Multiplier Phototube

10-Stage, Head-On Type Having S-11 Spectral Response

GENERAL

Spectral Response	S-11
Wavelength of Maximum Response	4400 ± 500 Å
Cathode, Semitransparent	Cesium-Antimony with High-Conductivity Grating
Area including grating	1.8 in^2 (11.6 cm^2)
Minimum diameter	1.5 in (3.8 cm)
Window	Corning[a] No.0080, or equivalent
Shape	Plano-Plano
Index of refraction at 4360 angstroms	1.523
Dynodes:	
Substrate	Copper-Beryllium
Secondary-Emitting Surface	Beryllium-Oxide
Structure	Circular-Cage, Electrostatic-Focus Type
Direct Interelectrode Capacitances (Approx.):	
Anode to dynode No.10	4.4 pF
Anode to all other electrodes	7.0 pF
Maximum Overall Length	5.81 in (14.8 cm)
Seated Length	4.88 ± 0.19 in (12.4 ± 0.48 cm)
Maximum Diameter	2.31 in (5.9 cm)
Bulb	T-16
Base	Medium-Shell Diheptal 14-Pin (JEDEC No.B14-38), Non-hygroscopic
Socket	Eby[b] No.9709-7, or equivalent
Magnetic Shield	Millen[c] Part No.80802B, or equivalent
Operating Position	Any
Weight (Approx.)	5.2 oz (174 g)

ABSOLUTE-MAXIMUM RATINGS

DC Supply Voltage:		
Between anode and cathode	1500 max.	V
Between anode and dynode No.10	250 max.	V
Between consecutive dynodes	250 max.	V
Between dynode No.1 and cathode	400 max.	V

Between focusing electrode and cathode . .	400 max.	V
Average Anode Current[e]	2 max.	mA
Average Cathode Current[f]	5 max.	μA
Ambient Temperature[g]	75 max.	°C

CHARACTERISTICS RANGE VALUES

Under conditions with dc supply voltage (E) across a voltage divider providing 1/6 of E between cathode and dynode No.1; 1/12 of E for each succeeding dynode stage; and 1/12 of E between dynode No.10 and anode. Focusing-electrode voltage is adjusted to that value between 10 and 60 per cent of dynode No.1 potential (referred to cathode) which provides maximum anode current.

With E = 1250 volts (Except as noted)

	Min.	Typical	Max.	
Anode Sensitivity:				
Radiant[h] at 4400 angstroms . .	–	4.8×10^{3}	–	A/W
Luminous (2870° K)[i]	2.5	6	75	A/lm
Cathode Sensitivity:				
Radiant[k] at 4400 angstroms . .	–	0.04	–	A/W
Luminous (2870° K)[m]	3×10^{-5}	5×10^{-5}	–	A/lm
Current with blue light source (2870° K + C.S. No.5-58)[n]	3×10^{-8}	5×10^{-8}	–	A
Quantum Efficiency at 4200 angstroms.	–	11.5	–	%
Current Amplification	–	1.2×10^{5}	–	
Anode Dark Current[p]	–	4×10^{-9}	4.5×10^{-8}	A
Equivalent Anode Dark Current Input[p]	– –	2×10^{-10} 2.5×10^{-13}[q]	2.25×10^{-9} 2.8×10^{-12}[q]	lm W
Equivalent Noise Input[r]	– –	5.6×10^{-12} 7×10^{-15}[s]	1.9×10^{-11} 2.3×10^{-14}[s]	lm W

[a] Made by Corning Glass Works, Corning, NY 14830.

[b] Made by Hugh H. Eby Company, 4701 Germantown Avenue, Philadelphia, PA 19144.

[c] Made by James Millen Manufacturing Company, 150 Exchange Street, Malden, MA 02148.

[e] Averaged over any interval of 30 seconds maximum.

[f] Above this value of average cathode current, serious loss in linearity between light input and anode current will be caused by the resistivity of the cathode.

[g] Tube operation at room temperature or below is recommended.

[h] This value is calculated from the typical anode luminous sensitivity rating using a conversion factor of 804 lumens per watt.

[i] 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.

[k] This value is calculated from the typical cathode luminous sensitivity rating using a conversion factor of 804 lumens per watt.

[m] 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 200 volts are applied between cathode and all other electrodes connected as anode.

[n] Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning C.S. No.5-58, polished to 1/2 stock thickness-Manufactured by the Corning Glass Works, Corning, NY 14830) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux incident on the filter is 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

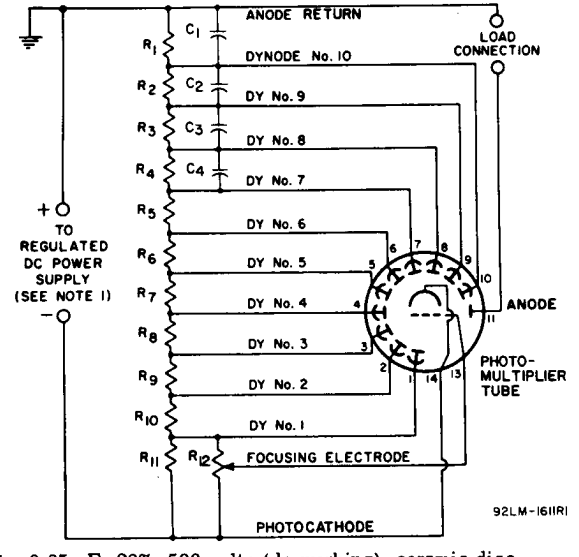
[p] At a tube temperature of 22° C. With supply voltage adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current caused by thermionic emission may be reduced by use of a refrigerant.

[q] At 4400 angstroms. These values are calculated from the EADCI values in lumens using a conversion factor of 804 lumens per watt.

[r] Under the following conditions: Tube temperature 22° C, external shield connected to cathode, bandwidth 1 Hz, 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.

[s] At 4400 angstroms. These values are calculated from the ENI values in lumens using a conversion factor of 804 lumens per watt.

TYPICAL VOLTAGE-DIVIDER ARRANGEMENT

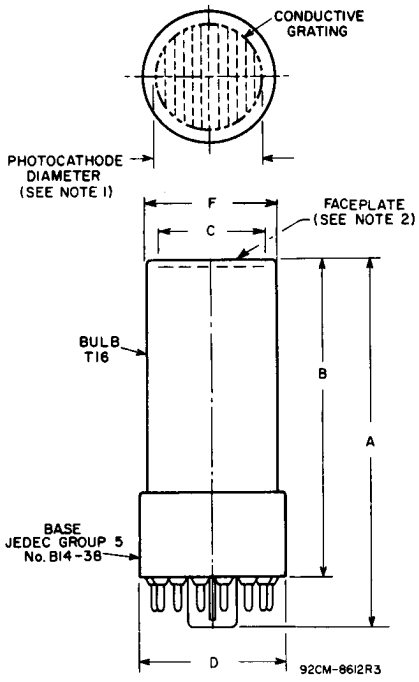


C_1: 0.05 μF, 20%, 500 volts (dc working), ceramic disc
C_2: 0.02 μF, 20%, 500 volts (dc working), ceramic disc
C_3: 0.01 μF, 20%, 500 volts (dc working), ceramic disc
C_4: 0.005 μF, 20%, 500 volts (dc working), ceramic disc
R_1 through R_{10}: 390,000 ohms, 5%, 1/2 watt
R_{11}: 910,000 ohms, 5%, 1/2 watt
R_{12}: 5 megohms, 20%, 1/2 watt, adjustable

Note 1: Adjustable between approximately 500 and 1500 volts dc.

Note 2: Component values are dependent upon nature of application and output signal desired.

DIMENSIONAL OUTLINE



℄ of bulb will not deviate more than 2^{o} in any direction from the perpendicular erected at the center of bottom of the base.

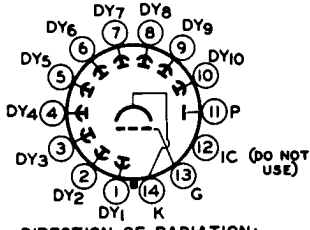
Note 1: The grating consists of 12 equally spaced conductive strips having a maximum width of 0.02" (0.5 mm).

Note 2: Deviation from flatness will not exceed 0.010" from peak to valley.

OUTLINE DIMENSIONS

Dimensions	Inches	mm
A	5.81 max.	147.5 max.
B	4.88 ± .19	123.9 ± 4.8
C	1.5 min. dia.	38 min. dia.
D	2.31 max. dia.	58.6 max. dia.
F	2.00 ± .06 dia.	50.8 ± 1.5 dia.

TERMINAL DIAGRAM (Bottom View)



DIRECTION OF RADIATION:
INTO END OF BULB

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: Dynode No.10

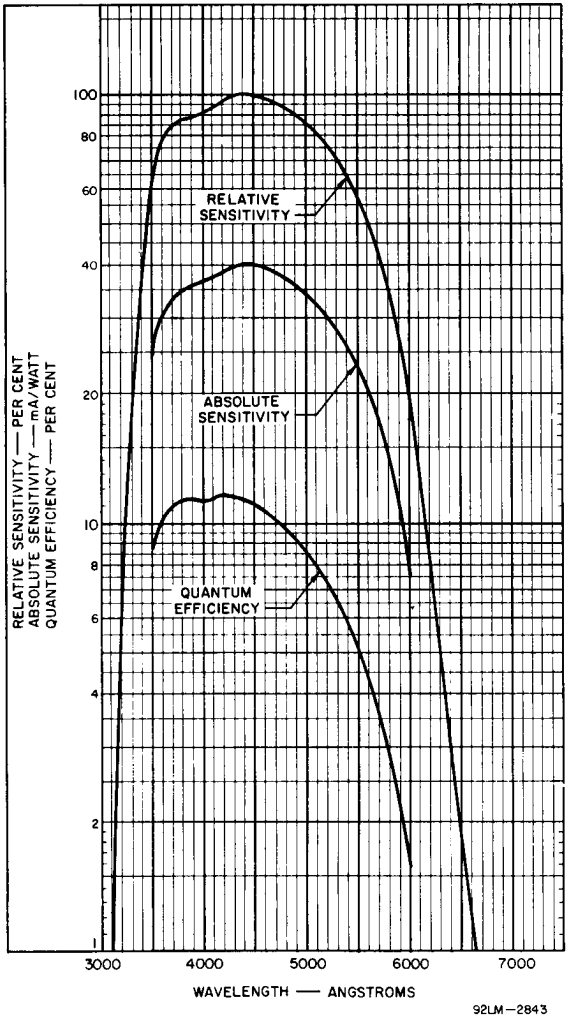
Pin 11: Anode

Pin 12: Internal connection-
Do not use

Pin 13: Focusing Electrode

Pin 14: Photocathode

Typical Spectral Response Characteristics

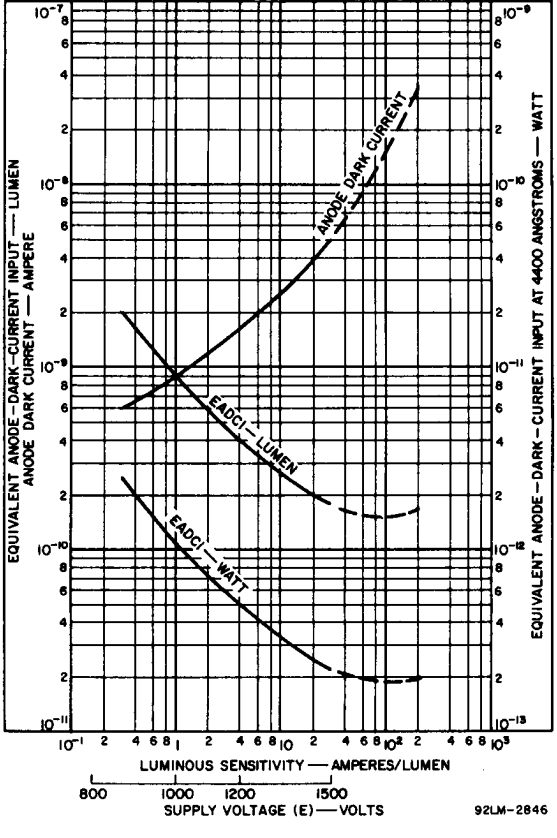


Typical EADCI and Anode Dark Current Characteristics

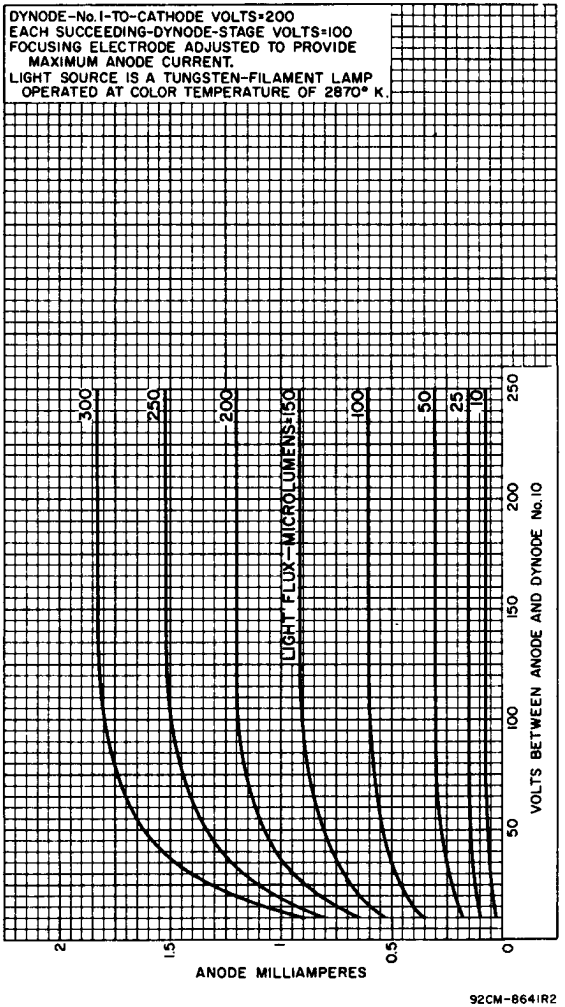
LUMINOUS SENSITIVITY IS VARIED BY ADJUSTING THE SUPPLY VOLTAGE (E) ACROSS A VOLTAGE DIVIDER PROVIDING 1/6 OF E BETWEEN CATHODE AND DYNODE No. 1; 1/12 OF E FOR EACH SUCCEEDING DYNODE STAGE, AND 1/12 OF E BETWEEN DYNODE No. 10 AND ANODE.

FOCUSING ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 10 AND 60 PER CENT OF DYNODE No. 1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.

LIGHT SOURCE IS A TUNGSTEN – FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870°K.
TUBE TEMPERATURE = 22°C

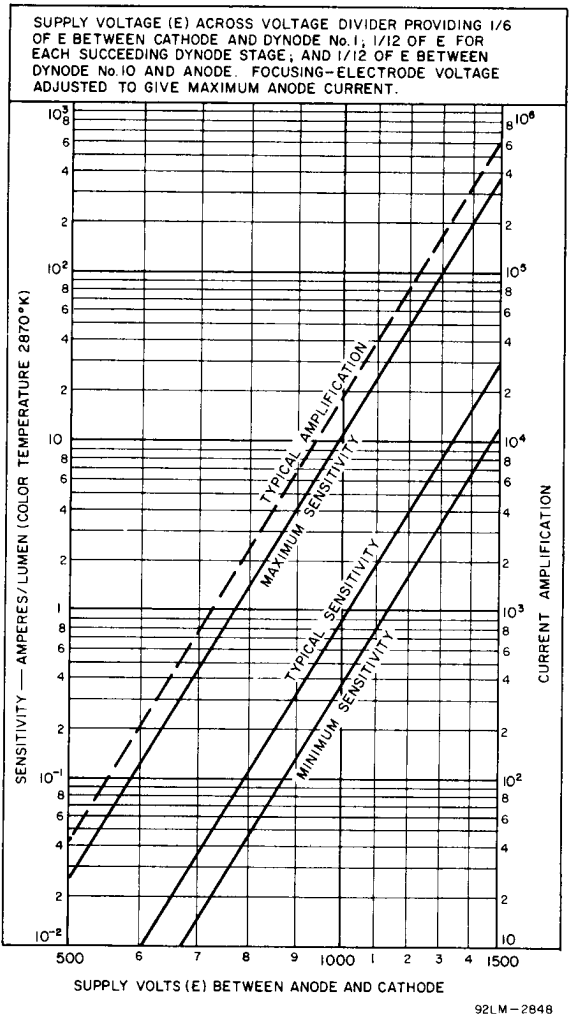


Typical Anode Characteristics

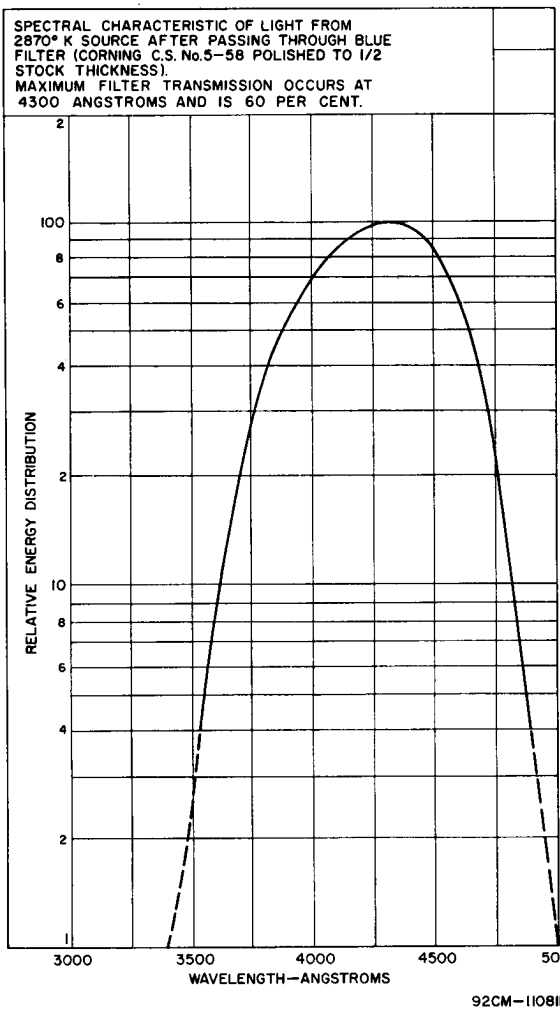


92CM-8641R2

Sensitivity and Current Amplification Characteristics



Spectral Energy Distribution of 2870° K Light Source After Passing Through Indicated Filter



Typical Effect of Magnetic Field on Anode Current