Photomultiplier Tube

1-1/8" Diameter, Side-On Type Having Bialkali Photocathode

Spectral Response . . . . . See accompanying *Typical Photocathode Spectral Response Characteristics*

Wavelength of Maximum Response . . . . . 400 ± 50 nm

Cathode, Opaque . . . . . Potassium-Cesium-Antimony (Bialkali)

Window . . . . . Corning No.0080, or equivalent

Dynodes:

Substrate . . . . . Nickel

Secondary-emitting surface . . . . . Cesium-Antimony

Structure . . . . . Circular-Cage, Electrostatic-Focus Type

Direct Interelectrode Capacitances:

Anode to dynode No.9 . . . . . 4.4 pF

Anode to all other electrodes . . . . . 6.0 pF

Socket . . . . . Cinch-Jones No.12CS-M, or equivalent

Magnetic Shield . . . . . See footnote a

Maximum Ratings, Absolute-Maximum Values:

DC Supply Voltage:

Between anode and cathode	1250 max.	V
Between anode and dynode No.9	250 max.	V
Between consecutive dynodes	250 max.	V
Between dynode No.1 and cathode	250 max.	V
Average Anode Current (30 seconds max. averaging time)	0.5 max.	mA
Ambient-Temperature Range	−80 to +85	°C

Characteristics Range Values for Equipment Design:

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, and at a temperature of 22° C.

With E = 1000 volts (Except as noted).

	Min.	Typ.	Max.	
Anode Sensitivity:				
Radiant, at 400 nanometers	–	1.7×10^5	–	A/W
Voltage required to provide an anode current of 100 μA[b]	250	–	500	V

Cathode Sensitivity:				
Radiant, at 400 nanometers	–	0.054	–	A/W
With blue light source[c] (2870° K + UG-5 and BG-12) (See Figure 2) . .	3.0×10^{-6}	4.5×10^{-6}	–	A/incident lm
Quantum Efficiency at 400 nanometers	–	17	–	%
Current Amplification . .	–	3×10^{6}	–	
Anode Dark Current, at 800 V	–	8×10^{-10}	1×10^{-8}	A

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a Magnetic shielding material in the form of foil or tape as available from the Magnetic Shield Division, Perfection Mica Company, 1322 N. Elston Avenue, Chicago, IL, 60622, or equivalent.

b Under the following conditions: Light incident on the cathode is transmitted through a blue filter combination (Jena UG-5 and Jena BG-12, manufactured by Jena[er] Glaswerk, Schott & Gen, Mainz, West Germany) from a tungsten-filament lamp operated at a color temperature of 2870° K. This filter combination is interposed between a 0.172" x 0.700" aperture and the tube entrance window. The light input incident on the filter combination is 1×10^{-2} lumen. The tube is rotated about its major axis to obtain maximum output current.

c Under the same conditions as footnote (b) except 60 volts are applied between cathode and all other electrodes connected as anode.

When the ratio of peak anode current to average anode current is high, non-inductive capacitors should be employed across the latter stages of the tube. The values of these capacitors should be chosen so that sufficient charge is available to prevent a change of more than a few per cent in interstage voltages throughout the pulse duration. The capacitor values across the dynode stages will depend upon the shape and the amplitude of the anode current pulse, and the time duration of the pulse, or train of pulses. When the output pulse is assumed to be rectangular in shape, the following formula applies:

$$C = 100\,\frac{i \cdot t}{V}$$

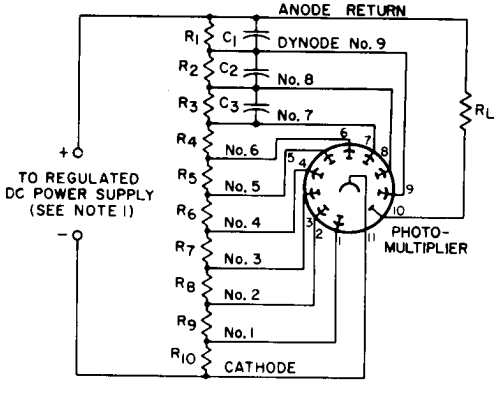
where C is in farads
i is the amplitude of anode current in amperes
V is the voltage across the capacitor in volts
and t is the time duration of the pulse in seconds

This formula applies for the anode-to-final dynode capacitor. The factor 100 is used to limit the voltage change across the capacitor to 1% maximum during a pulse. Capacitor values for preceding stages should take into account the smaller values of dynode currents in these stages. Conservatively, a factor of approximately 2 per stage is used. Capacitors are not required across those dynode stages where the dynode current is less than 1/10 of the current through the voltage-divider network.

For other shaped pulses or for a train of pulses, the total charge q should be substituted for (i·t) and the following formula applies:

$$C = 100\frac{q}{V} \qquad \text{where } q = \int i(t)\,dt \text{ coulombs}$$

TYPICAL VOLTAGE-DIVIDER ARRANGEMENT



92CS-11382R2

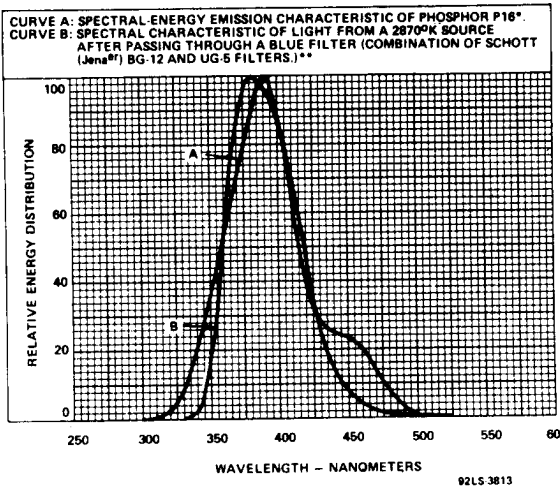
R_1 through R_{10} – 5000 to 1,000,000 ohms

Note: To assure a high degree of linearity, the values of the resistors

making up the voltage-divider network should be such that the current through the network, for the selected operating supply voltage, is at least 10 times greater than the maximum average anode current required.

Note: Capacitors C_1 through C_3 should be connected at the tube socket for optimum high-frequency performance. Leads to all capacitors should be as short as possible to minimize inductance effects.

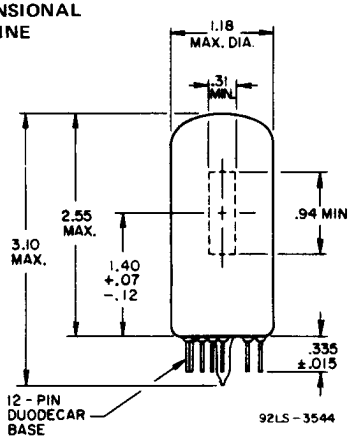
TYPICAL P16 SPECTRAL DISTRIBUTION CHARACTERISTIC AND THE SPECTRAL CHARACTERISTIC OF LIGHT FROM A 2870° K SOURCE AFTER PASSING THROUGH INDICATED FILTERS.



* JEDEC Publication 16A, January 1966.

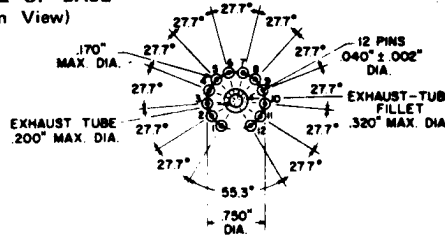
** Curve B is the product of the transmission characteristics of a combination of a BG-12 filter (1 mm thick) and a UG-5 filter (1mm thick) and the emission characteristics of a 2870° K tungsten-filament lamp. The filters are not in optical contact. The transmission characteristics of the filter combination include reflection losses at the air-glass interfaces. Some transmission occurs above 700 nanometers but is not indicated because it is beyond the spectral sensitivity range of the 4555. Information is obtained from "Color Glass Filters", Jena^er Glaswerk, Schott & Gen, 200 Park Avenue, NY 10017.

DIMENSIONAL OUTLINE

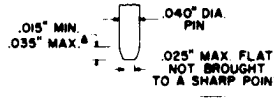


DIMENSIONS IN INCHES

DETAIL OF BASE
(Bottom View)

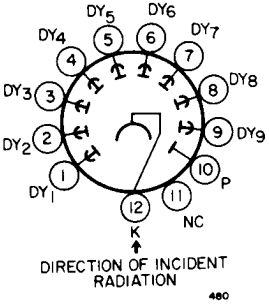


Duodecar-Base-Pin Contour



Base-pin positions are held to tolerances such that entire length of pins will, without undue force, pass into and disengage from flat-plate gauge having a thickness of 0.250" and thirteen holes with diameters of 0.0520" ± 0.0005" so located on a 0.7500" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.1795" ± 0.0005". Gauge is also provided with a hole 0.375" + 0.005" − 0.000" diameter concentric with the pin circle.

TERMINAL DIAGRAM (Bottom View)

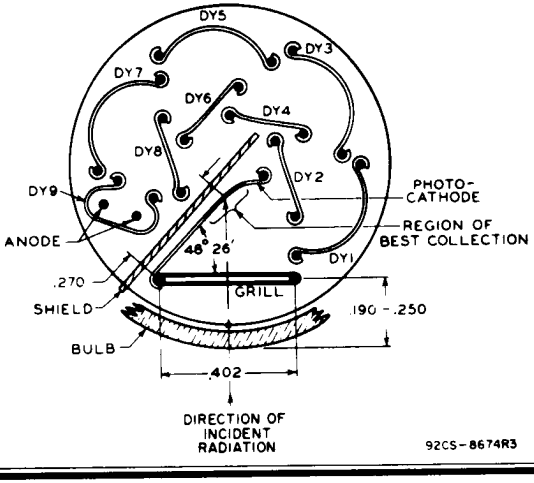


Pin 1– Dynode No.1
Pin 2– Dynode No.2
Pin 3– Dynode No.3
Pin 4– Dynode No.4
Pin 5– Dynode No.5
Pin 6– Dynode No.6
Pin 7– Dynode No.7
Pin 8– Dynode No.8
Pin 9– Dynode No.9
Pin 10– Anode
Pin 11– No Internal Connection*
Pin 12– Photocathode

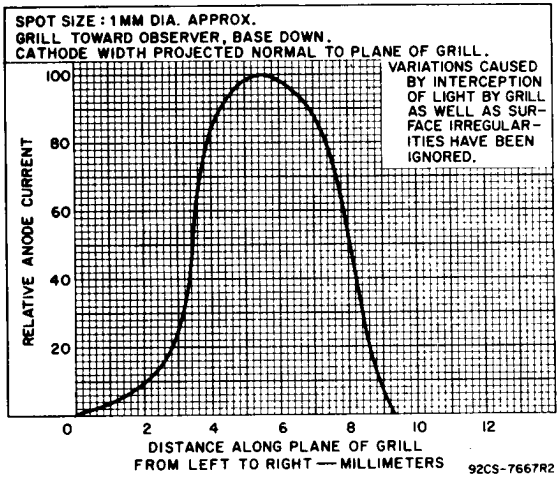
Note: The tube should be rotated about its major axis to provide maximum anode current.

* The socket terminal for Pin 11 may be used as a tie point for the voltage-divider resistor from dynode No.9 to the positive dc supply voltage and the load resistor from the anode to the positive dc supply voltage.

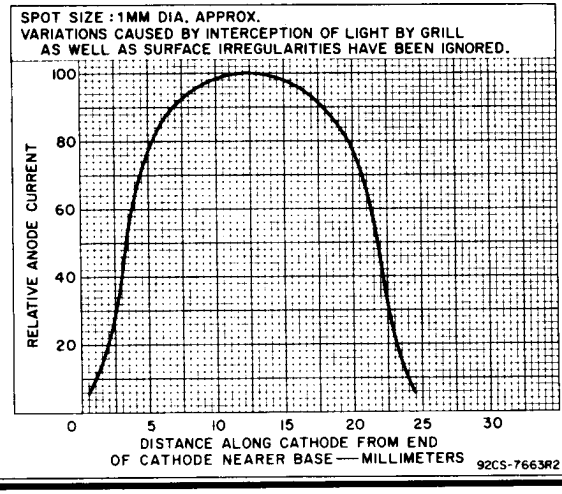
SCHEMATIC REPRESENTATION OF TUBE STRUCTURE



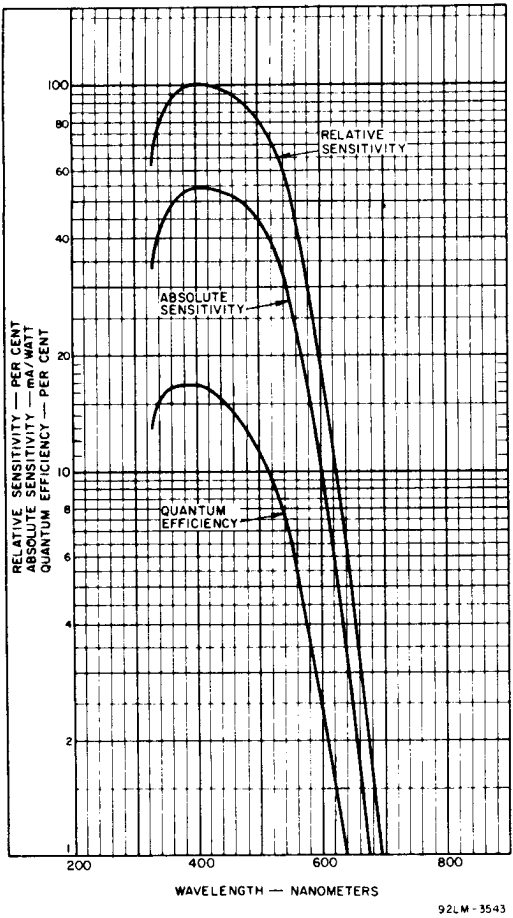
TYPICAL VARIATION OF PHOTOCATHODE SENSIVITY ACROSS PROJECTED WIDTH IN PLANE OF GRILL



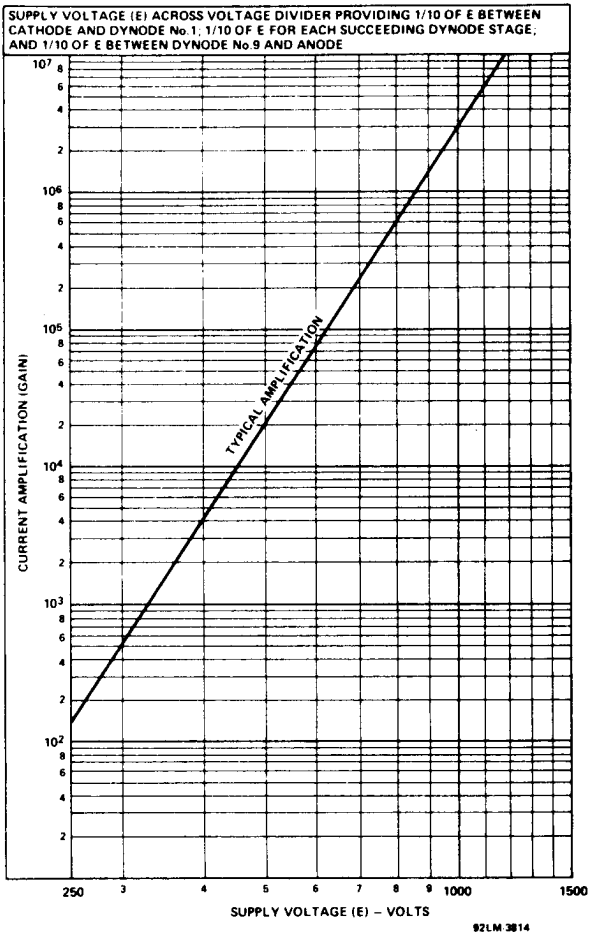
TYPICAL VARIATION OF PHOTOCATHODE SENSIVITY ALONG TUBE LENGTH



TYPICAL PHOTOCATHODE SPECTRAL RESPONSE CHARACTERISTICS

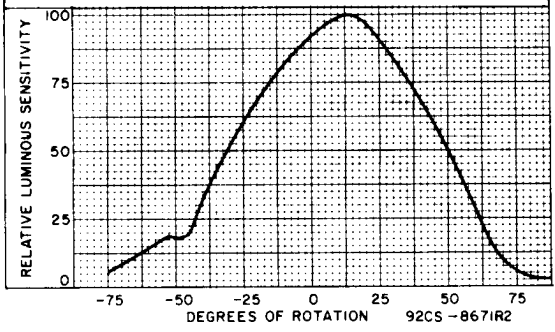


TYPICAL CURRENT AMPLIFICATION CHARACTERISTIC



TYPICAL VARIATION OF SENSITIVITY AS TUBE IS ROTATED WITH RESPECT TO FIXED LIGHT BEAM

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE = CONSTANT
ZERO-DEGREE ROTATIONAL POSITION OF TUBE IS ESTABLISHED BY A COLLIMATED LIGHT BEAM PERPENDICULAR TO AND FILLING THE PLANE OF THE GRILL.
TUBE MOUNTED VERTICALLY WITH ALLOWANCE MADE FOR ROTATION ABOUT MAJOR TUBE AXIS.
ROTATIONAL POSITION (TOP VIEW) CLOCKWISE = (-)
ROTATIONAL POSITION (TOP VIEW) COUNTERCLOCKWISE = (+)



TYPICAL EFFECT OF MAGNETIC FIELD ON ANODE CURRENT

SUPPLY VOLTAGE (E) ACROSS 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.
PHOTOCATHODE IS FULLY ILLUMINATED.
UNIFORM MAGNETIC FIELD PARALLEL TO MAJOR AXIS OF TUBE
POSITIVE VALUES OF MAGNETIC FLUX ARE FOR LINES OF FORCE TOWARD TUBE BASE.
TUBE IS DEGAUSSED PRIOR TO TEST AND IS AGAIN DEGAUSSED BEFORE FLUX DIRECTION IS CHANGED.