtained as in position #2.
   (b) Hard flame form 525D burner directed at collar of mount pin raises temperature to 340°-350°C on leaving.

5. Position (Pre-heating)
   (a) Fish tail burner is utilized to burn etch.
   (b) Heat neck of bulb with (hard fires) RA98. Burners thus attaining a temperature of 500°C, reading obtained as in position #2.
   (c) Direct hard flame on collar of mount pin so temperature rises to 380°-390°C on leaving.

6. Position (Shaping)
   (a) Direct fish tail burner at neck to burn in etch. Flame temperature at neck is 600-650°C.
   (b) To shape neck & seal use four #525D burners.
   (c) Heat from 2 end #525D burners prevents cullet from binding to mount pin (optional)
      (1) 6 #525D burners, 2 ends directed down at cullet, 4 middle directed horizonally at neck, slightly above flare of stem. (Moderate fires, gas & air - use of O_2 optional but not usually necessary).

7. Position (Shaping)
   (a) Heat from four #525D burners to shape seal.
   (b) Heat from two #525D burners to prevent cullet from binding mount pin.
      (1) Same set-up as position #6.
      Fires should be set so that cullet drops in this position prior to index.

8. Position (Cut-off)
   (a) Heat from 4 #525D burners, on both sides of bulb, directed at glass just under the neck and flare seal. Fires hard - gas & air.
   (b) Blow out air usually used in this position (amount of air varies with sealing conditions).

9. Position (Seal Polish)
   (a) Same as position #8 - fires not quite as hard but should be sufficiently hard to keep mount pin red and glass soft for pull down.

10. Position (First Anneal)
   (a) Heat from RA98 burner. Set so that hot draft brushes the seal. Temperature reading of 330°C. obtained with thermocouple suspended in region of sec. 1.

11. Position (Second Anneal)
   (a) Two RA98 burners obtained as in position #10.

12. Position (Third Anneal)
   (a) Two RA98 burners provides annealing - temperature of 240°C.

13. Position (Fourth Anneal)
   (a) One RA98 burner lowers temperature to 200°C.

14. Position (Fifth Anneal)
   (a) One RA98 burner lowers temperature to 150°C.

15. Position (Mount-pin Pre-Heating)
   (a) One RA98 burner directed on bulb neck 90°-100°C.
   (b) Two #525 burner directed on collar of Mount-pin hard flame raises temperature 300°C. on leaving.

16. Position (Unload)
   Temperature 270°C.

PROCEDURE:

1. Adjust tube sealing length gauge by placing end of proper insert on top of proper mount pin and adjust bulb gauge so that it touches other end of insert.

2. Straighten lead wires on stem so that they will not interfere when inserted into mount pin.

3. Load mount into mount pin so that grid lead is directly in line with second anode contact button in bulb.

4. Mark bulb with particular type number polygon etch required.

5. Insert bulb into upper part of head over mount, making sure neither touch the other.

6. Bring sealing length gauge over top of bulb and raise till face touches gauge, tighten bulbs in jaws with wrench, lock bulb in jaws by means of mechanism provided.

7. Watch sealing and cut off positions. Keep bulb in each of these positions, till each operation is completed. Lighting of lamps indicates that machine will index at end of 9 seconds.

PRECAUTIONS:

1. Check centering and loading position of mount.

2. Keep fires properly adjusted so that seals are straight.

3. Anneal seal carefully to avoid strain.

4. Keep mounts clean and dry.

5. Do not smear etching, inspect etch before loading bulb.

6. Make sure no bulb spacers are missing.

7. Remove cullet from unloading position with left hand. Handle mounts with right hand to prevent transfer of glass particles from cullet and mount.

8. Check strain pattern periodically in polariscope and compare with samples provided. See S.N. ⁂ 34-37-18.