4526

Photomultiplier Tube

10-Stage Dormer-Window Type Having Multialkali Photocathode Deposited on a Reflective Substrate

- **Detects Low-Level Light Signals in Presence of Relatively High Background Illumination**
- **Highly Suitable for Star-Tracking and Laser Detection Systems to Approximately 8000 Angstroms**

General Data

Spectral Response	See Fig.1
Wavelength of Maximum Response	5300 ± 500 Å
Cathode, Semitransparent	Potassium-Sodium-Cesium-
on Reflective Substrate	Antimony (Multialkali)
Shape	Concave Spherical Surface
Minimum projected length on plane of window	0.65 in (16.5 mm)
Minimum projected width on plane of window	0.50 in (12.7 mm)
Window	Corning[a] No.0080, or equivalent
Shape	Rectangular
Index of refraction at 5893 angstroms	1.51
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 pF
Anode to all other electrodes	6.5 pF
Maximum Overall Length	
(Excluding leads and attached base)	3.01 in (76.4 mm)
Maximum Diameter	1.56 in (39.6 mm)
Base (Temporary)	Small-Shell Duodecal 12-Pin JEDEC No.B12-43
Socket	Eby[b] Part No.9058, or equivalent
Bulb	T12 with Special End Contour
Magnetic Shield	Millen[c] Part No.80802M, or equivalent
Operating Position	Any
Weight (Approx.):	
With base attached	3 oz (85.1 g)
Without base	2 oz (56.7 g)

Maximum Ratings, Absolute-Maximum Values:[d]

DC Supply Voltage:	
Between anode and cathode	2000 max. V
Between anode and dynode No.10	250 max. V
Between consecutive dynodes	300 max. V
Between dynode No.1 and cathode	400 max. V
Average Anode Current[e]	100 max. μA
Ambient Temperature	85 max. °C

Characteristics Range Values for Equipment Design:

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.

With E = 1250 volts except as noted

	Min.	Typical	Max.	
Anode Sensitivity:				
Radiant[f] at 5300 angstroms . .	–	4.4×10^{3}	–	A/W
Luminous (2870° K)[g]	5	15	75	A/lm
Cathode Sensitivity:				
Radiant[h] at 5300 angstroms . .	–	8.9×10^{-2}	–	A/W
Luminous (2870° K)[i]	2×10^{-4}	3×10^{-4}	–	A/lm
With red light (2870° K + C.S. No.2-62 filter)[k]	8×10^{-8}	1.2×10^{-7}	–	A
With blue light (2870° K + C.S. No.5-58 filter)[m]	7×10^{-9}	9×10^{-9}	–	A
Quantum Efficiency at 5000 angstroms	–	21	–	%
Current Amplification	–	5×10^{4}	–	
Anode Dark Current[n]	–	2×10^{-9}	1×10^{-8}	A
Equivalent Anode-Dark-Current Input[n]	–	1×10^{-10}	5×10^{-10}	lm
	–	3.4×10^{-13}[p]	1.7×10^{-12}[p]	W
Equivalent Noise Input[q]	–	1.5×10^{-12}	–	lm
	–	5.1×10^{-15}[r]	–	W
With E = 1500 volts				
Anode Pulse Rise Time[s]	–	2×10^{-9}	–	s
Electron Transit Time	–	2×10^{-8}	–	s

[a] Made by Corning Glass Works, Corning, New York.

[b] Made by Hugh H. Eby Company, 4701 Germantown Avenue, Philadelphia 44, Pa. This socket mates with the temporary B12-43 base and is not required after initial testing of the tube.

[c] Made by James Millen Manufacturing Co., 150 Exchange Street, Malden 48, Mass.

[d] A description of the Absolute-Maximum Rating is given in the General Section, titled Rating Systems for Electron Tubes.

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

[f] This value is calculated from the typical anode luminous sensitivity rating using a conversion factor of 295 lumens per watt.

[g] 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 1 microlumen is used.

[h] This value is calculated from the typical cathode luminous sensitivity rating using a conversion factor of 295 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. The value of light flux is 0.001 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

[k] Under the following conditions: Light incident on the cathode is transmitted through a red filter (Corning C.S. No.2-62 Manufactured by the Corning Glass Works, Corning, New York) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux incident on the filter is 0.001 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

[m] 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, New York) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux incident on the filter is 0.001 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

[n] At a tube temperature of 22° C. With supply voltage adjusted to give a luminous sensitivity of 20 amperes per lumen.

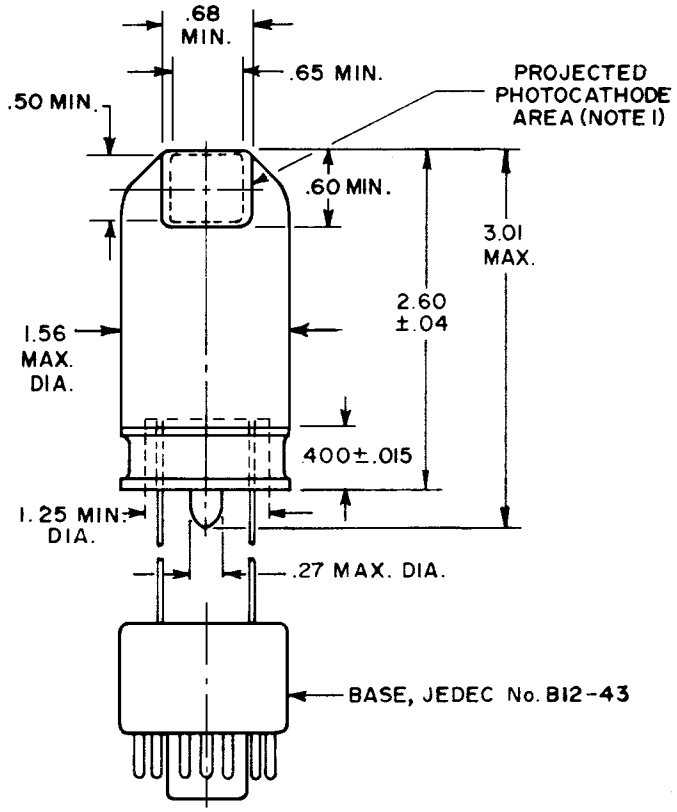
[p] At 5300 angstroms. This value is calculated from the EADCI value in lumens using a conversion factor of 295 lumens per watt.

[q] Under the following conditions: Supply voltage (E) is as shown, 22° C tube temperature, 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.

[r] At 5300 angstroms. This value is calculated from the ENI value in lumens using a conversion factor of 295 lumens per watt.

[s] 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.

DIMENSIONAL OUTLINE

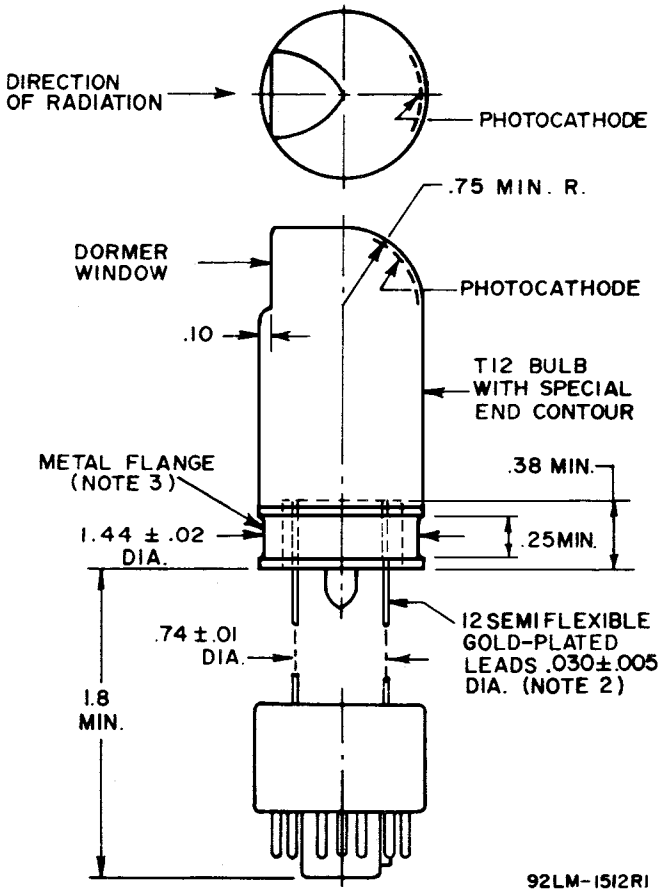


Dimensions are in inches unless otherwise stated. Dimensions tabulated below are in millimeters and are derived from the basic inch dimensions (1 inch = 25.4 mm).

Inch Dimension Equivalents in Millimeters

Inch	mm	Inch	mm	Inch	mm
.005	.127	.38	9.65	1.44	36.5
.015	.38	.40	10.1	1.56	39.6
.02	.50	.50	12.7	1.80	45.7
.03	.76	.60	15.2	2.60	66.0
.04	1.0	.65	16.5	3.01	76.4
.10	2.5	.68	17.2		
.25	6.3	.75	19.0		
.27	6.8	1.25	31.7		

DIMENSIONAL OUTLINE – cont'd

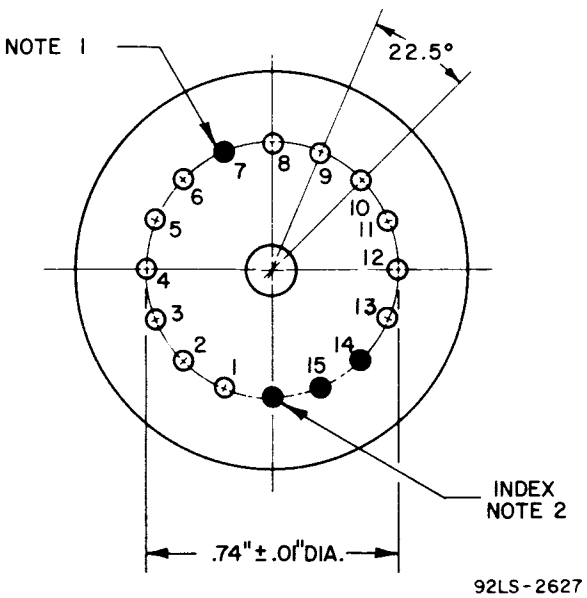


Note 1: Projected area lies between dashed lines.

Note 2: The semiflexible leads of the 4526 may be soldered, welded, or crimp connected into the associated circuit. However, when soldering or welding is employed for making such connections, care should be exercised to prevent tube destruction due to thermal stress of the glass-metal seals. A heat sink placed in contact with the semiflexible leads between the point being soldered, or welded, and the glass-metal seals is recommended.

Note 3: Metal flange is connected internally to the photocathode.

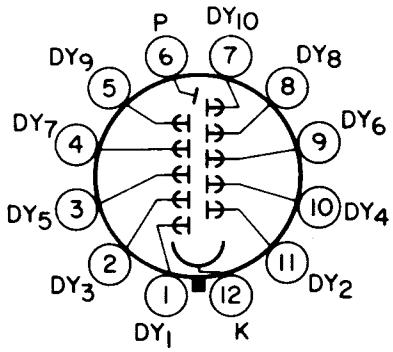
Lead Orientation Bottom View



Note 1: Leads 7, 14, and 15 are cut off within 0.16" (4 mm) of the glass button.

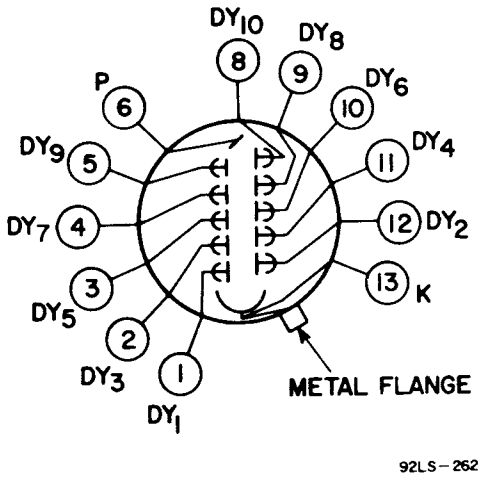
Note 2: Lead is cut off within 0.16" (4 mm) of the glass button for indexing.

Basing Diagram Bottom View (With Temporary Base)



Pin 1: Dynode No.1
Pin 2: Dynode No.3
Pin 3: Dynode No.5
Pin 4: Dynode No.7
Pin 5: Dynode No.9
Pin 6: Anode
Pin 7: Dynode No.10
Pin 8: Dynode No.8
Pin 9: Dynode No.6
Pin 10: Dynode No.4
Pin 11: Dynode No.2
Pin 12: Photocathode

Lead Connections Bottom View (With Base Removed)



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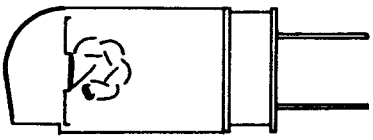
Lead 1 - Dynode No.1
Lead 2 - Dynode No.3
Lead 3 - Dynode No.5
Lead 4 - Dynode No.7
Lead 5 - Dynode No.9
Lead 6 - Anode
Lead 8 - Dynode No.10
Lead 9 - Dynode No.8
Lead 10 - Dynode No.6
Lead 11 - Dynode No.4
Lead 12 - Dynode No.2
Lead 13 and Metal Flange - Photocathode

Typical Effect of Indicated Magnetic Field on Anode Current

SUPPLY VOLTAGE (E) ACROSS 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.

PHOTOCATHODE IS FULLY ILLUMINATED.
TUBE IS ORIENTED IN MAGNETIC FIELD AS SHOWN BELOW.



H IN DIRECTION SHOWN:
(1) ←,(2) ↑, OR (3) ●

POSITIVE VALUES OF MAGNETIC FIELD INTENSITY (H) ARE FOR LINES OF FLUX (1) AND (2) IN INDICATED DIRECTION AND (3) OUT OF THE PAPER.

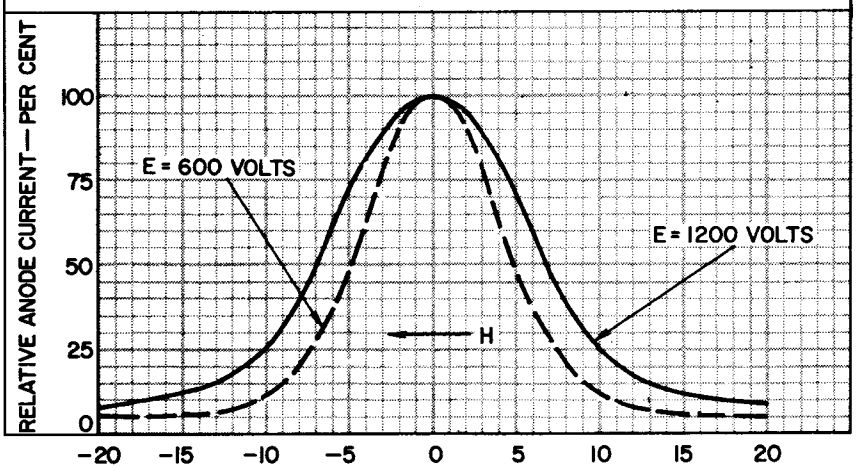


Figure 1

TYPICAL EFFECT OF INDICATED FIELD ON ANODE CURRENT – cont'd

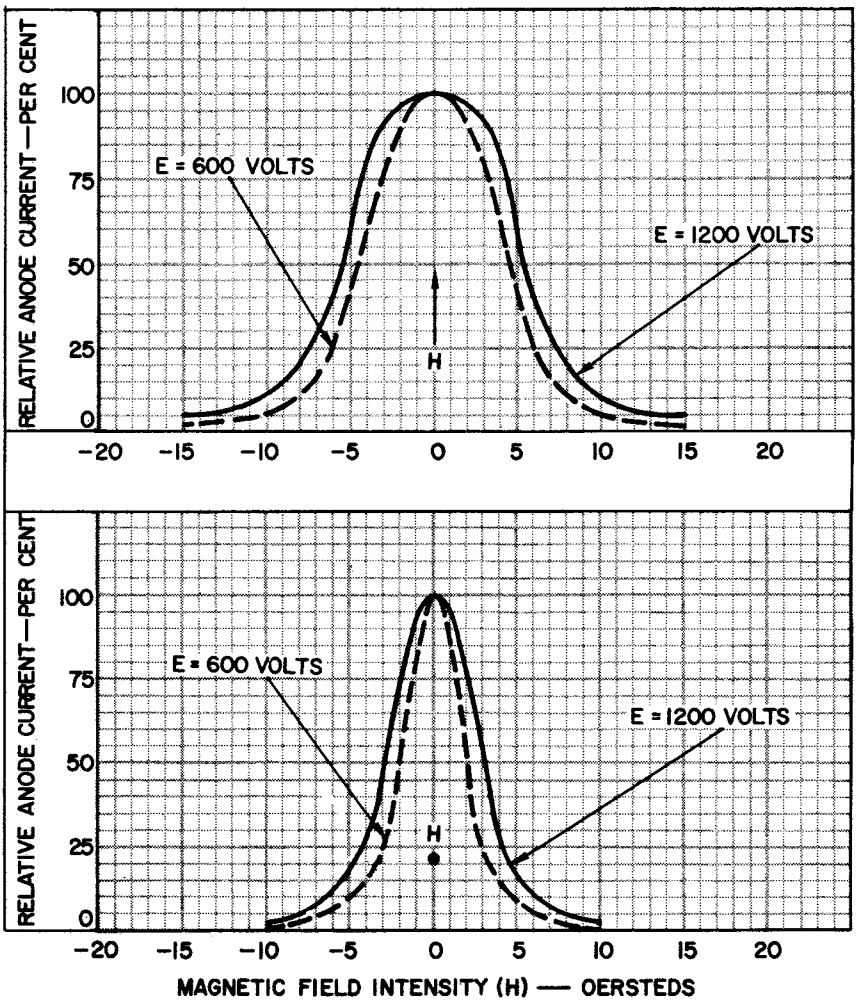


Figure 2

SCHEMATIC ARRANGEMENT OF TYPE 4526

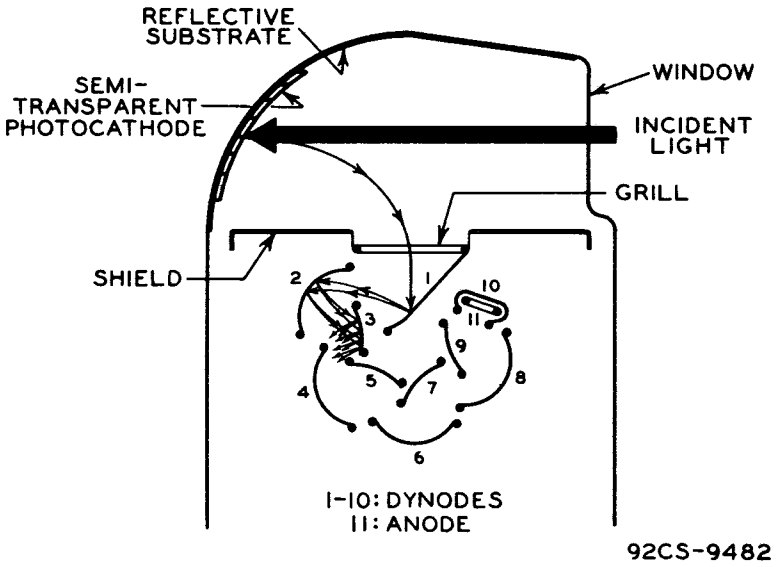


Figure 3

TYPICAL TIME-RESOLUTION CHARACTERISTICS

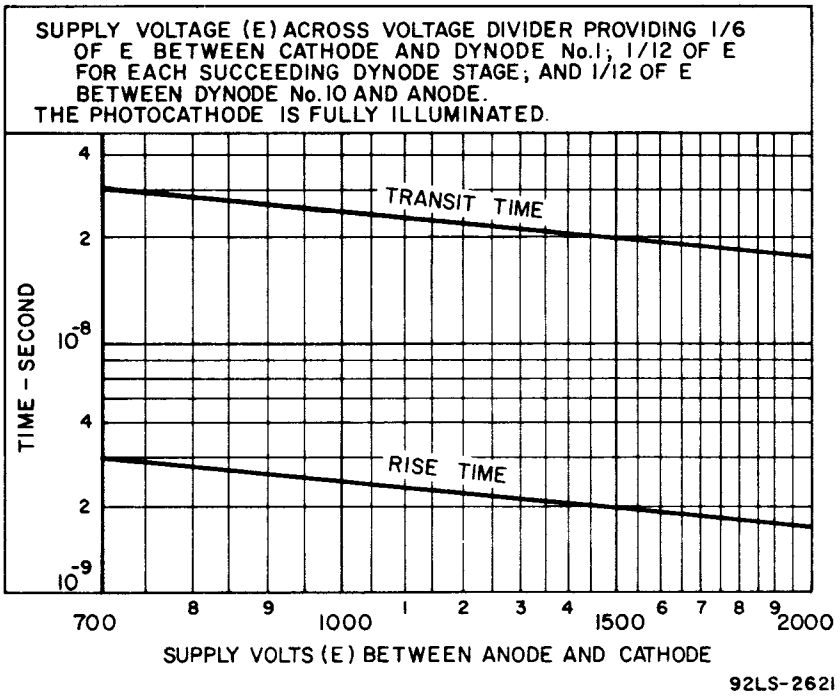


Figure 4

SPECTRAL RESPONSE CHARACTERISTICS

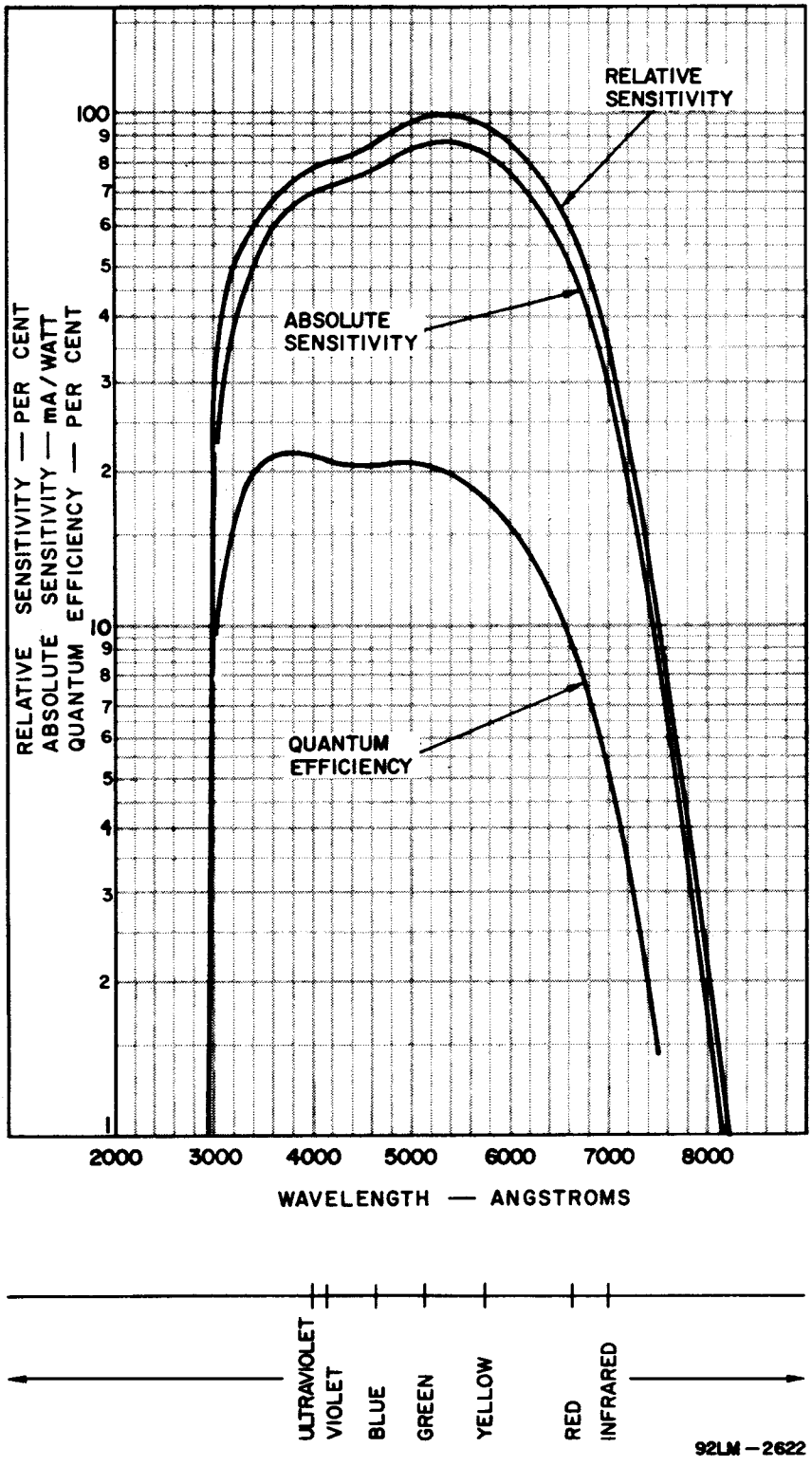


Figure 5

TYPICAL DARK CURRENT AND EADCI CHARACTERISTICS

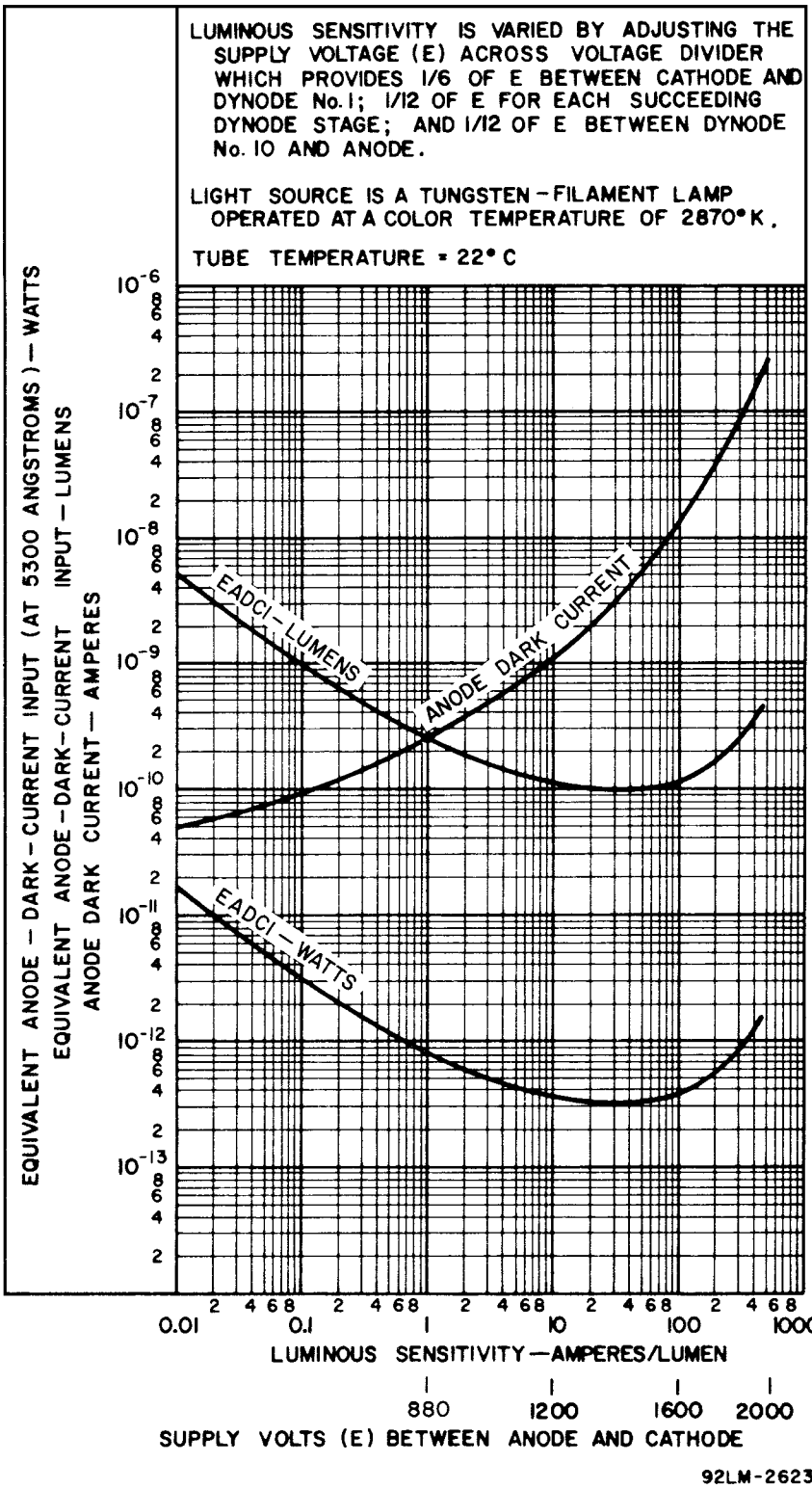


Figure 6

TYPICAL SENSITIVITY AND CURRENT AMPLIFICATION CHARACTERISTICS

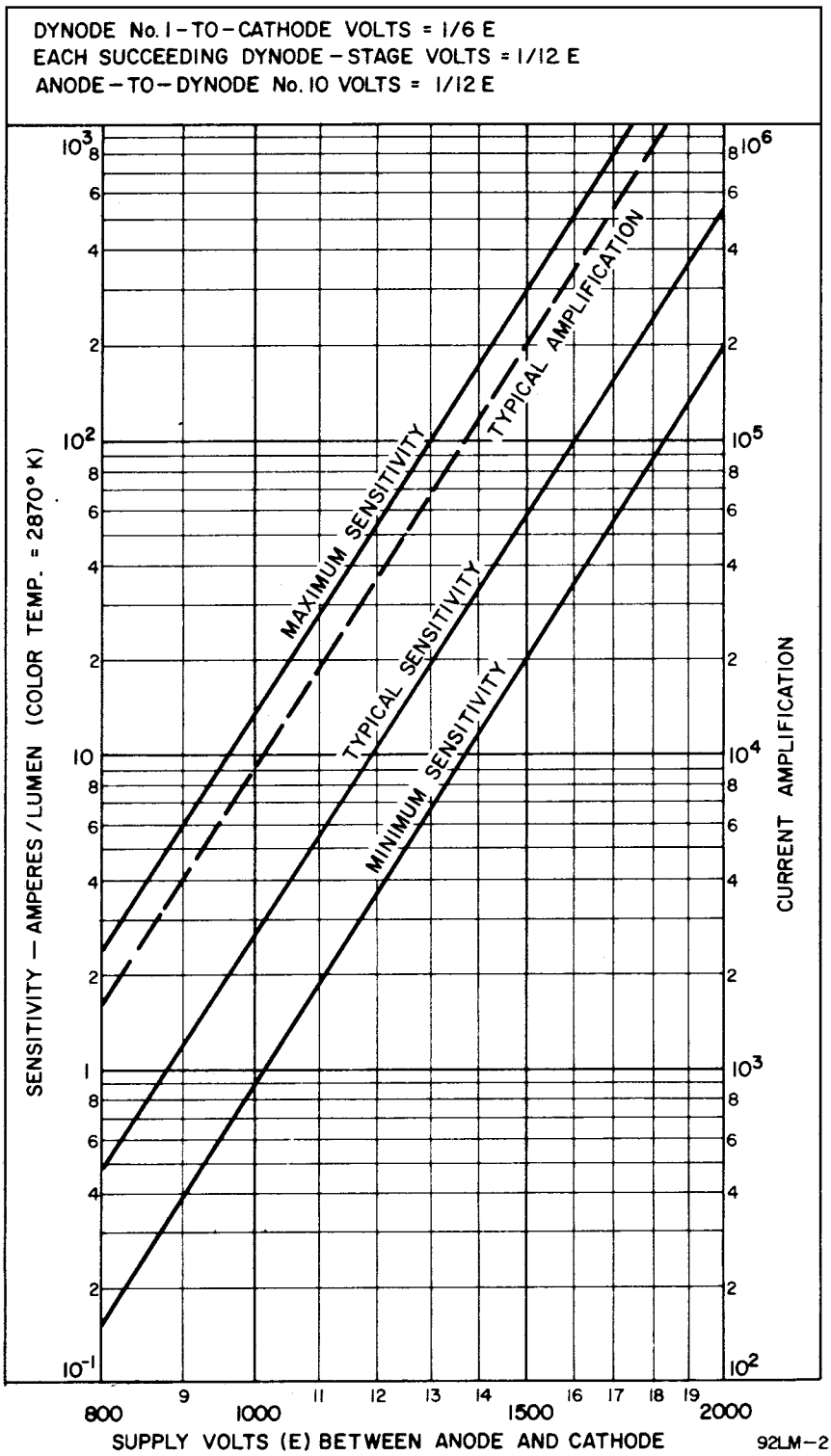


Figure 7

TYPICAL ANODE CHARACTERISTICS

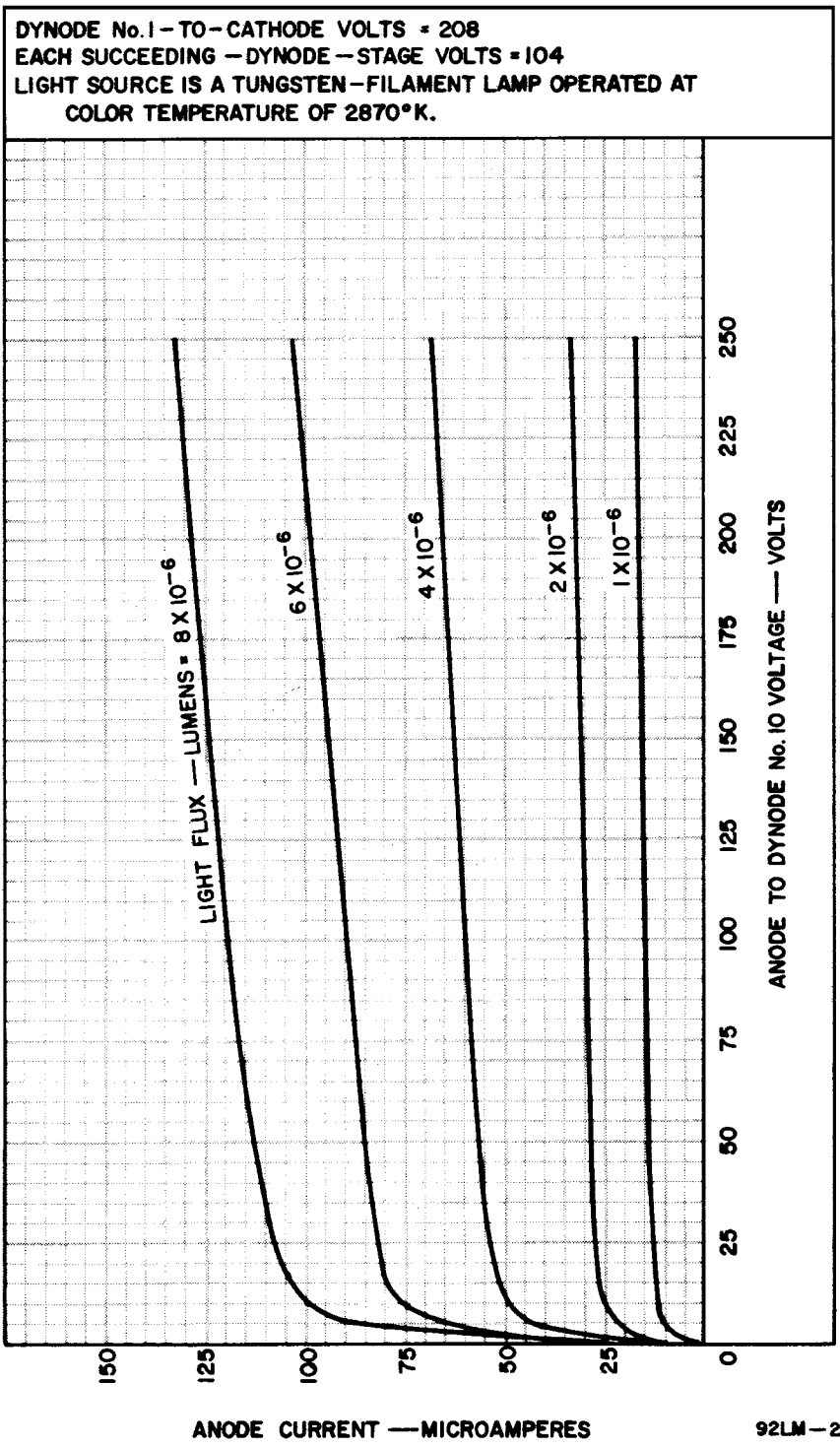
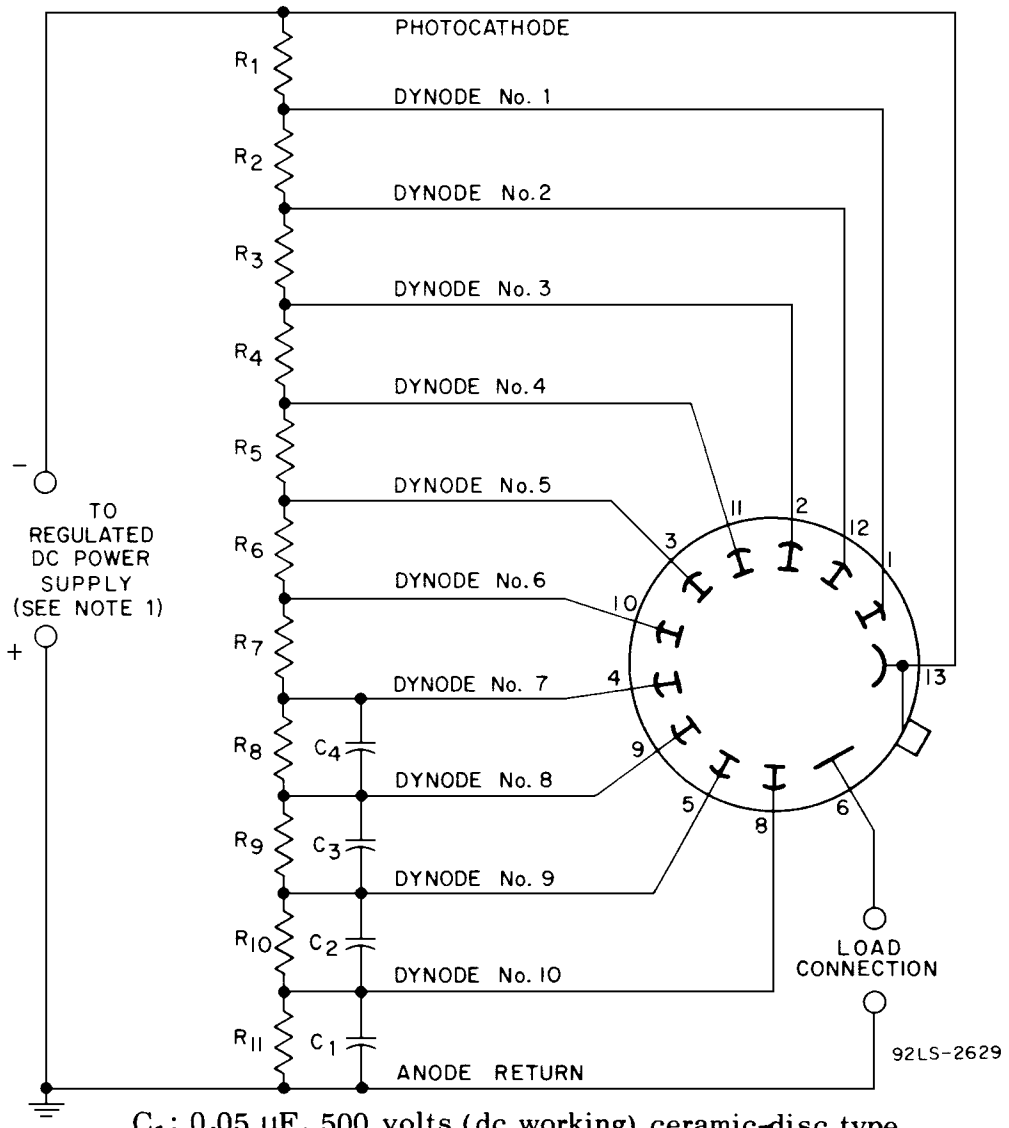


Figure 8

TYPICAL VOLTAGE-DIVIDER ARRANGEMENT



C_1: 0.05 μF, 500 volts (dc working) ceramic-disc type
C_2: 0.02 μF, 500 volts (dc working) ceramic-disc type
C_3: 0.01 μF, 500 volts (dc working) ceramic-disc type
C_4: 0.005 μF, 500 volts (dc working) ceramic-disc type
R_1: 330 kΩ ± 5%, 1 W
R_2 through R_{11}: 160 kΩ ± 5%, 1 W

Note 1: Adjustable between approximately 500 and 2000 volts dc.

Note 2: Component values are dependent upon nature of application and output signal desired. See discussion on **Typical Voltage Divider Arrangements** – Page 5.

Figure 9