Photomultiplier Tube[a]

S-13 RESPONSE

10-STAGE, HEAD-ON, FLAT-FACEPLATE

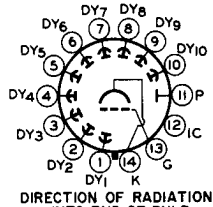
ELECTROSTATICALLY FOCUSED DYNODE STAGES

For Detection and Measurement of Ultraviolet Radiation and Other Low-Level Radiation Sources

GENERAL

Spectral Response	S-13
Wavelength of Maximum Response	4400 ± 500 angstroms
Cathode, Semitransparent	Cesium-Antimony
Shape	Flat, Circular
Minimum area	2 sq in
Minimum diameter	1-5/8 in
Window	Fused Silica
Maximum thickness	0.150 in
Index of refraction at 2000 angstroms	1.51
Dynode Material	Cesium-Antimony
Direct Interelectrode Capacitances (Approx.)	
Anode to dynode No.10	4.4 pF
Anode to all other electrodes	7.0 pF
Maximum Overall Length	6-9/16 in
Seated Length	5-5/8 ± 3/16 in
Maximum Diameter	2-5/16 in
Operating Position	Any
Weight (Approx.)	5.8 oz
Bulb	T16
Socket	Amphenol[b] No.59-417, or equivalent
Magnetic Shield	Perfection Mica Co.[c], No.P-108, or equivalent
Base	Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-38), Non-hygroscopic
Basing Designation for BOTTOM VIEW	14AA

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 – Do Not Use
Pin 13 – Focusing Electrode
Pin 14 – Photocathode



DIRECTION OF RADIATION: INTO END OF BULB

MAXIMUM RATINGS, ABSOLUTE-MAXIMUM VALUES

DC or Peak AC Supply Voltage		
Between anode and cathode	1250	V
Between dynode No.10 and anode	250	V
Between dynode No.1 and cathode	300	V
Between focusing electrode and cathode	300	V
Average Anode Current[d]	0.75	mA
Ambient Temperature	75	°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 = 1000 volts (Except as noted)

	Min	*Typ*	*Max*	
Sensitivity				
Radiant, at 4400 angstroms	-	7.2×10^{4}	-	A/W
Cathode radiant, at 4400 angstroms	-	0.047	-	A/W
Luminous:				
At 0 c/s[e]	10	90	300	A/lm
With dynode No.10 as output electrode[f]	-	52	-	A/lm
Cathode luminous:				
With tungsten light source[g]	4×10^{-5}	6×10^{-5}	-	A/lm
With blue light source[h,q]	4×10^{-8}	-	-	A
Current Amplification	-	1.5×10^{6}	-	
Equivalent Anode-Dark-Current Input[g]	-	5×10^{-10}[k]	2×10^{-9}[k]	lm
	-	6.3×10^{-12}[m]	2.5×10^{-12}[m]	W
Equivalent Noise Input				
Luminous[n]	-	6.7×10^{-12}	2.7×10^{-11}	lm
Radiant[p]	-	8.4×10^{-15}	-	W
Dark Current to any Electrode Except Anode at 25° C.	-	-	7.5×10^{-7}	A

With E = 750 volts (Except as noted)

	Min	*Typ*	*Max*	
Sensitivity				
Radiant, at 4400 angstroms	-	6.3×10^{3}	-	A/W
Cathode radiant, at 4400 angstroms	-	0.047	-	A/W

→ Indicates a change.

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	Min	Typ	Max	
Luminous:				
At 0 c/s[e]	-	7.9	-	A/lm
With dynode No.10 as output electrode[f] . .	-	4.6	-	A/lm
Cathode luminous:				
With tungsten light source[g]	$4x10^{-5}$	$6x10^{-5}$	-	A/lm
With blue light source[h]	$4x10^{-8}$	-	-	A
Current Amplification . . .	-	$1.3x10^{5}$	-	

[a] Alternate designation for Multiplier Phototube.

[b] Made by Amphenol Electronics Corporation, 1830 South 54th Avenue, Chicago 54, Illinois.

[c] Made by Magnetic Shield Division, Perfection Mica Co., 1829 Civic Opera Bldg., 20 North Wacker Drive, Chicago 6, Illinois.

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

[e] 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.

[f] An output current of opposite polarity to that obtained at the anode may be provided by using dynode No.10 as the output electrode. With this arrangement, the load is connected in the dynode-No.10 circuit and the anode serves only as collector. The curve shown in *Typical Anode Characteristics* does not apply when dynode No.10 is used as the output electrode.

[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. The value of light flux is 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

[h] Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning C.S. No.5-58, Glass Code No.5113 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 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

[j] For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1000 volts is recommended.

[k] Measured at a tube temperature of 25° 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.

[m] Determined at 4400 angstroms.

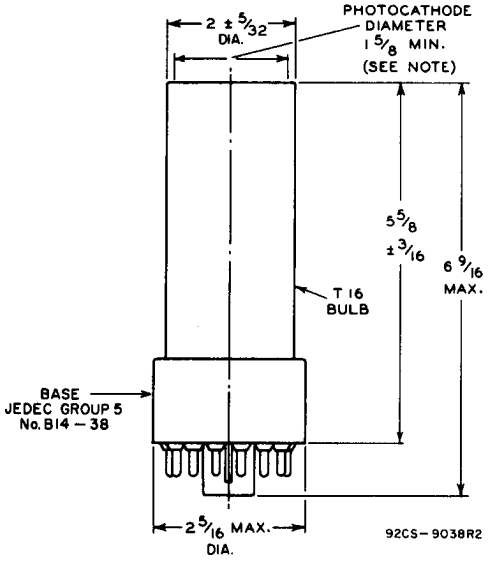
[n] Under the following conditions: Supply voltage (E) is as shown, 25° C tube temperature, external shield connected to cathode, bandwidth 1 cycle per second, tungsten-light source at a color temperature of 2870° K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period.

[p] Under the same conditions as shown under (n) except that use is made of a monochromatic source having radiation at 2537 angstroms.

[q] See *Spectral Characteristic of 2870° K Light Source and Spectral Characteristic of Light from 2870° K Source after Passing through Indicated Blue Filter* at front of this section.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-13 RESPONSE is shown at the front of this section

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Center line of bulb will not deviate more than 3° in any direction from the perpendicular erected at the center of bottom of the base.

Note: Within minimum diameter, deviation from flatness will not exceed 0.010" from peak to valley.

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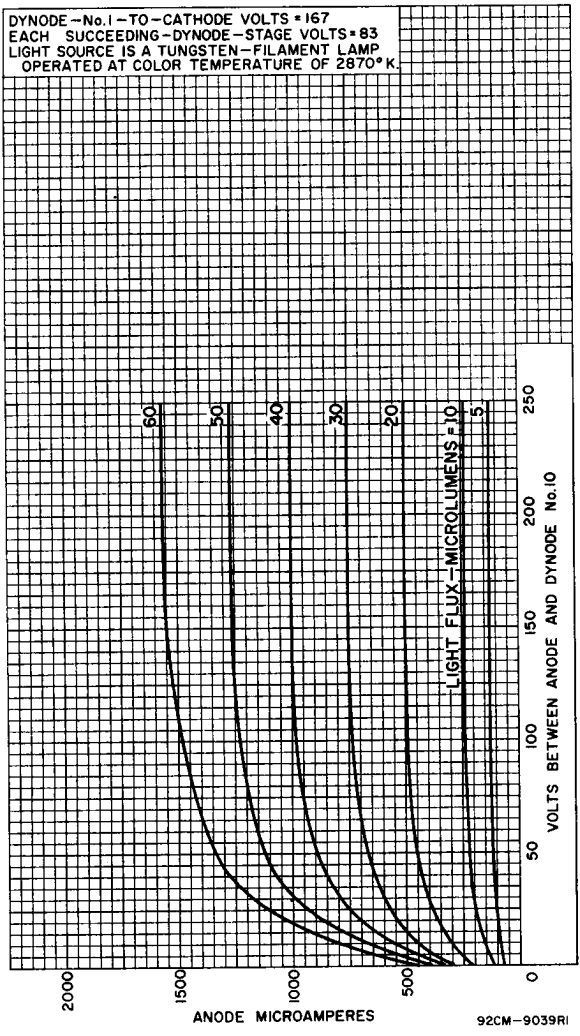
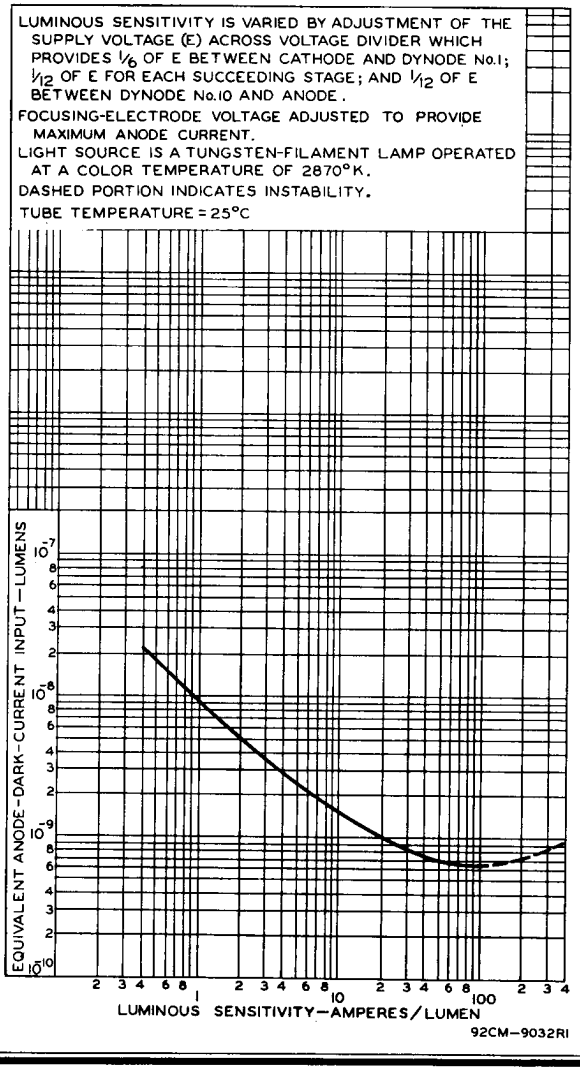
TYPICAL ANODE CHARACTERISTICS

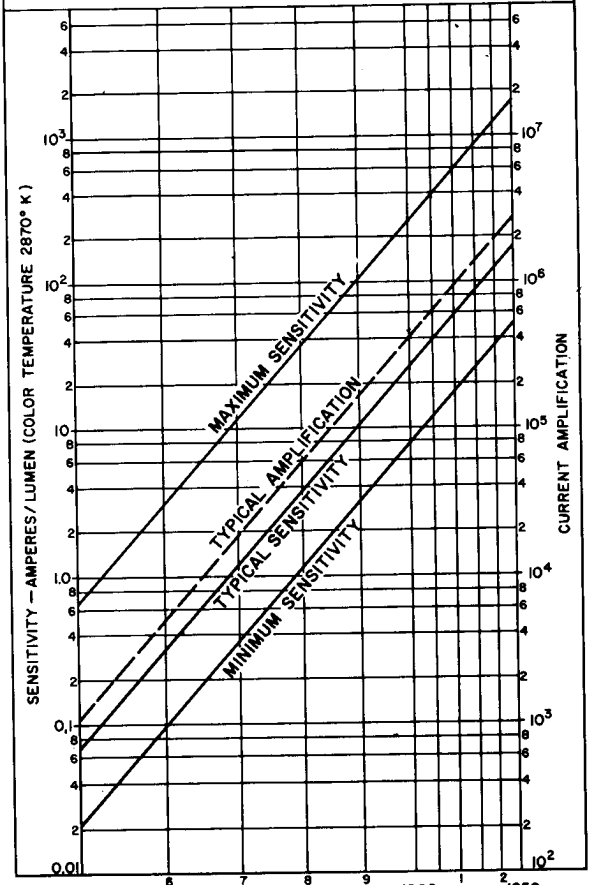


TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



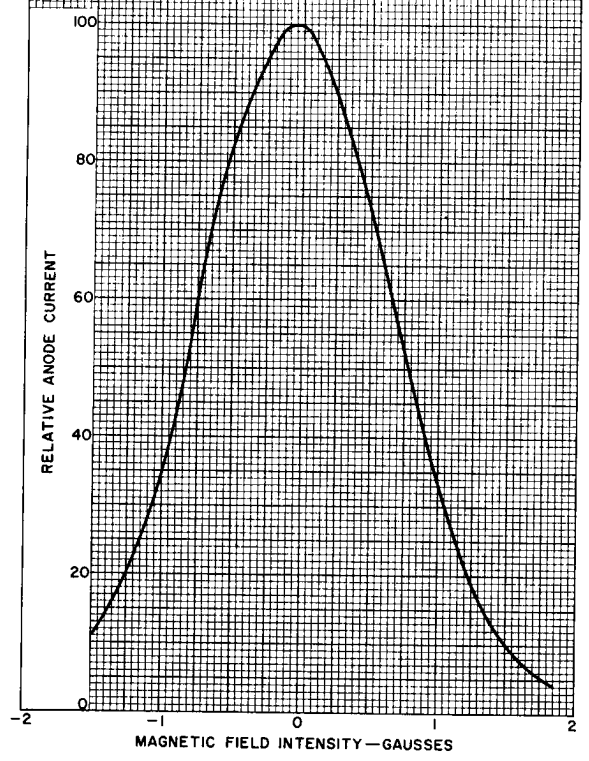
CHARACTERISTICS

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. FOCUSING—ELECTRODE VOLTAGE ADJUSTED TO GIVE MAXIMUM ANODE CURRENT.



TYPICAL EFFECT OF MAGNETIC FIELD ON ANODE CURRENT

MAGNETIC FIELD IS PARALLEL TO DYNODE—CAGE AXIS.
POSITIVE VALUES ARE FOR LINES OF FORCE FROM LEFT TO RIGHT WITH BASE DOWN AND BASE KEY TOWARD OBSERVER.
DYNODE—No.1—TO—CATHODE VOLTS = 150
EACH—SUCCEEDING—STAGE VOLTS = 100
FOCUSING-ELECTRODE VOLTAGE ADJUSTED TO GIVE MAXIMUM ANODE CURRENT.



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