

SUBJECT MEASUREMENT & SELECTION OF CATHODE  
ASSEMBLIES & GRID ASSEMBLIES - For  
Cathode-Ray Tubes

SUPERSEDED DATE 11/30/48

The herein outlined procedures for measuring cathode-ray tube cathode assemblies and assemblies comprised of grids, spacers, etc., to permit selection of these parts according to the required cathode-grid spacing, are standard. It is essential that distances between cathode ends and grid apertures be closely controlled in order to obtain proper tube characteristics such as focus, cut-off, maximum current, etc.

## 1. EQUIPMENT REQUIRED

- a. Two dial micrometer (Federal, Mod. No. E8B, 3 1/2" face), one with special sleeve around plunger for measuring cathode assemblies and the other with special sleeve for grid assemblies.
- b. Gauge - for checking cathode assembly micrometer.
- c. Plate - for checking grid assembly micrometer.
- d. Jig - for holding cathode assembly during measurement.
- e. Microscope - Bausch & Lomb, vertical measuring microscope #41942, dial division = .000183" and \*\*#AL471, dial division = .000394".
- f. Microscope platform plate for horizontal and vertical movement of grid assembly.
- g. Illuminator - 6V lamp with vertical illumination attachment and transformer.

- ## 2. PROCEDURE
- PRECAUTION: Handle all parts, tools, and fixture jigs carefully and keep materials as clean as possible.

### a. Checking Micrometers

1. Check cathode assembly micrometer by inserting check gauge all the way into sleeve which encloses micrometer plunger. The micrometer should register .070" or be set to this value by adjusting the dial.
2. Check grid assembly micrometer by pressing a flat piece of metal against bottom of sleeve around plunger. The micrometer should read .100" or else be adjusted to this value, i.e., while plate is against sleeve.

- ### b. Measuring Cathode Assemblies:
- Place cathode assembly, with tab attached into jig (1-d) as far as possible into micrometer sleeve. Note reading, lower jig, turn jig 120°, reinsert jig, and again note reading. (Readings must be taken in three positions due possibility of crooked cathodes). The following rules concerning spread of readings, etc., have been established.

1. If a cathode reading results in a variation from one side to another, take highest value of readings as given above. Thus, a reading of 118, 119 and 120 becomes 120.

- ### c. Measuring Grid Assemblies:
- Slide grid cylinder (with appropriate spacer and shield inserted or as assembled with a combination aperture disc, spacer and shield) over the sleeve thru which micrometer plunger extends, until cylinder comes to a stop. Note micrometer reading. Lower grid cylinder, turn 180°, raise cylinder, and again read micrometer. \*\*Readings should not vary by more than .001". Straighten surface of spacer with flat weight if readings vary.



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- \*\*d. Gauging of spacer eyelets: Spacer eyelets are received and identified on the box as to height in steps of .001" - one size in each box. The height so indicated is not within a tolerance suited for making good K-G assemblies, i.e., a box marked 0.096" will only indicate that the average will be 0.096" high, while some will range ±.001" up or down.

The spacers therefore necessitate a 100% gauging on a dial gauge where they should be sorted accurately in steps of .001" ±.005" and stored in table bins marked with these close tolerance sizes for use in the following procedure.

- \*\*e. Cautions to supervisors: An increase in spacer height is needed when using a part like the I 600A which has raised land on which the cathode rests.

The increased spacer height will be the regular spacer height plus height of the raised land on which the cathode rests.

### 3. TRAYING PARTS

- a. Cathode Assemblies: As cathode assemblies are measured, sort them according to measurements, into clean trays labeled with the respective possible measurements.

Trays are made of solid bakelite 20" long x 6" wide x 3/4" thickness in which holes 5/8" in diameter have been sunk to a depth of 1/4". Holes are spaced about 1" apart, center to center. To allow cathode assembly to remain upright in tray and to prevent contamination of end of cathode, the hole with diameter of 3/8" is continued through tray.

For storing cathode assemblies, use clean metal trays with corrugated bottoms, enclosing trays in suitable envelopes. Trays should be blown out daily with clean low pressure air to remove dust. All trays are to be washed before initial use and thereafter at the least sign of dirt which cannot be removed by the air blast.

NOTE: In order that trays may be cleaned daily the production of cathode assemblies should preferably be controlled so that they can all be used during the same day.

- b. Grid Assemblies: Flat bottom boats are required.

### 4. INSERTION

- a. The selection of the cathode and grid will, of course, be governed by the spacing desired. For example, if a spacing of .004" is desired, the grid spacing will depend upon the cathode spacing. If the cathode has a reading of .120" the grid reading must be .124".



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- b. After selection of cathode and grid, insert cathode. If a shield is specified, place it over cathode and insert retaining ring by means of an arbor press.
  - c. Weld retaining ring. If light shield is specified, insert and weld.
5. CHECK 100% FOR ACTUAL SPACING OF GRID TO CATHODE
- a. Turn on and adjust light to suitable location for grid inspection.
  - b. Raise microscope and insert assembly.
  - c. Move vernier or counter to 0.
  - d. Locate grid with aperture hole upward directly below microscope lens.
  - e. With coarse adjustment bring surface of aperture hole into sharp focus.
  - f. With vernier adjustment bring cathode coating surface into sharp focus.
  - g. Vernier or counter reading multiplied by dial division value minus aperture thickness gives actual spacing, reject limits of which are shown on FGK assemblies.
6. SUPERVISORY CHECKS
- a. See that trays are clean and blown with air daily and used correctly.
  - b. See that cathode micrometer is blown out so that cathode coating will not collect inside and possibly affect the spacing.
  - c. Check arbor press insertion constantly because this operation presents the greatest source of trouble.
  - d. See that cathode electrode is in good shape and that indentation in the end is not worn down.
  - e. Check welding of cathode tabs.
  - f. Put away micrometers every evening.
  - g. See that the initial checks are frequently repeated to insure accurate micrometer dial settings at all times.
  - h. Place assemblies face down in trays.
  - i. Do not lay parts on benches. Return to tray after each operation.
  - j. Keep assemblies covered as much as possible, i.e., keep covered if waiting before being assembled into guns.
  - k. An increase in spacer height is needed when using a part like the I600A which has raised land on which the cathode rests.
  - l. The increased spacer height will be the regular spacer height plus height of the raised land on which the cathode rests.

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5. CHECK 100% FOR ACTUAL SPACING OF GRID TO CATHODE (Cont'd)

Microscope Calibration on Johansen Blocks  
H.R. Patterson 3/25/44

.0075" RA3 Spacing (.000408" per ct.) ** .000386" per ct.		** (.000368" per ct.)		Units of Count
AL471	AL445	AK6939		
.00270	.002150	.001700		25
.003108	.002563	.002068		26
.003516	.002922	.002436		27
.003924	.003308	.002804		28
.004332	.003694	.003172		29
.004740	.004080	.003540		30
.005148	.004466	.003908		31
.005556	.004852	.004276		32
.005964	.005238	.004644		33
.006372	.005624	.005012		34
.006780	.006010	.005380		35
.007188	.006396	.005748		36
.007596	.006782	.006116		37
.008004	.007168	.006484		38
.008412	.007554	.006852		39
.008820	.007940	.007220		40
.009228	.008326	.007588		41
.009636	.008712	.007956		42
.010044	.009098	.008324		43
.010452	.009484	.008692		44
.010860	.009870	.009060		45
.011268	.010256	.009428		46
.011676	.010642	.009796		47
.012084	.011028	.010164		48
.012492	.011414	.010532		49
.012900	.011800	.010900		50
.013308	.012186	.011268		51
.013718	.012572	.011636		52
.014124	.012958	.012004		53
.014532	.013344	.012372		54
.014940	.013730	.012740		55
.015348	.014116	.013108		56
.015756	.014502	.013476		57
.016164	.014888	.013844		58
.016572	.015274	.014212		59
.016980	.015660	.014580		60
.017388	.016046	.014948		61
.017796	.016432	.015316		62
.018204	.016818	.015684		63
.018612	.017204	.016052		64
.019020	.017590	.016420		65
.019428	.017976	.016788		66
.019836	.018362	.017156		67
.020244	.018748	.017524		68
.020652	.019134	.017892		69
.021060	.019520	.018260		70
.021468	.019906	.018628		71
.021876	.020292	.018996		72
.022284	.020678	.019364		73
.022692	.021064	.019732		74
.023100	.021450	.020100		75

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SUBJECT GRID-CATHODE SPACE CHECKING  
Process Specification

SUPERSEDED DATE

ELECTRICAL METHOD

This method of grid-cathode space checking is much faster than the preceding microscope method and has initially been adopted as standard by the Lancaster Cathode-Ray Tube Factory. (The preceding specifications, pp. 1-4 incl., for the microscope method still apply in calibrating the electrical equipment herein specified.)

1. **PRINCIPLE:** The principle of operation for the grid-cathode space checker is based upon a relationship obtainable between applied voltage to the grid-cathode assly. and grid-cathode separation. A sufficiently high voltage must be applied between the grid aperture and cathode to cause dielectric breakdown and consequent arcing across the spacing between the two. The establishment of the arc across the spacing is uncertain within the limits of measurement, therefore, the voltage across the spacing must be raised above the high voltage limit and for subsequent measurements decreased to the desired values. Adverse effects to cathode surface due to excessive currents are prevented by current limiting resistor R1-10. Current flow is indicated by lighting of neon glow bulbs.
2. **PROCEDURE:**
  - a. Line switch is closed - "line on" bulb lights.
  - b. All equipment doors must be closed before "H.V." indicator lights due to interlock circuits.
  - c. Set must be calibrated as follows:
    - (1) Initial Calibration.  
Calibration meter is on low voltage side of accurate ratio potential transformer. Meter must read 25 ma full scale at 88.65 volts r.m.s. primary voltage which should indicate within an accuracy of 99.98% a secondary r.m.s. voltage of 1773 volts on a voltmeter across the secondary circuit. Meter adjustment to cause full scale reading is made by variable resistor R21.
    - (2) Floor Calibration.  
Recheck of calibration points made periodically using same procedure as for Initial Calibration with one exception - no secondary voltage check is used.
  - d. To determine value of multiplier resistors which will convert meter readings to suit any g-k used.
    - (1) Lo and Hi meters must be calibrated to multiplier unit for 25 ma red line reading.
    - (2) From cutoff limits noted on test sets, high and low limit voltage test points are selected and reduced to primary transformer voltages.
    - (3) Knowing desired amperage reading and required primary voltage the ratio of Pri. Voltage = resistance in multiplier unit - Amp. desired. Done for both limits.  
Caution - Meter calibration lines must be observed otherwise meters will go offscale when voltage is driven over high limit.
  - e. The voltage vs spacing characteristic for separation information is obtained by inspecting per the microscope method (pp 1-4 of this spec.) cathodes which meet test set cutoff specifications.

4-493-29-60 WJF, JMG - 121/bw





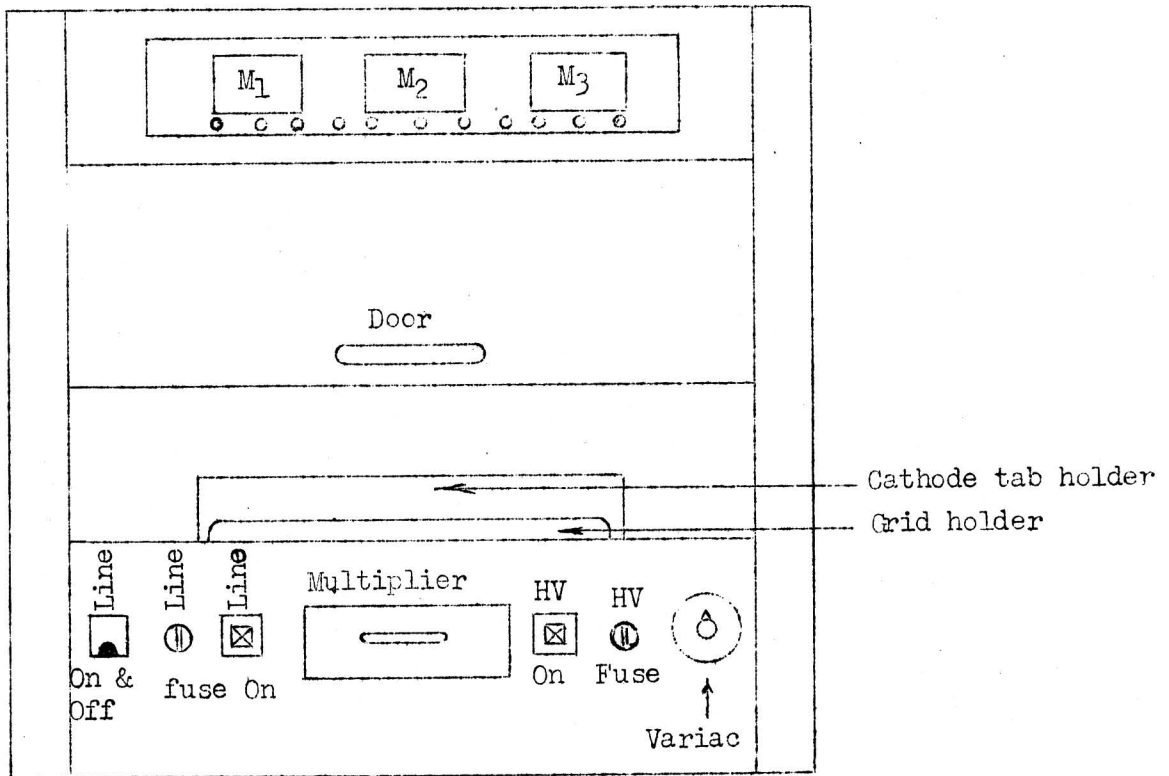
SUBJECT GRID-CATHODE SPACE CHECKING  
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3. GRID-CATHODE SPACE CHECKER

a. Operating Instructions:

- (1) Insert 15AP4 Multiplier into grid-cathode space checker.
- (2) Raise sliding door-releasing interlock, to place grid-cathode assembly in testing panel.
- (3) Place grid-cathode assembly in holder, inserting both cathode tabs in connector. Care must be taken not to cause grid to cathode short by allowing either cathode tab to touch the grid cylinder or any part attached thereto.
- (4) Using variac, raise voltage above test limits to establish a steady arc as indicated by all lights lighting.
- (5) Lower voltage to upper test limit as indicated on M<sub>3</sub>. Observe all lights that are out.
- (6) Lower voltage to lower test limit as indicated on M<sub>2</sub>. Observe all lights that remain on.
- (7) Remove all grid-cathode assemblies and place in trays according to the following characteristics.
  - (a) Those indicating no light at upper voltage limit, place in box for holding G-K spacing too great.
  - (b) Those that indicate a light at lower voltage limit, place in box for holding G-K spacing too small.
  - (c) Those that indicate light at high voltage limit and no light at low voltage limit in box for holding G-K spacing that is correct.
- (8) If a G-K short exists, it would be indicated by the neon bulb refusing to extinguish.



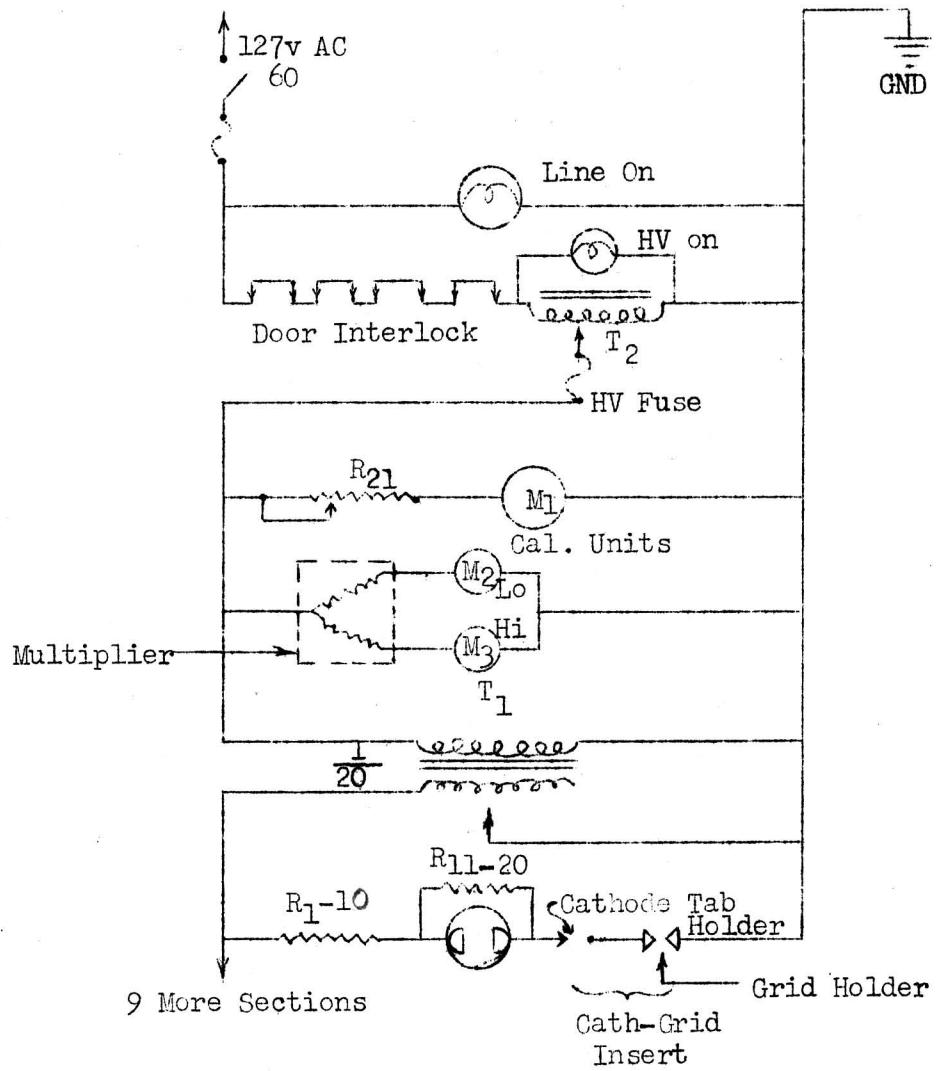


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Grid-Cathode Space Checker

Equipment Model 74 FEA  
 Equipment Schematic Diagram



- T<sub>1</sub> - G.E. Potential Transformer
- T<sub>2</sub> - General Radio Variac
- R<sub>21</sub> - Var-Resistor - 2000  $\Omega$
- R<sub>11-20</sub> - Resistor - 20 meg  $\Omega$
- R<sub>1-10</sub> - Resistor - 2meg  $\Omega$
- M<sub>1</sub> - Calibration
- M<sub>2</sub> - Low Limit Meter
- M<sub>3</sub> - High Limit Meter

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GRID-CATHODE SPACE CHECKING

SUBJECT: Process Specification

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MICROSCOPE METHOD

This method of grid-cathode space checking has been adopted by the Lancaster Development Shop and is initially standard for the developmental cathode ray tube types. C73162, C73262, C73294, C73295, C73140 and C73331.

1. EQUIPMENT Bausch & Lomb, Model VM25 microscope.

2. PROCEDURE

- a. Place grid-cathode assembly under microscope and focus on the grid surface.
- b. Using centering knobs, move microscope carriage until grid aperture is centered with respect to microscope viewing area.
- c. Set vernier height adjustment to zero and using large double screw adjustment, focus on cathode surface.
- d. Rotate vernier height adjustment 3 full revolutions counterclockwise.
- e. Turn vertical adjustment knob (on extreme right of carriage) clockwise till grid aperture just disappears from view.
- f. Adjust vernier height adjustment till grid surface is in focus and read spacing in millimeters on the height adjustment. Three revolutions represent 0.300 mm.

SCALE—

DIMENSIONS IN

UNLESS OTHERWISE SHOWN.

DIMENSIONS SHOWN WITHOUT TOLERANCES ARE DESIGN CENTERS

7-516-4-61 GRF-126DS

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