

# Photomultiplier Tube

9-STAGE, SIDE-ON TYPE

S-5 RESPONSE

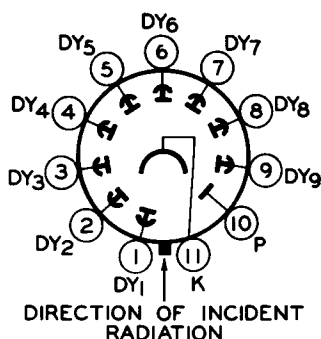
*For Detection and Measurement of  
Ultraviolet and Visible Radiation*

## GENERAL

|                                                 |                                                                              |
|-------------------------------------------------|------------------------------------------------------------------------------|
| Spectral Response . . . . .                     | S-5                                                                          |
| Wavelength of Maximum Response . . . . .        | 3400 ± 500 angstroms                                                         |
| Cathode, Opaque . . . . .                       | Cs-Sb                                                                        |
| Minimum projected length <sup>a</sup> . . . . . | 15/16 inch                                                                   |
| Minimum projected width <sup>a</sup> . . . . .  | 5/16 inch                                                                    |
| Window . . . . .                                | Ultraviolet-Transmitting Glass <sup>b</sup>                                  |
| Index of refraction at 5893 angstroms . . . . . | 1.47 ←                                                                       |
| Dynodes                                         |                                                                              |
| Substrate . . . . .                             | Ni                                                                           |
| Secondary-emitting surface . . . . .            | Cs-Sb                                                                        |
| Structure . . . . .                             | Circular Cage                                                                |
| Direct Interelectrode Capacitances (Approx.)    |                                                                              |
| Anode to dynode No.9 . . . . .                  | 4.4 pF                                                                       |
| Anode to all other electrodes . . . . .         | 6.0 pF                                                                       |
| Maximum Overall Length . . . . .                | 3-11/16 inch                                                                 |
| Maximum Seated Length . . . . .                 | 3-1/8 inch                                                                   |
| Length from Base Seat to Center of              |                                                                              |
| Useful Cathode Area . . . . .                   | 1-15/16 ± 3/32 inch                                                          |
| Maximum Diameter . . . . .                      | 1-5/16 inch                                                                  |
| Operating Position . . . . .                    | Any                                                                          |
| Weight (Approx.) . . . . .                      | 1.6 oz                                                                       |
| Envelope . . . . .                              | JEDEC T9                                                                     |
| Base . . . . .                                  | Small-Shell Submagnal 11-Pin,<br>(JEDEC Group 2, No.B11-88), Non-hygroscopic |
| Socket . . . . .                                | Amphenol <sup>c</sup> No.78S11T, or equivalent                               |
| Magnetic Shield . . . . .                       | Millen <sup>d</sup> Part No.80801B, or equivalent ←                          |

## TERMINAL DIAGRAM (Bottom View)

- Pin 1 - Dynode No.1  
 Pin 2 - Dynode No.2  
 Pin 3 - Dynode No.3  
 Pin 4 - Dynode No.4  
 Pin 5 - Dynode No.5  
 Pin 6 - Dynode No.6  
 Pin 7 - Dynode No.7  
 Pin 8 - Dynode No.8  
 Pin 9 - Dynode No.9  
 Pin 10 - Anode  
 Pin 11 - Photocathode



← Indicates a change.



## ABSOLUTE-MAXIMUM VALUES

### DC or Peak AC Supply Voltage

|                                              |      |    |
|----------------------------------------------|------|----|
| Between anode and cathode . . . . .          | 1250 | V  |
| Between dynode No.9 and anode . . . . .      | 250  | V  |
| Between consecutive dynodes . . . . .        | 250  | V  |
| Between dynode No.1 and cathode . . . . .    | 250  | V  |
| Average anode current <sup>e</sup> . . . . . | 0.5  | mA |
| Ambient temperature <sup>f</sup> . . . . .   | 75   | °C |

## CHARACTERISTICS RANGE VALUES

Under conditions with dc supply voltage (E) across a voltage divider providing 1/10 of E between cathode and dynode No.1, 1/10 of E for each succeeding dynode stage, and 1/10 of E between dynode No.9 and anode.

With E = 1000 V (Except as noted)

|                                                                  | Min                | Typ                                            | Max                                            |         |
|------------------------------------------------------------------|--------------------|------------------------------------------------|------------------------------------------------|---------|
| <b>Sensitivity</b>                                               |                    |                                                |                                                |         |
| Radiant, <sup>g</sup> at 3400 angstroms. . . . .                 | -                  | $1.2 \times 10^5$                              | -                                              | A/W     |
| Cathode radiant, <sup>h</sup> at 3400 angstroms . . . . .        | -                  | 0.05                                           | -                                              | A/W     |
| Luminous <sup>j</sup> . . . . .                                  | 17.5               | 100                                            | 500                                            | A/1m    |
| Cathode luminous <sup>k</sup> . . . . .                          | $1 \times 10^{-5}$ | $4 \times 10^{-5}$                             | -                                              | A/1m    |
| Quantum efficiency at 3200 angstroms. . . . .                    | -                  | 19                                             | -                                              | %       |
| <b>Current Amplification</b> . . . . .                           | -                  | $2.5 \times 10^6$                              | -                                              |         |
| <b>Equivalent Anode-Dark-Current Input<sup>n</sup></b> . . . . . | { -                | $2.5 \times 10^{-10m}$<br>$2 \times 10^{-13p}$ | $1.25 \times 10^{-9m}$<br>$1 \times 10^{-12p}$ | 1m<br>W |
| <b>Anode Dark Current at 20 A/1m<sup>m,n</sup></b> . . . . .     | -                  | $5 \times 10^{-9}$                             | $2.5 \times 10^{-8}$                           | A       |
| <b>Equivalent Noise Input<sup>q</sup></b> . . . . .              | { -                | $7.5 \times 10^{-13}$<br>$6 \times 10^{-16p}$  | -                                              | 1m<br>W |
| <b>Anode-Pulse Rise Time<sup>r</sup></b> . . . . .               | -                  | $1.9 \times 10^{-9}$                           | -                                              | s       |
| <b>Electron Transit Time<sup>s</sup></b> . . . . .               | -                  | $1.7 \times 10^{-8}$                           | -                                              | s       |

<sup>a</sup> On plane perpendicular to the indicated direction of incident light and passing through the major axis of the tube.

<sup>b</sup> Corning No.9741, Corning Glass Works, Corning, New York, or equivalent.

<sup>c</sup> Made by Amphenol Electronics Corporation, 1830 South 54th Avenue, Chicago 50, Illinois.

<sup>d</sup> Made by James Millen Manufacturing Company, 150 Exchange Street, Malden 48, Mass.

<sup>e</sup> Averaged over any interval of 30 seconds maximum.

<sup>f</sup> Tube operation at room temperature or below is recommended.

<sup>g</sup> This value is calculated from the typical luminous sensitivity rating using a conversion factor of 1252 lumens per watt.

<sup>h</sup> This value is calculated from the typical cathode luminous sensitivity rating using a conversion factor of 1252 lumens per watt.

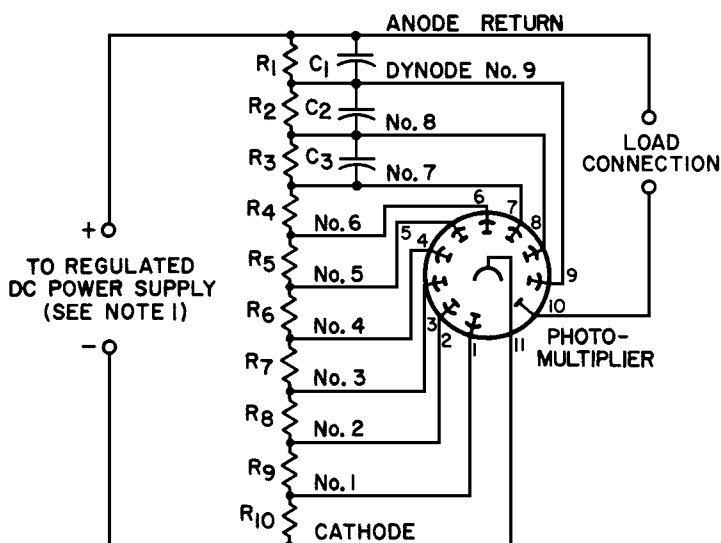
<sup>j</sup> Under the following conditions: The light source is a tungsten-filament lamp having a lime-glass envelope. It is operated at a color temperature of 2870°K and a light input of 10 microlumens is used.

<sup>k</sup> Under the following conditions: The light source is a tungsten-filament lamp having a lime-glass envelope. It is operated at a color temperature of 2870°K. The value of light flux is 0.01 lumen and 100 volts are applied between cathode and all other electrodes connected as anode.

➔ Indicates a change.

- <sup>m</sup> At a tube temperature of 22°C and with supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current may be reduced by use of a refrigerant.
- <sup>n</sup> For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1000 volts is recommended.
- <sup>p</sup> At 3400 angstroms. This value is calculated from the rating in lumen using a conversion factor of 1252 lumens/watt.
- <sup>q</sup> Under the following conditions: Supply voltage (E) is as shown, 22°C tube temperature, external shield connected to cathode, bandwidth 1 cycle per second, tungsten-light source at a color temperature of 2870°K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period.
- <sup>r</sup> Measured between 10 per cent and 90 per cent of maximum anode-pulse height. This anode-pulse rise time is primarily a function of transit time variation and is measured under conditions with the incident light fully illuminating the photocathode.
- <sup>s</sup> The electron transit time is the time interval between the arrival of a delta function light pulse at the entrance window of the tube and the time at which the output pulse at the anode terminal reaches peak amplitude. The transit time is measured under conditions with the incident light fully illuminating the photocathode.

## TYPICAL VOLTAGE-DIVIDER ARRANGEMENT



92CS-11382R1

R<sub>1</sub> through R<sub>10</sub> = 20,000 to 1,000,000 ohms

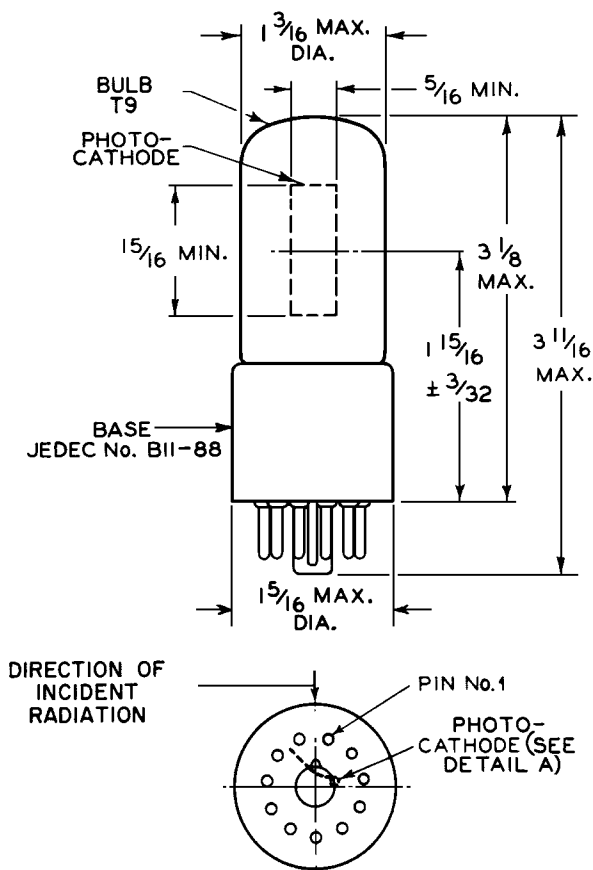
**Note 1:** Adjustable between approximately 500 and 1250 volts.

**Note 2:** Capacitors C<sub>1</sub> through C<sub>3</sub> should be connected at tube socket for optimum high-frequency performance.

**SPECTRAL-SENSITIVITY CHARACTERISTIC  
OF PHOTSENSITIVE DEVICE HAVING S-5 RESPONSE**  
is shown at the front of this section



## DIMENSIONAL OUTLINE

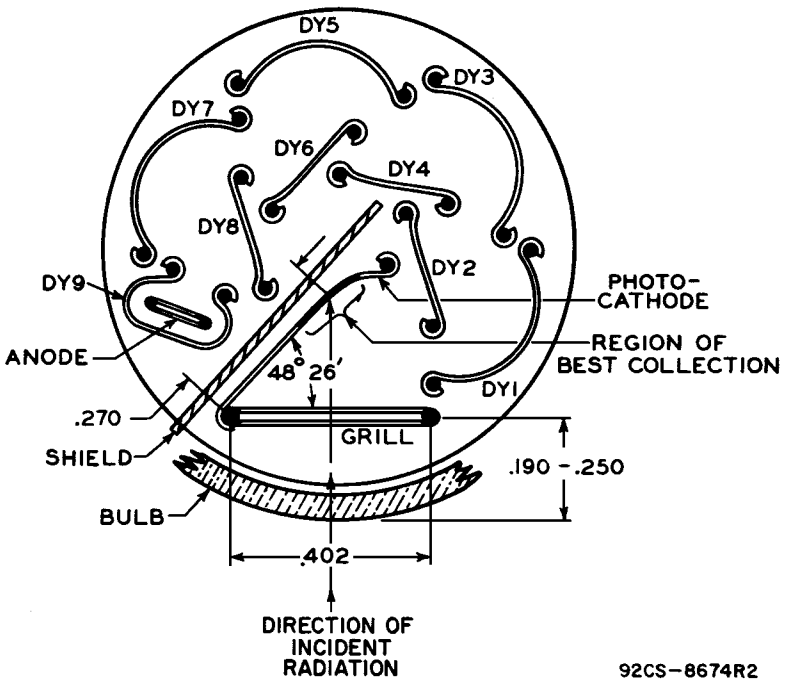


92CM-6264R9

## DIMENSIONS IN INCHES

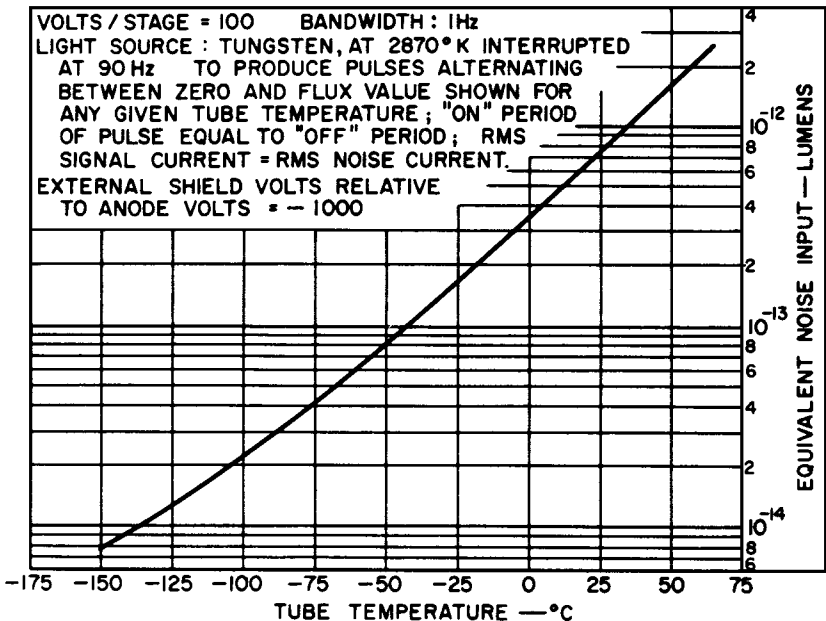
Center line of bulb will not deviate more than  $2^\circ$  in any direction from the perpendicular erected at center of bottom of base.

DETAIL A



92CS-8674R2

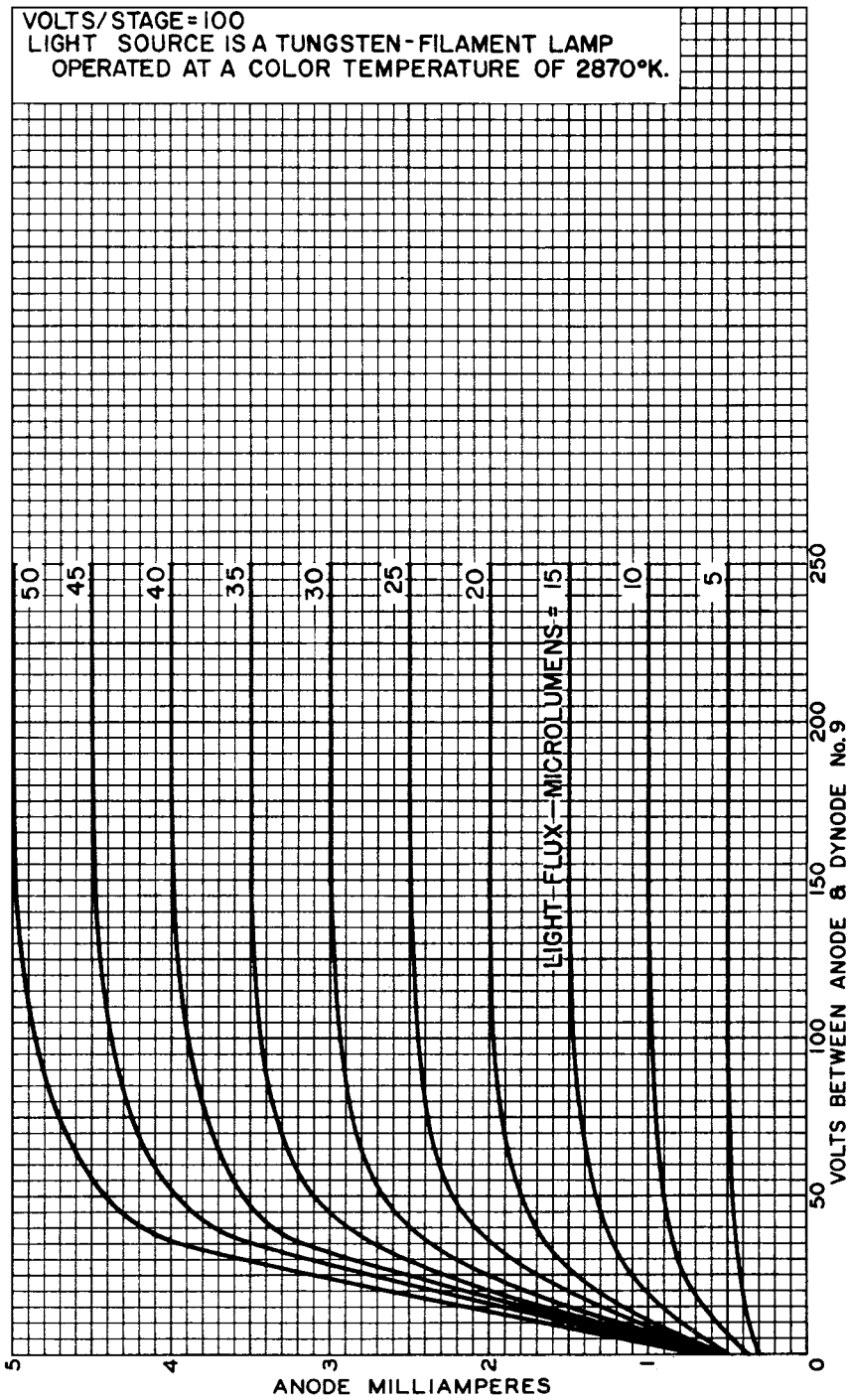
## Equivalent-Noise-Input Characteristic



92CS-7503R2



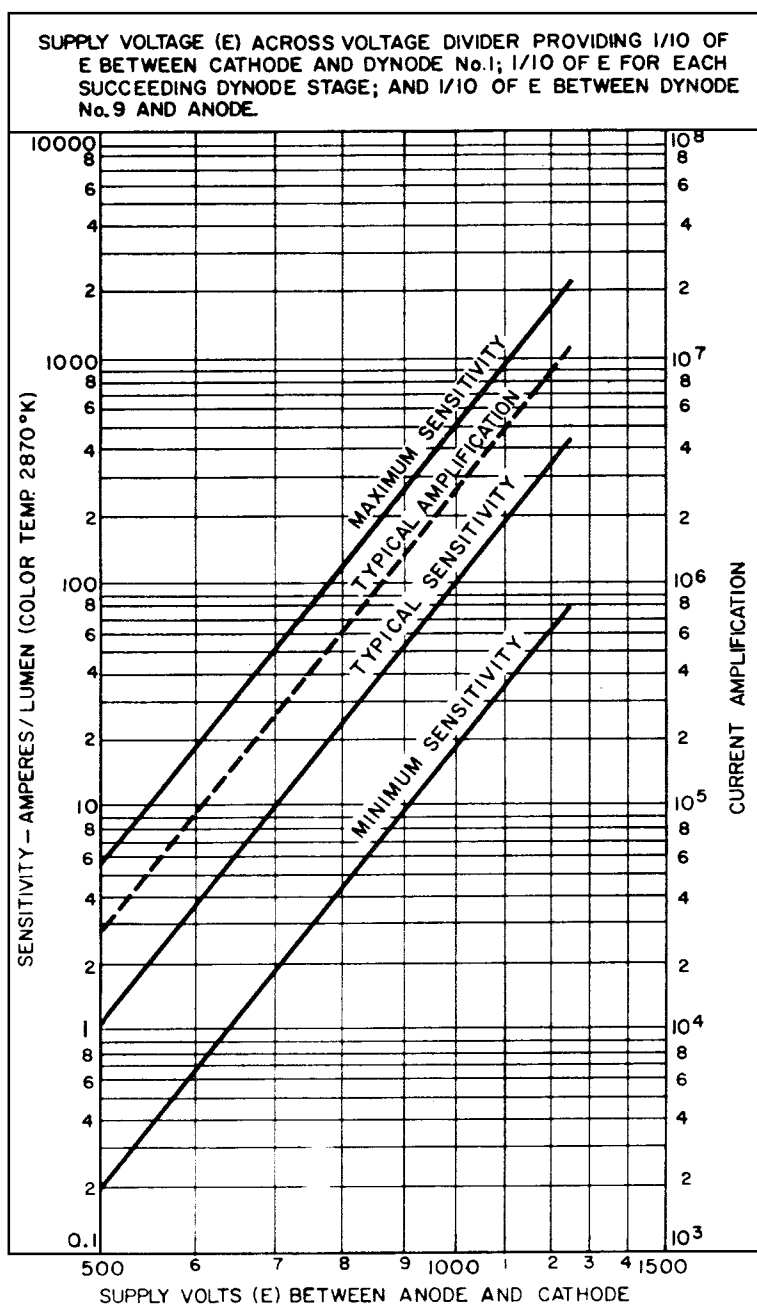
Typical Anode Characteristics



92CM-6632R4



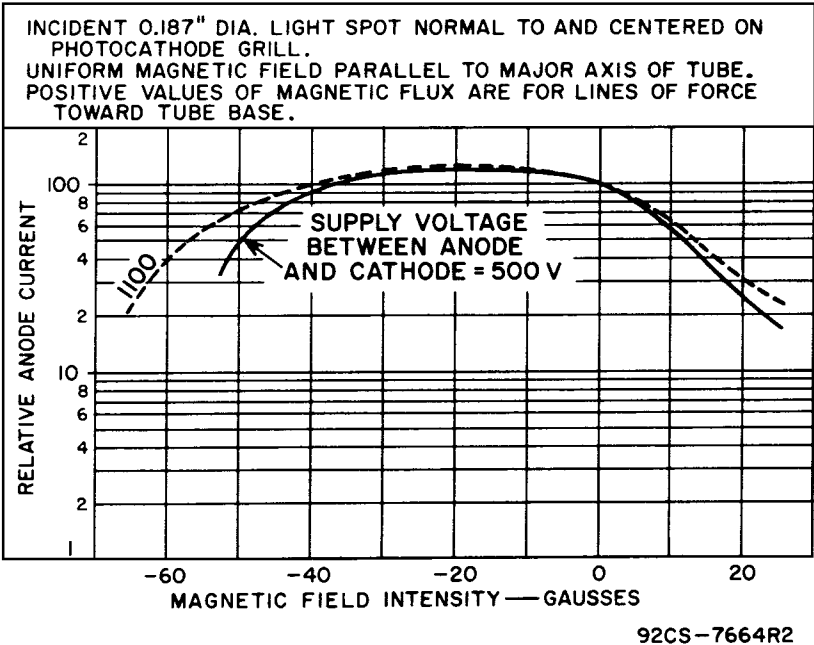
# Typical Sensitivity and Current Amplification Characteristics



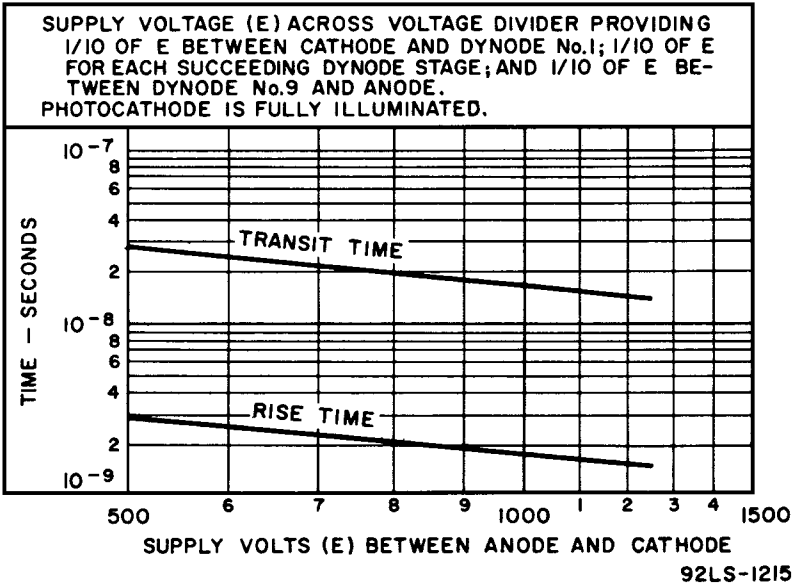
92 LM-1216



Typical Effect of Magnetic Field  
on Anode Current

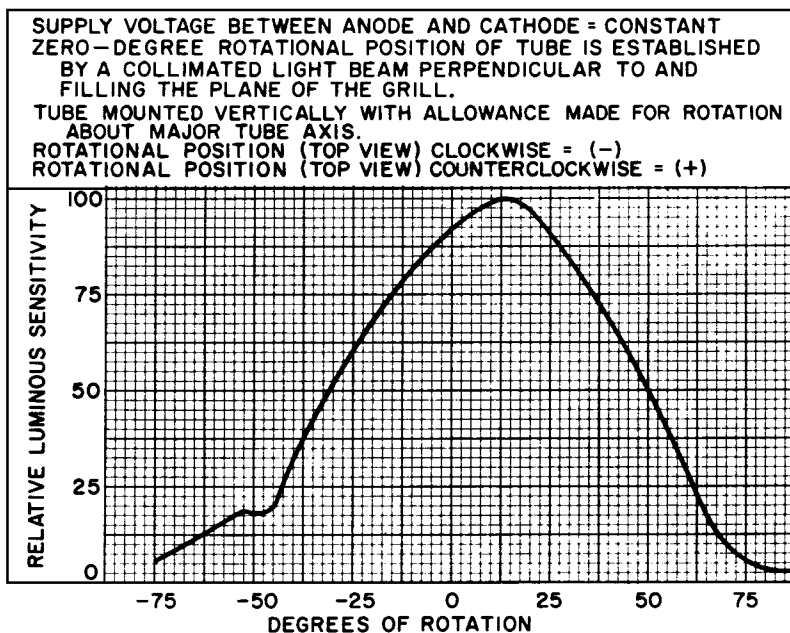


Typical Time-Resolution Characteristics



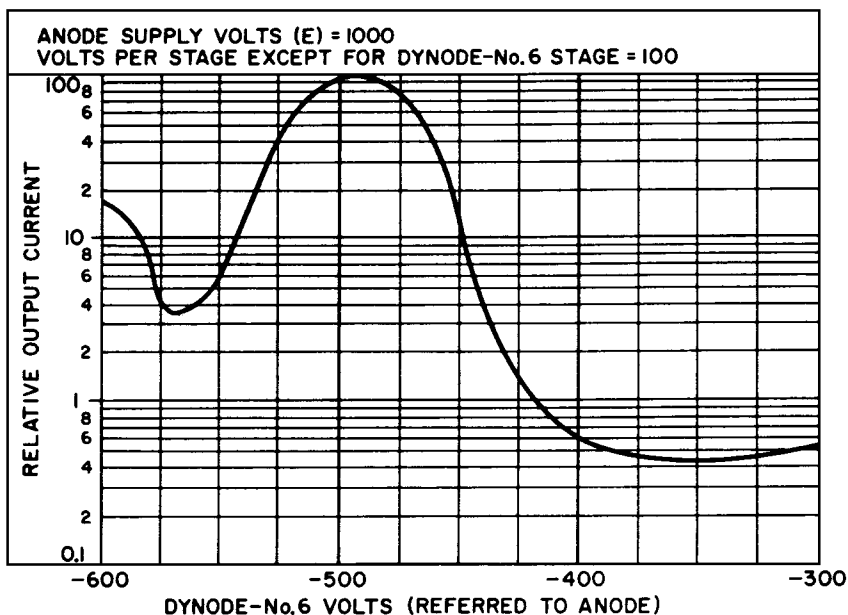


## Typical Variation of Sensitivity as Tube is Rotated with Respect to Fixed Light Beam



92CS-8671R2

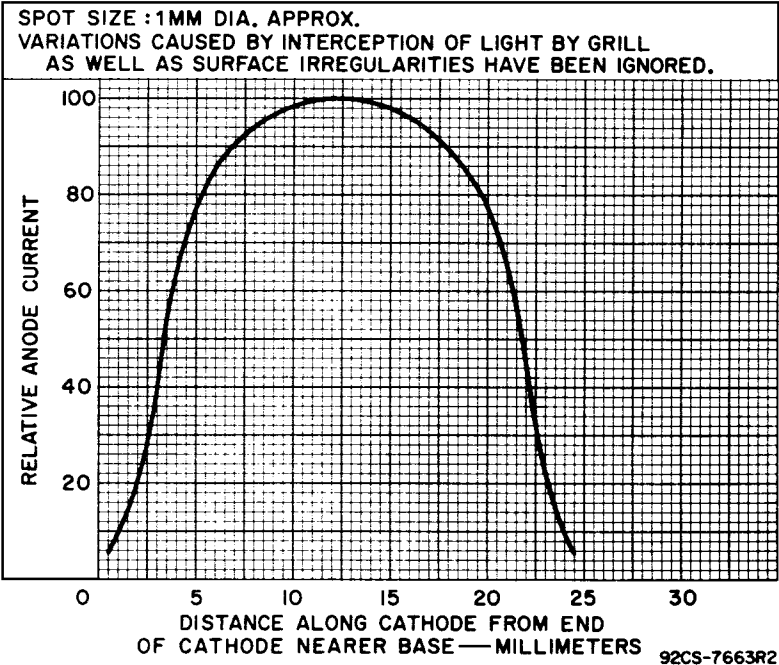
## Dynode Modulation Characteristics



92CS-8672R1



# Typical Variation of Photocathode Sensitivity Along Tube Length



# Typical Variation of Photocathode Sensitivity Across Projected Width in Plane of Grill

