



7448

## DISPLAY STORAGE TUBE

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DIRECT-VIEW TYPE  
3.8"-DIAMETER DISPLAYWRITING GUN:  
ELECTROSTATIC DEFLECTION  
ELECTROSTATIC FOCUSVIEWING GUN:  
NO DEFLECTION  
NO FOCUS

| 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 voltages are applied. . . . .  |  |                 |                    |
|  | -  | 30              | sec                |
| Direct Interelectrode Capacitances (Approx.): <sup>o</sup>                         |  |                 |                    |
| Grid No. 1 to all other tube electrodes . . . . .                                  | 6.5  | 11              | $\mu\text{lf}$     |
| Cathode to all other tube electrodes . . . . .                                     | 5.5  | 8               | $\mu\text{lf}$     |
| Backplate to all other tube electrodes . . . . .                                   | -  | 116             | $\mu\text{lf}$     |
| Deflecting electrode DJ <sub>1</sub> to deflecting electrode DJ <sub>2</sub> . . . | 1.9  | -               | $\mu\text{lf}$     |
| Deflecting electrode DJ <sub>3</sub> to deflecting electrode DJ <sub>4</sub> . . . | 2  | -               | $\mu\text{lf}$     |
| DJ <sub>1</sub> to all other tube electrodes.                                      | 6  | -               | $\mu\text{lf}$     |
| DJ <sub>2</sub> to all other tube electrodes.                                      | 7  | -               | $\mu\text{lf}$     |
| DJ <sub>3</sub> to all other tube electrodes.                                      | 5.5  | -               | $\mu\text{lf}$     |
| DJ <sub>4</sub> to all other tube electrodes.                                      | 4.8  | -               | $\mu\text{lf}$     |
| Focusing Method . . . . .  | Electrostatic  | None            |                    |
| Deflection Method . . . . .  | Electrostatic  | None            |                    |
| Deflecting-Electrode Arrangement.  | See Dimensional Outline                                  | -               |                    |
| Phosphor (For Curves, see front of this Section). . . . .                          |  |                 |                    |
|  | -  | P20, Aluminized |                    |
| Fluorescence. . . . .  | -  | Yellow-Green    |                    |
| Phosphorescence . . . . .  | -  | Yellow-Green    |                    |
| Minimum Useful Viewing Diameter <sup>v</sup> . . . . .                             |  |                 | 3.8"               |
| Maximum Overall Length. . . . .  |  |                 | 13.64"             |
| Seated Length . . . . .  |  |                 | 12.50" $\pm$ 0.39" |
| Greatest Bulb Diameter. . . . .  |  |                 | 5.25" $\pm$ 0.06"  |
| Maximum Tube Radius . . . . .  |  |                 | 2.69"              |
| Bulb Terminals:  |  |                 |                    |
| Caps (Three). . . . .  | Recessed Small Ball (JEDEC No. J1-22)                    |                 |                    |
| Cap . . . . .  | Recessed Small Cavity (JEDEC No. J1-21)                  |                 |                    |
| Temperature Range:   |  |                 |                    |
| Operating . . . . .  |  | -55° to +85°    | C                  |
| Storage . . . . .  |  | -65° to +100°   | C                  |
| Operating Position. . . . .  |  |                 | Any                |
| Weight (Approx.). . . . .  |  |                 | 2-3/4 lbs          |
| Base. . . . .  | Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No. B14-38) |                 |                    |

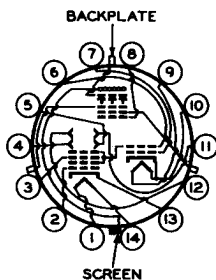


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BOTTOM VIEW

- Pin 1—Heater of Writing Gun  
 Pin 2—Grid No.1 of Writing Gun  
 Pin 3—Grid No.3 of Writing Gun  
 Pin 4—Deflecting Electrode DJ<sub>3</sub> of Writing Gun  
 Pin 5—Deflecting Electrode DJ<sub>4</sub> of Writing Gun  
 Pin 6—Grid No.2 of Viewing Gun, Grid No.2 and Grid No.4 of Writing Gun  
 Pin 7—Grid No.1 of Viewing Gun  
 Pin 8—Grid No.3 of Viewing Gun  
 Pin 9—Heater of Viewing Gun  
 Pin 10—Heater and Cathode of Viewing Gun  
 Pin 11—Deflecting Electrode DJ<sub>1</sub> of Writing Gun  
 Pin 12—Deflecting Electrode DJ<sub>2</sub> of Writing Gun



- Pin 13—Cathode of Writing Gun  
 Pin 14—Heater of Writing Gun  
 Recessed Ball Cap:  
*Over Pin*  
 3—Grid No.5 of Viewing Gun  
*Over Pin*  
 12—Grid No.4 of Viewing Gun  
*On Side of Tube Opposite Base*  
*Key—Backplate*  
 Recessed Cavity Cap:  
*Over Base*  
*Key—Screen*

## Maximum and Minimum Ratings, Absolute-Maximum Values:

For altitudes up to 10,000 feet

|   | Writing Section          |              | Viewing Section             |       |
|---|--------------------------|--------------|-----------------------------|-------|
| SCREEN VOLTAGE.   | -                        |              | 11000 max.**                | volts |
| BACKPLATE VOLTAGE (Peak).                                     | -                        |              | 20 max.**                   | volts |
|   | <i>Equivalent Values</i> |              | <i>Equivalent Values</i>    |       |
| GRID-No.5 VOLTAGE . . . . .                                   | -                        | -            | 300 max.**                  | volts |
| GRID-No.4 VOLTAGE . . . . .                                   | 2950 max.** <sup>▲</sup> | 200 max.**   | 300 max.**                  | volts |
| GRID-No.3 VOLTAGE . . . . .                                   | 1200 max.*               | -1550 max.** | { 200 max.**<br>10 min.** } | volts |
| PEAK VOLTAGE BETWEEN GRID No.3 AND GRIDS No.2 & No.4. . . . . | -                        | 2950 max.    | -                           | volts |



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|   | Writing Section          |              | Viewing Section          |            |       |
|---|--------------------------|--------------|--------------------------|------------|-------|
| GRID-No. 2 VOLT-AGE . . . . .   | 2950 max.** <sup>A</sup> | 200 max.**   | 2950 max.** <sup>A</sup> | 200 max.** | volts |
| CATHODE VOLT-AGE . . . . .  | -                        | -2750 max.** | -                        | -          | volts |
| GRID-No. 1 VOLT-AGE:  |                          |              |                          |            |       |
| Negative-bias value . . .   | 200 max.*                |              | 200 max.**               |            | volts |
| Positive-bias value . . .   | 0 max.*                  |              | 0 max.**                 |            | volts |
| Positive-peak value . . .   | 2 max.*                  |              | 0 max.**                 |            | volts |
| PEAK VOLTAGE BETWEEN GRIDS No. 2 & No. 4 AND ANY DEFLECTING ELECTRODE . . | 500 max.                 |              | -                        |            | volts |
| PEAK HEATER-CATHODE VOLTAGE:  |                          |              |                          |            |       |
| Heater negative with respect to cathode . .                               | 125 max.*                |              | -                        |            | volts |
| Heater positive with respect to cathode . .                               | 125 max.*                |              | -                        |            | volts |

## VIEWING SECTION\*\*

## Operating Values and Typical Performance Characteristics:

*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-gun beam on till the writing beam is turned off*

|  |           |          |       |
|--|-----------|----------|-------|
| Screen Voltage . . . . .                   | 10000     | 10000    | volts |
| Backplate Voltage (DC) . . . . .           | 2         | 2        | volts |
| Grid-No. 5 Voltage . . . . .               | 210       | 150      | volts |
| Grid-No. 4 Voltage* . . . . .              | 50 to 150 | 30 to 90 | volts |
| Grid-No. 3 Voltage* . . . . .              | 10 to 50  | 10 to 40 | volts |
| Grid-No. 2 Voltage* . . . . .              | 150       | 125      | volts |
| Grid-No. 1 Voltage* . . . . .              | 0 to -80  | 0 to -60 | volts |
| Maximum Screen Current . . . . .           | 0.75      | 0.5      | ma    |
| Maximum Backplate Current (Peak) . . . . . | 2         | 1.5      | ma    |
| Maximum Grid-No. 5 Current . . . . .       | 3         | 2.5      | ma    |
| Maximum Grid-No. 4 Current . . . . .       | 3         | 2.5      | ma    |
| Maximum Grid-No. 3 Current . . . . .       | 5         | 4        | ma    |



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|   |      |      |           |
|---|------|------|-----------|
| Maximum Grid-No.2 Current <sup>■</sup> . . . . .          | 3    | 2.5  | ma        |
| Maximum Cathode Current. . . . .                          | 8    | 6.5  | ma        |
| Number of Half-Tone Steps <sup>□</sup> . . . . .          | 5    | 5    |           |
| Viewing Duration <sup>▲▲</sup> . . . . .                  | 20   | 40   | sec       |
| Maximum Erasing-Uniformity Factor <sup>□□</sup> . . . . . | 0.45 | 0.4  |           |
| Resolution <sup>•</sup> . . . . .                         | 50   | 50   | lines/in. |
| Brightness <sup>••</sup> . . . . .                        | 2750 | 1500 | fl        |

WRITING SECTION<sup>•</sup>

## Range Values for Equipment Design:\*

For any grids-No.2 & No.4 voltage ( $E_{C2+4}$ ) between  
1500 and 2750 volts<sup>▲</sup>

|  |                              |                           |         |
|--|------------------------------|---------------------------|---------|
| Grid-No.3 Voltage for focus. . . . .                                       | 17.5% to 37.5% of $E_{C2+4}$ |                           | volts   |
| Maximum Grid-No.1 Voltage for cutoff of undeflected focused spot . . . . . | -4.6% of $E_{C2+4}$          |                           | volts   |
| Maximum Grid-No.3 Current. . . . .   | -15 to +10                   |                           | $\mu$ a |
| Maximum Cathode Current.   | See Curve                    |                           |         |
| Deflection Factors:  |                              |                           |         |
| DJ <sub>1</sub> & DJ <sub>2</sub> . . . . .                                | 36 to 48                     | v dc/in./kv of $E_{C2+4}$ |         |
| DJ <sub>3</sub> & DJ <sub>4</sub> . . . . .                                | 35 to 47                     | v dc/in./kv of $E_{C2+4}$ |         |
| Focused Beam Position. . . . .   | ##                           |                           |         |
| Writing Speed <sup>††</sup> . . . . .                                      | 300000                       |                           | in./sec |

## Examples of Use of Design Ranges:\*

|   |            |  |       |
|---|------------|--|-------|
| For grids-No.2 & No.4 voltage ( $E_{C2+4}$ ) <sup>▲</sup>                 | 2000       |  | volts |
| Grid-No.3 Voltage for focus. . . . .                                      | 350 to 750 |  | volts |
| Maximum Grid-No.1 Voltage for cutoff of undeflected focused spot. . . . . | -92        |  | volts |
| Deflection Factors:   |            |  |       |
| DJ <sub>1</sub> & DJ <sub>2</sub> . . . . .                               | 72 to 96   |  | volts |
| DJ <sub>3</sub> & DJ <sub>4</sub> . . . . .                               | 70 to 94   |  | volts |

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

|  |                |                |       |
|--|----------------|----------------|-------|
| Cathode Voltage. . . . .                         | -1850          | -1875          | volts |
| Grid-No.3 Voltage for focus. . . . .             | -1100 to -1500 | -1125 to -1525 | volts |
| Grids-No.2 & No.4 Voltage <sup>▲</sup> . . . . . | +150           | +125           | volts |

## VIEWING SECTION and WRITING SECTION

## Circuit Values:

|   |           |        |
|---|-----------|--------|
| Grid-No.1-Circuit Resistance (Either gun). . . . .  | 1 max.    | megohm |
| Resistance in Any Deflecting-Electrode Circuit <sup>■</sup> . . . . .                             | 0.1 max.  | megohm |
| Series Current-Limiting Resistor (Unbypassed)<br>In Grid-No.5 (Viewing-Section) Circuit . . . . . | 0.01 min. | megohm |



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Backplate-Circuit Resistance. . . . . 0.005 max. megohm  
 Series Current-Limiting Resistance in  
 Screen Circuit. . . . . 1 min. megohm

- Without external shield.
- ♥ Minimum useful viewing area may be eccentric with respect to the tube face.
- \*\* Voltages are shown with respect to cathode of Viewing Gun.
- \* Voltages are shown with respect to cathode of Writing Gun.
- ▲ Grids No.2 and No.4 of Writing Gun are connected together and to grid No.2 of Viewing Gun within the tube.
- # Adjusted for brightest, most uniform pattern.
- With writing beam cut off. Since grid No.2 of the Viewing Gun and grids No.2 and No.4 of the Writing Gun are connected together within the tube, the maximum total current collected by these electrodes is essentially equal to the sum of the maximum grid-No.2 current of the Viewing Gun and the maximum cathode current of the Writing Gun (See *Writing-Gun-Current-Characteristic Curve*).
- Observed with an RCA-2F21 Monoscope display.
- ▲▲ Expressed in terms of the time required for the brightness of the unwritten background to rise from just zero brightness (viewing-beam cutoff) to 10 per cent of saturated brightness.
- Determined as follows: With no erasing pulse, overscan the storage surface with writing beam to obtain maximum pattern brightness. Then cut off writing beam. Apply rectangular erasing pulses having an amplitude of between 8 to 10 volts and adjust duty cycle to obtain complete erasure in approximately 10 seconds. Measure time ( $t_1$ ) from start of erasing to the instant at which any area within the minimum useful viewing diameter is reduced to background-brightness level, and time ( $t_2$ ) from start of erasing to the instant at which the entire area within the minimum useful viewing-diameter area is reduced to background-brightness level. The erasing-uniformity factor is defined as  $(t_2 - t_1)/t_2$ .
- Measured by shrinking-raster method at a display brightness of 50 per cent of saturated brightness and with grids No.2 & No.4 of Writing Gun at about +2000 volts with respect to cathode of Writing Gun.
- Measured with entire storage grid written to produce saturated brightness and with screen at indicated voltage.
- The cathode of the Writing Gun is operated at about -2000 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 and having its center on the Writing-Gun axis (See *Dimensional Outline*) under the following conditions: grids No.2 & No.4 of Writing Gun at +2000 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.
- †† 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 & No.4 of Writing Gun at +2000 volts with respect to cathode of Writing Gun.
- It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

## OPERATING CONSIDERATIONS

**Shielding.** 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.



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*Terminal Connections.* The base pins of the 7448 fit the Diheptal 14-contact socket. The *Recessed Small Ball caps* and the *Recessed Small Cavity cap* require standard flexible-lead connectors.

*The high voltages at which the 7448 is operated may be very dangerous.* Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Safety precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is desired.

In the use of high-voltage tubes, it should always be remembered that high voltages may appear at normally low-potential points in the circuit as a result of capacitor breakdown or incorrect circuit connections. Therefore, before any part of the circuit is touched, the power-supply switch should be turned off, and both terminals of any capacitors grounded.

*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 till the writing beam is turned off.

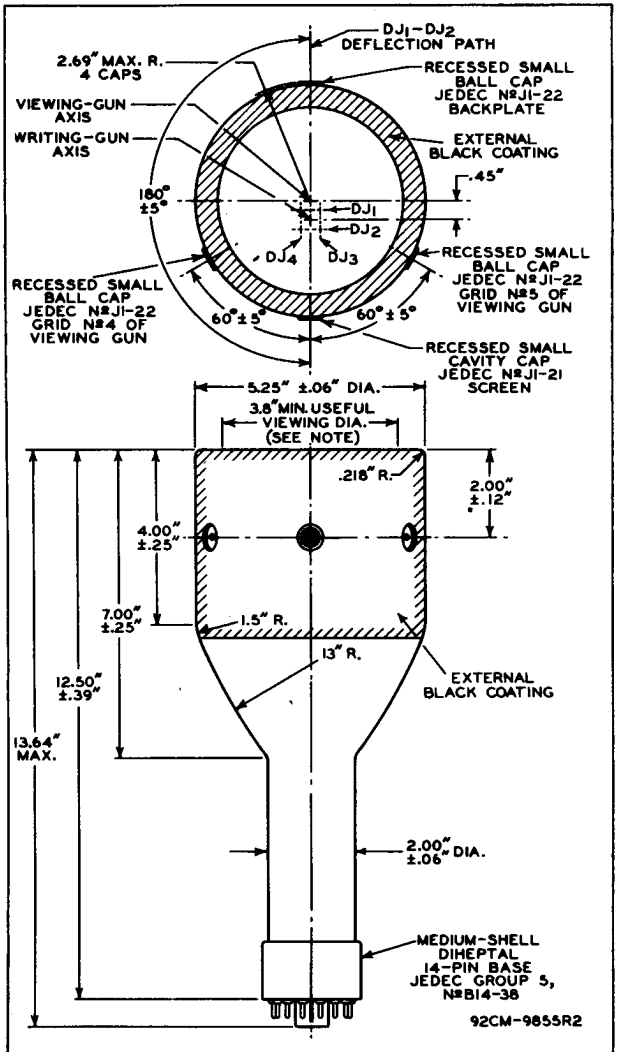
*Failure of scanning while the writing beam is turned on* may permanently damage the storage grid. Therefore, provision should be made to cut off automatically the writing-beam current in case of a scanning failure. The writing-beam current can be cut off by an electronic switch which applies -200 volts bias to grid No. 1 of the Writing Gun. This switch should be actuated by a portion of the scanning voltages applied to both sets of deflecting electrodes.



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**NOTE:** MINIMUM USEFUL VIEWING AREA MAY BE ECCENTRIC WITH RESPECT TO THE TUBE FACE. THE MINIMUM USEFUL VIEWING AREA WILL HAVE DIAMETER OF 3.8".

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN  $2^{\circ}$  IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

DEFLECTING ELECTRODES  $DJ_1$  AND  $DJ_2$  ARE NEARER THE SCREEN: DEFLECTING ELECTRODES  $DJ_3$  AND  $DJ_4$  ARE NEARER THE BASE. WITH  $DJ_1$  POSITIVE WITH RESPECT TO  $DJ_2$ , THE SPOT WILL BE DEFLECTED TOWARD PIN 8; LIKewise, WITH  $DJ_3$  POSITIVE WITH RESPECT TO  $DJ_4$ , THE SPOT WILL BE DEFLECTED TOWARD PIN 4.

THE ANGLE BETWEEN THE DEFLECTION PATH PRODUCED BY  $DJ_1$  AND  $DJ_2$  MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND THE BASE KEY BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF  $\pm 10^{\circ}$ . THE ANGLE BETWEEN THE DEFLECTION PATH PRODUCED BY  $DJ_1$  AND  $DJ_2$  MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND THE SCREEN CAP BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF  $\pm 10^{\circ}$ . ANGLE BETWEEN  $DJ_1 - DJ_2$  DEFLECTION PATH AND  $DJ_3 - DJ_4$  DEFLECTION PATH IS  $90^{\circ} \pm 3^{\circ}$ .

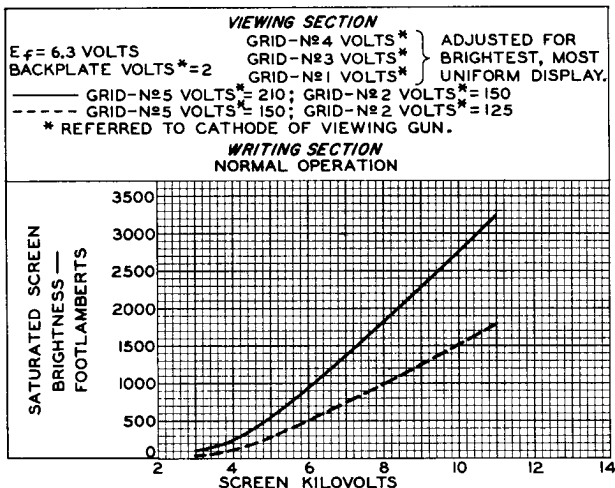




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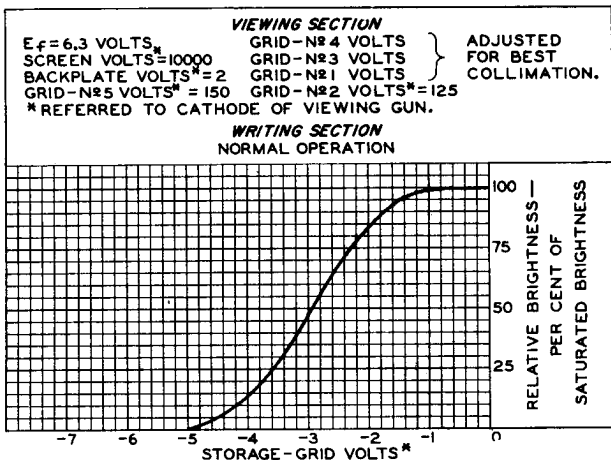
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## TYPICAL CHARACTERISTICS



92CS-9858

## TYPICAL STORAGE-GRID CHARACTERISTIC



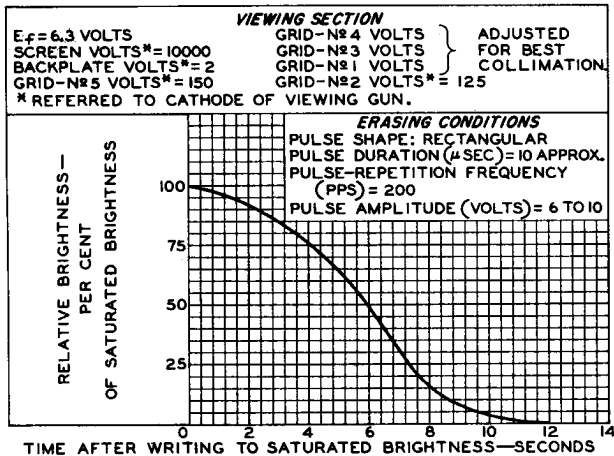
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## TYPICAL ERASURE CHARACTERISTIC



92CS-9860

## WRITING-GUN-CURRENT CHARACTERISTIC

