GENERAL ELECTRODYNAMICS CORPORATION

8484 VIDICON

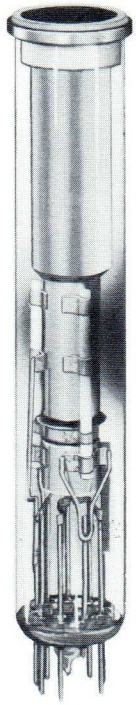
MAGNETIC FOCUS AND DEFLECTION

The 8484 Vidicon has been specially designed for televising live scenes giving pictures of satisfactory quality with as little as 0.2 foot-candles of illumination on the faceplate. The improved photoconductive coating features high sensitivity, resistance to burn-in, and excellent uniformity, so that optimum pictures may be obtained by adjustment of the signal electrode voltage without limiting restrictions on the dark current. The 8484 features uniformity of focus over the scanned area and high resolution and sensitivity at the corners as well as in the center of the faceplate. Patented internal construction allows the tube to be operated in any position and in high ambient noise environments. The 8484 supersedes tube types 7325 and 7735A.

DATA

GENERAL:

Operating Position	Any
Focusing Method	Magnetic
Deflection Method	Magnetic
Max. Useful Diagonal of Rectangular Image (4 x 3 Aspect Ratio)	0.625 in.
Orientation of Image....Horizontal Scan should be essentially parallel to a plane passing through tube axis and the short index pin.	



ELECTRICAL CHARACTERISTICS:

Heater	
Voltage (AC or DC)	6.3 V ±10%
Current	.60 A ±10%
Direct Interelectrode Capacity (Signal Electrode to all other Electrodes)	3.1 pf
Spectral Response (See Fig. 4)	S-18

ABSOLUTE MAXIMUM RATINGS:

Heater - Cathode Peak Values	
Heater Negative with Respect to Cathode	125 V
Heater Positive with Respect to Cathode	10 V
Grid No. 1 Voltage	
Negative Bias Values	300 V
Positive Bias Values	0 V
Grid No. 2 Voltage	1000 V

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ABSOLUTE MAXIMUM RATINGS (Continued):

Grid No. 3 Voltage	1000 V
Faceplate	
Illumination	1000 ft-c
Operating Temperature	71° C
Storage Temperature	125° C
Signal Electrode Current	.60 uA

TYPICAL OPERATION:

Minimum Peak-to-Peak Blanking Voltage	
When applied to Grid No. 1	30 V
When applied to Cathode	10 V
Grid No. 1 Voltage (For picture cut off with no blanking voltage on Grid No. 1)	-45 to -100 V
Grid No. 2 Voltage	300 V
Grid No. 3 Voltage	200 to 300 V
Signal Electrode Voltage	
For 5 ft-c faceplate illumination and signal output current of .2 uA	20 to 50 V
For .2 ft-c faceplate illumination and signal output current of .14 uA	40 to 100 V
*Optimum Signal Output Current (See Figure 6)	
For uniform 2870° K Tungsten Illumination on faceplate down to .5 ft-c	.2 uA
For uniform 2870° K Tungsten Illumination on faceplate from .2 ft-c to .5 ft-c	.14 to .2 uA
Average Gamma of Transfer Characteristic over Signal Output Current operating range of .05 to .2 uA	.65
**Scanned Area	0.500 x 0.375"
Faceplate Temperature	30° to 35° C.
Magnetic Field Intensity at Center of Focusing Device	40 gauss
Magnetic Field Intensity of Adjustable Alignment Coil	0 to 4 gauss

*Signal output current equals signal electrode current minus dark current.

**A scanned area of 0.500 x 0.375" was used to obtain all data and characteristic curves.

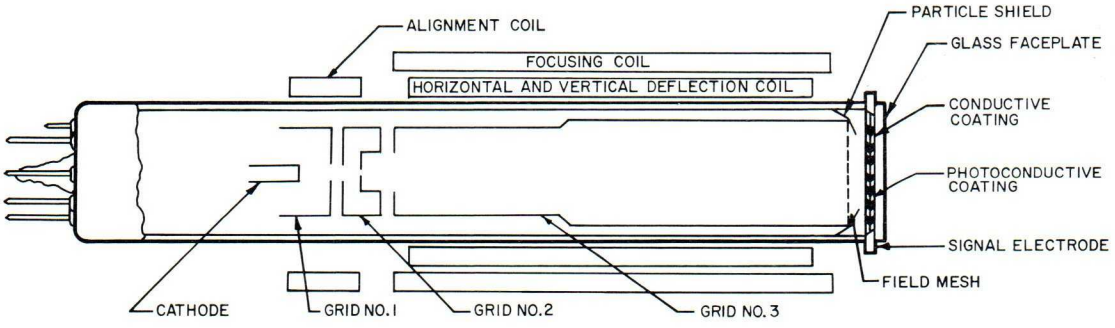

FIG. 1

PRINCIPLES OF OPERATION

The 8484 is intended primarily for use in closed circuit television applications. The high sensitivity of the tube results in high quality pictures under normal room and industrial area lighting conditions.

The operation of the 8484 Vidicon is based on the principle of photoconductivity which produces a change in electrical conductivity with variations in incident light intensity.

The inside surface of the vidicon faceplate is coated with a transparent conductive coating as shown in Figure 1. Over this is deposited a layer of photoconductive material. This material, when dark, is a reasonably good insulator. The electron beam is made to scan the back surface of this photoconductive surface.

In operation, the front surface of the photoconductor is held at a potential of approximately 30V, positive with respect to the cathode, by the application of this voltage to the transparent conductive coating. The scanning electron beam deposits a negative charge on the back surface of the photoconductor. Where the photoconductor is dark, and its resistance therefore high, the negative charge accumulates until this back surface is at the same potential as the cathode; any further electrons will be turned away. The dark portions of the photoconductor thus become charged in the manner of a capacitor. Dark current is slight electrical leakage through the dark areas.

But where light falls on the photoconductor, from the image of the scene, the conductivity of the material is substantially increased. The resulting leakage of the charge leaves a "hole" in the pattern of negative charge at any illuminated point. Upon its next trip across this point, then, the scanning beam will deposit electrons into this "hole"; this movement of charge calls for a corresponding flow of current into the transparent conductive coating, and the resulting voltage across the load resistor is the output video signal.

The vidicon thus has the ability to "store" the image for an entire scanning cycle; the image is "photographed" in the pattern of negative charge on the back surface of the photoconductive material, and is accumulated there for the time of one complete frame. This process allows the improved 8484 Vidicon to produce usable output from scenes which are dimly lighted.

The end of Grid No. 3 nearest the faceplate is covered by a very fine mesh screen. The purpose of this screen is to establish a uniform decelerating field in the vicinity of the photoconductive surface, so that the electrons will arrive perpendicular to this surface and with low velocity. The fine mesh screen provides a conducting plane through which electrons can readily pass.

Focusing of the electron beam is accomplished by a magnetic field which is parallel to the axis of the tube. Two magnetic fields which are perpendicular to the axis of the tube and to each other are the means of alignment. Deflection is accomplished by means of magnetic fields perpendicular to the axis of the tube. External coils are necessary to produce these fields.

OPERATING CONSIDERATIONS

DARK CURRENT:

The 8484 Vidicon has an extremely uniform dark current over the entire scanned area, which eliminates the problem of edge flare, shading and graininess. Dark current, which is a result of a slight leakage through the dark areas of the photoconductive coating is very consistent from tube to tube. The dark current increases as the signal electrode voltage increases and as the faceplate temperature increases. The faceplate temperature should be held constant or the signal electrode voltage must be adjusted in order to operate at the same signal level. See Figure 7 for lag (which increases with dark current) vs. dark current characteristics.

SIGNAL ELECTRODE CURRENT AND SENSITIVITY:

Sensitivity is a function of the characteristics of the photoconductive coating and the signal electrode voltage. The 8484 Vidicon has a high inherent sensitivity due to the unique quality of its photoconductive coating. Due to the exceptional uniformity of the coating, the 8484 may be operated at higher levels of dark current with resultant higher sensitivity (see Figure 6 for optimum operating conditions).

Figure 2 also shows the variation of sensitivity with dark current. For example, at one foot-candle and .02 uA dark current, the signal output is .20 uA. Increasing the dark current to .2 uA increases the signal output to .50 uA. Since dark current increases with signal electrode voltage, this curve demonstrates the variation of sensitivity with signal electrode voltage.

TEMPERATURE:

The tube may be stored at temperatures up to 125°C with no damage to the tube. A constant operating temperature of 30° to 35° C is recommended. No damage will result in operating up to 71° C; however, the picture quality will be somewhat reduced. If the tube is to be operated in high light levels, an infrared filter should be used to hold down the faceplate temperature. The signal electrode voltage should be reduced if the tube is being operated at higher temperatures in order to maintain a constant signal electrode current.

TUBE POSITION AND SCAN SIZE:

Orientation and size of scan is important for proper operation of the tube. The scanned area should be one-half inch by three-eights inch and oriented so that the horizontal scan is parallel to a line through the tube axis and the short index pin. Scanning a smaller area will result in loss of resolution and signal. The resolution varies approximately as the length of scan, and the signal varies in proportion to the area scanned. Permanent changes in sensitivity and dark current occur in the scanned area regardless of raster size. If underscanning has taken place, the sensitivity change will be visible when normal operation is restored. Provision should be made for biasing the tube to cutoff in the absence of scanning in order to prevent damage to the photoconductive coating.

Care should also be taken to assure proper mechanical centering of the tube in the focus, alignment and deflection coils. Highest quality magnetic components must be used to obtain full potential of the 8484 Vidicon. The quality of these components is particularly important when operating at higher voltages.

VOLTAGE:

A decrease of effective beam spot size, with a resultant increase in resolution, occurs when operating the tube at a higher G_3 voltage level. Conversely, operating at a lower voltage causes a decrease in resolution and picture quality. This characteristic is shown in Figure 3. Grid No. 1 voltage should be maintained just low enough to discharge the highlights of the picture. Excessive beam current will cause a loss of resolution.

PERSISTANCE:

The 8484 Vidicon has improved persistance characteristics as a result of its new photoconductive surface. Figure 7 shows these characteristics.

LIGHT TRANSFER CHARACTERISTICS:

Typical signal output current as a function of faceplate illumination is shown in Figure 2. The slope of the curve gives the average gamma of the tube. The tube gamma of .65 is held quite constant from tube to tube making the 8484 ideal for use in color cameras where matched tube characteristics are very important.

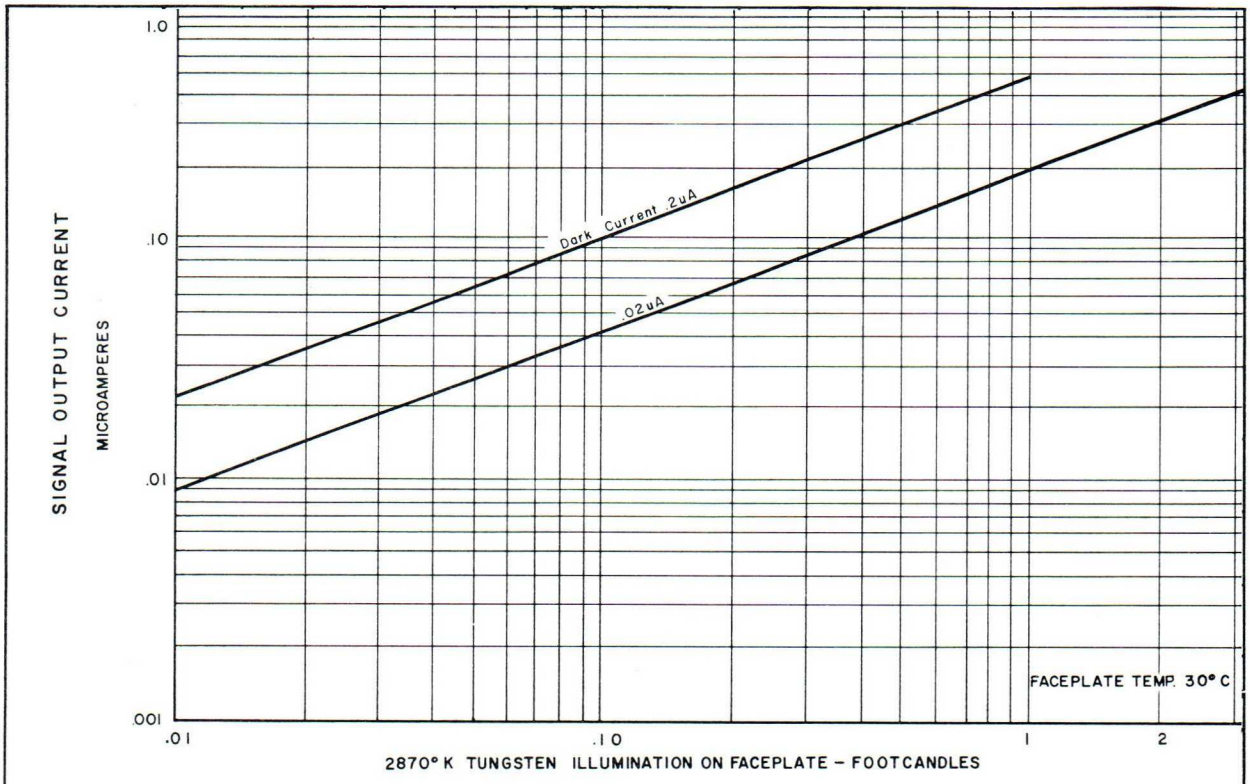

FIG. 2 TYPICAL LIGHT TRANSFER CHARACTERISTIC

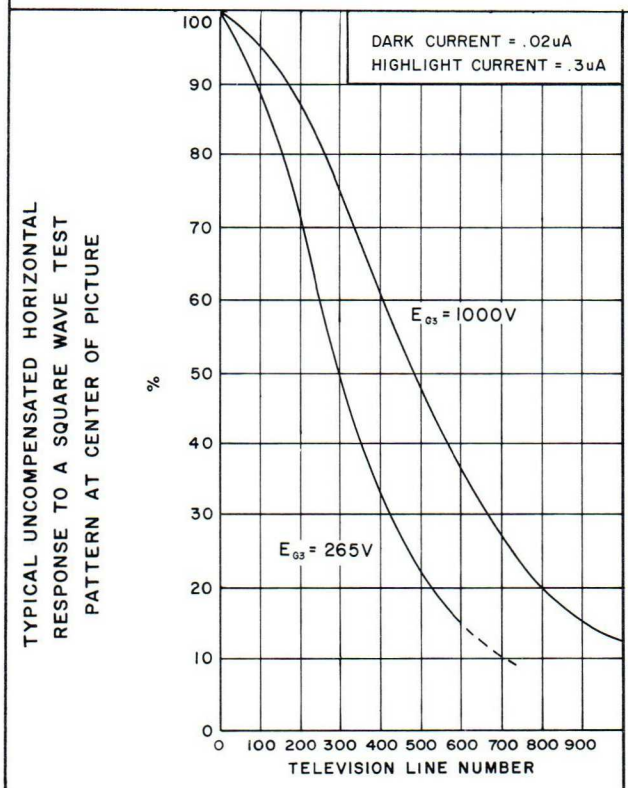

FIG. 3 AMPLITUDE RESPONSE

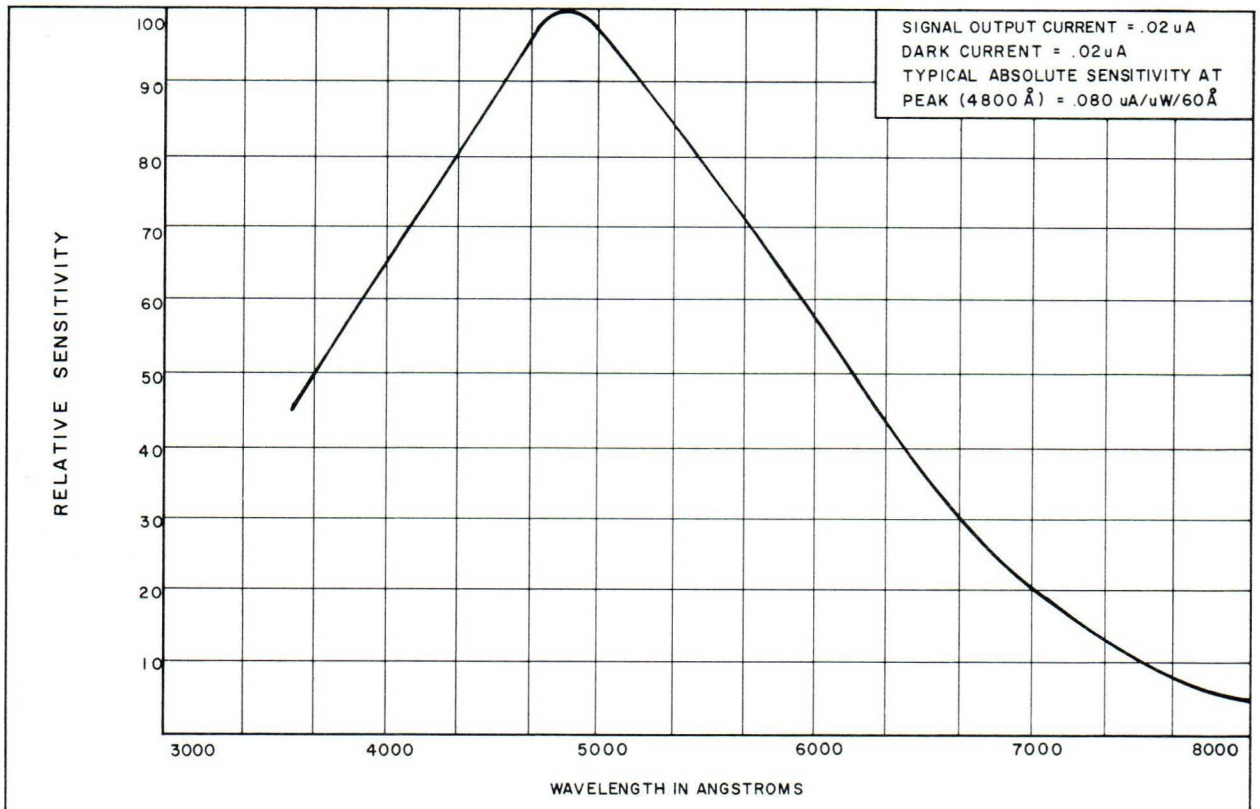

FIG. 4 SPECTRAL RESPONSE

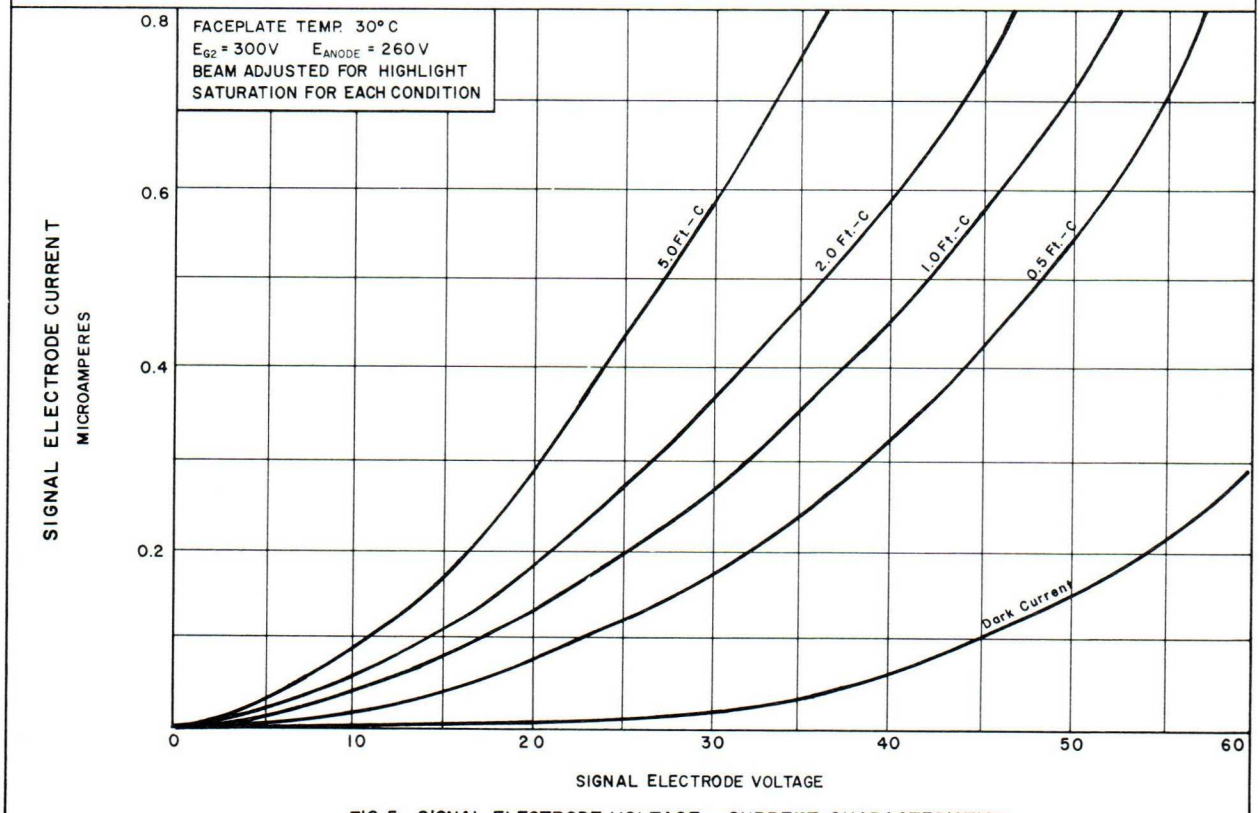

FIG. 5 SIGNAL ELECTRODE VOLTAGE — CURRENT CHARACTERISTICS

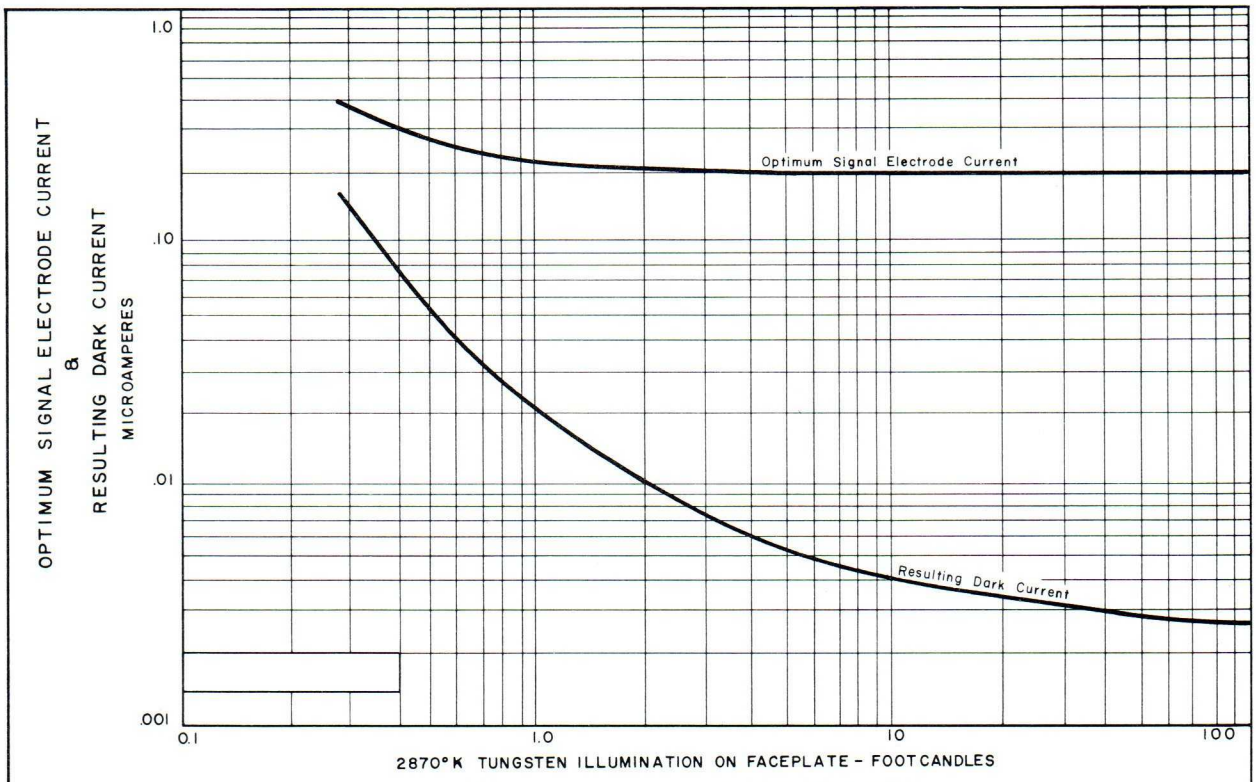

FIG. 6 OPTIMUM SIGNAL ELECTRODE CURRENT

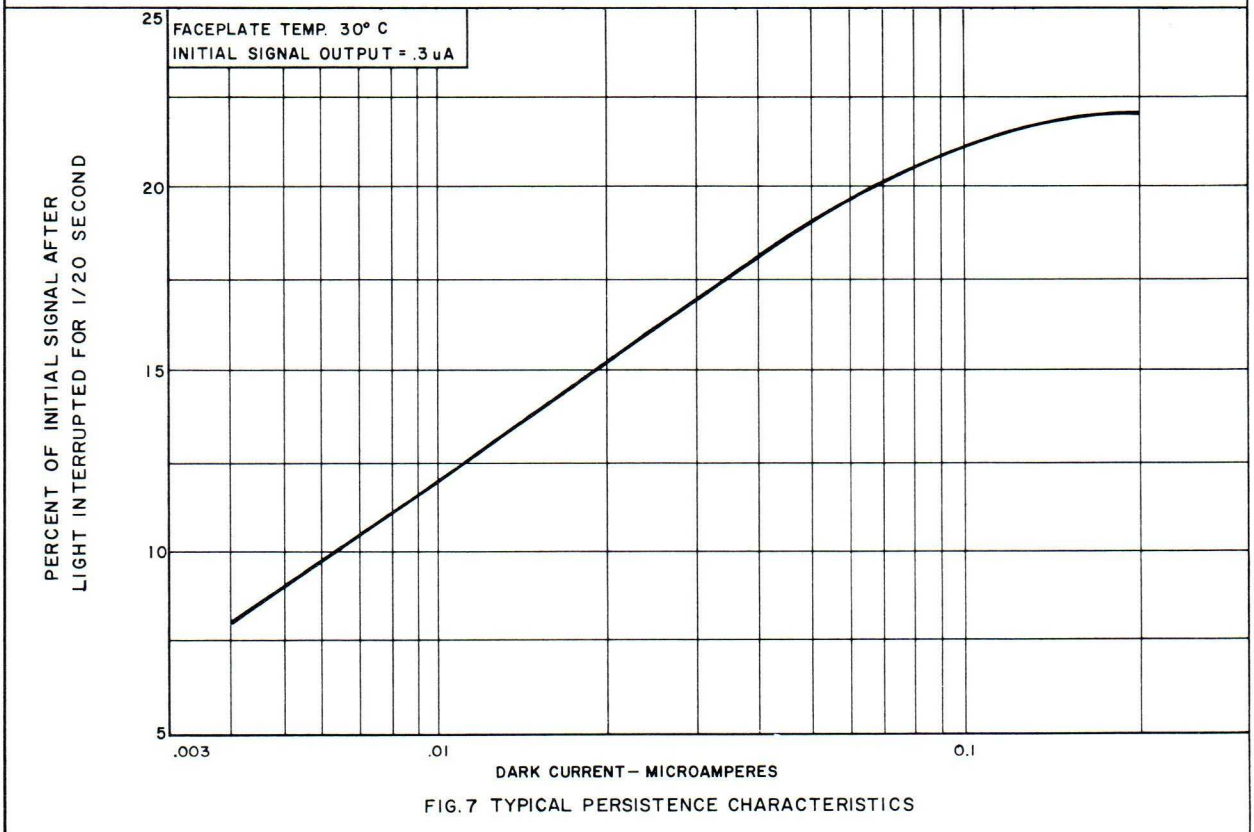

FIG. 7 TYPICAL PERSISTENCE CHARACTERISTICS

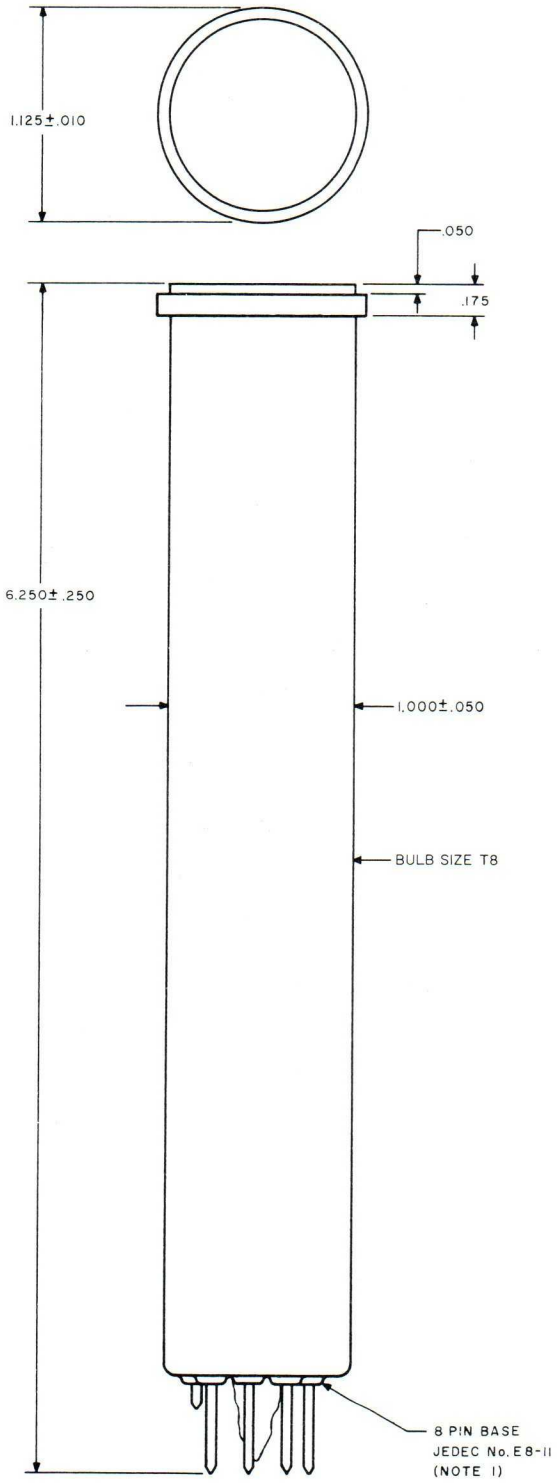

FIG.8

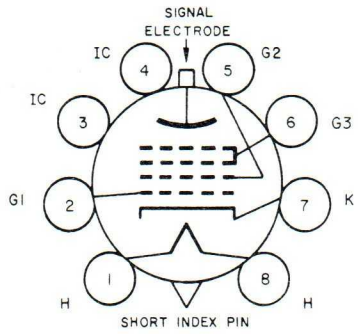

FIG.9

PIN 1: HEATER
PIN 2: GRID No. 1
PIN 3: INTERNAL CONNECTION--DO NOT USE
PIN 4: INTERNAL CONNECTION--DO NOT USE
PIN 5: GRID No. 2
PIN 6: GRID NO. 3
PIN 7: CATHODE
PIN 8: HEATER
FLANGE: SIGNAL ELECTRODE
SHORT INDEX PIN: INTERNAL CONNECTION--DO NOT USE

NOTES

1. Base-pin positions fit 0.25 inch thick, 10-hole flat-plate gage with holes located as follows: 9 holes, 0.0550 (±0.0005) inch diameter equally spaced, 0.2052 (±0.0005) inch apart on a circle, 0.6000 (±0.0005) inch diameter, plus a center hole, 0.300 (±0.001) in. diameter, concentric with 9-hole circle.

2. All dimensions are shown in inches.

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