



7326

MULTIPLIER PHOTOTUBE

1.68" Dia. Curved
Circular Semitrans-
parent Photocathode

10-Stage, Head-On Type, Flat Faceplate
S-20 Response
TENTATIVE DATA

6.78" Max. Length
2.38" Max. Diameter
Dihedral 14-Pin Base

RCA-7326 is a head-on type of multiplier phototube intended for use in applications such as flying-spot scanning and photometry, which require low dark current as well as high sensitivity over the entire visible spectrum. In addition, its high blue sensitivity, fast response, relative freedom from after-pulses, and small spread in electron-transit time make the 7326 particularly useful in scintillation counters.



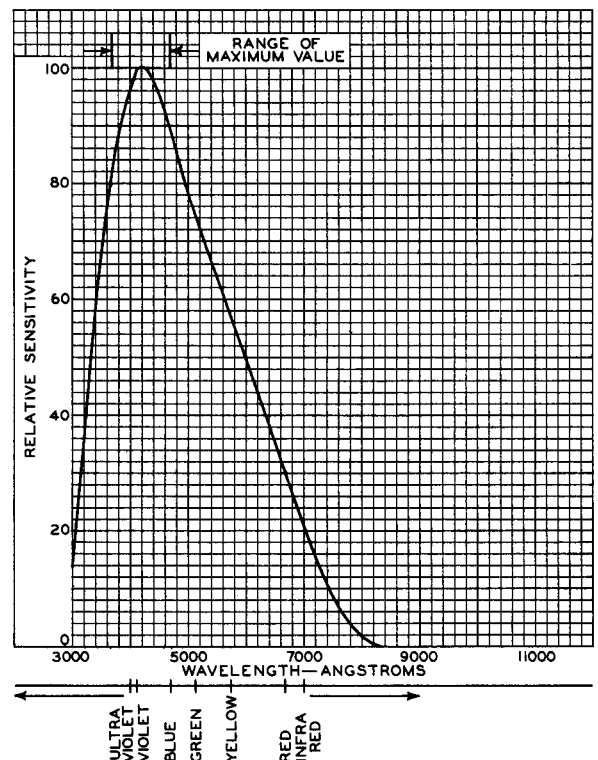
The spectral response of the 7326 covers the range from about 3000 to 7500 angstroms, with maximum response at approximately 4200 angstroms, as shown in Fig. 1. It will be noted that the response extends beyond the visible region into the blue region on the one end and well into the red region on the other end.

The 7326 utilizes a new and improved semi-transparent photocathode characterized by high sensitivity, low thermionic dark current, and high conductivity even at low temperatures. The photocathode may be cooled to liquid-air temperature to reduce its low thermionic dark current to an extremely low value without sacrificing its conductivity to such an extent that its current-carrying capability is impaired.

Design features of the 7326 include stable dynodes, a focusing electrode with external connection for shaping the field which directs photoelectrons from the photocathode onto the first dynode, and a semitransparent photocathode on the curved inner surface of the face end of the bulb.

The focusing electrode permits optimizing the magnitude, uniformity, or speed of the response in critical applications.

The curved photocathode surface of the 7326 assures very good collection by dynode No. 1 of electrons from all parts of the useful photocathode area. The curved surface together with the electrode configuration employed in the 7326 minimizes variation in electron-transit time between the photocathode and dynode No. 1.



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Fig. 1 - Tentative Spectral Sensitivity Characteristic of Type 7326 Which Has S-20 Response. Curve is Shown For Equal Values of Radiant Flux at All Wavelengths.



DEFINITIONS

Radiant Sensitivity. The quotient of output current by incident radiant power of a given wavelength, at constant electrode voltages.

Cathode Radiant Sensitivity. The quotient of current leaving the photocathode by incident radiant power of a given wavelength.

Luminous Sensitivity. The quotient of output current by incident luminous flux, at constant electrode voltages.

Current Amplification. Ratio of the output current to the photocathode current, at constant electrode voltages.

Equivalent Anode-Dark-Current Input. The quotient of the anode dark current by the luminous sensitivity.

Equivalent Noise Input. That value of incident luminous flux which when modulated in a stated manner produces an rms output current equal to the rms noise current within a specified bandwidth.

Pulse Rise Time. The time required for the instantaneous amplitude of the pulse to go from 10 per cent to 90 per cent of the peak value.

DATA

General:

Spectral Response	S-20
Wavelength of Maximum Response . . .	4200 ± 500 angstroms
Cathode, Semitransparent:	
Shape	Curved Circular
Window:	
Area	2.2 sq.in.
Minimum diameter	1.68 in.
Index of refraction	1.51
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.10	2.4 μmf
Anode to all other electrodes	5.5 μmf
Dynode No.10 to all other electrodes	6.5 μmf
Maximum Overall Length	6.78"
Seated Length	5.84" ± 0.19"
Maximum Diameter	2.38"
Bulb	T-16
Base	Medium-Shell Diheptal 14-Pin, (JEDEC Group 5, No.814-38) Non-hygroscopic
Operating Position	Any
Weight (Approx.)	6 oz

Maximum Ratings, Absolute Values:

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC)	2400 max. volts
SUPPLY VOLTAGE BETWEEN DYNODE No.10 AND ANODE (DC)	500 max. volts
SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES (DC)	600 max. volts
DYNODE No.1 SUPPLY VOLTAGE (DC)	500 max. volts
FOCUSING-ELECTRODE SUPPLY VOLTAGE (DC) .	500 max. volts
AVERAGE ANODE CURRENT	1 max. ma
AMBIENT TEMPERATURE	85 max. °C

Characteristics Range Values for Equipment Design:

Under conditions with dc supply voltage (E) across a voltage divider providing 1/8 of E between cathode and dynode No.1; 1/8 of E between cathode and focusing electrode; 1/12 of E for each succeeding dynode stage; and 1/12 of E between dynode No.10 and anode.

With E = 1800 volts (except as noted)

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4200 angstroms	-	9600	-	μa/μw
Cathode Radiant, at 4200 angstroms	-	0.064	-	μa/μw
Luminous	5	22.5	150	amp/lumen
Cathode Luminous:				
With tungsten light source	120	150	-	μa/lumen

Min. Median Max.

Cathode Luminous (Cont'd):

With blue light source**	0.05	-	-	μa
With red light source	0.30	-	-	μa

Current Amplification	-	1.5 x 10 ⁵	-	
Equivalent Anode-Dark-Current Input†	-	3 x 10 ⁻¹⁰	1.4 x 10 ⁻⁹	lumen
Equivalent Noise Input:★				
At +25° C	-	1.9 x 10 ⁻¹²	4.3 x 10 ⁻¹²	lumen
At -80° C	-	3 x 10 ⁻¹³	6 x 10 ⁻¹³	lumen
Anode-Pulse Rise TimeⓈ	-	2.5	-	milliμsec
Greatest Delay Between Anode Pulses:				
Due to position from which electrons are simultaneously released within a circle centered on tube face and having a diameter of--				
1.12"	-	1†	-	milliμsec
1.56"	-	3†	-	milliμsec

- Averaged over any interval of 30 seconds maximum.
- Ⓢ Under the following conditions: The light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light input of 0.1 microlumen is used. The load resistor has a value of 0.01 megohm.
- ▲ Under the following conditions: The light source is a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux is 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected together as anode. The load resistor has a value of 0.01 megohm.
- ** Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning, Glass Code No.5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm and 200 volts are applied between cathode and all other electrodes connected together as anode.
- Under the following conditions: Light incident on the cathode is transmitted through a red filter (Corning, Glass Code No.2418, or equivalent) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 200 volts are applied between cathode and all other electrodes connected together as anode.
- Ⓢ Measured at a tube temperature of 25° C and with the supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission may be reduced by the use of a refrigerant.
- For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1800 volts is recommended.
- ★ Under the following conditions: Supply voltage (E) is 1800 volts, external shield potential of -1800 volts, ac-amplifier bandwidth of 1 cycle per second, tungsten light source 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. The output current is measured through a filter which passes only the fundamental frequency of the pulses.
- Ⓢ Measured between 10 per cent and 90 per cent of maximum anode-pulse height. This anode-pulse rise time is determined primarily by transit-time variations in the multiplier stages and with an incident light spot approximately 1 millimeter in diameter centered on the photocathode.



† These values also represent the difference in time of transit between the photocathode and dynode No.1 for electrons simultaneously released from the center and from the periphery of the specified areas.

OPERATING CONSIDERATIONS

The *maximum ratings* in the tabulated data are established in accordance with the following

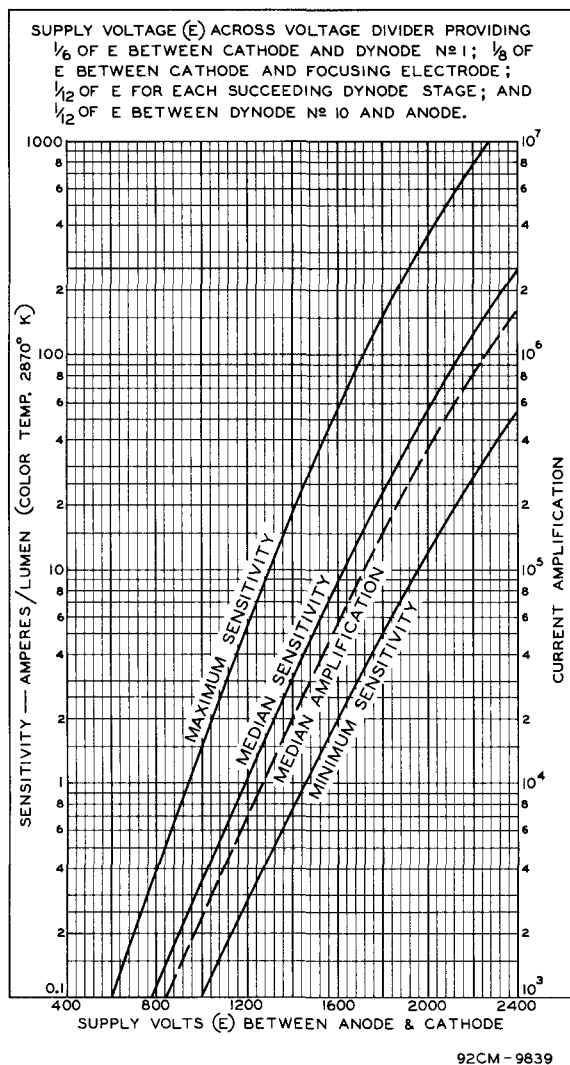


Fig.2 - Characteristics of Type 7326.

definition of the *Absolute-Maximum Rating System* for rating electron devices.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environment variations, and the effects of changes in operating conditions due to variations in device characteristics.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage varia-

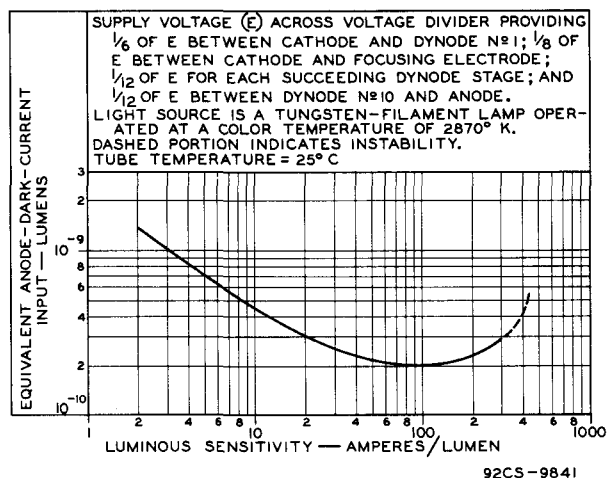


Fig.3 - Typical Anode-Dark-Current Characteristics of Type 7326.

tion, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in device characteristics.

The use of an *average anode current* well below the maximum rated value of 1 milliampere is recommended when stability of operation is important.

Electrostatic and/or magnetic shielding of the 7326 may be necessary. When a shield is used it should be connected to a potential near that of the cathode. It is to be noted that the use of an external magnetic and/or electrostatic shield at high negative potential presents a safety hazard unless the shield is connected through a high impedance in the order of 10 megohms to the potential. If the shield is not so connected, *extreme care should be observed in providing adequate safeguards to prevent personnel from coming in contact with the high potential of the shield.*

The high voltages at which the 7326 is operated are very dangerous. Before any part of the circuit is touched, the power-supply switch should be turned off and both terminals of any capacitors grounded.

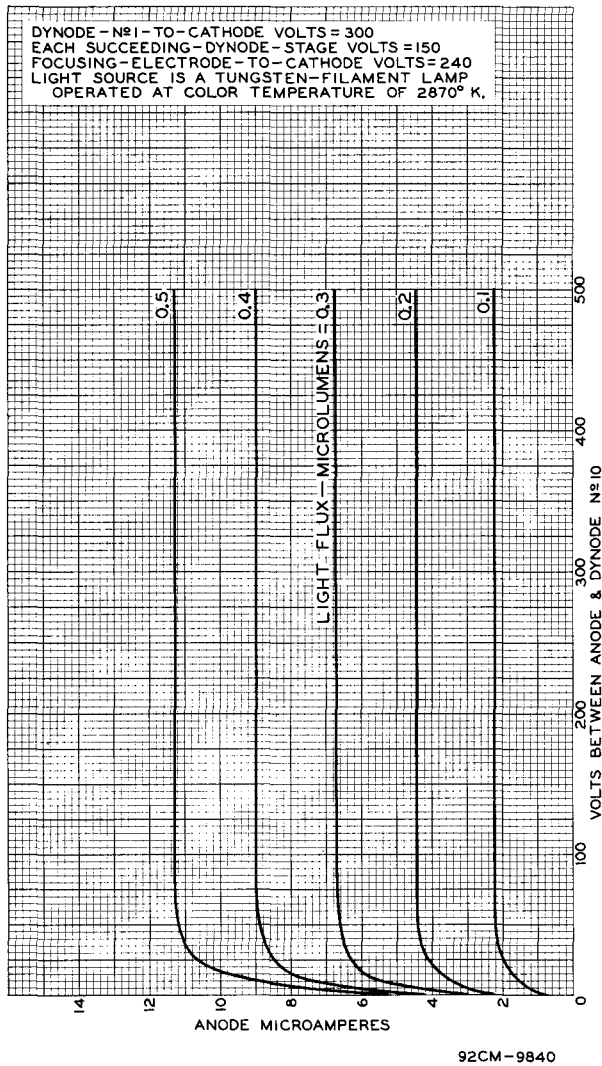
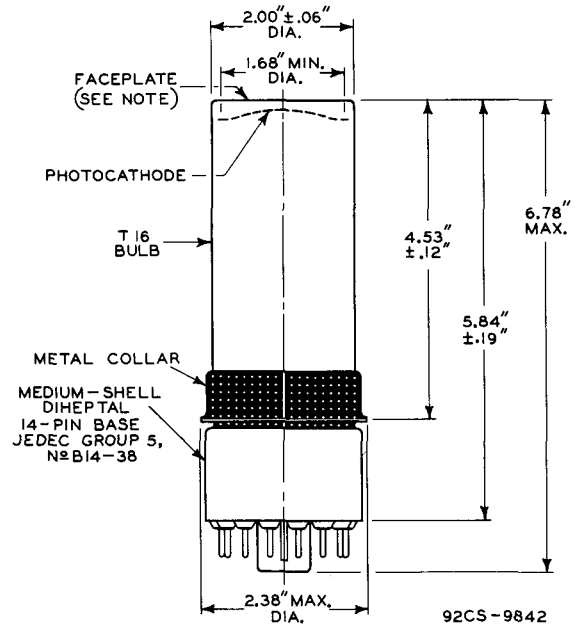


Fig. 4 - Typical Anode Characteristics
of Type 7326.

DIMENSIONAL OUTLINE

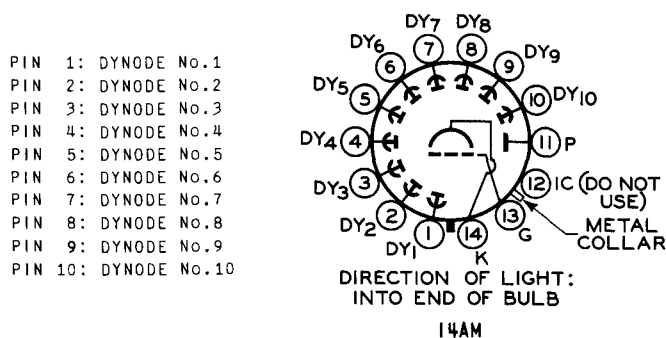


⊥ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE: WITHIN 1.68" DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.005" FROM PEAK TO VALLEY.

SOCKET CONNECTIONS

Bottom View



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