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## DISPLAY STORAGE TUBE

DIRECT-VIEW TYPE  
4"-DIAMETER DISPLAY  
NON-EQUILIBRIUM WRITING GRID-CONTROL READING (VIEWING)

## DATA

## General:

## Writing Section Viewing Section

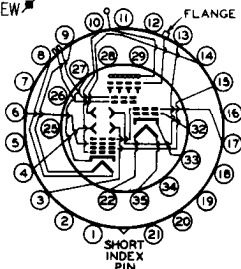
|                                               |                                                    |                   |                    |
|-----------------------------------------------|----------------------------------------------------|-------------------|--------------------|
| Heater, for Unipotential Cathode:             |                                                    |                   |                    |
| Voltage (AC or DC) . . . . .                  | 6.3                                                | 6.3               | volts              |
| Current . . . . .                             | 0.6                                                | 0.6               | amp                |
| Minimum Cathode Heating Time                  |                                                    |                   |                    |
| before other electrode volt-                  |                                                    |                   |                    |
| ages are applied. . . . .                     | -                                                  | 30                | sec                |
| Direct Interelectrode                         |                                                    |                   |                    |
| Capacitances (Approx.): <sup>o</sup>          |                                                    |                   |                    |
| Grid No. 1 to all other                       |                                                    |                   |                    |
| tube electrodes . . . . .                     | 6                                                  | 18                | $\mu\text{uf}$     |
| Cathode to all other                          |                                                    |                   |                    |
| tube electrodes . . . . .                     | 4.2                                                | 6.5               | $\mu\text{uf}$     |
| Deflecting electrode DJ <sub>1</sub> to       |                                                    |                   |                    |
| deflecting electrode DJ <sub>2</sub> . . .    | 1.8                                                | -                 | $\mu\text{uf}$     |
| Deflecting electrode DJ <sub>3</sub> to       |                                                    |                   |                    |
| deflecting electrode DJ <sub>4</sub> . . .    | 1.8                                                | -                 | $\mu\text{uf}$     |
| DJ <sub>1</sub> to all other tube electrodes. | 7.5                                                | -                 | $\mu\text{uf}$     |
| DJ <sub>2</sub> to all other tube electrodes. | 8                                                  | -                 | $\mu\text{uf}$     |
| DJ <sub>3</sub> to all other tube electrodes. | 6                                                  | -                 | $\mu\text{uf}$     |
| DJ <sub>4</sub> to all other tube electrodes. | 7.                                                 | -                 | $\mu\text{uf}$     |
| Focusing Method . . . . .                     | Electrostatic                                      | None              |                    |
| Deflection Method . . . . .                   | Electrostatic                                      | None              |                    |
| Deflecting-Electrode Arrangement.             | See Dimen-                                         | -                 |                    |
|                                               | sional Outline                                     |                   |                    |
| Phosphor. . . . .                             | -                                                  | High-Visual-Effi- |                    |
|                                               |                                                    | ciency Type,      |                    |
|                                               |                                                    | Aluminized        |                    |
| Fluorescence . . . . .                        | -                                                  | Yellow            |                    |
| Phosphorescence. . . . .                      | -                                                  | Yellow            |                    |
| Minimum Useful Screen Diameter. . . . .       |                                                    |                   | 4"                 |
| Maximum Overall Length. . . . .               |                                                    |                   | 15-1/2"            |
| Seated Length . . . . .                       |                                                    |                   | 14" $\pm$ 3/8"     |
| Maximum Tube Radius . . . . .                 |                                                    |                   | 3-5/32"            |
| Bulb-Flange Diameter. . . . .                 |                                                    |                   | 5-1/8" $\pm$ 1/16" |
| Greatest Bulb Diameter. . . . .               |                                                    |                   | 5" $\pm$ 1/16"     |
| Bulb Terminals:                               |                                                    |                   |                    |
| Caps (Two). . . . .                           | Recessed Small Cavity (JETEC No. J1-21)            |                   |                    |
| Flange. . . . .                               | See Dimensional Outline                            |                   |                    |
| Flexible cable. . . . .                       | See Dimensional Outline                            |                   |                    |
| Ambient-Temperature Range . . . . .           | -65° to +100 °C                                    |                   |                    |
| Mounting Position . . . . .                   | . . . . . Any                                      |                   |                    |
| Weight (Approx.). . . . .                     | 2 lbs                                              |                   |                    |
| Socket. . . . .                               | Alden Part No. 435SBA, or equivalent               |                   |                    |
| Base. . . . .                                 | Small-Button Thirtyfivar 31-Pin (JETEC No. E31-36) |                   |                    |

<sup>o</sup> without external shield.



## DISPLAY STORAGE TUBE

BOTTOM VIEW



Pin 1—No Connection

Pin 2—Same as Pin 1

Pin 3—Deflecting Electrode  $DJ_4$  of Writing Gun

Pin 4—Deflecting Electrode  $DJ_3$  of Writing Gun

Pin 5—Same as Pin 1

Pin 6—Grid No.3 of Writing Gun

Pin 7—Same as Pin 1

Pin 8—Heater of Writing Gun

Pin 9—Heater of Writing Gun

Pin 10—Grid No.1 of Writing Gun

Pin 11—Same as Pin 1

Pin 12—Same as Pin 1

Pin 13—Deflecting Electrode  $DJ_1$  of Writing Gun

Pin 14—Deflecting Electrode  $DJ_2$  of Writing Gun

Pin 15—Grid No.2 of Writing Gun

Pin 16—Internal Connection—Do Not Use

Pin 17—Grid No.4 of Writing Gun, Grid No.2 of Viewing Gun

Pin 18—Same as Pin 1

Pin 19—Same as Pin 1

Pin 20—Same as Pin 16

Pin 21—Same as Pin 1

Pin 22—Heater of Viewing Gun

Pin 25—Same as Pin 1

Pin 26—Same as Pin 1

Pin 27—Cathode of Writing Gun

Pin 28—Same as Pin 1

Pin 29—Same as Pin 1

Pin 32—Grid No.1 of Viewing Gun

Pin 33—Cathode of Viewing Gun

Pin 34—Same as Pin 1

Pin 35—Heater of Viewing Gun

Flexible Cable—Connection to Screen

Flange—Backing—Electrode

Recessed Cavity Cap—Nearer Tube

Face—Grid No.4 of Viewing Gun

Nearer Electron

Guns—Grid No.3 of Viewing Gun

## Maximum Ratings, Absolute Values:

## Writing Section Viewing Section\*\*

|                                          |   |            |       |
|------------------------------------------|---|------------|-------|
| SCREEN VOLTAGE . . . . .                 | — | 11000 max. | volts |
| PEAK BACKING-ELECTRODE VOLTAGE . . . . . | — | 20 max     | volts |

\* Pins 23 and 31 are not shown because they are trimmed to the same dimension as the short index pin and are not to be used.

\*\* See next page.



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## DISPLAY STORAGE TUBE

|                               | Writing Section | Viewing Section** |                |
|-------------------------------|-----------------|-------------------|----------------|
| Equivalent Values             |                 |                   |                |
| GRID-No.4 VOLTAGE . . . . .   | 2900 max.*      | 150 max.**        | 300 max. volts |
| GRID-No.3 VOLTAGE . . . . .   | 1000 max.*      | —                 | 300 max. volts |
| GRID-No.2 VOLTAGE . . . . .   | 2750 max.*      | —                 | 150 max. volts |
| CATHODE VOLTAGE . . . . .     | —               | -2900 max.**      | — volts        |
| GRID-No.1 VOLTAGE:            |                 |                   |                |
| Negative bias value . . . . . | 200 max.*       | 100 max.          | volts          |
| Positive bias value . . . . . | 0 max.*         | 0 max.            | volts          |
| Positive peak value . . . . . | 2 max.*         | 0 max.            | volts          |
| PEAK VOLTAGE BETWEEN          |                 |                   |                |
| GRID No.4 AND ANY             |                 |                   |                |
| DEFLECTING ELECTRODE. . . . . | 500 max.        | —                 | volts          |
| PEAK HEATER-CATHODE           |                 |                   |                |
| VOLTAGE:                      |                 |                   |                |
| Heater negative with          |                 |                   |                |
| respect to cathode. . . . .   | 125 max.*       | 125 max.          | volts          |
| Heater positive with          |                 |                   |                |
| respect to cathode. . . . .   | 125 max.*       | 125 max.          | volts          |

## VIEWING SECTION\*\*

## Operating Values and Typical Performance Characteristics:

|                                                  |           |           |           |           |
|--------------------------------------------------|-----------|-----------|-----------|-----------|
| Screen Voltage . . . . .                         | 5000      | 10000     | 10000     | volts     |
| DC Backing-Electrode                             |           |           |           |           |
| Voltage . . . . .                                | 5         | 5         | 5         | volts     |
| Grid-No.4 Voltage . . . . .                      | 150       | 210       | 150       | volts     |
| Grid-No.3 Voltage <sup>#</sup> . . . . .         | 25 to 125 | 50 to 150 | 25 to 125 | volts     |
| Grid-No.2 Voltage <sup>†</sup> . . . . .         | 50 to 75  | 70 to 105 | 50 to 75  | volts     |
| Grid-No.1 Voltage <sup>#</sup> . . . . .         | 0 to -50  | 0 to -75  | 0 to -50  | volts     |
| Maximum Screen Current. . . . .                  | 350       | 600       | 350       | μamp      |
| Maximum Peak Backing-                            |           |           |           |           |
| Electrode Current . . . . .                      | 1.5       | 2         | 1.5       | ma        |
| Maximum Grid-No.4 Current <sup>•</sup> . . . . . | 2         | 3         | 2         | ma        |
| Maximum Grid-No.3 Current <sup>•</sup> . . . . . | 1.5       | 2         | 1.5       | ma        |
| Maximum Cathode Current <sup>•</sup> . . . . .   | 3         | 4         | 3         | ma        |
| Writing Speed <sup>††</sup> . . . . .            | 300000    | 300000    | 300000    | in./sec   |
| Number of Half-Tone Steps <sup>□</sup> . . . . . | 5         | 5         | 5         |           |
| Viewing Duration <sup>▲</sup> . . . . .          | 40        | 20        | 40        | sec       |
| Maximum Erasing-Uniformity                       |           |           |           |           |
| Factor <sup>□□</sup> . . . . .                   | 0.5       | 0.5       | 0.5       |           |
| Resolution <sup>§</sup> . . . . .                | 50        | 50        | 50        | lines/in. |
| Brightness <sup>••</sup> . . . . .               | 275       | 2750      | 1500      | f1 ←      |

\*\* Voltages are shown with respect to cathode of Viewing Gun.

<sup>#</sup> Adjusted for brightest, most uniform pattern.<sup>†</sup> Grid No.2 of the Viewing Gun is connected internally to grid No.4 of the Writing Gun.<sup>•</sup> For conditions with combined adjustment of grid-No.1 voltage, grid-No.2 voltage, and grid-No.3 voltage to give brightest, most uniform pattern.

\*, ††, □, ▲, §, ••: See next page.

← Indicates a change.



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## DISPLAY STORAGE TUBE

## WRITING SECTION\*

## Range Values for Equipment Design:\*

With any grid-No.2 voltage ( $E_{C_2}$ ) between 500 and 2750 volts

|                                                                                |                                   |           |
|--------------------------------------------------------------------------------|-----------------------------------|-----------|
| Grid-No.4 Voltage ( $E_{C_4}$ ) . . . . .                                      | 95% to 105% of $E_{C_2}$          | volts     |
| Grid-No.3 Voltage for Focus . . . .                                            | 14% to 28% of $E_{C_2}$           | volts     |
| Maximum Grid-No.1 Voltage<br>for Cutoff of Undelected<br>Focused Spot. . . . . | -4.6% of $E_{C_2}$                | volts     |
| Maximum Grid-No.3 Current . . . . .                                            | -15 to +10                        | $\mu$ amp |
| Maximum Cathode Current . . . . .                                              | See Curve                         |           |
| Deflection Factors:                                                            |                                   |           |
| $DJ_1$ and $DJ_2$ . . . . .                                                    | 28 to 38 v dc/in./kv of $E_{C_4}$ |           |
| $DJ_3$ and $DJ_4$ . . . . .                                                    | 28 to 38 v dc/in./kv of $E_{C_4}$ |           |
| Focused Beam Position . . . . .                                                | ##                                |           |

## Examples of Use of Design Ranges:\*

|                                                                                |              |              |          |
|--------------------------------------------------------------------------------|--------------|--------------|----------|
| With grid-No.2 voltage of                                                      | 1500         | 2500         | volts    |
| Grid-No.4 Voltage ( $E_{C_4}$ ) . . . . .                                      | 1425 to 1575 | 2375 to 2625 | volts    |
| Grid-No.3 Voltage for Focus . . . .                                            | 210 to 420   | 350 to 700   | volts    |
| Maximum Grid-No.1 Voltage<br>for Cutoff of Undelected<br>Focused Spot. . . . . | -69          | -115         | volts    |
| Deflection Factors<br>when $E_{C_4} = E_{C_2}$ :                               |              |              |          |
| $DJ_1$ and $DJ_2$ . . . . .                                                    | 42 to 57     | 70 to 95     | v dc/in. |
| $DJ_3$ and $DJ_4$ . . . . .                                                    | 42 to 57     | 70 to 95     | v dc/in. |

Equivalent Values for Examples of Writing-Gun Voltages  
Referred to Cathode of Viewing Gun:

|                                     |                |                |       |
|-------------------------------------|----------------|----------------|-------|
| Cathode Voltage . . . . .           | -1450 to -1395 | -2450 to -2395 | volts |
| Grid-No.2 Voltage . . . . .         | -25 to +180    | -75 to +230    | volts |
| Grid-No.3 Voltage for Focus . . . . | -1240 to -975  | -2100 to -1695 | volts |
| Grid-No.4 Voltage . . . . .         | 50 to 105      | 50 to 105      | volts |

## VIEWING SECTION and WRITING SECTION

## Circuit Values:

|                                                                     |            |        |
|---------------------------------------------------------------------|------------|--------|
| Grid-No.1-Circuit Resistance (Either gun) . . . . .                 | 1.0 max.   | megohm |
| Resistance in Any Deflecting-Electrode Circuit <sup>■</sup> . . . . | 0.1 max.   | megohm |
| Backing-Electrode-Circuit Resistance. . . . .                       | 0.005 max. | megohm |
| Series Current-Limiting Resistance in Screen Circuit. .             | 1.0 min.   | megohm |

\* voltages are shown with respect to cathode of Writing Gun.

†† Measured under conditions of writing from just zero brightness (viewing-beam cutoff) to maximum brightness with grid No.1 of Writing Gun at -10 volts with respect to cathode of Writing Gun, and grids No.2 and No.4 of Writing Gun at +2500 volts with respect to cathode of Writing Gun.

□ Observed with an RCA-2F21 Monoscope display.

▲, □, #, ●, ●, ●, ##, ■: See next page.



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## DISPLAY STORAGE TUBE

- ▲ Expressed in terms of the time required for the brightness of the un-written background to rise from just zero brightness (viewing-beam cutoff) to 10% of the maximum brightness.
- Defined as  $(t_2 - t_1)/t_2$ , where
- $t_1$  = time measured from start of erasing to instant at which any screen area is reduced to zero brightness.
  - $t_2$  = time measured from start of erasing to instant at which entire screen area is reduced to zero brightness.
- ⊕ Measured by shrinking-raster method at a display brightness of 50% of saturated brightness and with grids No.2 and No.4 of Writing Gun at +2500 volts with respect to cathode of Writing Gun.
- ⊕ Measured with entire storage grid written to produce maximum brightness and with screen at indicated voltage.
- The cathode of the Writing Gun is operated at about -2500 volts with respect to the cathode of the Viewing Gun which is usually operated at ground potential.
- ## The center of the undeflected focused beam will fall within a circle having a 10-mm radius concentric with the center of the face under the following conditions: grids No.2 and No.4 of Writing Gun at +2500 volts with respect to cathode of Writing Gun, grid No.3 of Writing Gun at voltage to give focus, grid No.1 of Writing Gun at voltage which will permit storage of a charge just sufficient to give a barely perceptible spot on screen, Viewing Section operating under normal conditions, and tube shielded against extraneous fields.
- It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

## OPERATING CONSIDERATIONS

*Magnetic shielding* must be provided to prevent external fields from interfering with the required accurate control of the low-velocity viewing beam. A cylindrical shield of properly annealed high-permeability material about 1/16-inch thick is usually satisfactory. The screen cable should be placed outside the shield.

The *metal flange* at the face end of the tube requires the use of a spring-contact ring bearing against the edge of the flange.

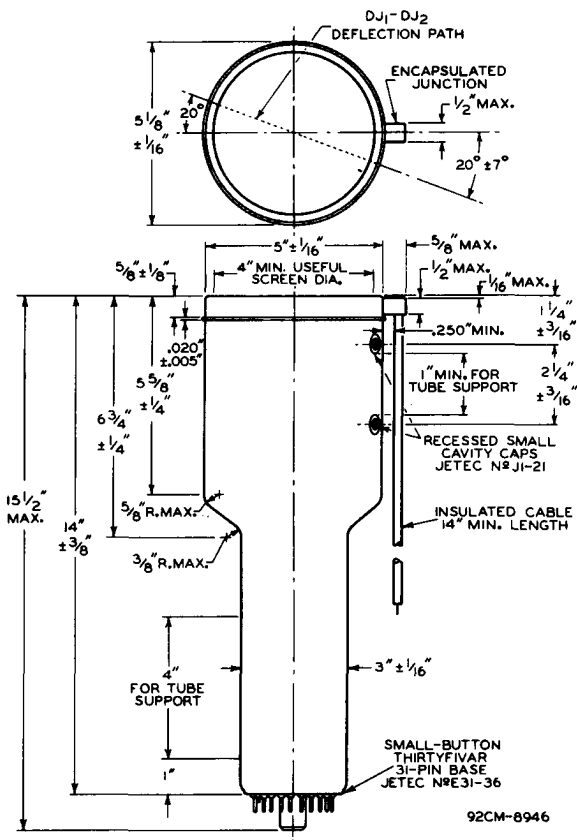
To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing beam on until the writing beam is turned off.

—Indicates a change.



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## DISPLAY STORAGE TUBE



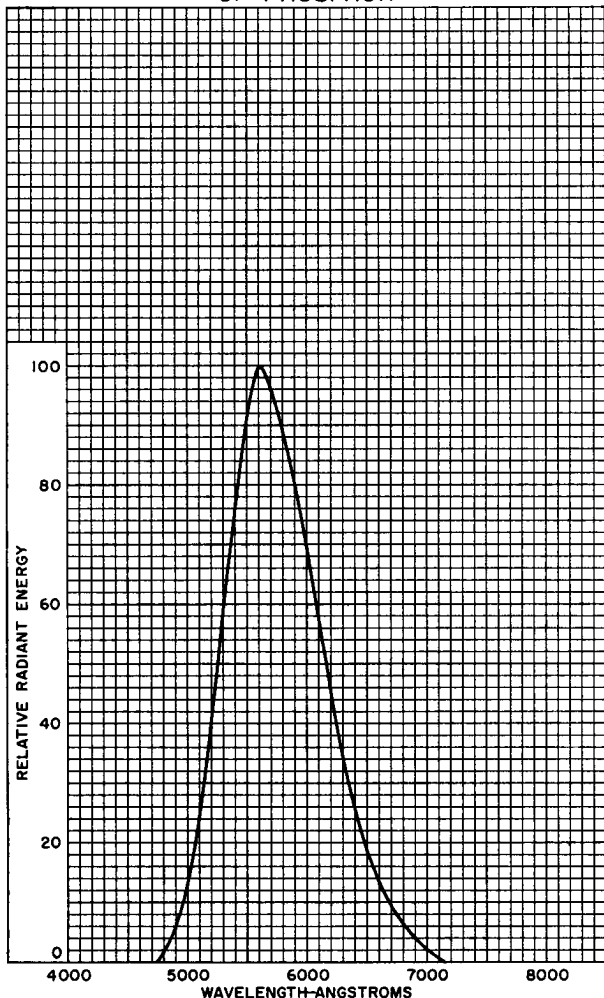
CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 30° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF FACEPLATE. THE PLANE THROUGH TUBE AXIS AND EACH OF THE FOLLOWING ITEMS MAY VARY FROM THE DEFLECTION PATH PRODUCED BY DJ<sub>1</sub> AND DJ<sub>2</sub> BY THE FOLLOWING ANGULAR TOLERANCES (MEASURED ABOUT THE TUBE AXIS): PIN 27, ± 10°; EACH CAVITY CAP (ON SAME SIDE AS PIN 27), ± 17°; ENCAPSULATED JUNCTION, ± 10°. ANGLE BETWEEN DJ<sub>1</sub> - DJ<sub>2</sub> DEFLECTION PATH AND DJ<sub>3</sub> - DJ<sub>4</sub> DEFLECTION PATH IS 90° ± 30°.



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# SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR



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## AVERAGE CHARACTERISTIC

VIEWING SECTION $E_f = 6.3$  VOLTS

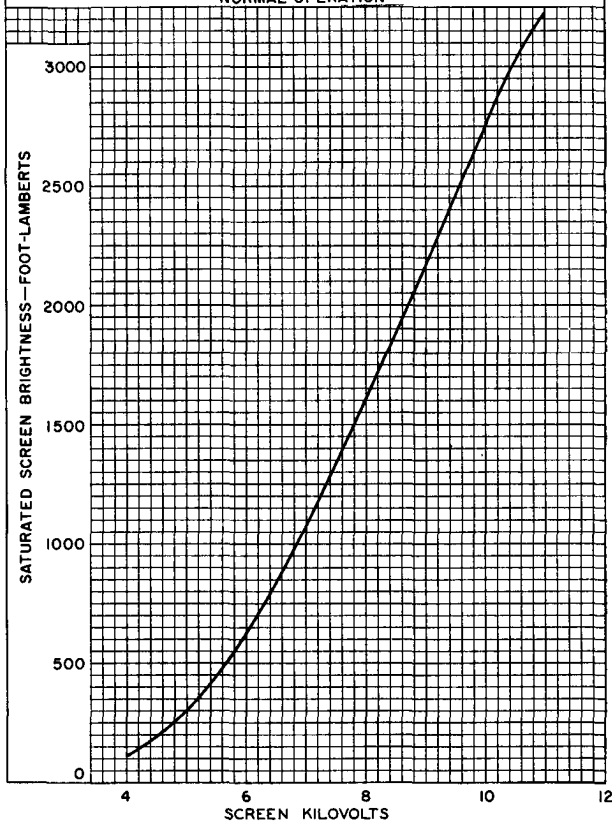
BACKING-ELECTRODE VOLTS\* = 5

GRID-N<sub>2</sub> 4 VOLTS\* = 210GRID-N<sub>2</sub> 2 VOLTS\* = 85GRID-N<sub>2</sub> 3 VOLTS\* } ADJUSTED FOR BRIGHTEST,  
GRID-N<sub>2</sub> 1 VOLTS\* } MOST UNIFORM DISPLAY.

\*REFERRED TO CATHODE OF VIEWING GUN.

WRITING SECTION

## NORMAL OPERATION



ELECTRON TUBE DIVISION

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## AVERAGE CHARACTERISTICS

VIEWING SECTION $E_f = 6.3$  VOLTS

SCREEN KILOVOLTS\* = 5 TO 10

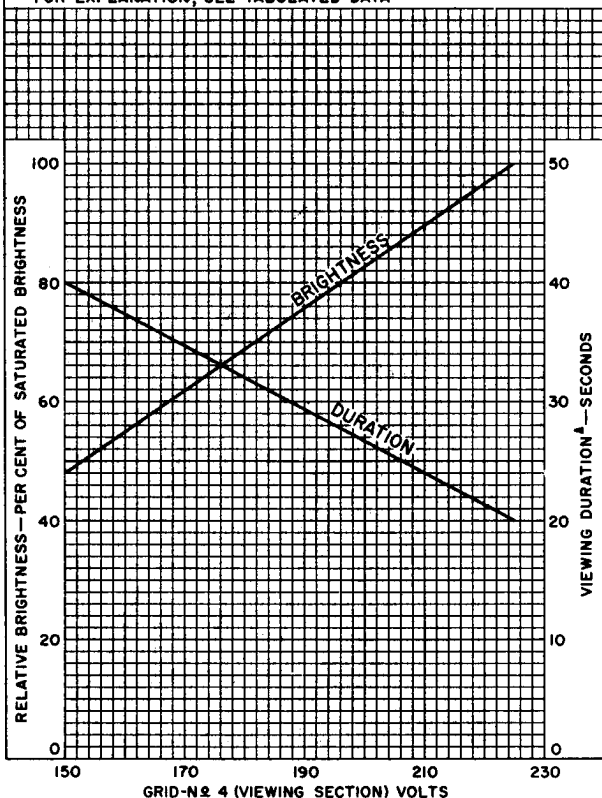
BACKING-ELECTRODE VOLTS\* = 5

GRID-N $\phi$  2 VOLTS\* = 85GRID-N $\phi$  3 VOLTS\* } ADJUSTED FOR BRIGHTEST,  
GRID-N $\phi$  1 VOLTS\* } MOST UNIFORM DISPLAY

\* REFERRED TO CATHODE OF VIEWING GUN

WRITING SECTION

NORMAL OPERATION

<sup>A</sup> FOR EXPLANATION, SEE TABULATED DATAGRID-N $\phi$  4 (VIEWING SECTION) VOLTS

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92CM-9044

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## TYPICAL ERASURE CHARACTERISTICS

## VIEWING SECTION

 $E_f = 6.3$  VOLTS

GRID-Nº 4 VOLTS\* = 210

SCREEN KILOVOLTS\* = 10

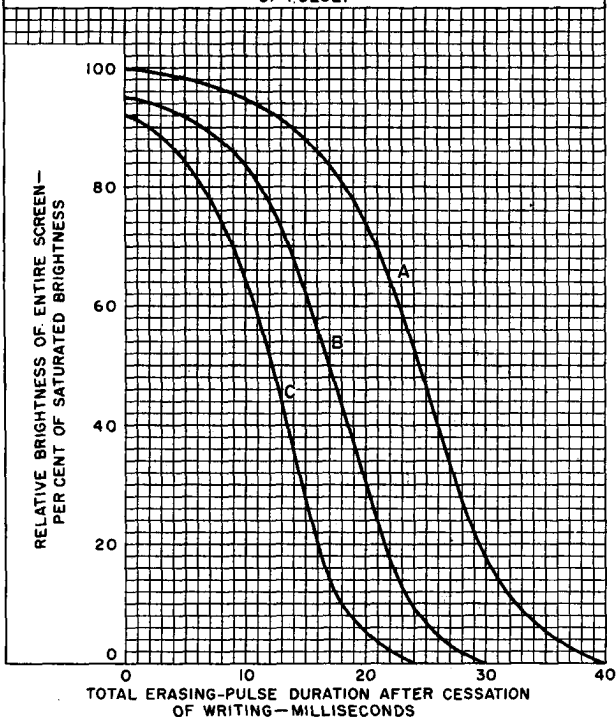
GRID-Nº 2 VOLTS\* = 85

 GRID-Nº 3 VOLTS\* } ADJUSTED FOR BRIGHTEST,  
 GRID-Nº 1 VOLTS\* } MOST UNIFORM DISPLAY

\*REFERRED TO CATHODE OF VIEWING GUN

| CURVE | BACKING-ELECTRODE VOLTS |                                                |
|-------|-------------------------|------------------------------------------------|
|       | DC                      | POSITIVE RECTANGULAR PULSE AMPLITUDE (APPROX.) |
| A     | 10                      | 10                                             |
| B     | 5                       | 8                                              |
| C     | 2                       | 7                                              |

ERASURE IS PRODUCED BY POSITIVE RECTANGULAR PULSE APPLIED TO BACKING-ELECTRODE. INDICATED DURATION IS SUM OF DURATIONS OF NUMBER OF PULSES OR ELAPSED TIME AFTER START OF PULSE.



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92CM-9045



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# CURRENT CHARACTERISTIC FOR WRITING GUN

## WRITING SECTION

 $E_f = 6.3$  VOLTS

GRID-NO 4 VOLTS\* = GRID-NO. 2 VOLTS

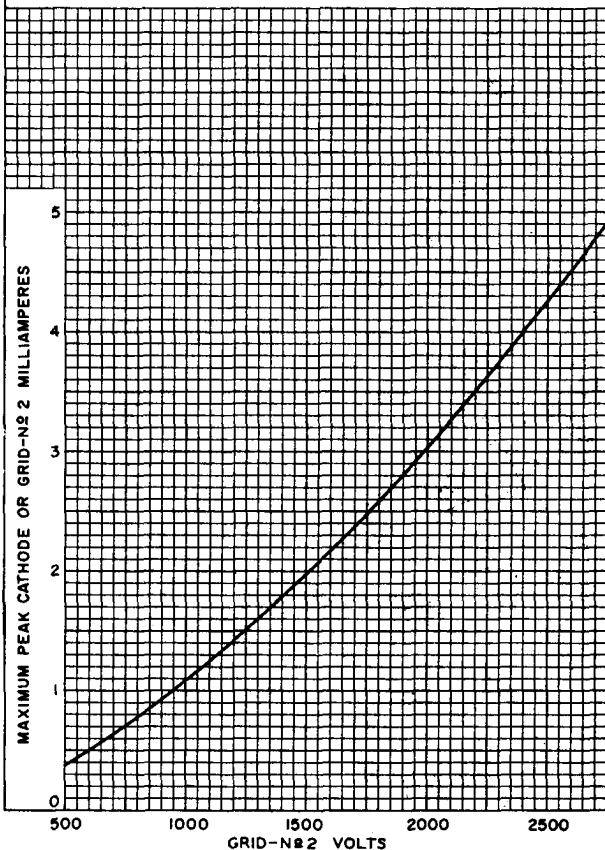
GRID-NO 3 VOLTS\* = ADJUSTED FOR FOCUS

GRID-NO 1 VOLTS\* = 0

\*REFERRED TO CATHODE OF WRITING GUN

## VIEWING SECTION

NORMAL OPERATION



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# TYPICAL DRIVE CHARACTERISTIC FOR WRITING GUN

## WRITING SECTION

$E_f = 6.3$  VOLTS  
 GRID-Nº 4 VOLTS\* = 2500  
 GRID-Nº 3 VOLTS\* = ADJUSTED FOR FOCUS  
 GRID-Nº 2 VOLTS\* = 2500  
 GRID-Nº 1\* BIASED TO SPOT CUTOFF  
 \*REFERRED TO CATHODE OF WRITING GUN

## VIEWING SECTION

### NORMAL OPERATION

